

**Project Summary**  
**Rocky Mountains Cooperative Ecosystem Studies Unit**

**Project Title:** Assistance for Visibility Data Analysis and Image Display Techniques

**Discipline:** Interdisciplinary  
**Type of Project:** Technical Assistance  
**Funding Agency:** National Park Service  
**Other Partners/Cooperators:** Colorado State University  
**Effective Dates:** 9/1/2008 - 8/31/2009  
**Funding Amount:** \$1,080,160.00

**Investigators and Agency Representative:**

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**Project Abstract:**

The following proposal describes a cooperative effort between the National Park Service (NPS) and the Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University (CSU) to analyze, interpret, and make available air quality, deposition, and visibility data and analyses of these data. These data, interpretations, and analyses will be available to the scientific community, regulatory agencies, and the public.

The public visits national parks and wilderness areas to enjoy nature in an unblemished setting. Air pollutants can adversely affect that visitor experience by degrading the vistas they come to see and by affecting the natural ecosystems of these areas. The NPS and CSU scientists are working together to better understand the scientific basis of these issues and to make that information available to regulatory agencies and to interpret it for the public.

Particles and gases in the atmosphere scatter and absorb light, affecting the view one has of a scene. This project analyzes particle data collected through the Interagency Monitoring of Protected Visual Environments (IMPROVE) program to determine its origins and electro-optical properties and to better understand its chemical makeup. These analyses will be published in the scientific literature, presented at scientific meetings, and made available with the data through the World Wide Web. The electro-optical properties of aerosols ultimately affect how the particles impair visibility. However, it is difficult for the public to visually interpret the meaning of changes in electro-optical variables used to quantify changes in scene appearance under different atmospheric-particulate-loading conditions. The most effective ways to present the effects of pollutants on scenic vistas are by photographic imaging techniques that accurately depict how the scene will appear under various illuminations and meteorological and pollutant conditions, through video productions that demonstrate pollutant effects on a scene over time, and by regional air quality simulation modeling. An image-based depiction of visibility reduction due to pollutants is dependent on a firm understanding of the electro-optical characteristics of pollutants, on state-of-the-art measuring techniques, on a valid understanding of how chemicals are transformed as they travel through the atmosphere, on the ability to simulate accumulated effects, and on professional quality image and video production techniques. The aforementioned analyses and techniques are the key elements of successfully carrying out this cooperative project.

Healthy ecosystems are critical to having a natural, unblemished visitor experience. Ecosystem changes due to atmospheric deposition of nitrogen compounds have been documented at Rocky Mountain National Park. The origins, chemical makeup, and temporal scales of changes in the deposition are not well understood. Field measurements were made in the spring and summer of 2006 to provide data to enhance our understanding. This project analyzes some of these data and runs 4-dimensional chemical transport models to assess atmospheric nitrogen deposition at the park.

**Outcomes with Completion Dates:**

Presentations at and participation in the AAAR annual meeting,	October 20, 2008
Complete new set of smoke measurements	November 30, 2008
Complete preparations for new IMPROVE calendar.	November 30, 2008
Presentations at and participation in the AGU fall meeting,	December 15, 2008

Ingest latest IMPROVE data submissions from UC Davis	February 28, 2009
Presentations at and participation in the AWMA annual meeting,	June 30, 2009
Draft publications submitted for review	December 31, 2008
Draft report from RoMANS Task	November 30, 2008
Manuscripts submitted for publication	March 31, 2009
Continuous operation of IMPROVE web site	August 31, 2009

**Keywords:** Visibility Data, air quality, air pollutants , Interagency Monitoring of Protected Visual Environments (IMPROVE) program, Colorado State University, Cooperative Institute for Research in the Atmosphere (CIRA), National Park Service