Prescribed Fires and Nutrient Base Cation Supplies

A Southern Perspective

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Prescribed Fires

Southern Region treats about 1.1 million acres each year
**Air Quality Index (AQI)**

**Green**: No health warning

**Yellow**: Unusually sensitive people should consider reducing prolonged or heavy exertion

**Orange**: People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.

**Red**: People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.

**Purple**: People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
Planning - VSMOKE-GIS

- A simple screening model to show predicted downwind concentrations of particulate matter.
- For use in flat to gently rolling terrain, and steady wind conditions.
- Use with caution in complex terrain.

Concentrations are color coded using the Air Quality Index (AQI) 1-hour values developed by California Air Resources Board.
Planning - VSMOKE

• Predicts particulate matter, carbon monoxide, and visibility estimates at 31 logarithmically spaced distances.

• Calculates Atmospheric Dispersion Index (ADI) and LVORI.

• Produces a draft report.

Concentrations are color coded using the Air Quality Index (AQI) 1-hour values developed by California Air Resources Board.
Planning – CalPuff

Maximum PM2.5 At Each Receptor
Operational – PC HYSPLIT
Hourly Output
Operational – PC HYSPLIT
24-Hour Average Output
35 µq/m³
Atmospheric Dispersion Index (ADI)

An estimate of the capacity of the atmosphere to disperse smoke (DI >=30).

50 km = 31 miles
### Lavdas Atmospheric Dispersion Index (ADI)

#### Table 9.2 from Smoke Management Guidebook

<table>
<thead>
<tr>
<th>ADI</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>Very poor dispersion</td>
</tr>
<tr>
<td>7-12</td>
<td>Poor dispersion</td>
</tr>
<tr>
<td>13-20</td>
<td>Generally poor dispersion</td>
</tr>
<tr>
<td>21-40</td>
<td>Fair dispersion</td>
</tr>
<tr>
<td>41-60</td>
<td>Generally good dispersion</td>
</tr>
<tr>
<td>61-100</td>
<td>Good dispersion</td>
</tr>
<tr>
<td>&gt;100</td>
<td>Very good dispersion</td>
</tr>
</tbody>
</table>

Generally burning is not allowed.
Low Visibility Occurrence Risk Index (LVORI)

A risk index (ranging from 1 to 10) of low visibility on highways due to smoke and/or fog.

Input values include atmospheric dispersion index and relative humidity.
Do Our Watersheds Have Enough Base Cations?

Cherokee National Forest

How much more does it need to decrease?

Air Resource Management
Critical Load Development

- Critical load
- No harmful effect
- Harmful effect

Load (kg/ha/yr) vs. Effect to specific resource
Critical load development is illustrated with various indicators and effects. Critical loads are defined for specific indicators and effects:

- **Forest health decline**
- **Chronic acidification**
- **Episodic acidification**
- **Change in plant communities**
- **Changes in soil chemistry**

The diagram shows the progression of these effects with increasing load (kg/ha/yr). The critical loads are associated with different stages of impact on ecosystems and are crucial for managing air resource impacts.
Are There Enough Base Cations?

Base Cations (BC) = calcium + magnesium + potassium + sodium

Timber harvesting does remove base cations.
Steady State Critical Load

\[ CL_S = BC_{\text{dep}} + BC_w - BC_{\text{up}} - ANC_{\text{leaching}} \]

- Grimm
- SAMI
- Literature
- MAGIC Model
- User Defined

\( BC_{\text{up}} \) is set to zero if there is no timber harvesting.
<table>
<thead>
<tr>
<th>ANC Category (ueq/L)</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;= 100</td>
<td>Water chemistry should not limit the survival, reproduction, or brook trout and other aquatic species.</td>
</tr>
<tr>
<td>&gt;= 65</td>
<td>Median value modelled in 1860 for 65 streams. Above 50 ueq/L expect reproducing brook trout populations where habitat is</td>
</tr>
<tr>
<td>&gt;= 50</td>
<td>Below 50 ueq/L the catchment is extremely sensitive to brook trout response is variable. May be 50% less aquatic comparison to 100 ueq/L.</td>
</tr>
<tr>
<td>&gt;= 30</td>
<td>Lowest value modelled for 1860. Number of aquatic species continues decline.</td>
</tr>
<tr>
<td>&gt;= 20</td>
<td>Sub-lethal and/or lethal effects on brook trout and other aquatic species are possible. Below this value a sharp decline in acid aquatic insects reported in western Virginia.</td>
</tr>
<tr>
<td>&gt;= 0</td>
<td>Lethal effects to brook trout are probable. The stream is likely to support only acid tolerant species, such as water striders.</td>
</tr>
</tbody>
</table>
2009 – 2011 Average Total Sulfur Deposition Continues

Harvest Non-Wilderness Areas

No Timber Harvesting

Air Resource Management
Harvest Non-Wilderness Areas

Continue Total Sulfur Deposition

50% Reduction In Sulfur Deposition
2009 – 2011 Average Sulfur Deposition Continues

Harvest Non-Wilderness Areas

50% Reduction in 2009 – 2011 Average Sulfur Deposition

No Timber Harvesting

[Map showing Acid Neutralizing Capacity categories and Wilderness areas]
Decreases in Sulfur Deposition Will Continue

2009 - 2013 Average
26 miles

2064 Goal
62 miles
Why do we monitor air quality and visibility?

Monitoring the air quality within and near the National Forests in the Eastern (Region 9) and Southern (Region 8) Regions is one example of how the Forest Service is “caring for the land, and serving people.” The air quality monitoring information is used for environmental assessments, and for our forest planning for each National Forest in the Eastern and Southern Regions. Furthermore, the Region 8 and 9 Air Resource Management staff use the Information when providing technical advice to the appropriate Forest Supervisor (designated as the Federal Land Manager according to the Clean Air Act Amendments of 1977) when a new (large) stationary source of air pollution has the potential to impact any Air Quality Related Value at one or more of the 17 federally mandated Class I areas.

Webcams:

- Joyce Kilmer
- Shining Rock
- Upper Buffalo
- Boundary Waters
- Dolly Sods
- Presidential Peaks

Air Pollutants of Concern:

- Acidic Deposition
- Ozone