2011 Calendar

IMPROVE

Interagency Monitoring of Protected Visual Environments

CIRA

Colorado State University

IMPROVE Monitoring Update

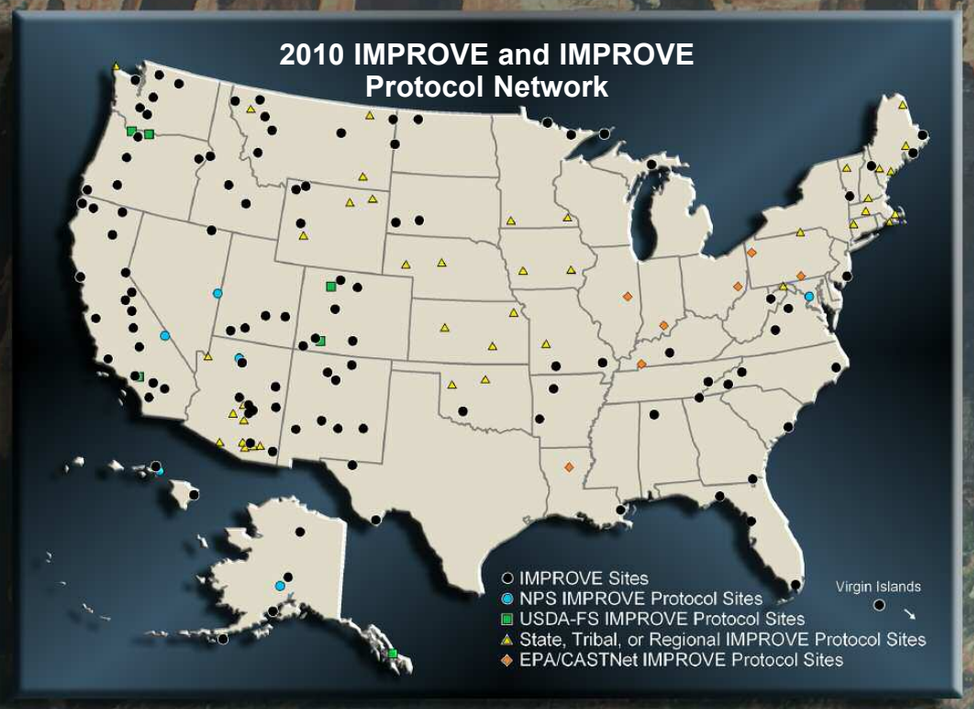
The IMPROVE (Interagency Monitoring of Protected Visual Environments) program consists of 110 aerosol visibility monitoring sites selected to provide regionally representative coverage and data for 155 Class I federally protected areas. Additional instrumentation that operates according to IMPROVE protocols in support of the program includes

- 57 aerosol samplers,
- 20 nephelometers,
- 2 transmissometers.
- 70 Webcam systems,
- 5 interpretive displays,

Data and photographic spectrums are available on the IMPROVE Web site at http://vista.cira.colostate.edu/improve/Data/data.htm and on the VIEWS Web site at http://vista.cira.colostate.edu/views. Aerosol data are available through September 2009. Nephelometer and transmissometer data are available through March 2010 and December 2009, respectively. Webcamera real-time images and data are available on agency-supported Web sites:

Visibility Information Exchange Web System:
http://views.cira.colostate.edu/web/
National Park Service: http://www.nature.nps.gov/air/WebCams/
USDA-Forest Service: http://www.fsvisimages.com
CAMNET (Northeast Camera Network): http://www.hazecam.net
Midwest Haze Camera Network: http://www.mwhazecam.net
Wyoming Visibility Network: http://www.wyvisnet.com
Phoenix, Arizona Visibility Network: http://www.phoenixvis.net

The Environmental Protection Agency (EPA) AIRNow Web site http://airnow.gov includes many of these as well as additional visibility-related Webcameras. Click on View Other Visibility Webcams.



Network Notes

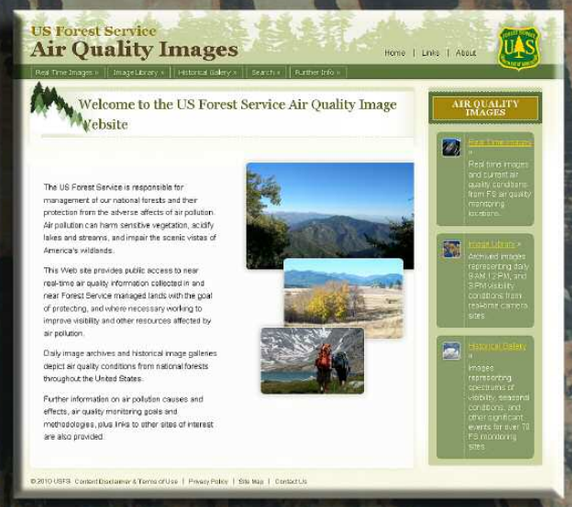
In September 2010 the U.S. Environmental Protection Agency celebrated the 40th anniversary of the signing of the Clean Air Act Amendments, a landmark piece of legislation that has led to significant environmental and public health benefits across the United States. The Clean Air Act was signed by President Richard Nixon on December 31, 1970. By 1990, the clean air acts helped prevent more than 200,000 premature deaths and almost 700,000 cases of chronic bronchitis. Over the last 20 years, total emissions of the six principal air pollutants have decreased by more than 41 percent.

Also in 2010, the IMPROVE national air quality monitoring program marked 25 years of operation. This extensive air monitoring program was implemented in 1985 to establish the current visibility conditions, track changes in visibility, and determine the causes and mechanisms for visibility impairment in national parks, wilderness areas, wildlife refuges, and tribal lands across the nation. The data are used to determine compliance with the National Ambient Air Quality Standards and to assess national and regional air pollution control policies. The IMPROVE dataset provides vital information to Congress, air pollution control agencies, academia, and the public.

The National Park Service Air Resources Division (NPSARD) in Denver, CO, maintains a Digital Webcamera Network with Web sites that provide real-time photographic images and current air quality and weather information. Sixteen Web sites have been redesigned to encourage visitors to learn more about air quality and impacts on national parks. The redesign incorporates new navigation bars and tabs for easier access to a variety of air quality information. To learn more, visit http://www.nature.nps.gov/air/WebCams.

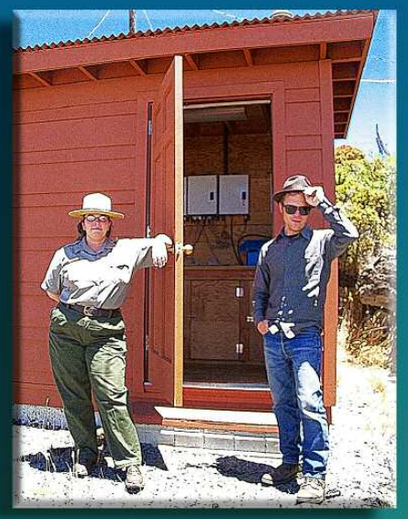
Scientists from the U.S. Environmental Protection Agency are studying the air quality effects of the Deepwater Horizon oil spill in the Gulf of Mexico, and have asked IMPROVE scientists for early access to the carbonaceous aerosol data from the Gulf region. Laboratory staff at the University of California-Davis and at the Desert Research Institute have been expediting the shipment and analysis of filters from several IMPROVE sites along the Gulf Coast. The Breton Island monitoring site is located 120 miles north of the Deepwater Horizon Well. Daily patrols of air, boat, and ground traffic are part of the spill cleanup efforts in the area. Tar balls have been recovered near the monitoring site.

The USDA Forest Service has a newly designed Web site that hosts 20 monitoring sites from which images are collected and posted. The new Web site has been completely rewritten to improve its speed and add features. It can be found at http://www.fsvisimages.com.



The U.S. Environmental Protection Agency Office of Radiation and Indoor Air manages an environmental laboratory to perform annual quality assurance studies of laboratories doing speciation filter analysis. The University of California-Davis (UCD), Desert Research Institute (DRI), and Research Triangle Institute (RTI) laboratories routinely participate in these studies as a quality assurance measure. Results from the 2009 study to evaluate laboratory performance are now available at http://www.epa.gov/ttn/amtic/pmspec.html.

Haleakala National Park, Hawaii



Isolated in the mid-Pacific, the Hawaiian Islands are the most remote major island group on earth. They were formed as the Pacific plate moved across a volcanic "hot spot" within the earth's mantle. Lying 2,400 miles from the nearest continent, they have never had connection to any other land mass. Accidental arrivals of various life forms, isolated from mainland populations, took strange courses of adaptation and allowed a unique biota to develop. Haleakala NP has more endangered species than any other park in the NPS, even including species that are listed as endangered but not native to the park.

Haleakala operates two air quality sites; one in the Crater District near the arid summit, and the other located within the rain belt on the northeastern slopes of the volcano. Under normal conditions, northeasterly trade winds blowing straight onto Maui give Haleakala some of the cleanest air in the world. However, Maui lies between one of the most active volcanoes in the world and the city of Honolulu, both of which affect air quality. Sugar cane burning also affects local conditions. Five other islands in the Hawaiian archipelago are observable from the summit on a good day, while on a bad day acrid fumes burn eyes and cause headaches and respiratory problems for many visitors.

The two sites are maintained by Jessica Mjelde, Ross Hart, and Russell Shurtz. Ross had been the primary operator for nearly a decade, but with his coming retirement, responsibilities were switched to Jessica, who loves the weekly drive through the woods out to the remote station.

January

Which is the most visited park in the National Park System: Acadia, Grand Canyon, Great Smoky Mtns., or Yellowstone?

Flip up the lower half of calendar to see the answer on the back cover.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
◆ Check temperature at setup to assure it is within 10° C of outdoor temperature. Dec 2010: S M T W T F S / 1 2 3 4 / 5 6 7 8 9 10 11 / 12 13 14 15 16 17 18 / 19 20 21 22 23 24 25 / 26 27 28 29 30 31 Feb 2011: S M T W T F S / 1 2 3 4 5 / 6 7 8 9 10 11 12 / 13 14 15 16 17 18 19 / 20 21 22 23 24 25 26 / 27 28 ◆ Call UC Davis at 530-752-1123 to figure out how holidays affect sample change schedules.						**1** *1 Julian day* New Year's Day
2 *2*	**3** *3* IMPROVE particle sampling day	**4** *4* Change IMPROVE particle cartridges.	**5** *5*	**6** *6* IMPROVE particle sampling day	**7** *7*	**8** *8*
9 *9* IMPROVE particle sampling day	**10** *10*	**11** *11* Change IMPROVE particle cartridges.	**12** *12* IMPROVE particle sampling day	**13** *13*	**14** *14*	**15** *15* IMPROVE particle sampling day
16 *16*	**17** *17* Martin Luther King, Jr. Day	**18** *18* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**19** *19*	**20** *20*	**21** *21* IMPROVE particle sampling day	**22** *22*
23 *23*	**24** *24* IMPROVE particle sampling day	**25** *25* Change IMPROVE particle cartridges.	**26** *26*	**27** *27* IMPROVE particle sampling day	**28** *28*	**29** *29*
30 *30* IMPROVE particle sampling day	**31** *31*					

UC Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

Operator Involvement -- The Key to Network Success

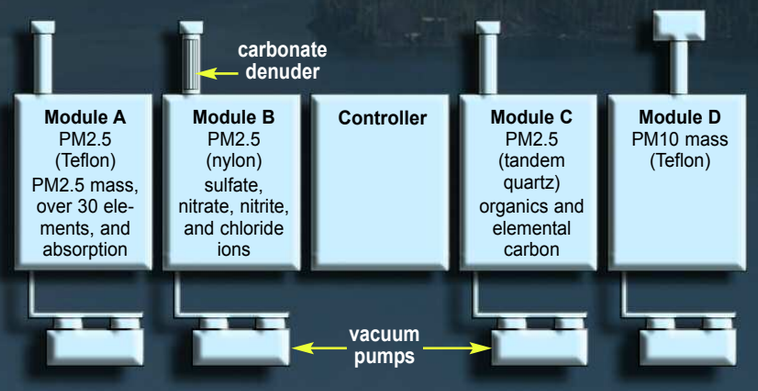
The IMPROVE Aerosol Sampler Past and Present

The original 20 IMPROVE network sites employed the version I IMPROVE aerosol sampler beginning in early 1988. The original sampler consisted of four independent filter modules connected to a common controller module utilizing independent air streams with separate sizing devices, critical orifice flow controllers, and pumps. Each module had solenoids for exposing up to four filters between changes.

The version I sampler operated very reliably, with minimal downtime, but several factors led to a need for modifications. Microprocessor technology had advanced greatly from 1987 to 1999, and the change to a 1-day-in-3 protocol required replacement of the weekday oriented clock. In addition, parts for the version I samplers were not readily available and existing sites were due for replacement, having been in the field for up to a decade. By shifting all samplers to version II at this point, a uniform network could be maintained. Cassettes, now used for twenty years, had been discontinued by the manufacturer which opened avenues for improving the way filters were handled in the laboratory and in the field.

The new version II sampler design promoted easier maintenance and servicing, and incorporated a new controller with microprocessor and new filter cassettes. This sampler was also more than capable of handling several new requirements requested by the EPA. These requests included integrating collected data with the national particulate matter (PM) monitoring program – which required the monitoring schedule to change to a 1-day-in-3 operation starting in 1999. All past and future data were to be provided to the EPA AIRS (now AQS - Air Quality System) database, and a portion of monitoring sites were to include routine, collocated sampling to allow precision and accountability assessments.

The IMPROVE Aerosol Sampler Today



Although retrofits were made to the basic sampling system, it is important to note that the fundamental measurements remained unchanged. Since 1999 the standard version II IMPROVE aerosol sampler has been used throughout the network and in all IMPROVE protocol sites, maintaining network continuity and providing a basis for direct comparisons of data spanning 25 years.

The IMPROVE sampler is designed to obtain a complete signature of the composition of the airborne particles affecting visibility. PM2.5 (fine) particles are collected on Teflon, nylon, and quartz filters; and PM10 particles on a Teflon filter. Each filter is in a separate module. The PM10 module is on the right with the larger inlet head. The inlets are normally 24 inches apart. The controller module is the center box with no inlet.

The version II IMPROVE aerosol sampler consists of:

- a controller module that contains a microprocessor to start and stop sample collection and record the flow rates for each module continuously,
- three PM2.5 modules (A, B, C) -- fine particles 2.5 microns and smaller,
- one PM10 module (D) -- larger particles 10 microns and smaller, and
- four vacuum pumps to provide air flow through the filters.

IMPROVE samples are intended to be collected under conditions as close to ambient temperature as possible.

IMPORTANT: Valid Measurements

A visibility impairment value is calculated for each sample day. To get a valid measurement, all four modules must collect valid samples. The Regional Haze Regulation uses the average visibility values for the clearest days and the worst days. The worst days are defined as those with the upper 20% of impairment values for the year, and the clearest days as the lower 20%. The goal is to reduce the impairment of the worst days and to maintain or reduce it on the clear days. For your site's data to be considered under the regional haze regulations, criteria have been set to determine the minimum number of daily samples needed to have a valid year. Because concentrations of the groups vary seasonally, there are both annual and seasonal criteria. The criteria are:

- 75% of the possible samples for the year
- 50% of the possible samples for each calendar quarter must be complete.
- No more than 10 consecutive sampling periods may be missing.

From January to November 2010, sample recovery was about 94%. Reasons for the 6% sample losses were due to the following causes:

- 34% equipment problems,
- 31% no sample taken (because of operator absences),
- 20% power outages,
- 9% bad installation,
- 5% sample damage, and
- 1% site offline.

Shenandoah Natl. Park, Virginia, seen in a broad spectrum of visibility levels

Mt. Zirkel Wilderness Area, Colorado

In the high country of Colorado, **Nicolai Bencke** motors up the eight miles to the IMPROVE monitoring site in Routt Natl. Forest – sometimes by truck, and sometimes by snowmobile in some of the deepest snows in Colorado. Good snowmobiles are a must.

Visibility is very good and the weather is sunny much of the year at the lower altitudes, but he says the micro-climates of the higher altitudes, such as around Buffalo Pass, can produce hammering snow while the sun is still shining down below in Steamboat Springs. The town is dependent on tourists and skiers, and so depends upon clean, clear air for its appeal as a key destination resort. Also, the surrounding forests, already under widespread pine beetle attack, do not need smog and other pollutants to make it any harder on them to survive.

The main pollution sources in the area are coal-fired power plants located in Hayden and Craig, about 30 and 50 miles west of town respectively. Although the retrofitting and scrubbers installed in those plants since the environmental lawsuits a couple of decades ago seem to have helped significantly, monitoring continues nonetheless. Other pollution comes from cars, construction, and fires (wild and prescribed).

Nicolai's main job is making maps as a GIS Specialist for the Forest Service in Steamboat Springs. He's also on a Rocky Mtn. Incident Management Team (Type II, Team B) to fight wildfires in a five-state Rocky Mountain area as a GISS.

Nicolai grew up in southern California and Scandinavia, has a BA from UC-Santa Barbara in geography and environmental studies, and has spent 15 years in Colorado with the Forest Service in Steamboat Springs. Married with no children, he enjoys mountain biking, skiing, hockey, playing his guitar, and traveling with his wife on biking and skiing adventures. He enjoys working for IMPROVE, saying, "I get to leave the office once a week guaranteed and either snowmobile to the site or take a nice scenic truck drive up there. It's a great place to see all the seasons changing. I see some great wildlife every once in a while (four moose yesterday -- two males fighting right in front of us). Good times!"

February

Which is the newest national park: Congaree, Big Bend, Mount Rainier, or Great Sand Dunes?
Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941		**1** *32 Julian day* Change IMPROVE particle cartridges.	**2** *33* Groundhog Day IMPROVE particle sampling day	**3** *34*	**4** *35*	**5** *36* IMPROVE particle sampling day
6 *37*	**7** *38*	**8** *39* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**9** *40*	**10** *41*	**11** *42* IMPROVE particle sampling day	**12** *43* Lincoln's Birthday
13 *44*	**14** *45* Valentine's Day IMPROVE particle sampling day	**15** *46* Change IMPROVE particle cartridges.	**16** *47*	**17** *48* IMPROVE particle sampling day	**18** *49*	**19** *50*
20 *51* IMPROVE particle sampling day	**21** *52* Presidents Day	**22** *53* Washington's Birthday Change IMPROVE particle cartridges.	**23** *54* IMPROVE particle sampling day	**24** *55*	**25** *56*	**26** *57* IMPROVE particle sampling day
27 *58*	**28** *59*					

Jan 2011

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Mar 2011

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

- Electrical connections (e.g., extension cords) exposed to wet conditions should be GFCI protected.
- Watch for frost on the inlets.
- Watch for lightning damage.
- Check site conditions (e.g., a tree growing beyond acceptance criteria).

Operator Involvement -- The Key to Network Success

Filters

Filters cycle through several processes before they reach the monitoring site and after they return to the University of California, Davis.

Pre-Shipping...

1. Clean A and D module filters are pre-weighed on a balance. Clean B and C module filters are simply placed in a cassette without being weighed. This is called uploading.

2. The uploader weighs the A and D filters. Each filter has an ID according to the site it will be sent to and the date that the filter will be used. Each A and D filter's weight is automatically recorded in a database.

3. After the box has been uploaded, the work is double-checked. This is the final process before the box is shipped out.

After Return From the Field...

4. After the log sheets and flashcards are removed from the box, the data in the flash card is read and automatically placed into a database.

5. After the flash card is read into the database, its data is compared to the data written on the log sheets. Any problems a box might have are dealt with at this point.

6. The B and C filters are placed in a petri dish with the corresponding identification sticker.

7. The B and C petri dishes are placed in trays in a particular order generated by the database.

8. After the B and C filters are downloaded, the box moves on to the post-weighing station where the sampled A and D filters are weighed.

9. After post-weighing, the filter is stored in a pre-labeled slide mount for later analysis.

10. After downloading the B and C filters and post-weighing the A and D filters, the box is placed back at the uploading station to start the process again.

The first step in correctly diagnosing and solving any problem is to call UCD's General Lab at (530) 752-1123. No problem is too small, and a correct diagnosis is more likely to be made.

Has a filter or cartridge been dropped?

The cartridges are well protected, and unless the operator is physically forcing air through the media, there should be no immediate problem. Pay careful attention to any fluctuation in the normal readings on that particular set of filters. As with any significant event, note it on the log sheet and detail what occurred. Notify UCD about any questions or concerns.

What if the filter gets wet?

Although this can significantly affect the sample, UCD may or may not be able to send a replacement. Call the lab so that UCD can deal with it properly and note it on the log sheet.

Missed changing filters on the regular Tuesday?

Immediately call UCD to get instructions before proceeding with the sample change. Experienced operators should still call UCD to advise of any deviation in the sample changing schedule.

* **If there are remaining sampling days in the week:** Remove the exposed filters as would normally be done, and put in the clean filters that were to have been installed on the last change day. Make a note on the log sheet.

* **If the week is completely missed:** Remove the exposed filters as would normally be done, but do not put in the filters for the missed change day. Keep these in the shipping box, and send them back to UCD when both weeks in that box have passed. Install the appropriate filters for the current week. Make a note on the log sheet of the filters that were not installed.

Trouble with the "red button"-controlled motors?

Sometimes when the weather turns cold, the electric motor that raises and lowers the solenoids works very slowly. If this occurs, or if the red buttons fail to work for any reason, follow these steps:

Modules A-C:
The motor is located in the top right area.

1. Disengage motor by gently pushing down on the top of the motor.

2. "Lockout" the motor by rotating it toward the solenoids.

3. Raise and lower the solenoids by turning the handwheel at the top of the module.

Module D:
The motor is located in the bottom left area.

1. Disengage motor by gently pushing up on the bottom of the motor.

2. "Lockout" the motor by rotating it toward the solenoids.

3. Raise and lower the solenoids by turning the handwheel at the bottom of the module.

For questions or problems with:

When a problem is identified with the sampler, first note the issue on the logsheet. The first step in correctly diagnosing and solving any problem is to call the UC Davis sample-handling laboratory at 530-752-1123 (fax: 530-752-4107; e-mail fieldops@crocker.ucdavis.edu). If possible, call from the site to facilitate troubleshooting.

Dome Land Wilderness Area, California

Sherry Montgomery is the IMPROVE sampler operator in this rather remote and often windy, high desert area full of sage brush and Joshua trees. Summertime highs can reach 115 degrees, and winter lows can dip down to 15, with occasional snow. The wind often kicks up dust, which can be a problem, and smoke from fires in the surrounding area has a tendency to hang in the valley around Onyx.

The samplers are located at the BLM Station near Onyx in central California, which is approximately 30 miles from Sherry's office in Kernville. She describes the main challenge of the job for her as simply getting there every week. Kathy Baker is her backup, but on some Tuesdays when Sherry can't make it out there, Kathy is not always available to take over.

Sherry has worked for the Forest Service since 1991, starting out on the trail crew, then becoming an administrative assistant for awhile. She now supervises the visitor information desks in Kernville and at the Blackrock Ranger Station and is in charge of the fuel wood permit program in the district, where she tracks and audits timber sales and collects and processes campground fees.

She says, "I have five children, four grown and a ten-year-old. I also have several wonderful grandchildren. I live in Mt. Mesa, California, with my 10-year-old daughter, two dogs, three cats, two guinea pigs, two cockatiels, one rabbit -- and whatever other animal needs a home at the time."

Sherry likes to hike, ride dirt bikes, travel, and practice photography. She adds, "We go to Cancun every other year and Hawaii in between. I have a daughter and granddaughter who live on the big island, so we try to visit at least twice a year." Occassionally they'll also take a cruise.

March

Which national park has banned nearly all vehicles from its roads during peak season? Joshua Tree, Olympic, Yosemite, or Zion?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Feb 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28		**1** *60 Julian day* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**2** *61*	**3** *62*	**4** *63* IMPROVE particle sampling day	**5** *64*
6 *65*	**7** *66* IMPROVE particle sampling day	**8** *67* Change IMPROVE particle cartridges.	**9** *68*	**10** *69* IMPROVE particle sampling day	**11** *70*	**12** *71*
13 *72* Daylight Savings Time begins IMPROVE particle sampling day	**14** *73*	**15** *74* Change IMPROVE particle cartridges.	**16** *75* IMPROVE particle sampling day	**17** *76* St. Patrick's Day	**18** *77*	**19** *78* IMPROVE particle sampling day
20 *79*	**21** *80*	**22** *81* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**23** *82*	**24** *83*	**25** *84* IMPROVE particle sampling day	**26** *85*
27 *86*	**28** *87* IMPROVE particle sampling day	**29** *88* Change IMPROVE particle cartridges.	**30** *89*	**31** *90* IMPROVE particle sampling day	Apr 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	

Of Interest to Operators...

IMPROVE field operations benefit from understanding the issues identified during the field audit process. The issues outlined here are under site operator control, and awareness of these potential problems will improve overall data quality, decrease data loss, and aid troubleshooting field operations.

Operator Observations

- Inspect sampler inlets every three months for insect infestations in the sampler inlet, flies in the module or released from cassette upon removal, and spider webs.
- Rodent infestation may occur, especially in fall and winter. Check wires and tubing for damage.
- Verify that the calibration plug is seated (at bottom of T-fitting where the inlet tube enters) in every module. Check at each filter exchange.
- Check the temperature at each setup to assure it is within 10 degrees C of outdoor temperature.
- Clocks should be reset when they vary by ±5 minutes or more.
- In November, December, and January, operators should call UC Davis (530-752-1123) to properly determine how the holidays will affect their sample change schedules in order to not lose samples.

At three sites last year, UC Davis technicians flew out on emergency trips to repair equipment. In all three cases the problem was that debris of some sort had managed to get into the air stream and clog the air flow valve. Debris was getting through from the open manifold when operators make their sample change. Specific problems at sites included rat feces clogging the air stream, a spider web and fly in the cyclone, and a sticker from the filter cartridge which had fallen off and landed perfectly on the manifold and clogged one of the channels. Modules need to be kept clean and free of debris. The maintenance teams clean the enclosures (out and in), but this is done only once a year. Operator help with this effort is appreciated.

Another problem that manifested this year was rodents chewing electrical cables or pump hoses. Recently, squirrels have chewed cables at Hance Camp and Indian Gardens at Grand Canyon NP, AZ. At Indian Gardens, the operator used a PVC sheath to cover the cables, and at Hance Camp, the pumps were moved from an outdoor enclosure to an indoor.

Checking Value Ranges and Reporting Problems

It is important to be mindful of the values that get written down on the log sheets, and what those values mean. In one case a value of 10.0 for the MxVAC value was recorded for five weeks straight but not reported to UC Davis technicians. One of the pumps had failed but it was not discovered until 12 consecutive samples were lost.

The log sheet template is a guide to help operators recognize a problem that requires immediate mitigation. The values chosen are deliberately broad because there is no tight band that will represent all sites. The log sheet values are affected by different versions of electronic equipment, as well as the site's elevation. For example, most sites under 5,000 feet will have a MxVAC value of 40 which represents the maximum vacuum of an ideal pump. The same pump will have an optimum value of 32 if it is at 10,000 feet like at Wheeler Peak, NM, or White River Natl. Forest, CO. For this reason a minimum value of 31 was chosen. The ET values are the same for all sites. "ET" means elapsed time in minutes. They should all be 1440, which corresponds to a 24-hour sampling period. The exception is position three (which is the sample that runs on Tuesdays) which can be shorter because operators typically interrupt this sample when they do their filter changes on Tuesdays.

In 2011 a sample log sheet for each site with their unique ranges will be left with all operators. Details are still being worked out as to location and type of list. This check is expected to become a standard procedure. The hope is that response time to address faulty equipment will become much less if operators alert us to aberrant data as they discover it.

Logsheet Template.txt

IMPROVE Network Field Log
3217
INSTALL ON --> | ACAD1 10/05/2010 |
Preweighed by: JM
09/22/2010
FC# 2,654,200

				INITIAL READINGS			FINAL READINGS			
Operator Initials____ Date:___/___/___ Time:_____							Init____ Date:___/___/___ Temp____ Time:_____			
SamDate		(Ori) MxVac	Cass	Ori Vac	Cyc Mag		Ori Vac	Cyc Mag	ET	
10/08/2010	Fri		1	>=11	12-24		>=11	12-24	1440	
Mod A >30										
10/11/2010	Mon		2	>=11	12-24		>=11	12-24	1440	
10/05/2010	Tue		3	(>=11)	(12-24)		>=11	12-24	1080	
10/08/2010	Fri		1	>=12	12-24		>=12	12-24	1440	
Mod B >30										
10/11/2010	Mon		2	>=12	12-24		>=12	12-24	1440	
10/05/2010	Tue		3	(>=12)	(12-24)		>=12	12-24	1080	
10/08/2010	Fri		1	>=13	12-24		>=13	12-24	1440	
Mod C >30										
10/11/2010	Mon		2	>=13	12-24		>=13	12-24	1440	
10/05/2010	Tue		3	(>=13)	(12-24)		>=13	12-24	1080	
10/08/2010	Fri		1	10 or 11	4-5		10 or 11	4-5	1440	
Mod D >30										
10/11/2010	Mon		2	10 or 11	4-5		10 or 11	4-5	1440	
10/05/2010	Tue		3	10 or (11)	(4-5)		10 or 11	4-5	1080	

Always Orient each Cartridge Plate as per Instructions on each Door

Lab Use Only | Comments - For Help Call (530) 752-1123
42.219 41.799 | (Please note anything abnormal)
41.032 41.507 |

In Case of Emergency

Operators should first call the UC Davis Air Quality Group (AQG) lab (530-752-1123) and inform personnel of the situation. If they cannot contact a technician, they should leave a message with pertinent information including:

1. operator's name,
2. site name (printed on the side of each filter box),
3. operator's phone number, and a
4. brief description of the situation.

Assess the situation. If there is any possibility of danger, do not attempt to visit the site. If it is safe to approach the site, it is preferred that the equipment be removed and stored in a secure and dry area. Note that in order to remove the equipment, a 5/32" and/or 1/8" hex L-key (Allen wrench) is required.

The equipment is very heavy; modules weigh 45 lbs, while pumps weigh 22 lbs, so be careful when lifting them. The following steps will help ensure safe removal of the equipment:

1. If time allows, run through final filter readings as if it were a normal Tuesday sample change. Leave the filters in the modules; they will provide support to the inner structure during transportation.
2. After taking final readings, disconnect the power cord to the controller.
3. If the site's breaker is accessible, turn it off.
4. Disconnect all cables and vacuum hoses from underneath the modules and controller.
5. Remove stacks by loosening the stack collar. The D module stack will have an internal brace that needs to be loosened with the 5/32" Allen wrench.
6. Use the Allen wrench to free the module from the top bracket. This will allow the module to swing down and come off the wall.
7. Remove the pumps by first disconnecting all vacuum hoses and power cables.
8. If time allows, remove all cables and hoses. Some cables may be anchored to the stand or shed.
9. Contact the UC Davis AQG lab at the earliest convenience.

Lassen Volcanic National Park, California

April

Which is the only state without a National Park Service area of some kind? Delaware, Illinois, Rhode Island, or Mississippi?

Flip up the back cover for the answer.

Located in northeastern California, Lassen Volcanic National Park is home to a diverse array of species that inhabit ecosystems ranging from lower-elevation mixed conifer forests to high-elevation alpine areas that surround Lassen Peak. The park's active geothermal sites draw many tourists, as does the opportunity to climb Lassen Peak (10,457 ft.), whose spectacular 1915 eruption is responsible for the area's designation as a national park.

Scenic vistas and fresh air are very important for visitors who come long distances to climb the peak. The park currently has very good air quality and visibility; however, impacts resulting from both smog and light pollution are evident, and park staff is very concerned about deterioration of the park's air quality as development from the nearby northern Sacramento Valley continues.

Since the park road is closed in winter due to heavy snow, getting to the site involves a 3-hour round trip around the park's western boundary, and then some snow-shoveling at the site. Power outages are also common in the area in the winter, which receives between 4 and 5 feet of snow.

Nancy Nordensten is the primary station operator and is the park's biologist. Her other responsibilities include overseeing the park's Geographical Information System (GIS) and inventory and monitoring programs, and monitoring of aspen, pika, bufflehead duck broods, and songbirds. She enjoys working at Lassen and considers the air quality monitoring as providing "one of the best, long-term datasets we have, well worth collecting." When not working, Nancy enjoys backpacking, hiking with her dog, and harassing her cat.

Mike Magnuson (on the right) is one of two backup operators. He is the park's wildlife biologist and expert in identifying bird calls, and conducts wildlife inventories, oversees research permit requests, operates the park's songbird banding station, conducts pest management in the park's developed areas, and is an avid fisherman.

Jon Arnold (left) has been the park's second backup operator and will be the primary operator in 2011. He initiated the park's inclusion into both the CastNet and NADP networks. Currently, he is the park's forester and oversees forest health and pest management. He is a dedicated backpacker and desert lover.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941	◆ Check for insect infestations in spring and summer (e.g., mud daubers in sampler inlet and spider webs). ◆ Check for melting ice on tops of sampler modules.	Mar 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	May 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1 *91 Julian day*	2 *92*
3 *93* IMPROVE particle sampling day	4 *94*	5 *95* Change IMPROVE particle cartridges.	6 *96* IMPROVE particle sampling day	7 *97*	8 *98*	9 *99* IMPROVE particle sampling day
10 *100*	11 *101*	12 *102* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	13 *103*	14 *104*	15 *105* IMPROVE particle sampling day	16 *106*
17 *107*	18 *108* IMPROVE particle sampling day	19 *109* Change IMPROVE particle cartridges.	20 *110*	21 *111* IMPROVE particle sampling day	22 *112*	23 *113*
24 *114* IMPROVE particle sampling day	25 *115*	26 *116* Change IMPROVE particle cartridges.	27 *117* IMPROVE particle sampling day	28 *118*	29 *119*	30 *120* IMPROVE particle sampling day

Operator Involvement -- The Key to Network Success

Benefits of a National Air Quality Monitoring Network

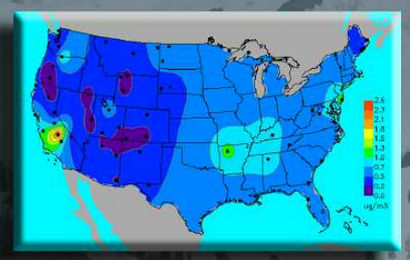
The network consists of 110 sites chosen to represent 155 of the 156 visibility-protected federal Class I national parks and wilderness areas. Management of the network is overseen by a 10-member, federal and regional steering committee. Fifty additional IMPROVE protocol sites operate identically to network protocols but are sponsored by federal, state, and tribal organizations.

IMPROVE samplers are designed to obtain a complete signature of the composition of the airborne particles that affect visibility and other air quality related values. Aerosol data are analyzed for major aerosol species and trace elements and are a key component of the EPA's national fine particle monitoring. Network measurements are critical to tracking progress related to the regional haze regulations. The benefits of a national monitoring network are important and diverse, proving that the sum of the parts is greater than the whole.

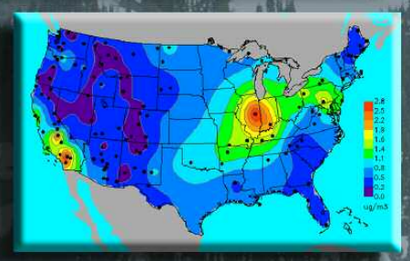
Benefit 1: Ability to Track Large Spatial and Long-term Temporal Trends

Without the benefit of national coverage and long-term data collection, the large Midwestern nitrate sources might have gone undetected.

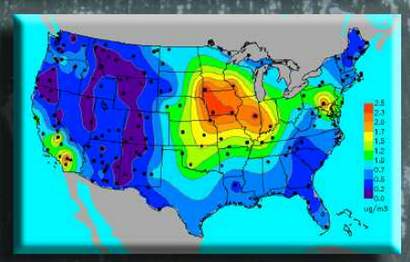
Nitrate was principally seen as a rural Southern California phenomenon in 2000.



New sites in the center of the country show a bulge centered on Illinois in 2002.

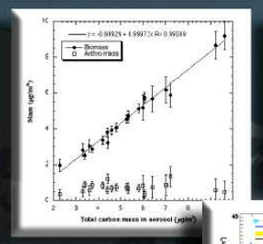


Additional Midwestern sites in 2004 show the full extent of the rural nitrate bulge, which dominates winter PM2.5 and seems to coincide with the region of high ammonia emissions.

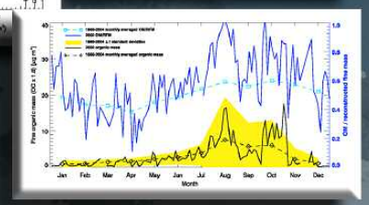


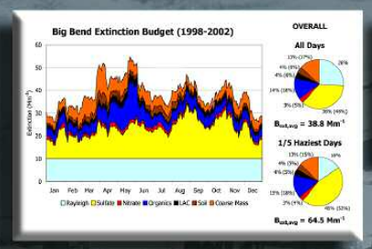
Benefit 2: Provides Context to Smaller-scale, Short-term Air Quality Studies

What causes the high organics at sites on the west slopes of the Sierra Nevada Mtns.?

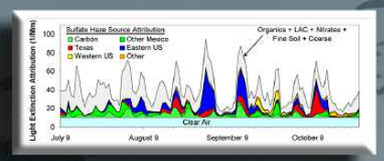


A special study conducted during the period of historically high organic mass at Yosemite shows that the carbon is mostly recent, not fossil.

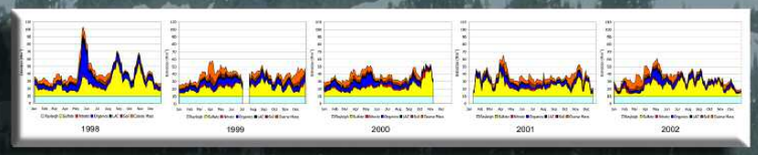




At Big Bend NP, multiyear composite data was used to help select the study period (July - October).

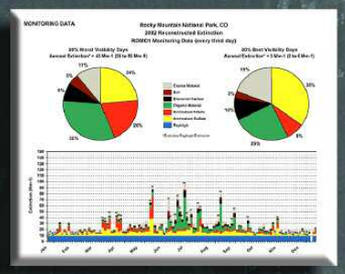


Attribution modeling showed that some source regions contribute in short term episodes, causing large haze peaks.

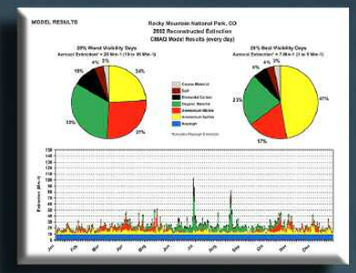


Data from individual years demonstrate a large degree of interannual variability used to provide long-term context for this four-month study.

Benefit 3: Consistent Datasets for Use in Regional and Continental-Scale Source and Receptor Modeling



Comparisons of IMPROVE measured data and computer-simulated haze by aerosol component are used to demonstrate model performance. Regional planning organizations conduct similar assessments for all rural IMPROVE monitoring sites.



Benefit 4: Infrastructure to Investigate and Refine Monitoring Methods and Data Quality

Mud daubers and other insects made homes in the original IMPROVE sampler inlet cap. This adversely affected data for a few monitoring sites. The original IMPROVE sampler design made it hard to inspect and clean the inlet caps.

A new, easily-inspected and cleaned inlet cap was designed for the version II IMPROVE samplers deployed during the network expansion in 1999. A screen to help keep the insects out has been added without adversely affecting aerosol collection efficiency.

Benefit 5: Consistent and Accessible Ambient Data and Methods Documentation

The IMPROVE Website is the primary information dissemination tool for the IMPROVE program. All data is reviewed, compiled, validated, and maintained on the IMPROVE Website along with a summary of any data anomalies or other findings. It is a public archive of:

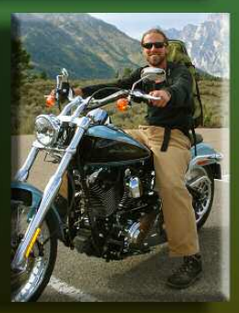
- gray literature, data advisories, newsletters, meeting summaries;
- SOPs and quality assurance documents and special study reports;
- IMPROVE reports, publications, and other presentations using IMPROVE data;
- raw and processed data, data summaries, and display graphics;
- location maps and photos; and
- equipment, site, and program histories.

Lye Brook Wilderness Area, Vermont

Lye Brook Wilderness is located on Little Equinox Mountain, elevation 3310', east of the Green Mtns., within the Taconic mountain range. The land is owned by the Charter House of the Transfiguration, the only Carthusian monastery in North America. Access to the IMPROVE samplers is via a seasonally-open and very scenic Skyline Drive toll road up Mt. Equinox. It's not maintained in winter, so access is often by snowshoe during the winter months. The Forest Service has also established 15 long-term study plots in Green Mtn. Natl. Forest, and will establish 5 more next year. Ten-year checks will be at each site for changes in soil vegetation over the next fifty years.

Keith Sargent obtained a bachelor's degree in wildlife management from the University of New Hampshire, and began working in 2003 for five seasons for the Forest Service in Helena Natl. Forest as a wildland firefighter. He moved back to Vermont in 2008 and became a seasonal wildlife and fisheries biological technician in the Green Mtn. Natl. Forest until he accepted his current position as visitor services information assistant in 2009. He is still actively involved in the forest's wildlife, fisheries, and fire programs, and has hopes of advancing his career within at least one of these fields.

He spent much of his childhood on his grandparents' farms in Vermont's Pawlet Valley. He says "I was the first in my family to complete college, and my career made it possible for me to see much of the country." He enjoys the variety of his work in the wildlife, fisheries, and fire fields, which has given him opportunities to hand-rear white-tailed deer fawns, track radio-collared moose, stock Atlantic salmon, electrofish, work on various habitat restoration projects, and respond to natural disasters.



Keith enjoys the outdoors, spending time with family and friends, traveling, riding his motorcycle, hunting, fishing, and hiking.

May

Which of the following exists within the boundaries of a national park: the highest point in North America, the longest cave system in the world, the deepest lake in the U.S., or all of these?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 *121 Julian day*	**2** *122*	**3** *123* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**4** *124*	**5** *125*	**6** *126* IMPROVE particle sampling day	**7** *127*
8 *128* Mother's Day	**9** *129* IMPROVE particle sampling day	**10** *130* Change IMPROVE particle cartridges.	**11** *131*	**12** *132* IMPROVE particle sampling day	**13** *133*	**14** *134*
15 *135* IMPROVE particle sampling day	**16** *136*	**17** *137* Change IMPROVE particle cartridges.	**18** *138* IMPROVE particle sampling day	**19** *139*	**20** *140*	**21** *141* Armed Forces Day IMPROVE particle sampling day
22 *142*	**23** *143*	**24** *144* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**25** *145*	**26** *146*	**27** *147* IMPROVE particle sampling day	**28** *148*
29 *149*	**30** *150* Memorial Day (Observed) IMPROVE particle sampling day	**31** *151* Change IMPROVE particle cartridges.				

Apr 2011

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Jun 2011

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

UC Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

Collaboration Between IMPROVE Agencies

1985-1992

Winter Haze Intensive Tracer Experiment (WHITEx) assessed visibility impacts of an isolated pollutant source (Navajo Generating Station) on Glen Canyon Natl. Rec. Area and the Grand Canyon, Bryce Canyon, and Canyonlands national parks. Aerosol samplers and transmissometers were field tested before becoming standard instruments in the IMPROVE network.

WHITEx (1987-1990)

This photographic study used 35 mm still-frame and 8 mm movie cameras to document visible plume impacts from a pulp and paper mill 5 miles upwind of the Moosehorn National Wildlife Refuge (NWR).

Moosehorn (1989)

The Navajo Generating Station (NGS) Visibility Study was conducted by the Salt River Project, operators of NGS, in 1990. Its purpose was to address visibility impairment in Grand Canyon NP during the winter months and the levels of improvement that might be achieved if SO_2 emissions from NGS were reduced.

NGS (1990)

Pacific Northwest Regional Visibility Experiment (PReVEnt) used natural tracers at 34 sites in Washington and Oregon to investigate the contribution of emission sources to ambient particulate concentrations and regional haze in Class I areas in Washington state.

PReVEnt (1990)

The Shenandoah study was designed to assess eastern aerosols and their effect on visibility under high relative humidity conditions.

Shenandoah (1991)

Project Measurement of Haze and Visibility Effects, more commonly referred to as Project MOHAVE, was designed to determine the extent to which the Mohave Generating Station (Laughlin, NV) contributed to visibility impairment at the Grand Canyon.

MOHAVE (1992)

1993-2002

Southeastern Aerosol and Visibility Study (SeAVS) was a collaborative research effort at Great Smoky Mountains NP to characterize rural aerosols in the southern U. S. and determine the contribution of major aerosol constituents, including water, to the total particle mass and light extinction.

SeAVS (1995)

The Mt. Zirkel Reasonable Attribution Visibility Study included aerosol, visibility, and meteorological measurements collected throughout the Yampa Valley in northwestern Colorado to determine the extent of visibility impairment in the Mt. Zirkel Wilderness Area and assess whether it could be reasonably attributed to emissions from one or more sources.

Mt. Zirkel Reasonable Attribution Visibility Study (1995)

BRAVO (1999)

The Big Bend Regional Aerosol and Visibility Observational Study-(BRAVO) was designed to understand the long-range, trans-boundary transport of visibility-reducing particles from regional sources in the U.S. and Mexico, and to quantify the contributions of specific U.S. and Mexican source regions and source types responsible for poor visibility at Big Bend NP.

YACS (2002)

The Yosemite Aerosol Characterization Study – (YACS) was an intensive field measurement campaign to investigate sources of regional haze in Yosemite NP. IMPROVE data records from 1988-2004 show seasonal trends in organic aerosols with large fractions of carbonaceous particles. This study investigated the origins and physical/optical characteristics of this carbon aerosol.

2003-2010

IMPROVE Coarse Mass Speciation Study (2003)

The IMPROVE Coarse Mass Speciation Study was designed to investigate the composition of coarse particles at nine sites selected to be representative of the continental United States and operated according to IMPROVE protocol analytic procedures.

Biogenic Smoke Study (2003)

The Biogenic Smoke Study focused on quantifying optical and chemical properties associated with smoke emitted from the burning of various fuel types. Research at USDA-FS Fire Science Laboratory in Missoula, MT addressed how we can differentiate between smoke and any other organic aerosol without visual observation.

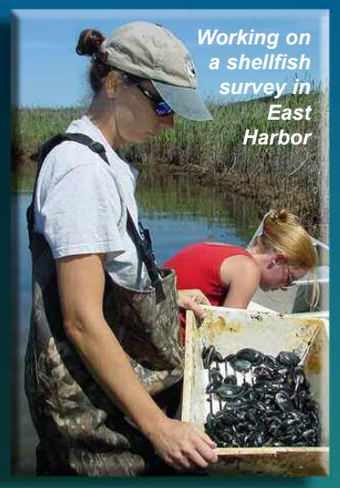
Great Smoky Mtns. Ammonia Study (2004)

The Great Smoky Mtns. Ammonia Study at Great Smoky Mountains NP addressed issues related to accurately measuring ammonium with nylon filters in humid, acidic, summer environments, and to assess the effects of any contamination during sample handling. The study addressed issues related to estimating aerosol light extinction in the IMPROVE network.

RoMANS (2006)

The Rocky Mountain Atmospheric Nitrogen and Sulfur Study (RoMANS) was designed to understand the origins of emissions affecting ecosystems and visibility in Colorado's Rocky Mountain region. Differentiating impacts from emission sources within the state from those originating outside the state was a particular concern regarding effects at Rocky Mountain NP.

Cape Cod National Seashore, Massachusetts



Working on a shellfish survey in East Harbor

Krista Lee is a physical scientist with the Resource Management Division at Cape Cod National Seashore. Her main responsibilities include the management of the North Atlantic Coastal Laboratory and Atlantic Research Center Laboratory at Cape Cod NS. Her primary day-to-day duties include providing technical assistance to visiting researchers, staff, and interns; water quality monitoring and sample analyses for salt marsh restoration and estuarine-related projects; and the operation of the air quality station, which includes the IMPROVE samplers and the National Atmospheric Deposition Program (NADP), National Trends Network (NTN), and Mercury Deposition Network (MDN) equipment for wet deposition. Additionally, she offers logistical support for the Massachusetts Department of Environmental Protection's equipment for ozone and other primary pollutants.

Cape Cod Natl. Seashore, barrier beach breach

Krista currently shares the responsibility of IMPROVE site operator with her lab technician, Judith Oset. In her spare time, Krista enjoys travelling, especially if it is by boat!

"We get plenty of wind at the site and this can be challenging during a full-blown Nor'easter. The visibility is generally good on Cape Cod, although in the summer months we do have issues with ground-level ozone and related haze. The major visibility impediment is due to exhaust from vehicles (i.e. high visitation & lots of traffic) at the seashore in the summer months and fog in the spring, fall, and winter," she said.

"I love working and living on Cape Cod because of the dynamic coastal processes and the abundant estuarine and freshwater habitats, as well as the laid-back lifestyle."

June

Yellowstone National Park's geothermal Morning Glory Pool has changed color over the years. Which is responsible for the change: bird droppings, sulfur evaporation, trash, or climate change?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Jul 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			**1** *152 Julian day*	**2** *153* IMPROVE particle sampling day	**3** *154*	**4** *155*
5 *156* IMPROVE particle sampling day	**6** *157*	**7** *158* Change IMPROVE particle cartridges.	**8** *159* IMPROVE particle sampling day	**9** *160*	**10** *161*	**11** *162* IMPROVE particle sampling day
12 *163*	**13** *164*	**14** *165* Flag Day IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**15** *166*	**16** *167*	**17** *168* IMPROVE particle sampling day	**18** *169*
19 *170* Father's Day	**20** *171* IMPROVE particle sampling day	**21** *172* Change IMPROVE particle cartridges.	**22** *173*	**23** *174* IMPROVE particle sampling day	**24** *175*	**25** *176*
26 *177* IMPROVE particle sampling day	**27** *178*	**28** *179* Change IMPROVE particle cartridges.	**29** *180* IMPROVE particle sampling day	**30** *181*	◆ Check for insect infestations throughout the summer (e.g., mud daubers, flies, spider webs). ◆ Watch for lightning damage during the summer.	**UC Davis**: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941

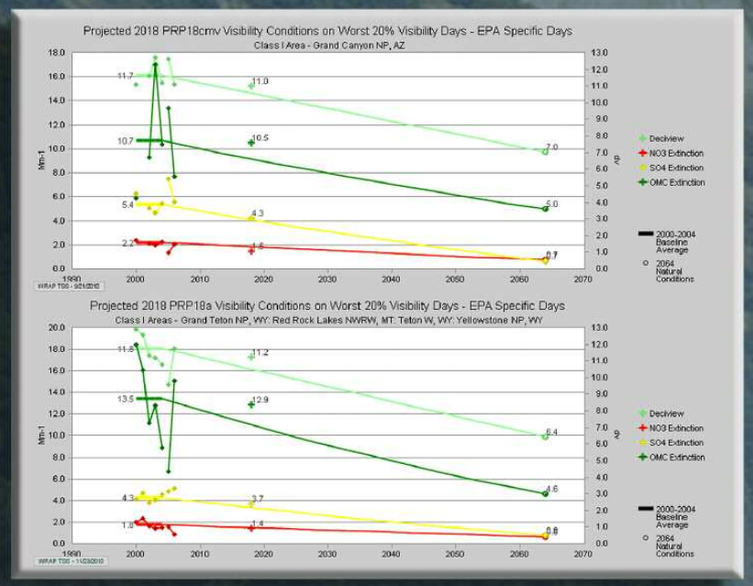
Operator Involvement -- The Key to Network Success

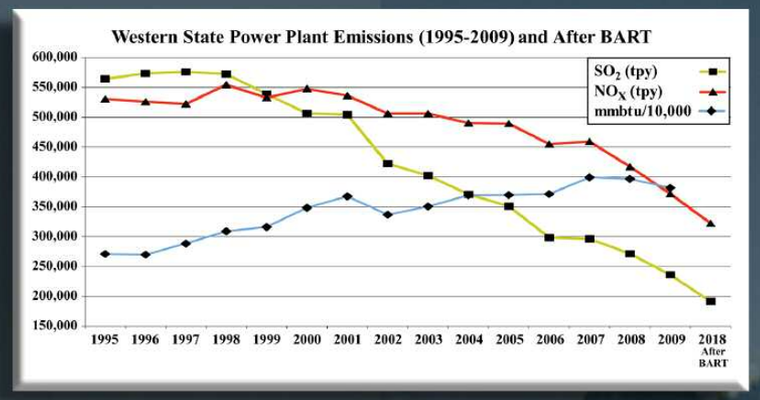
Emissions Sources' Effects on Western Regional Haze Planning

Tom Moore, Western Regional Air Partnership, Cooperative Institute for Research in the Atmosphere, Colorado State University, Ft. Collins, CO

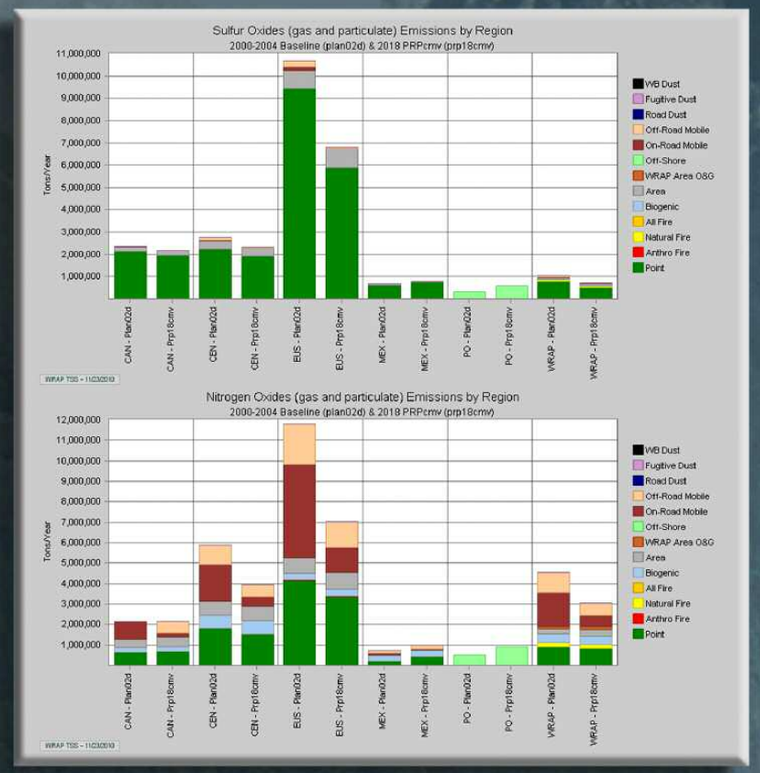
The Regional Haze Rule (RHR) requires federal and state agencies to have plans to reduce pollutant emissions that contrbute to haze in Class I areas and return them to "natural visibility conditions" free of human-caused pollution by 2064. Multistate regional planning organizations were responsible for collecting and analyzing data to assist states in preparing these plans. Analysis of sources contributing to the haziest 20% days for the RHR 2000-2004 baseline period and projections to the first 2018 planning milestone have been completed and are being used in State Implementation Plans (SIPs) across the country for the 156 visibility-protected Class I areas. The 15-state WRAP region has 118, or ~75% of these protected areas. Emissions of sulfur oxides, nitrogen oxides, and primary organic carbon from the key western source categories of fossil-fuel-fired power plants and on- and off-road mobile sources, versus wildland fire, show variable effects on visibility during the baseline period and will significantly affect air quality planning for the glide path to natural conditions. Two example Western Class I areas (Grand Canyon NP and those in Wyoming / Montana) are presented. The graphs below show measured annual haziest days' values for deciview (the RHR progress metric), sulfate (SO_4), nitrate (NO_3), and primary organic carbon (OMC) from 2000 through 2006. The 2000-2004 baseline period averages, projected 2018 visibility improvement, and the glide path to 2064 default natural conditions – the required values for RHR SIPs, are also shown.

While sulfate and nitrate are much smaller contributors to regional haze at these three parks than primary organic carbon, due to emissions reductions from mobile sources and power plant emissions already underway, with more reductions to follow, the 2018 sulfate and nitrate projections all show declines. Presented next are the trend in western power plant NO_X and SO_2 emission from 1995 to 2009 and projected reductions by 2018. SO_2 emissions have fallen by more than 50% and NO_X by ~40%. At the same time, generating capacity has risen by 40%.

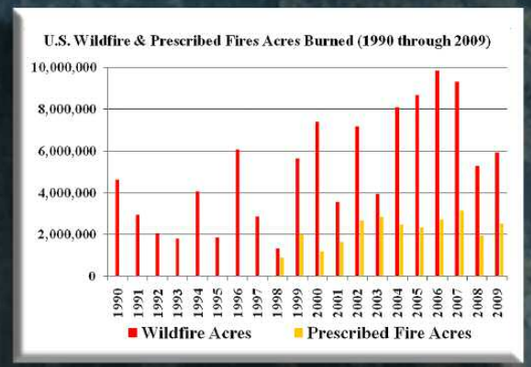


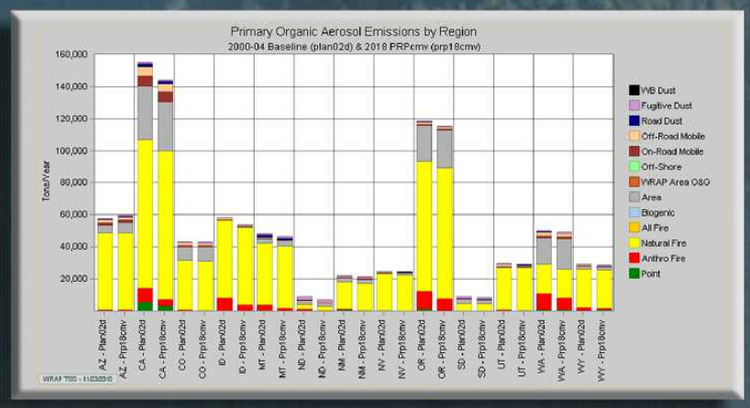


Projected NO_X and SO_2 emissions used in RHR SIPs show reductions in all U.S. regions, some quite significant on a percentage basis. These reductions are from point and mobile sources, from federal mobile source rules implementing tailpipe controls and cleaner fuels. Point source controls are implemented by state agencies using federal guidelines. Canadian emissions remain flat. In contrast, industrial activity from population growth in Mexico and expanded commercial marine shipping in the eastern Pacific Ocean show increases in emissions.

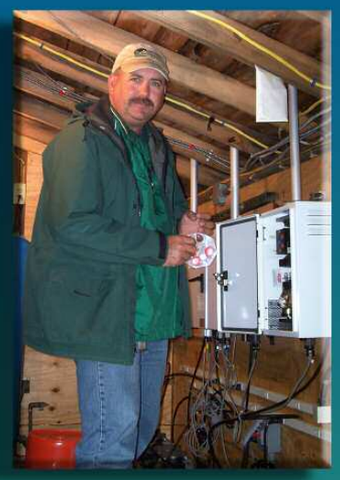


While U.S. industrial and mobile sources' NO_X and SO_2 emissions are declining and projected to further decrease, the incidence of wildfire and prescribed fire activity and associated emissions show both inter-annual and geographic variability, but has been generally increasing over the 1990 to 2009 time frame as shown, since the Clean Air Act was last amended. A key species emitted from both types of fire activity, contributing significantly to visibility impairment, is primary organic aerosol (POA) – most large U.S. wildfires occur each year in the West. POA emissions, which are measured on IMPROVE filters as OMC, is the single largest contributor to measured visibility impairment on the haziest days at the two example Class 1 areas, but varying on these haziest days from year-to-year by a factor of two to three. Given the uncertainty of the location, specific timing, and magnitude of wildfire and prescribed fire in the future, for RHR SIPs, western regional analyses held 2018 wildfire estimates constant to the 2000-2004 average emissions by state. Western prescribed fire was downscaled for 2018 from the 2000-2004 averages by state, by applying sub-regional suites of Emissions Reduction Techniques (ERTs) developed by federal land managers (FLMs) for the application of prescribed fire. ERTs are now generally required and in routine use by FLMs through cooperative state-FLM smoke management programs.





Pack Monadnock, New Hampshire



Two years ago the Pack Monadnock (PACK1) monitoring station joined the IMPROVE aerosol network. Operated by the State of New Hampshire, Department of Environmental Services, Air Resources Division (DES ARD), the site is unique in several ways. Its high elevation coupled with moist climate is not common to other sites in the network, hence the site collects periods of peculiar data. The air quality monitoring station also collects ozone, nitrogen dioxide, PAMS (continuous fine particulate and meteorological parameters), and is part of a state network of monitoring stations.

Scott Klose, the station's operator, has been an air pollution technician with the state for nearly 10 years. His work keeps him primarily in the field each day, maintaining several of the state's monitoring stations. He ensures that the systems run properly, performs troubleshooting, and maintains station housekeeping. "Most of the stations are in very public areas," said Scott. "Miller State Park can see 200-600 visitors daily, so the stations are maintained to be aesthetically pleasing. It is important to us that the visitors see our air monitoring efforts as a good thing."

Scott is also an experienced carpenter and a jack-of-all-trades, so he is often called upon to help the air quality group, part of the state DES ARD, Technical Services Bureau. He loves his job because it keeps him outdoors where he can find numerous things to do, including hunting, fishing, boating, snowmobiling, and playing softball. His extended family is all in the local area so he doesn't have to go far to visit.

"Last year we received 14 inches of rain in 30 days," said Scott. "Water got in the aerosol modules and I worked closely with Eric Harvey (operator and field support at UC Davis) to alleviate the water problem." Scott then put in extra effort to solve the issue by drying out the cyclones and tubing lines, then checked them frequently during rains to make sure the problem didn't reoccur until a more permanent solution was implemented, along with many other maintenance issues. These extra efforts helped prevent further data loss.

July

Which of the following presidents more than doubled the acreage of the National Park System: Calvin Coolidge, Richard Nixon, Jimmy Carter, or George H.W. Bush?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
◆ Check temperature at setup to assure it is within 10° C of outdoor temperature.	Jun 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	Aug 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		◆ Call UC Davis at 530-752-1123 to figure out how holidays affect sample change schedules.	**1** *182 Julian day*	**2** *183* IMPROVE particle sampling day
3 *184*	**4** *185* Independence Day	**5** *186* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**6** *187*	**7** *188*	**8** *189* IMPROVE particle sampling day	**9** *190*
10 *191*	**11** *192* IMPROVE particle sampling day	**12** *193* Change IMPROVE particle cartridges.	**13** *194*	**14** *195* IMPROVE particle sampling day	**15** *196*	**16** *197*
17 *198* IMPROVE particle sampling day	**18** *199*	**19** *200* Change IMPROVE particle cartridges.	**20** *201* IMPROVE particle sampling day	**21** *202*	**22** *203*	**23** *204* IMPROVE particle sampling day
24 *205*	**25** *206*	**26** *207* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**27** *208*	**28** *209*	**29** *210* IMPROVE particle sampling day	**30** *211*
31 *212*						

UC Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

Operator Involvement -- The Key to Network Success

Data Losses During Wildfire Events

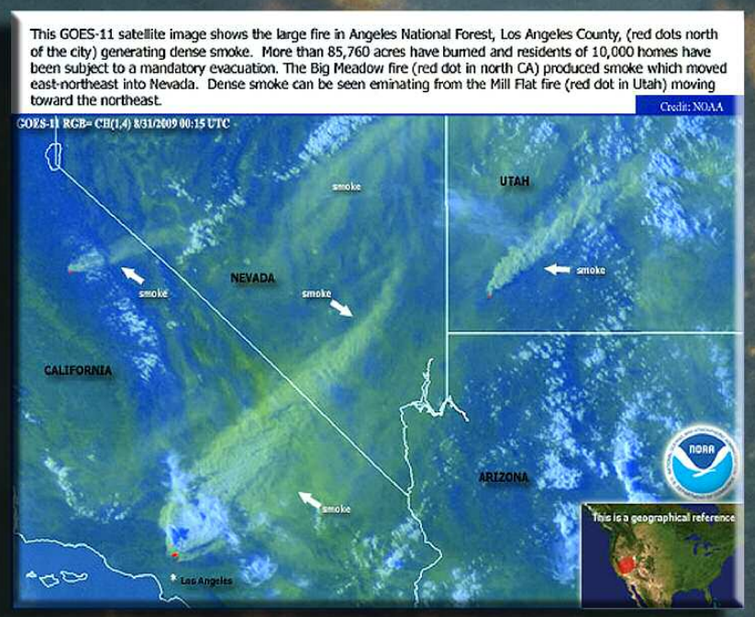
Chuck McDade, University of California, Davis

Introduction

Wildfires occur every year throughout the United States. These fires can occur in clusters and are often regional in scope, blanketing hundreds of square miles with smoke for days at a time. Many IMPROVE sites are located in or near forests and grasslands where fires occur, so IMPROVE samplers can be impacted by smoke from fires often far from the monitoring site. Moderate amounts of particulate material collected during these events can provide interesting insights into the behavior and composition of wildfire smoke. However, when the smoke becomes too thick, the sampler clogs and data can be lost for those days.

Regional Haze Rule Intent

Smoky days lie at one extreme of the distribution of particulate concentrations, and crystal-clear days lie at the other extreme. These extreme days are of great interest to data analysts and are the focus of much of the federal Regional Haze Rule (RHR) analysis. Reducing the visibility impacts on the haziest days and maintaining excellent visibility on the clearest days are at the heart of the RHR's purpose. Analysis of IMPROVE data under the Regional Haze Rule is intended to establish a baseline of existing visibility conditions at the beginning of the 21st century and then to track progress toward the mid-century goal of achieving natural visibility conditions. IMPROVE data are analyzed to evaluate the conditions that lead to the 20% haziest days and the 20% clearest days. When smoke episode data are missing due to filter clogging, those days that represent the very hazy days are not included in the analysis and typically drive down the average aerosol concentrations determined on the haziest days.



Filter Clogging Example

Every IMPROVE sampling day begins at midnight with a fresh set of filters. As particles are collected on the filters, the flow resistance through the filters gradually increases and the flow rate decreases. On most days, this decrease in flow rate is gradual and slight, and it has no significant impact on sampling. But on very hazy days, the clogging can become sufficiently severe such that the sample must be declared invalid, and in some cases the filter actually ruptures. IMPROVE has strict quantitative criteria for invalidating clogged filters. The flow rate is recorded electronically by the IMPROVE sampler every 15 minutes and is stored on the sampler's flashcard. If the flow rate remains below 15 liters/minute for more than one hour, then the sample is declared invalid. At such low flow rates, the sampler calibration is no longer accurate, so the flow rate cannot be determined quantitatively.

Figure 1 shows an example of the decrease in flow rate during a sampling day when the filter is clogging. The figure illustrates the 15-minute flow rate data for the Module A Teflon filter at the Weminuche Wilderness, CO, monitoring site during June 27, 2005, shown by the dotted line. For comparison, the solid line shows the flow rate on the prior sampling day, June 24, before the clogging event occurred. The June 27 clogging event coincided with extremely high organic and elemental carbon concentrations at Weminuche, consistent with a smoke episode. The flow rate on the fresh filter began in excess of 22 liters/minute and immediately began decreasing. By noon, the flow rate had dropped below 15 liters/minute, IMPROVE's data validity limit.

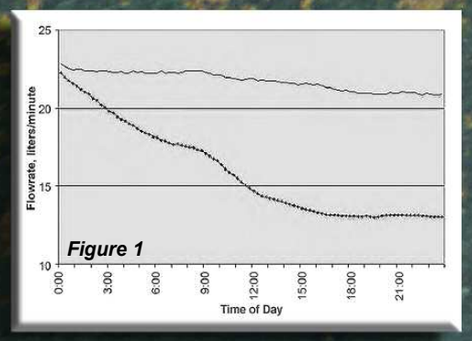


Figure 1

Due to its texture, the Teflon® filter (Modules A and D) is the most likely of the IMPROVE filters to clog. Teflon is plastic and susceptible to clogging as particles accumulate. Nylon and quartz filters (Modules B & C), on the other hand, are more porous and thus are able to maintain low to moderate flow resistance even as they collect particles. These filters tend to clog less frequently than do Teflon® filters.

In Figure 2, the dotted line shows the flow rate trace for the Module C quartz filter at Weminuche for the same clogging event, June 27, 2005. The solid line shows the flow rate on June 24. The flow rate on June 27 decreased somewhat throughout the day, starting at 23.4 liters/minute and finishing the day at 21.6 liters/minute. This slight decrease is well within IMPROVE's validation limits and does not approach the 15 liters/minute limit that was violated before noon with the Teflon® filter.

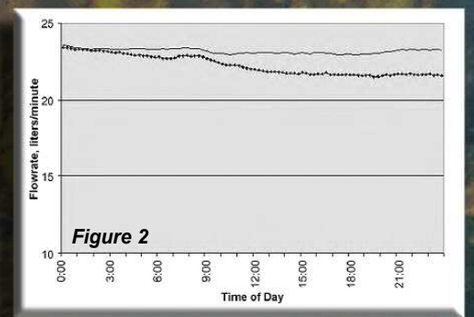


Figure 2

In a typical year, approximately 50 sample days suffer from clogging in one or more sampler modules, out of a total of around 20,000 sample days collected. Here, a sample day is defined as the set of four filters collected at a site on a single day. So, a very small percentage (less than 1%) of total sample days are lost due to clogging. However, the lost days can be among the most extreme hazy days in the year.

What Operators Can Do

The Regional Haze Rule distinguishes between regional wildfire events and localized fires that may occur in the immediate vicinity of an IMPROVE site (for example, a nearby structural fire). Notes from IMPROVE site operators' log sheets can identify occurrences of localized fires. When available, this information is stored with the IMPROVE data on the VIEWS Website, allowing states to identify data from these days and to exclude them from regional analyses. The worst case for data loss would be the destruction of an IMPROVE sampler during a fire. In a few cases in which fires have been predicted to come close to an IMPROVE monitoring site, alert operators have removed the samplers and stored them in a safe place until the fire passed.

For more information, e-mail Chuck McDade at the University of California-Davis at mcdade@crocker.ucdavis.edu.

Ike's Backbone, Arizona

If you ever need something fixed, **Elmer Alston** is your man. He looks after the Ike's Backbone IMPROVE monitoring site in central Arizona. He retired in July 2010 from Arizona Public Service, where he had worked as an electrician / communications technician, maintaining high-voltage lines, and high-voltage and communications equipment. His experience in that job, along with that gained from being a machinist, makes maintenance of the IMPROVE site short work for him. "Once, I could hear the sampler pump had changed pitch. I knew the bearings were going bad, so I changed them before the pump actually failed, preventing downtime and data loss," said Elmer.

He is a lifelong resident of Arizona and understands the importance of this air quality station, so his involvement in having the station operate continually without problems results in a more complete database for researchers to study. He showed equal enthusiasm in a prior job maintaining 12 sulfur dioxide monitoring sites near Tucson.

The Ike's Backbone IMPROVE site is sponsored by the USDA-Forest Service, as it represents both the Mazatzal and Pine Mountain wildernesses. The Arizona Department of Environmental Quality collects additional aerosol data at Ike's Backbone with an ambient nephelometer. Elmer visits the aerosol shelter weekly, twice weekly if necessary, for routine maintenance and filter changing. As keeper of the station, he ensures it runs continually, 24/7. His dedication is reflected in the collection statistics for the site -- it consistently achieves 100% collection quarter after quarter.

Visiting this site "requires 4-wheel drive and can be a monster to get to, with mud, snow, and the like," said Elmer. "Driving two miles takes 20 minutes each way, but it is an excellent location for an air quality monitoring site, with breathtaking, expansive views in all directions."

Elmer lives with wife Tana and has a small machine shop at his residence. He's also been helping the Forest Service restore the old Childs power house on the Verde River. In his spare time, he tinkers with tube-type amplifiers and other instrumentation.

August

Which shape is the emblem of the National Park Service: arrowhead, diamond, log cabin, or redwood tree?
Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941	**1** *213 Julian day* IMPROVE particle sampling day	**2** *214* Change IMPROVE particle cartridges.	**3** *215*	**4** *216* IMPROVE particle sampling day	**5** *217*	**6** *218*
7 *219* IMPROVE particle sampling day	**8** *220*	**9** *221* Change IMPROVE particle cartridges.	**10** *222* IMPROVE particle sampling day	**11** *223*	**12** *224*	**13** *225* IMPROVE particle sampling day
14 *226*	**15** *227*	**16** *228* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**17** *229*	**18** *230*	**19** *231* IMPROVE particle sampling day	**20** *232*
21 *233*	**22** *234* IMPROVE particle sampling day	**23** *235* Change IMPROVE particle cartridges.	**24** *236*	**25** *237* IMPROVE particle sampling day	**26** *238*	**27** *239*
28 *240* IMPROVE particle sampling day	**29** *241*	**30** *242* Change IMPROVE particle cartridges.	**31** *243* IMPROVE particle sampling day			

Jul 2011

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Sep 2011

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Operator Involvement -- The Key to Network Success

Who Made That Smoke?

Published from a Joint Fire Science Program, Fire Science Brief, Issue 123, December 2010, "Who Made that Smoke" -- more information is available at www.firescience.gov.

Wildland Fire and Air Quality

Management of smoke from prescribed fires has both operational and regulatory aspects. Short-term needs include determining suitable times for burning and estimating the impact of smoke on neighboring communities as well as on fire crews. Tools have been developed to assist fire managers in planning prescribed burns.

Another aspect of these fires is their potential impact on local and regional air quality. The U.S. Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) for pollutants considered to be harmful to public health and the environment. These include primary standards, which protect public health, and secondary standards, set to protect human welfare. Secondary standards include protection for visibility and reducing effects on ecosystems.

Smoke from prescribed burns provides an important data source in studying smoke characteristics.

Fires can contribute significantly to levels of ozone and fine particulate materials (PM), causing nonattainment of both the primary and secondary NAAQS in communities and regions throughout the U.S. Regulations set limits on ambient concentrations allowed for hourly, daily and annual average values.

Smoke from prescribed fires can also contribute to haze in national parks and wilderness areas. Haze is regulated using EPA's Regional Haze Rule (RHR), which requires each state to set "reasonable progress" goals to return visibility to natural conditions in these areas on the 20 percent of haziest days by 2064, while preventing degradation of visibility on the 20 percent of least-hazy days. Progress towards these goals is tracked using five-year-average values. Fire emissions also contain substantial levels of reactive nitrogen, and at some time in the future there may be a secondary total reactive nitrogen deposition standard.

Challenges Facing Fire Managers

Currently, both PM and ozone NAAQS are violated in a number of areas, and virtually all Class I areas (CLAs) have haze levels above natural background levels. One of the principal difficulties in understanding the role of smoke is that often more than 50 percent of the smoke particulate mass is secondary organic aerosols (SOA)—particulates formed in the atmosphere from emitted organic gases. These SOAs are similar in composition to SOAs formed from gases from plant respiration and are particularly important in the southeastern and northwestern U.S. where fire activity is also high. Further, these SOAs are important contributors to the formation of fine PM and ozone.

Finding the Sources of Smoke

Regulation requires a clear distinction between the identification of the amount and type of haze and PM2.5 from natural and anthropogenic sources and from natural and international sources that cannot be controlled. Haze and PM2.5 from smoke originates from wildfires and human-caused fires, including agricultural burning, prescribed fires, and residential wood burning. Understanding the relative contributions of natural and anthropogenic fires is essential for regulators to track progress in haze regulation implementation and to address PM2.5 exceedances.

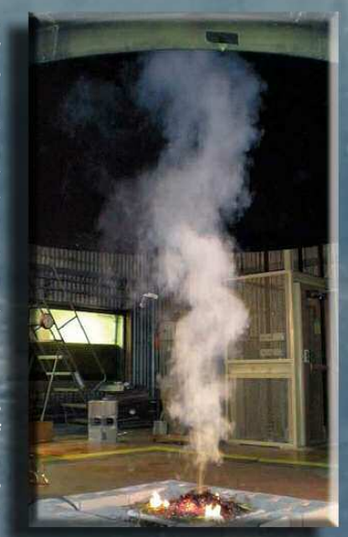
Currently wildfire accounts for the majority of smoke emissions in the western U.S. Anthropogenic fires tend to occur in different seasons and geographic regions from wildfires, but can contribute to haze on both best and worst haze days. In the West, wildfires tend to occur most often in the warmest months, while prescribed and agricultural fires occur most often in the cooler spring, fall, and winter months.

Haze from non-fire-related sources is often lower during the winter months, and thus winter prescribed fires can diminish visibility on what would otherwise be some of the clearest days of the year. Smoke concentrations from residential wood burning also tend to occur in population centers during cold months and these can be transported to CIAs.

In the Southeast, smoke from prescribed fire emissions is generally greater than from wildfire. Prescribed fires are typically used in this region from October through April. It is expected that in the future, prescribed fires will significantly increase, thereby reducing wildfires. In this way, there is an increased likelihood of even higher emissions.

To evaluate and track fire impacts, tools are needed to differentiate between air contaminants originating from industrial and mobile-source activity, and those from natural and anthropogenic fires. One project, "Characterizing Particulate Matter Emissions by Wildland Fires Relevant to Visibility Impairment and PM Non-Attainment," was sponsored by the Joint Fire Science Program in cooperation with researchers from the National Park Service, the Desert Research Institute, and Colorado State University.

The study was a first step to understanding which of the many sources of smoke contribute to NAAQS violations and to impaired visibility. A cost-effective methodology was developed to allow monitoring networks to characterize smoke marker species linked to primary emissions originating with prescribed fires and wildfire burn activities.



Laboratory burns assisted in creating smoke profiles of various fuel types.

Measurements were made in fresh smoke plumes from wild and prescribed fires to validate laboratory results. IMPROVE network sites assisted in finalizing a proven composition source profile.

Smoke from prescribed burns provides important data about smoke characteristics.

Work continues to document the stability of tracer levoglucosan during long-range transport of smoke. Recent studies suggest it may be degraded by chemical reaction in aging smoke plumes, and it is important to better understand the rate of its destruction, whether traceable breakdown products are formed, and whether it can serve as a "clock" for plume aging. Tools are being developed that are retrospective in nature in that they are used to estimate smoke contributions to air quality after the event has occurred. They will not help to predict whether burning will contribute to a NAAQS violation, but with increased knowledge of the characteristics of smoke from biomass burning, better decisions can be made.

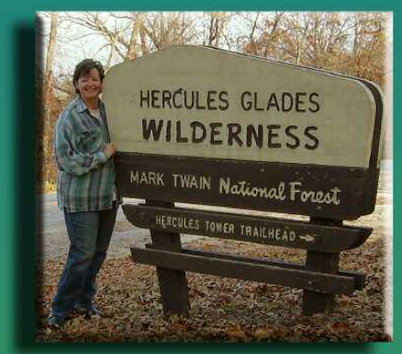
Key Findings

- Increasingly, stringent air quality regulations require both land managers and air quality regulators to have a better understanding of the contributions of prescribed burns and wildfire to regional air quality and visibility levels.
- Constituents of smoke from wild land fires are identifiably different from emissions from industrial, residential, and mobile sources.
- Laboratory burns of fuels from the West and the Southeast demonstrate variability in smoke constituents and in their potential to contribute to reduced visibility.
- Levoglucosan and other carbohydrate constituents of wood smoke are potentially useful markers of wood smoke, allowing managers to understand the effects of smoke on general air quality and visibility.
- Accurate and affordable methods of analysis of marker carbohydrates promise to make post-fire evaluation of atmospheric smoke a common practice.
- Early analyses of smoke from actual field fires generally confirm the general conclusions from laboratory studies, but the wide variability in fuel and weather conditions in the real world means that more work is needed in applying these tools.

Hercules Glades Wilderness Area, Missouri

The Wymans have been the air quality sampler operators at the Hercules Glades Wilderness Area for ten years. **Rick**, the primary operator, first worked for the Forest Service in 1978 with the Young Adult Conservation Corps. He has worked for the Missouri Dept. of Agriculture as a gypsy moth trapper, and with other invasive species projects for the past seven years. Back-up operators include wife **Leslie**, father **Elwood**, and mother **Frances**.

The Hercules Glades Wilderness Area is located in southwestern Missouri in the Ava Ranger District of Mark Twain National Forest and includes some of the most scenic and unique country in the Midwest. It offers open grassland, steep rocky hillsides, and forested knobs, all contributing to its beauty.



The Wymans are active in many outdoor activities. Leslie is one of the co-chairs of the White River Valley Historical Society's cemetery committee, and spends much time tracking down lost cemeteries and single gravesites, helping with preservation efforts to save these areas. Frances and Elwood were cultural resource volunteers and worked with 4-H groups and the Passport in Time project. Rick and daughter Valerie have founded one of the many Conservation Stream Teams which clean up and preserve natural streams, and educate landowners and the public on the importance of protecting watersheds from pollution and erosion.

Taney County has a rich history, and both Elwood and Frances' families have been part of that history for five generations, including several ancestors who were involved with the notorious Bald Knobber vigilante group that terrorized the area in the late 1890's. In addition, many past family members were postmasters, elected officials, and veterans of past wars.

Rick's hobbies include hunting, fishing, woodworking, and antique motorcycles, including one he built from scratch which he calls "The Goldberg Special".

September

Which was the first national park established east of the Mississippi River? Mammoth Cave, Everglades, Shenandoah, or Acadia?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
◆ Check for rodent infestations in the fall and winter.				**1** *244 Julian day*	**2** *245*	**3** *246* IMPROVE particle sampling day
4 *247*	**5** *248* Labor Day	**6** *249* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**7** *250*	**8** *251*	**9** *252* IMPROVE particle sampling day	**10** *253*
11 *254*	**12** *255* IMPROVE particle sampling day	**13** *256* Change IMPROVE particle cartridges.	**14** *257*	**15** *258* IMPROVE particle sampling day	**16** *259*	**17** *260*
18 *261* IMPROVE particle sampling day	**19** *262*	**20** *263* Change IMPROVE particle cartridges.	**21** *264* IMPROVE particle sampling day	**22** *265*	**23** *266*	**24** *267* IMPROVE particle sampling day
25 *268*	**26** *269*	**27** *270* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**28** *271*	**29** *272*	**30** *273* IMPROVE particle sampling day	**UC Davis**: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941

Aug 2011

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Oct 2011

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30	31					

Operator Involvement -- The Key to Network Success

Seeing Through the Haze

A Tool for Apportioning Emission Sources for Use in Smoke Management Programs

Published from a Joint Fire Science Program, Fire Science Brief, Issue 122, November 2010, "Seeing Through the Haze" -- more information is available at www.firescience.gov.

Smoked Out

Evidence shows that smoke from fires (wildfire, controlled burning, and agricultural burning) is contributing significantly to fine particulate matter (PM2.5) and haze in many urban and rural areas, affecting health, visibility, and ecosystems. In addition to the primary particulate matter directly emitted by fires, gaseous organic compounds are emitted that transform into "secondary" particulate matter downwind from fires, contributing notably to PM2.5 and haze. Air quality regulators must be able to correctly identify sources that contribute fine particulates so managers can implement emission reduction strategies.

Yosemite Valley on a clear day and a day obscured by smoke from fires.

So, what exactly is fine particulate matter? Also known as PM2.5 (particles less than 2.5 microns), it is composed of compounds from different sources, such as the combustion of fossil fuels in power plants and cars, and also biogenic sources, such as fire and secondary organic material formed from gases emitted by the natural respiration of vegetation. Until recently, regulators were looking mainly at reducing PM2.5 contributions from power plants, factories, and vehicles. But emissions from many of these sources have significantly decreased over the past two decades, so they began looking to other sources. Evidence revealed that smoke from fire is contributing considerably to fine particulate matter and haze, but how much was still unclear because the tools necessary to determine amounts were lacking. It turns out that biogenic sources are contributing significantly to fine particulate matter: over 50 percent of PM2.5 in many rural and urban areas (Figure 1). In addition to affecting visibility and creating adverse health effects, smoke from fires also influences the earth's radiation balance and ozone levels. Haze both absorbs and reflects solar radiation, affecting climate. And emissions from fires contribute to elevated ozone concentrations that can damage plants and affect nitrogen deposition.

Sleuthing Out the Sources

Smoke is an important source since natural sources of haze are not controllable under the Regional Haze Rule (RHR), but human-caused sources are. Although annual natural wildfire accounts for the majority of smoke emissions in the western United States, prescribed fires can significantly contribute to haze (in some cases, close to 100 percent) and PM2.5 events. Most controlled burning in the U.S. takes place from late winter to late spring, while wildfires typically occur in the summer. In Figure 2, it can be seen that fires during the spring months contribute about 10 percent to fine particulate matter in the Northwest and up to 30 percent in the Southeast. There is a need to differentiate between natural and human-caused sources, but a finer distinction must also be made at the modeling level to account for how much of the PM2.5 is composed of primary particulate matter and how much is secondary particulate matter.

When the contribution of secondary particulates from vegetation is added into the mix, the total PM2.5 from biogenic sources rises considerably. Figure 1 shows that during the summer in the Northwest, approximately 60% of the PM2.5 was due to biogenic sources (fires and secondary particulate matter). In Figure 2, of that 60% PM2.5 from biogenic sources, fires account for about 40% of the summertime fine particulate matter in the region. So, the remaining 20% would constitute contributions from secondary fine particulate matter from vegetation. Moreover, near the fire, concentrations of primary PM2.5 are high; but downwind from the fire, the primary PM2.5 tends to become diluted and, at the same time, the chemical reactions of the gaseous compounds are taking place and increasing the concentrations of the secondary PM2.5. Current models overestimate concentrations near the fire and underestimate them farther away.

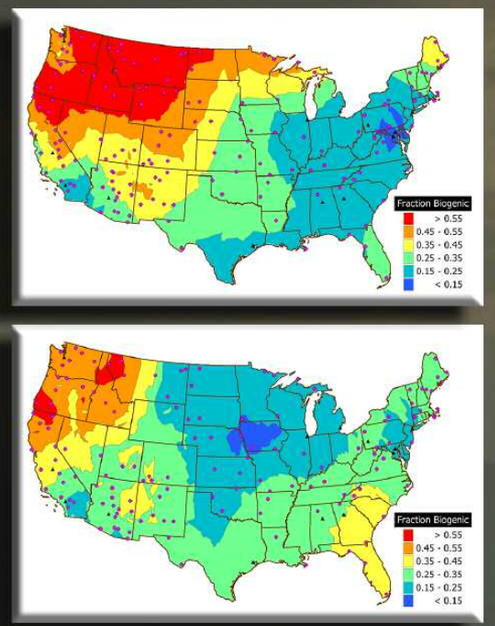

Figure 1: Contribution of biogenic sources, including fires, to fine particulate matter during the summer (top) and winter (bottom).

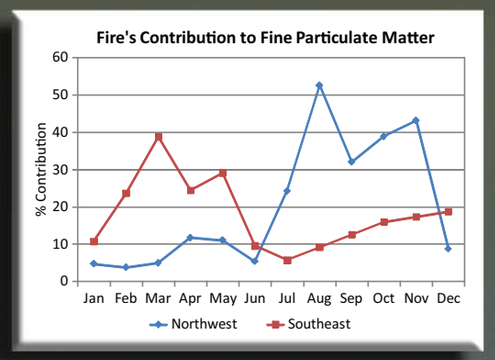

Figure 2: Estimated seasonal contribution of fires to fine particulate matter in the rural Northwest (Washington, Oregon, Idaho, and Montana) and the rural Southeast (Arkansas, Alabama,Geogia, and Florida.

Merging Models

Analysis tools can be categorized into operational and retrospective tools. Operational tools apply in a controlled burning situation where managers need to know if it's okay to burn. Models that simulate where the smoke will go help managers make "go/no-go" decisions. In the case of a current fire, such models can also allow for advanced warning to communities if smoke is heading their way. Retrospective tools, provide information on the causes of past air quality events or, if a particulate exceedance occurs in an area, regulators need to be able to determine what caused the exceedance.

Source-oriented models start from the source and attempt to directly simulate pollutant emissions, their transport, and fate. Receptor models work from the end-point. They rely on the fact that sources emit a unique proportion of aerosol constituents known as their "source profile", and then use measured chemical and physical characteristics of the particulate matter to apportion it to various source types, such as fires or mobile (automobile) and point (industrial plants/factories) sources. Both types of models have their limitations. Source-oriented air quality models can't distinguish well between primary and secondary fine particulate matter. And receptor models have difficulty in separating fire's contributions to PM2.5 from contributions of secondary organic material, and some receptor models account only for the primary particulate matter, not the secondary. In addition, these models have difficulty in differentiating between smoke type sources.

Hybrid source apportionment modeling directly combines measured data from the receptor models with air quality modeling results, ideally preserving the source type resolving power of the air quality models and satisfying the source profiles of the receptor models, all with results that are bounded by measured data.

The hybrid receptor modeling methodology looks for patterns or 'finger prints' in the measured data. The model measures the ratio of elemental carbon (EC) to organic carbon (OC) because fossil sources (industrial plants) have different EC/OC profiles than do biogenic sources. Hybrid models apportion particulate matter to fires and other sources (mobile and point). If it has the necessary inputs, the model can also apportion average primary and secondary contributions from fires. Finally there is an attempt to apportion fire's contributions to specific fire types using air quality modeling results and relying on fire classifications in the emissions inventories. Future plans include developing the ability to apportion fire's contributions to source regions, such as individual states.

Key Findings

- Smoke affects air quality significantly; thus, managers need tools to retrospectively assess its contributions to fine particulate matter.
- Twenty-five to fifty percent of the annual average fine particulate matter comes from biogenic sources, including fires and secondary organic material from the natural respiration of vegetation.
- Emerging evidence indicates that secondary particulate matter can significantly increase fire's contributions to fine particulate matter levels.
- We currently lack the tools to predict the amount of secondary particulate matter from fires, and current models can inaccurately attribute the secondary material from vegetation to fires and vice versa. Such misidentification can cause states to implement smoke mitigation strategies that won't adequately assist attainment of air quality standards.
- By combining source-oriented air quality models with receptor models, hybrid source apportionment modeling was successful at improving estimates of fire's contributions to fine particulate matter.

Chiricahua National Monument, New Mexico

Site operators are a varied bunch -- some are federal employees who service their IMPROVE sites in addition to their already tightly scheduled duties, and some are retired people who want a little part-time work. Operator **Tina Thompson** has an interest in her environment and finds time to do more.

Tina has been the sampler operator at Chiricahua as a contract employee since April 2006. "I've enjoyed learning about the equipment and I like the challenge of keeping everything running in good order," said Tina. The air quality station at Chiricahua has a comprehensive array of monitors. In addition to the IMPROVE sampler, Tina maintains instrumentation for the National Atmospheric Deposition Program, the National Park Service Gaseous Pollutant Monitoring Program, and the Clean Air Status and Trends Network. She devotes about four hours every Tuesday to weekly checks and routine maintenance of the instrumentation, and collecting and changing filters. Tina is also quick to respond to the station during the week if anything goes awry, and is proactive in communicating with all of the networks she supports.

Tina's interest in nature has always been with her. She pursued interests in forestry at Northern Arizona University and agriculture and animal husbandry at Cochise College. Currently, she spends two days each week working at Chiricahua's Visitor Center. She also enjoys gardening, canning vegetables, and photographing southern Arizona.

A lifelong resident of Arizona, Tina spends much of her time with her family and working on the family ranch. "Growing up here on the ranch has given me a deep respect and love for the land. I have always been interested in the plants and animals that surround us, and I have turned into a natural history nut that can't pass up a good field identification book."

She is the fifth generation to live and work on the ranch that her great, great-grandfather homesteaded in 1879. Tina, her husband David, and son Cory still live at the original homestead site.

October

Where was the first wildlife refuge formed in 1903: Mai Po March Reserve in Hong Kong; Pelican Island NWR in Florida; Elk I. NP in Alberta, Canada; or Virunga NP in the Congo?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
◆ Call UC Davis at 530-752-1123 to figure out how holidays affect sample change schedules.		Sep 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	Nov 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			**1** *274 Julian day*
2 *275*	**3** *276* IMPROVE particle sampling day	**4** *277* Change IMPROVE particle cartridges.	**5** *278*	**6** *279* IMPROVE particle sampling day	**7** *280*	**8** *281*
9 *282* IMPROVE particle sampling day	**10** *283* Columbus Day (Observed)	**11** *284* Change IMPROVE particle cartridges.	**12** *285* IMPROVE particle sampling day	**13** *286*	**14** *287*	**15** *288* IMPROVE particle sampling day
16 *289*	**17** *290*	**18** *291* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**19** *292*	**20** *293*	**21** *294* IMPROVE particle sampling day	**22** *295*
23 *296*	**24** *297* IMPROVE particle sampling day	**25** *298* Change IMPROVE particle cartridges.	**26** *299*	**27** *300* IMPROVE particle sampling day	**28** *301*	**29** *302*
30 *303* IMPROVE particle sampling day	**31** *304* Halloween					

UC Davis: *Sampler*:
General Lab
(530) 752-1123

ARS: *Optical*:
Carter Blandford or
Karen Rosener
Photography:
Karen Fischer
(970) 484-7941

Operator Involvement -- The Key to Network Success

Trends in Elemental Carbon and Fine Particle Mass in the United States

Daniel M. Murphy, National Oceanic and Atmospheric Administration

Summary

Widespread decreases in elemental carbon and particulate matter in the United States represent a success for air quality, but also imply that reducing warming by controlling black carbon may be less than expected from older inventories.

Controls on black carbon emissions are being considered as a policy tool for rapid reductions in radiative forcing. Observations at national parks and other remote sites show that average elemental carbon and fine particle mass concentrations in the United States decreased by over 25% between 1990 and 2004. Percentage decreases in elemental carbon were much larger in winter than in summer. These data suggest that emissions controls have been effective in reducing particulate concentrations both in polluted areas across the nation. Despite the reduction in elemental carbon, the simultaneous decrease in non-absorbing particles implies that the overall radiative forcing from these changes was toward warming. The use of 2005 instead of 1990 as a baseline for climate-relevant emissions from the United States would imply a significantly lower baseline for aerosol emissions. The use of older data will generally overestimate the possibility for future reductions in warming due to black carbon controls.

Black Carbon and Elemental Carbon Trends

It is customary to distinguish between black carbon (BC) and elemental carbon (EC) even though they are closely related in the atmosphere. BC is derived from light absorption measurements, often using the attenuation of light reflected from or transmitted through a filter. EC is determined by physical analyses such as heating of the sample in oxidizing and non-oxidizing atmospheres, sometimes with an optical correction for charring of some organic carbon to EC during analysis. "Soot" is a specific form of elemental carbon produced by combustion. There are large differences between BC or EC measured by different methods. We use data from the IMPROVE network aerosol samplers, where 24-hour filters are collected every third day and analyzed at a central laboratory. Strengths of the IMPROVE data are the length of the record, the number of sites, and consistent techniques.

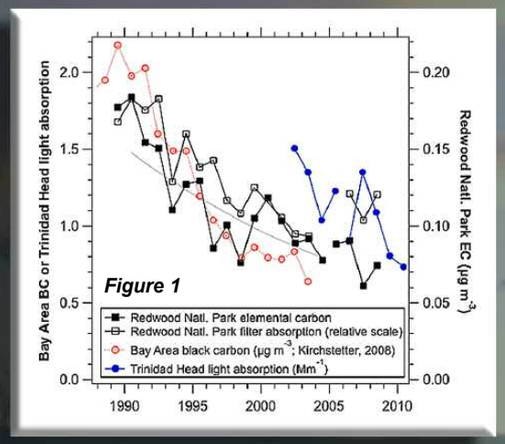

Figure 1

Figure 1 shows EC and BC measurements from northern California, chosen because independent data sets are available at Trinidad Head and the San Francisco Bay area. The trend in EC measurements at Redwood National Park is similar to that for the San Francisco Bay area except that absolute concentrations are a factor of 10 lower at Redwood National Park.

Fine particles in the atmosphere, or aerosols, are important climate forcing agents. Non-absorbing particles cool the Earth while sufficiently-light-absorbing particles warm the Earth. Controls on BC have been proposed as part of a strategy to reduce abrupt climate change.

Figure 2 shows the percentage trends in EC and PM2.5 mass for 50 IMPROVE sites with sufficient data to compute a trend before 2005. Marker size indicates the magnitude of the trend. Triangle direction and blue or red color corresponds to the direction of the trend. Color saturation is proportional to the average concentration in 1991 with full saturation at twice the national median.

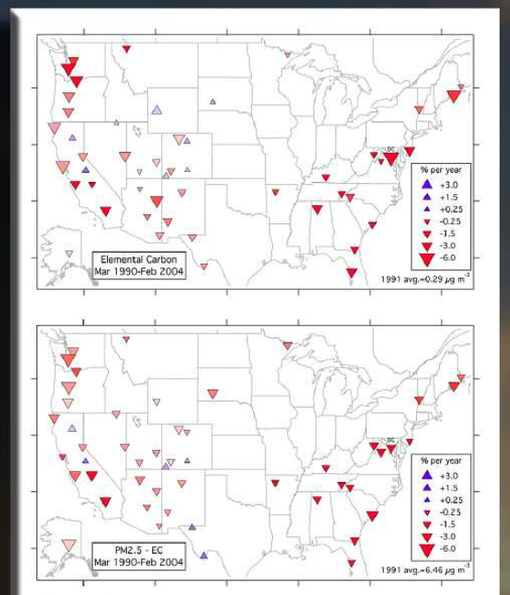

Figure 2

Trends in EC show decreases across the continental US and at Denali Natl. Park in Alaska. Trends in filter blackness, measured independently on different filters in the same samplers, provide confirmation of the trends in EC. The filters became less black by about the amount expected for the decrease in EC. The decreasing concentrations are almost certainly due to decreases in emissions from the United States. There is no reason to believe that removal processes changed by so much over this period. Long-range transport from Asian sources would cause an increase, not a decrease, during the period 1990-2005. The importance of United States emissions is supported by consistently negative trends at eastern sites least susceptible to transport from outside the US.

Figure 3 shows seasonal average national trends for the 14-year period March 1990 to March 2004 for elemental carbon and the balance of fine particle mass. (DJF: December, January, and February; MAM: March, April, and May; JJA: June, July, and August; and SON: September, October, and November).

From 1990 to 2004, EC decreased by almost 50% for the entire winter and spring (December through May) period. This would reduce the melting of snow cover induced by deposition of BC. Indeed, when trajectories came from North America, BC concentrations in the Arctic decreased significantly between 1990 and 1998.

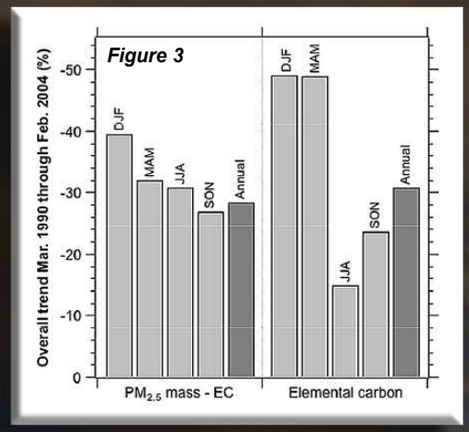

Figure 3

Major sources of elemental carbon in the United States are internal combustion engines (especially diesels), wild and controlled burning of vegetation, and in places, wood stoves and other biofuels. Summer increases in EC were evident in the mountain western US. This is consistent with large decreases in controlled anthropogenic sources coupled with an increase in summer wildfires.

EC accounts for about 5% of the fine particle PM2.5 mass at non-urban IMPROVE sites. Therefore, the observed trend in mass must be caused by more abundant species. Most of the decrease in PM2.5 mass was due to organic carbon and sulfate. Silicon and other mineral dust elements in PM2.5 increased from 1990 to 2004. Trends in EC at individual sites were uncorrelated with trends in sulfate. In contrast, trends in EC and organic carbon were correlated. The total carbon, which can be measured more reliably than either component, decreased. Decreasing emissions from wood stoves would reduce both elemental and organic carbon. Recent work suggests that, because of semi-volatile compounds, the formation of secondary organic aerosol from diesel engines is much larger than previously thought. If so, reductions in diesel emissions may be responsible for much of the trend in both EC and organic carbon mass.

Implications

There are several implications to these trends. Emissions standards and restrictions implemented during the 1990s on diesel engines and residential wood-burning stoves have apparently had a significant effect on BC concentrations across the United States. Further reductions can be expected from the stricter diesel standards implemented in 2007 and the complementary low-sulfur fuel introduced nationally in 2006. It is important to use up-to-date emissions inventories to evaluate both health effects and radiative forcing. If BC is included in these emissions, then using 2005 as a reference year will mean a significantly lower baseline for US BC emissions than 1990. Decreased concentrations also imply that the room for reducing warming by controlling BC may be less than expected if older inventories are used.

Casco Bay, Maine

Casco Bay, Maine is one of those "On Golden Pond" areas, according to **Don Prince**. That's one reason he plans on staying put when he makes his decision to retire. Until then, he is dedicated to working at the Maine Department of Environmental Protection (DEP) providing field service and data processing for the southern region's air quality stations.

Don has worked with the DEP for 15 years and is the primary operator for the Casco Bay monitoring station as well as the backup operator for the IMPROVE Bridgton station. He is also responsible for sites that run several types of samplers, including gaseous (ozone, sulfur dioxide, carbon monoxide, and nitrogen oxides), acid deposition, mercury, filter-based particulate, and hazardous pollutant. "I'm also the 'first responder' to my backup sites if there's a maintenance issue," he said. He keeps the instrumentation operating smoothly and is quick to correct any issues that arise.

In the office, he polls data from the six stations in the region, and assigns a flag to any missing parameter value describing the reason for the missing data. Then the data are forwarded onto the U.S. Environmental Protection Agency (EPA). "The DEP has changed their operations dramatically over the past few years," said Don. "Data collection involves more elaborate electronic methods, and methods of forwarding data to the EPA change from year to year."

Don graduated from Cornell University with a B.S. degree in pomology (science of fruit cultivation), then joined his father on the family's apple orchard. He later took over management of the orchard. In 1989 he dissolved the 200-year-old family business to seek a change. He joined the state's Pesticide Control Board as a field inspector before coming to the DEP.

Mr. Prince loves to spend time with his grandchildren, hike to mountaintops, and glide across a nearby pond in an old canoe. His semi-rustic cabin in the woods, where you can hear the loons at dusk, is only 10 minutes from his house.

Looking out to the Atlantic

Location of the samplers

Freeport, ME

November

Where was the first national forest established: Maine, Wyoming, California, or Washington?
Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941	◆ Check sampler inlets every 3 months. ◆ Call UC Davis at 530-752-1123 to figure out how holidays affect sample change schedules.	**1** *305 Julian day* Change IMPROVE particle cartridges.	**2** *306* IMPROVE particle sampling day	**3** *307*	**4** *308*	**5** *309* IMPROVE particle sampling day
6 *310* Daylight Savings Time Ends	**7** *311*	**8** *312* Election Day IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**9** *313*	**10** *314*	**11** *315* Veterans Day IMPROVE particle sampling day	**12** *316*
13 *317*	**14** *318* IMPROVE particle sampling day	**15** *319* Change IMPROVE particle cartridges.	**16** *320*	**17** *321* IMPROVE particle sampling day	**18** *322*	**19** *323*
20 *324* IMPROVE particle sampling day	**21** *325*	**22** *326* Change IMPROVE particle cartridges.	**23** *327* IMPROVE particle sampling day	**24** *328* Thanksgiving	**25** *329*	**26** *330* IMPROVE particle sampling day
27 *331*	**28** *332*	**29** *333* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	**30** *334*			

Oct 2011

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Dec 2011

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11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Operator Involvement -- The Key to Network Success

Operators: Thanks for all you do!

Monitoring is more than just collecting samples...

It's also about spotting problems and dealing with them. It's about getting the small things right. IMPROVE sincerely thanks our field operators for your attention to detail and relentless determination to acquire a quality data set.

Operators are our boots on the ground and eyes in the field. You provide field service, spot and document potential problems, do data processing, and continue education to keep abreast of changing electronic methods and changing data reporting methods. You do this while fighting insects, animals, weather, power outages, and fire threats. Thank you for your quality work and a job well done!

Capitol Reef National Park, Utah

Prior to working for the National Park Service, **Randy Sadler** and his wife Melody lived in Salt Lake City, UT. Randy says they used to visit Capitol Reef Natl. Park on long weekends and fell in love with the area. "We were always particularly struck by the peacefulness and the beauty of the clear blue skies against the red rocks," he said. Then one day, he became an employee at the park.

Randy relates, "After retiring from an earlier career in the copy/printing business, we jumped at the chance to volunteer as campground hosts for Capitol Reef, accompanied by our three-year-old son, Dylan. One thing led to another, and I now find myself 10 years into a career with the federal government working at a place I care about."

"My primary responsibilities for the park service are in contracting. When spending most of my time on a computer, it is easy to forget the role I play in supporting the NPS mission statement of preserving and protecting our parks. It is refreshing to have an excuse every Tuesday to get out from behind the desk to take the IMPROVE air quality readings. It gives me a chance to participate in the science of the park service and to remember what it was about the park service that enticed me into this field in the first place.

"The air quality at Capitol Reef is among the best in the country. The site sits atop a hill overlooking the Henry Mtns. in the distance and the spectacular scenery of Waterpocket Fold, a 100-mile wrinkle in the earth's crust. I feel I am doing my part to facilitate the protection of this area by performing my duties at the air quality station."

Randy and Melody enjoy hiking the remote canyons and slickrock of Capitol Reef, and cross-country skiing in the mountains of Dixie and Fishlake Natl. Forests in winter.

December

Where is the largest wilderness and national wildlife refuge in the U.S.: Texas, California, Florida, or Alaska?

Flip up the back cover for the answer.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
UC Davis: *Sampler*: General Lab (530) 752-1123 **ARS**: *Optical*: Carter Blandford or Karen Rosener *Photography*: Karen Fischer (970) 484-7941 Nov 2011 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 Jan 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1 *335 Julian day*	2 *336* IMPROVE particle sampling day	3 *337*
4 *338*	5 *339* IMPROVE particle sampling day	6 *340* Change IMPROVE particle cartridges.	7 *341*	8 *342* IMPROVE particle sampling day	9 *343*	10 *344*
11 *345* IMPROVE particle sampling day	12 *346*	13 *347* Change IMPROVE particle cartridges.	14 *348* IMPROVE particle sampling day	15 *349*	16 *350*	17 *351* IMPROVE particle sampling day
18 *352*	19 *353*	20 *354* IMPROVE particle sampling day Special IMPROVE particle cartridge change. Move cassette 3 from old cartridge to new.	21 *355*	22 *356*	23 *357* IMPROVE particle sampling day	24 *358*
25 *359* Christmas	26 *360* IMPROVE particle sampling day	27 *361* Change IMPROVE particle cartridges.	28 *362*	29 *363* IMPROVE particle sampling day	30 *364*	31 *365* New Year's Eve

Operator Involvement -- The Key to Network Success

IMPROVE STEERING COMMITTEE

IMPROVE Steering Committee members represent their respective agencies and meet periodically to establish and evaluate program goals and actions. IMPROVE-related questions within agencies should be directed to the agency's steering committee representative.

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ASSOCIATE MEMBERS
Associate Membership in the IMPROVE Steering Committee is designed to foster additional comparable monitoring that will aid in understanding Class I area visibility, without upsetting the balance of organizational interests obtained by the steering committee participants. The Associate Member representative is

STATE OF ARIZONA
currently vacant

Celebrating 25 Years of Helping Clear the Air

In 2010, the IMPROVE national air quality monitoring program marked 25 years of operation. This extensive air monitoring program was implemented in 1985 to establish the current visibility conditions, track changes in visibility, and determine the causes and mechanisms for visibility impairment in national parks, wilderness areas, refuges, and tribal lands across the nation. The data are used to determine compliance with the National Ambient Air Quality Standards and to assess national and regional air pollution control policies. The IMPROVE dataset provides vital information to Congress, air pollution control agencies, academia, and the public.

For questions or problems with optical or scene monitoring equipment, contact Mark Tigges, Air Resource Specialists, Ft. Collins, CO, at 970-224-9300. For questions or problems with air sampler controllers, filters, or audits, contact Jose Mojica, UC Davis, at 530-752-1123.
We would like to thank all the contributing IMPROVE sampler operators who took time out of their busy schedules to send us their site descriptions, photos, and personal stories and insights. These efforts help to enrich this publication and put a human face on our program.

Answers to trivia questions:

January Great Smoky Mountains NP, on the Tennessee / North Carolina border, had 6.4 million visitors in 2009.

February Great Sand Dunes NP in CO became the newest park in 2002.

March In 2000, Zion NP in Utah banned nearly all vehicles from peak season travel.

April Delaware is the only state without a national park unit of some kind within its borders.

May All the extraordinary features listed are contained within national park boundaries.

June Trash. Coins, bottles, and other debris obstruct hot water circulation from the pool's vents.

July Jimmy Carter signed the Alaska Natl. Interest Lands Conservation Act of 1980, securing an additional 40 million acres of federal lands.

August An arrowhead, which symbolizes history and archaeology.

September Acadia Natl. Park in Maine (originally called Lafayette Natl. Park) was established in 1919.

October Pelican Island Natl. Wildlife Refuge in Florida was established on March 14, 1903.

November Shoshone Natl. Forest in Wyoming became the first national forest through an act signed by President Benjamin Harrison in 1891.

December The 8 million acres of the Arctic Natl. Wildlife Refuge in northeast Alaska is the nation's largest.

Front cover photo: Monument Valley, Utah. Photographer: Jeff Lemke