



Smoke Management for Prescribed Fires Ventilation Index System (VIS)



The Ventilation Index System (VIS) is a method for managing smoke from prescribed burns in North Carolina. This information is intended to assist those trained as NC Certified Burners in managing smoke from their burns. Prior to conducting a burn, a written prescribed burning plan should be prepared. Much of the information needed to use VIS for smoke management can be found in a prescribed burning plan. A simple worksheet is available to assist you at the end of this document.

Step-by-Step Instructions

1. Locate the ventilation rate and the nighttime smoke dispersion for the burn location from the appropriate National Weather Service (NWS) Fire Weather Daily Text Forecast [website](#). The ventilation rate formula is **mixing height (ft.) X transport wind speed (MPH)=ventilation rate**.
2. Determine the Burning Category from Table 1. More information on Burning Categories can be found [here](#).

Table 1: Burning Category

Ventilation Rate	Burning Category
0 to 33,499	1
33,500 to 44,999	2
45,000 to 59,999	3
60,000 to 111,999	4
112,000 or greater	5

3. What type of burn will be conducted? – **Open**: (ex.-site preparation, longleaf pine savannah (approximate basal area ≤ 40 ft²/acre basal area), **Understory**: (ex.-silvicultural burn in loblolly pine or hardwood stand).
4. When you will be burning? – **Day Only** or **Day and Night**.
5. Determine **location of Smoke Sensitive Areas (SSAs)** that your smoke could impact (schools, hospitals, homes, chicken houses, etc.)
6. Determine **distance to SSAs** (based on wind direction provided by NWS and the burn tract location. Keep in mind down drainage smoke drift in mountainous terrain or when burning near water features).
7. Using data collected, determine allowable tonnage to be burned from Table 2.

Table 2: Smoke Management Tonnage Table

Burn Category	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
Burn Type	None	Open	Understory	Open	Understory	Open	Understory	Open	Understory	Open	Understory	Open	Understory	Open	Understory	Open	Understory
Night time Smoke Dispersion	Any	Poor, Very Poor	Poor or 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 Smoke Sensitive Area (miles)	MAXIMUM ALLOWABLE TONS OF FUEL THAT MAY BE BURNED PER DAY PER 16,000 ACRE SQUARE BLOCK (25 SQUARE MILES) DURING DAYLIGHT AND/OR NIGHTTIME BURNING.																
0-1/2	0	0	0	0	0	0	0	0	0	0	0	0	1030	0	0	0	1350
1/2-5	0	360	720	720	1080	450	900	900	1350	720	1440	1440	2160	900	1800	1800	2700
5-10	0	720	1440	1440	2160	900	1800	1800	2700	1400	2880	2880	4320	1800	3600	3600	5400
10-20	0	1080	2160	2160	3024	1350	2700	2700	4150	2160	4320	4320	6480	2700	5400	5400	8100
20-30	0	1200	2400	2400	3600	1600	3200	3200	4800	2500	5000	5000	7500	3000	6000	6000	9000
30+	0	1440	2880	2880	4320	1800	3600	3600	5400	2880	5760	5760	8640	3600	7200	7200	10800

8. Estimate total tons of available fuel to be consumed in burn from Table 3. More information can be found [here](#). If you are not confident in making this determination, contact your [local NCFS office](#) for assistance.

Table 3: Estimating Forest Fuel Loading

Fuel Type	Estimated Available Tons Per Acre*		
	Low	Medium	High
Pine litter	3	6	12
Hardwood Litter	3	5	7
Mixed litter	4	6	8
Brush < 2 ft.	4	7	10
Brush 2 - 4 ft.	6	8	15
Brush > 4 ft.	10	20	30
Light (thin) slash	5	10	20
Medium (chopped) slash	10	20	40
Heavy (clearcut harvest) slash	30	40	60
Short grass/Wire grass	2	5	7
Tall grass/Broomsedge/Marsh grass	3	6	8

*This information is based on results of actual sample measurements and has represented accurately the fuel availability based on the selected loading range. Research studies and surveys that provide more accurate site-specific information concerning tonnage or fuel availability can be used.

Tables maintained by the NCFS Fire Environment Forester. For information about this page or the NCFS Smoke Management Program contact Cabe Speary at cabe.speary@ncagr.gov, 252-325-3089.

9. If your burn will exceed the allowable tonnages in the above chart, you will need to alter your plans (cancel the burn, decrease acreage to be burned, change time of burn, etc.)
10. If you determine your burn will not exceed the allowable tonnage, and you decide to burn, call the [local NCFS District Office](#) on the day of the burn to give them your smoke management information. Remember, these allowable tonnages are for a 25 square mile block. If others are burning within the same block at the same time, you may need to alter your burn plan.
11. Follow the Smoke Management Guidelines shown below while executing your burn.

Smoke Management Guidelines

Category 1:

No burning allowed under VIS.

Category 2:

Burning is usually only during the Daytime. Burning starts after the inversion is no longer present. If Nighttime Smoke Dispersion (NSD) is poor, burning will cease by sunset and when NSD is very poor, the active fire burning and significant smoke production will cease two hours prior to sunset. At these times the fire should be appreciably burned out with smoke production substantially ended. If the forecast NSD is fair or good, then burning past sunset is permissible.

Category 3:

If an inversion is present, then ignition of the burn must be delayed until after the inversion is no longer present. If NSD is predicted to be poor then burning will cease by sunset and when NSD is very poor the active fire burning and significant smoke production will cease two hours prior to sunset. If forecasted NSD is poor or very poor, only daytime burning is allowable. The fire should be appreciably burned out by the end of this time frame, with smoke production substantially ended.

If the NSD is fair or good, then daytime burning (all hours) and nighttime burning are permissible. If nighttime burning is allowed, ignition prior to receiving the new category day the following morning will be allowed based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

Category 4:

Daytime burning (all hours) and night time burning is permissible with forecasted fair or good NSD. Night time ignitions prior to receiving the new category day the following morning will be based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

If the forecasted NSD is poor, burning will cease by sunset and when the NSD is very poor, burning will cease two hours prior to sunset. If forecasted NSD is poor or very poor, then only daytime burning will be permitted. The fire should be appreciably burned out by the end of the respective time frames with smoke production substantially ended.

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Category 5:

Daytime burning - (all hours) and night time burning is permissible with forecasted fair or good NSD. Night time ignition prior to receiving the new category day the following morning will be based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

If the predicted NSD is poor then, burning will cease by sunset and when the NSD is very poor, burning will cease two hours prior to sunset. If forecasted NSD is poor or very poor, then only daytime burning will be permitted. The fire should be appreciably burned out by the end of the respective time frames with smoke production substantially ended.

Organic Material - Residual Burning

When organic material is ignited during prescribed burning activities, and the material continues to burn, a daily evaluation will be made to estimate the acres continuing to burn within a given 16,000-acre block and approximate daily tonnage that will be consumed. The standard daily burning rate of undisturbed organic material is 16 tons/acre/day. This assumes that one solid acre burns at the same rate of approximately one inch per day. Adjustments to the daily burning rate of organic material and to the actual number of acres on fire are necessary to actually assess the impact or residual burning within each 16,000-acre block. The tonnage derived from residual burning will be subtracted from the available total tonnage each day to determine the adjusted tonnage that can be burned within the 16,000 acre block.

More detailed Smoke Management information can be found on the [Smoke Management Plan Tech Notes website](#).

VIS Smoke Management Worksheet for _____ Burn. Date: _____

Instruction

- 1 Ventilation Rate: _____
- 1a Nighttime Smoke Dispersion: _____
- 2 Burning Category: _____
- 3 Type of Burn: _____
- 4 Day or Day and Night?: ___-----_____
- 5 Location of SSAs (compass direction from burn): _____
- 6 Distance to SSAs (miles): _____
- 7 Allowable tonnage: _____
- 8 Available tons to be consumed: _____