

Visibility Data Summary: Shining Rock Wilderness, NC



United States
Department
of Agriculture

Forest Service
Air Program

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Introduction

Air pollution often has a subtle but critical impact on ecosystems and vistas, and can alter ecosystems by harming plants and animals, or changing soil or water chemistry. As a result, ecosystems then become more vulnerable to damage from insects and diseases, drought, or invasive species. Additionally, since many visitors to national forests value pristine areas with magnificent vistas, air pollution can spoil their experience and lessen their enjoyment of national forests.

Background

One of the most noticeable forms of air pollution is haze, a veil of smog-like pollution that can blur the view of many urban and rural areas. As part of the Clean Air Act, Congress has established a goal to prevent future and remedy existing visibility impairment in 156 national parks, wildlife refuges, and wildernesses, known as Class I Areas. Federal rules require state and federal agencies to work together to improve visibility in these areas so that natural background conditions are achieved by the year 2064. Figure 1 shows a visual representation using the model WinHaze of how that improvement would appear at the Shining Rock Wilderness Area.

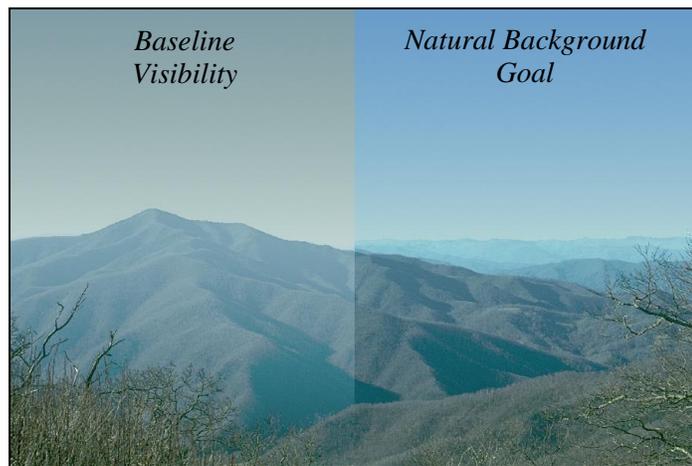


Figure 1: Baseline versus Natural Background Visibility at Shining Rock Wilderness Area in North Carolina.

IMPROVE Monitoring Network

The IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring network collects aerosol samples at monitors throughout the country, which are then analyzed to obtain a complete chemical profile of the airborne particles that are affecting visibility in the area. The data established baseline visibility conditions and track changes over time, helping resource managers understand the causes of haze.

About This Location

Shining Rock Wilderness Area is a federally mandated Class I Area located in the Pisgah National Forest in western North Carolina, as shown in Figure 2.



Figure 2: Location of Shining Rock Wilderness Area.

An IMPROVE monitor was established at the adjacent Frying Pan Mountain site in 1994 to assess visibility impairment at this Class I Area. An analysis of the monitoring data indicates that sulfates are the largest contributor to visibility impairment, as shown in Figure 3 in units of light extinction over distance.

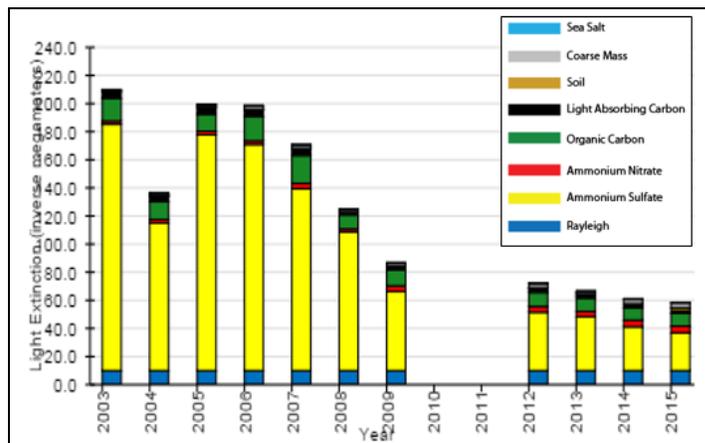


Figure 3: Composition of Particulate Matter on Hazy Days at Shining Rock Wilderness Area.

What Pollutants Are Reducing Visibility?

Regional haze comes from a variety of anthropogenic (man-made) and natural sources. Typical visibility-impairing pollutants such as sulfates, nitrates, organic carbon, and particulate matter are identified in the IMPROVE data and can help identify pollution sources that are contributing to regional haze at a particular location. For Shining Rock Wilderness, along with other eastern Class I areas, the sulfates are first emitted as sulfur

dioxide (a gas) before being transformed into fine particles in the form of aerosols. Coal-fired power plants are the primary emitter of sulfur dioxide, while diesel engines and industrial boilers also contribute some sulfur dioxide. Trees are the primary emitter of organic carbon, but additional contributions also occur from wildland fires and the burning of fossil fuels.

What Is Being Done to Improve Visibility?

Federal and state agencies analyze IMPROVE monitoring data (Figure 3) to identify the pollutants that impair visibility in each Class I Area. Nearby sources of these pollutants are then evaluated to determine if emissions can be further reduced, usually through the application of pollution control technology. The state is required to develop a plan (SIP, or State Implementation Plan) to improve visibility at Class I Areas, and the Forest Service provides input to this process.

Other regulatory efforts to reduce air pollution can also have a positive impact on visibility. For example, in 2002, the General Assembly of North Carolina enacted the Clean Smokestacks Act, which required a 73% reduction in sulfur dioxide emissions from coal-fired power plants by 2013. Since sulfates are the largest contributor to regional haze at this site, visibility has improved.

Is Visibility Improving at This Location?

Visibility is quantified using either standard visual range (SVR) or deciviews. SVR is the farthest distance one can see a dark object against a light background as measured in kilometers or miles; higher values are better. Conversely, each change in deciview is roughly equivalent to a just noticeable change in visibility; higher deciview values indicate hazier conditions while lower values are clearer. The Regional Haze Rule established a uniform rate of progress, also called the haziest glide slope (or path), for each Class I Area to measure if enough progress is being made to meet natural background conditions.

Figure 4 shows the deciview improvement on the 20% haziest days from baseline to current conditions, as well as the uniform rate of progress (red line) and the clearest baseline (green line) in terms of deciview units.

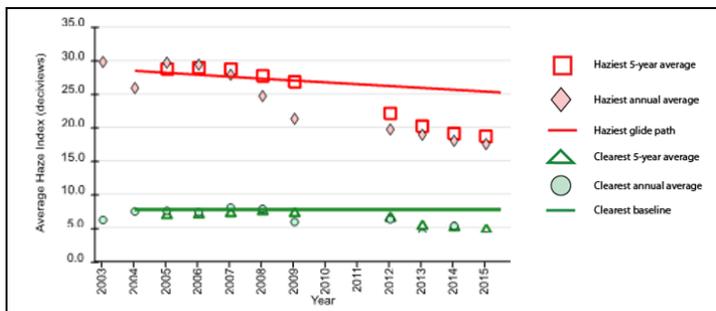


Figure 4: Changes in Visibility as Compared to Uniform Rate of Progress (red line) and Clearest Baseline (green line) Goal at Shining Rock Wilderness Area.

The running 5-year average visibility on the haziest days (red squares) has improved approximately 35% over the past 11 years at Shining Rock Wilderness. Figure 5 shows what this improvement looks like.



Figure 5: Computer Generated Approximation of the Visibility Improvement at Shining Rock Wilderness Area for the 5-year rolling average of the haziest days in 2005 (left) and 2015 (right).

Are We on Track to Meet Natural Background?

The declining red line in Figure 4 shows the glide slope needed to meet natural background conditions (11.5 deciviews) by 2064 on the haziest days. In 2005, the 5-year average for the haziest days was 28.5 deciviews. Based on the most recent measured visibility, Shining Rock Wilderness Area is experiencing improvements in visibility faster than the uniform rate of progress required to meet natural background. The five-year average in 2015 (18.5 deciviews) meets the average haziest visibility desired by 2040.

For More Information

Malm, W. (1999). *Introduction to Visibility*. Retrieved from <http://www.epa.gov/visibility/pdfs/introvis.pdf>

Moore, T. and S. Copeland (2011). *RHR Progress Tracking Metrics*. Retrieved from <http://vista.cira.colostate.edu/improve/Publications/Reports/2011/PDF/Chapter9.pdf>

IMPROVE Website <http://vista.cira.colostate.edu/improve/Default.htm>

Shining Rock IMPROVE Results

<https://webcam.srs.fs.fed.us/graphs/vis/index.php?wilderness=shinin>

Shining Rock Webcam

<https://webcam.srs.fs.fed.us/webcams/shining.php>