Rocky Mountain National Park
Fact Sheet
January 2014

Title: Air Quality

Status/Background:
The National Park Service (NPS) is mandated by several legislative acts to maintain and preserve natural conditions at Rocky Mountain National Park (RMNP) for future generations. These acts include the 1915 Act that established RMNP, the NPS Organic Act (1916), the Wilderness Act (1964) and the Clean Air Act amendment (1977). RMNP is classified as a Class 1 air quality area (cleanest air designation) as defined by the Clean Air Act. Regional haze, ground-level ozone, and atmospheric nitrogen deposition are issues currently affecting park resources and visitor experiences. Learn more about these topics at www.nature.nps.gov/air/Permits/aris/romo.

Regional Haze:
Visibility impairment is one of the most basic indicators of pollution in the air. Haze occurs as a result of the scattering and absorption of light by particles and gases in the atmosphere. Two of the leading agents impacting visibility at RMNP are ammonium nitrate and ammonium sulfate. Without the effects of pollution, natural visual range is approximately 140 miles. The current visual range for the park is approximately 30 to 90 miles. The Environmental Protection Agency Region 8 (EPA) approved the Colorado Department of Public Health and Environment (CDPHE) Regional Haze State Implementation Plan (RH SIP) on May 25, 2011, which anticipates a 37% reduction of statewide nitrogen oxide emissions by 2018. Implementation of the RH SIP should reduce regional haze and improve visibility range in the park. RMNP is continuing to monitor haze and visibility and continues to work with the CDPHE on long-range goals for reducing haze along the Colorado Front Range.

Ground-Level Ozone:
The eastern portion of the park is included in a seven-county Denver Metropolitan "non-attainment area" for high ground-level ozone levels, as designated by the EPA. During the summer seasons, RMNP experiences exceedances of the 8-hour EPA human health standard. The park is continuing to cooperate with the CDPHE's Ozone Action Plan to address ozone issues and bring the region back into "ozone attainment."

Concerns related to high ground-level ozone levels in the park are impacts to human and plant health. Visitors come from around the world to explore, hike and climb in the park. Visitors with preexisting respiratory ailments may be affected when exerting themselves at high elevations and high ozone levels. Ozone advisories are issued by the park for staff and visitors when monitoring indicates the ground-level ozone conditions may become unhealthy. Unhealthy conditions exist when ozone levels exceed 75 parts per billion over an 8 hour average. Six park ozone advisories were issued during the 2013 summer season. Seven plant species in RMNP are known to be susceptible to injury from elevated ozone levels. A five year study from 2006 to 2010, documented ongoing foliar ozone injury within the park.

Serviceberry, Amelanchier alnifolia
Spreading dogbane, Apocynum androsaemifolium
Louisiana sage, Artemisia ludoviciana

Quaking Aspen, Populus tremuloides
Skunkbrush, Rhus trilobata
Scouler willow, Salix scouleriana
Cutleaf coneflower, Rudbeckia laciniata var. ampla

Atmospheric Nitrogen Deposition:
Nitrogen emissions from a variety of human made sources, including nitrogen oxides from fossil fuel combustion, and ammonia from agricultural production, contribute to excess atmospheric nitrogen deposition at RMNP. Over 25 years of scientific research indicates that nitrogen deposition is 15 times greater than the natural background deposition rate. Three-quarters of the park is above 9000 feet where the high elevation ecosystems are especially susceptible to excess nitrogen due to their evolution under and adaptation to low nitrogen conditions. Within these ecosystems, alpine tundra, aquatic plants, soil and water quality are most affected. Scientists are also concerned that elevated nitrogen levels may contribute to an increase in non-native plants and reduced forest health.

Peer-reviewed scientific research has determined that the critical load of wet nitrogen deposition has been exceeded and direct injury to natural resources and associated processes is occurring. The park's high elevation lake system critical load is 1.5 kilograms of nitrogen per hectare per year (kg N/ha/yr) which is the rate of deposition that unnatural changes begin to occur. The 2012 deposition rate of 2.9 kg N/ha/yr would need to be reduced below the critical load to prevent injury. The natural deposition rate is estimated at approximately 0.2 kg N/ha/yr.

Nitrogen Deposition Reduction Plan:
Following a series of discussions and work that began in 2004, the NPS, CDPHE, and the EPA endorsed the RMNP Nitrogen Deposition Reduction Plan (NDRP) Memorandum of Understanding (MOU) in August 2007, formalizing a collaborative approach to address these air quality issues.

The NDRP documents how ecosystem health first began to decline at high-elevation areas on the east side of RMNP between 1950 and 1964 as indicated by a shift in aquatic biota from a natural to a disturbed condition. The beginning of this shift corresponded to the critical load of wet nitrogen deposition of 1.5 kg N/ha/yr. This threshold has been designated the resource management goal for restoration of healthy ecosystems at high elevation areas of RMNP.

The NDRP (1) seeks to reduce nitrogen deposition levels that are protective of park resources; (2) seeks a 25-year timeframe (by 2032) to achieve the management goal of less than 1.5 kg N/ha/yr: (3) includes nitrogen reducing actions already sought under the Colorado RH SIP to reduce Haze; and (4) utilizes Best Management Practices to reduce ammonia in the agricultural sector. The NDRP is a working document with deposition reduction milestones scheduled every five years. The first milestone calls for wet nitrogen deposition at RMNP to be reduced from the baseline loading of 3.1 kg N/ha/yr in 2006 to 2.7 kg N/ha/yr in 2012. A Contingency Plan was approved in 2010, for use to improve deposition reduction should any five years milestone not be realized.

2012 Nitrogen Deposition Milestone:
The 2012 deposition rate was 2.9 kg N/ha/yr, therefore the 2012 milestone goal of 2.7 kg N/ha/yr was not achieved. However, MOU agencies are electing not to activate the Contingency Plan. Instead, agencies will allow current and developing strategies adequate time to show effectiveness in reducing nitrogen deposition that has already stabilized (is no longer increasing) in recent years. Strategies include Colorado RH SIP provisions that anticipate 37% reduction in state nitrogen oxide emissions by

2018, and an early warning system (EWS) under development by Colorado agricultural producers that may reduce ammonia emissions transported to the park. The NDRP 2012 Milestone Report, and supporting documents are available at www.colorado.gov/cdphe/rmnpinitiative.

Next steps for the MOU agencies include a review and update of the 2010 Contingency Plan, continued work on ammonia and NO_x emission inventory improvements, ongoing stakeholder collaboration, and continued evaluation of nitrogen deposition reduction over time. The agencies will continue to monitor nitrogen deposition levels as strategies are implemented to determine whether additional steps are needed, in or prior to 2017, to meet the next milestone.

Collaboration with Colorado Agriculture:
MOU agencies are working with Colorado agriculture to adopt voluntary best management practices (BMPs) to improve efficiency and reduce nitrogen emissions from ammonia. Producers are developing a 5 year plan including research, monitoring, outreach, and the EWS (www.rmwarningsystem.com) development. The EWS would advise agricultural producers to avoid high nitrogen-emitting activities, such as certain methods of manure handling and crop fertilizing, during specific weather events that could readily transport nitrogen into RMNP.

Broader use science-based BMPs can help reduce agriculture ammonia emissions by: 1) reducing nitrogen inputs, 2) keeping more nitrogen in the final agricultural product, or 3) preserving more nitrogen in the soil on the farm. Research at Colorado State University is focused on refining BMPs for agricultural production activities including the EWS. Other BMPs being evaluated include, reducing dietary crude protein and using animal feed additives and hormones. Together these techniques for livestock may help increase fed nitrogen retention to improve production or animal rate of gain, and reduce nitrogen lost to the environment. Crop production efficiency is also improving with advances in nitrogen fertilizer application to optimize fertilizer amount, timing, and placement. Conservation tillage techniques, precision watering, and crop technology are also ways to improve nitrogen use efficiency.