# 2005 Calendar

# IMPROVE

## Interagency Monitoring of Protected Visual Environments

# THE IMPROVE PROGRAM

# WHITE PASS, GIFFORD PINCHOT NATL. FOREST

**IMPROVE**
Interagency Monitoring of Protected Visual Environments

The Interagency Monitoring of Protected Visual Environments (IMPROVE) program is a cooperative air quality monitoring effort between federal land managers; regional, state, and tribal air agencies; and the Environmental Protection Agency. The IMPROVE monitoring program was established in 1985 to aid in the implementation of the 1977 Clean Air Act goal of preventing future and remedying existing visibility impairment in 156 Class I areas (national parks, wilderness areas, and wildlife refuges). The network began operating in 1988 and currently consists of 163 monitoring sites. The data collected are critical for the implementation of our national goal to reduce regional haze in Class I areas by establishing the current visibility conditions, tracking the progress toward attaining the goal, and identifying the chemical species and emission sources responsible for existing visibility impairment.


The IMPROVE White Pass monitoring site is located in the state of Washington in the breathtaking Cascade Mountains. Visibility at the site is usually dependant on weather. During high pressure weather the view is grand with Mount Rainier to the northwest, the Gifford Pinchot National Forest and Goat Rocks Wilderness to the south, the William O. Douglass Wilderness to the northeast, and the Wenachee National Forest to the east.

Access to the site can be a challenge. Although the site is located on a ski lift departure platform, it is not always available for use. On a good day the chair is operating and it's a 10-minute trip to Pigtail Peak (elevation 6000 ft.), the location of the IMPROVE sampling system. On a bad day, it's a 2-hour hike, about a mile and a half in distance with a 1500-foot elevation gain. After July 4, a service road is open and driving to the site is possible until late September. Weather can be extreme in the Cascade Mountains of Washington; on Tuesday, November 3, 2004, it was 12 degrees F with 40 mph wind gusts when Tom Griffith visited the site. At times during the summer Pigtail Peak is over 90 degrees F, and swarms of mosquitoes impair service operations when there is no wind!

The White Pass site exhibits some of the best air quality measured in the continental United States. The area benefits from being located north of the Columbia River Gorge and southeast of Puget Sound. Prevailing winds bring air masses which miss both the urban areas of Portland, Oregon, and Seattle, Washington. Average annual visibility is about 137 miles but ten percent of the time it exceeds 180 miles. The haziest days occur in August, September, and November when visibility dips below 75 miles. Almost 50% of the haze can be attributed to sulfates, pointing to industrial activities involving fossil fuel combustion. Depending on the time of year, 20-30% of the haze can be attributed to organic compounds. Organics can be emitted from automobiles, diesel engines, and forest fires.

The White Pass IMPROVE site also hosts a joint Washington State Department of Ecology and USDA Forest Service ozone monitoring station and a nephelometer during the months of May through September. This site has the highest elevation of all the ozone sites in Washington State. Tom and Steve are also responsible for keeping the ozone samplers operating.


Clear Day

# White Pass, Gifford Pinchot National Forest

# January

"Conservation is the foresighted utilization, preservation and/or renewal of forests, waters, lands and minerals, for the greatest good of the greatest number for the longest time."
Gifford Pinchot

In addition to being the primary White Pass IMPROVE site operator, Tom Griffith's duties are in the Fire and Aviation Management organization working as the lead fire prevention technician on the Cowlitz Valley Ranger District of the Gifford Pinchot National Forest. He supervises the district's seasonal fire detection, prevention, and suppression work force and is away from the district much of the summer responding to project fires all over the West as an Air Operations Branch Director on one of Washington's Interagency Incident Management Teams.

Tom has two grown stepchildren and four grandchildren who keep him and Marilyn busy. His hobbies include being the assistant coach for the White Pass High School boy's basketball team. He's an avid sports fan and follows high school, college, and professional sports throughout the year.

Steve Freitas is the back-up White Pass IMPROVE site operator when Tom is away from the district on fire assignments. His duties include silvicultural operations - planning and implementing of the reforestation and timber stand improvement programs in the Cowlitz Valley Ranger District. Steve is also the Heritage Program coordinator for the district and the cultural resource technician for the forest. Steve does a significant amount of archaeological work for the forest - primarily conducting surveys in search of prehistoric and historic sites.

Steve is married and has three sons, two attending college and one in high school. His hobbies include playing guitar and bass in a local bluegrass folk rock band.

Tom and Steve like the fact that the air quality monitoring work adds a different dimension to working in the forest. Most of the time it's an enjoyable break from their normal routines, and they think that the view of Mt. Rainier from the White Pass IMPROVE site on Pigtail Peak is spectacular!

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| Dec 2004<br>S M T W T F S<br>1 2 3 4<br>5 6 7 8 9 10 11<br>12 13 14 15 16 17 18<br>19 20 21 22 23 24 25<br>26 27 28 29 30 31 | | | Feb 2005<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 | | | 1<br>*1 Julian day*<br>National Environmental Policy Act, 1969<br>New Year's Day<br>IMPROVE particle sampling day |
| 2<br>*2* | 3<br>*3* | 4<br>*4*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 5<br>*5* | 6<br>*6* | 7<br>*7*<br>IMPROVE particle sampling day | 8<br>*8* |
| 9<br>*9* | 10<br>*10*<br>IMPROVE particle sampling day | 11<br>*11*<br>Change IMPROVE particle cartridges. | 12<br>*12* | 13<br>*13*<br>IMPROVE particle sampling day | 14<br>*14* | 15<br>*15* |
| 16<br>*16*<br>IMPROVE particle sampling day | 17<br>*17*<br>Martin Luther King, Jr. | 18<br>*18*<br>Change IMPROVE particle cartridges. | 19<br>*19*<br>IMPROVE particle sampling day | 20<br>*20* | 21<br>*21* | 22<br>*22*<br>IMPROVE particle sampling day |
| 23<br>*23* | 24<br>*24* | 25<br>*25*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 26<br>*26* | 27<br>*27* | 28<br>*28*<br>IMPROVE particle sampling day | 29<br>*29* |
| 30<br>*30* | 31<br>*31*<br>IMPROVE particle sampling day | | | | | |

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

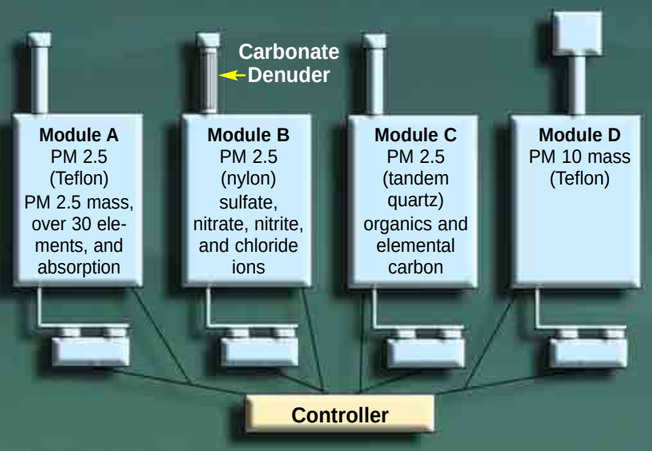
**ARS**: *Optical*:
Carter Blandford or
Karen Rosener
*Photography*:
Karen Fischer
(970) 484-7941

"Operator Involvement -- The Key to Network Success"

# THE IMPROVE AEROSOL SAMPLER

# LOSTWOOD NATIONAL WILDLIFE REFUGE

Monitoring of particulate concentrations began at some national park service sites in 1979. Today, all IMPROVE program sites conduct particle sampling to pinpoint the type of particles causing visibility degradation.Through sample analysis, the particle sizes, chemical compositions, and concentrations can be characterized. Particle measurements in conjunction with optical measurements allow estimation of the sources of visibility impairment.




The standard IMPROVE particulate sampler has four sampling modules. Modules A, B, and C collect fine particles (2.5 microns and smaller (PM2.5)), while Module D collects larger particles. Fine particles have the greatest impact on visibility, can adversely affect human health, and are often the result of human activities. Module D collects particles 10 microns and smaller (PM10). The coarse mass (particles larger than 2.5 microns) is primarily composed of soil and carbonaceous material and is often of natural origins. IMPROVE aerosol data are used for assessing the contribution of various sources to haze. In addition, these data are the basis for tracking progress related to the regional haze regulations.

Filter analysis provides concentrations and composition of atmospheric particles. Common fine particles include sulfates, nitrates, organic material, elemental carbon (soot), and soil. An indication of sources can be obtained from the analysis of trace elements.

| | |
|---|---|
| ◆ vanadium/nickel | petroleum-based facilities, autos |
| ◆ arsenic | copper smelters |
| ◆ selenium | power plants |
| ◆ crustal elements | soil dust (local, Saharan, Asian) |
| ◆ potassium (non-soil) | forest fires |

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

Lostwood National Wildlife Refuge, established in 1935, lies in the highly productive prairie pothole region of North Dakota that produces more waterfowl than any other region in continental United States. The refuge is a land of rolling hills, mantled in short-grass and mixed-grass prairie interspersed with numerous wetlands that can exceed 150 basins per square mile. Visitors essentially enjoy the same grasslands experienced by the first European settlers. A refuge and breeding ground for migratory birds and other wildlife, Lostwood NWR boasts species including Baird's and Le Conte's sparrows, Sprague's pipit, sharp-tailed grouse, and the threatened piping plover.

In 1975 Congress established the Lostwood Wilderness Area, located in the northwest corner of the refuge. Air quality monitoring started in 1998 with the installation of an IMPROVE sampling site. There is also a precipitation site in the refuge that monitors total mercury in the rainfall. Servicing the site is generally not a problem except during a week or two in the winter when the temperature dips to 30-40 below 0°F and pumps freeze!

Lostwood NWR is mandated to protect the air quality values at the class I level in the wilderness area. Managing the refuge and the wilderness as an integrated ecosystem will help insure the best possible air quality for the refuge as a whole. On clear days visibility can be over 50 miles. Most reductions to visibility are caused by fog or precipitation. During years of drought and fire in the West (as in the summer of 2000), visibility can drop to one mile. In that summer, smoke from large fires in Montana and Canada filled the air. The nearest sources of air-borne sulfate are coal-fired power plants in Canada, whose border is 23 miles north of Lostwood NWR.

Because of its high density of wetlands, air quality related values are important in the refuge. The wetlands function as sediment traps and filters for natural and man-made pollutants. Deposition of pollutants further burdens the filtering capacity of these wetlands, possibly adding to already high methylmercury content. Mercury studies are underway to determine if mercury is being deposited from the air by wet and dry mechanisms, how mercury changes to methylmercury, and if it is moving up the food chain. Mercury levels are low at Lostwood but methylmercury levels are high. Studies are also trying to understand whether the high methylmercury levels are natural or man-made, and whether or not vertebrate and invertebrate populations are impacted.

# Lostwood National Wildlife Refuge

# February

"To the dull mind nature is leaden. To the illumined mind the whole world burns and sparkles with light."
Ralph Waldo Emerson

**The site's operator is Mike Graue. He lives in Kenmare, ND, with his wife Colleen and son Thomas who was born in July, 2004. He spends his spare time camping, fishing, and hunting with his wife and friends.**

**Mike is the private lands biologist for the Lostwood Wetland Management District (Lostwood WMD), and has been working at the Lostwood WMD since March, 2003. His duties as the private lands biologist are to develop agreements with private land owners who want to implement conservation practices on their land. He works with landowners helping them develop practices that will benefit wildlife and their land-use operations. He primarily works with farmers and ranchers restoring wetlands and grasslands, developing dams and designing managed grazing systems to help conserve grasslands for increased wildlife utilization and increased weight gain on stock animals. He also helps with annual sharp-tailed grouse counts on the refuge, waterfowl pair counts in the district, and prescribed burning on refuge lands.**

**Mike feels fortunate to be able to work with private landowners and the U.S. Fish and Wildlife Service's Partners for Wildlife Program. Ninety percent of the land is in private ownership, and the Partners for Wildlife Program gives them the opportunity to provide or enhance wildlife habitat on these lands while keeping the land private.**

*"Potholes" in morning fog*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| **UC-Davis**: *Sampler*: General Lab (530) 752-1123<br><br>**ARS**: *Optical*: Carter Blandford or Karen Rosener<br>*Photography*: Karen Fischer (970) 484-7941 | | 1<br>*32 Julian day*<br>Change IMPROVE particle cartridges. | 2<br>*33*<br>Groundhog Day | 3<br>*34*<br>IMPROVE particle sampling day | 4<br>*35* | 5<br>*36* |
| 6<br>*37*<br>IMPROVE particle sampling day | 7<br>*38* | 8<br>*39*<br>Change IMPROVE particle cartridges. | 9<br>*40*<br>IMPROVE particle sampling day | 10<br>*41* | 11<br>*42* | 12<br>*43*<br>Lincoln's Birthday<br>IMPROVE particle sampling day |
| 13<br>*44* | 14<br>*45*<br>Valentine's Day | 15<br>*46*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 16<br>*47* | 17<br>*48* | 18<br>*49*<br>IMPROVE particle sampling day | 19<br>*50* |
| 20<br>*51* | 21<br>*52*<br>President's Day<br>IMPROVE particle sampling day | 22<br>*53*<br>Washington's Birthday<br>Change IMPROVE particle cartridges. | 23<br>*54* | 24<br>*55*<br>IMPROVE particle sampling day | 25<br>*56* | 26<br>*57*<br>Grand Canyon National Park established, 1919 |
| 27<br>*58*<br>IMPROVE particle sampling day | 28<br>*59* | | | | | |

Jan 2005

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| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 | | | | | |

Mar 2005

| 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 | | |

"Operator Involvement -- The Key to Network Success"

# IMPROVE AEROSOL SAMPLER OPERATIONS

## PHOENIX

The IMPROVE network operates on the one-day-in-three protocol. Sample change is always on Tuesday. (Arrangement of ambient filters varies each week; pattern repeats every third week.)

**For two of the three weeks**, the sampler will not be operating on the sample-changing day. The operator records final readings, replaces old cartridges, and records the initial readings. There will be initial or final readings for the filter in position 3 for two of the three weeks. The log sheet and display indicate when values for position 3 are recorded.

**Every 3rd week,** the sampler will be operating when the operator arrives. When sample change is initiated the controller will:

- Suspend sampling.
- Read flow rates on all filters and record information.
- Transfer the cassette in position 3 from the old cartridge to the new one. (New cartridges have no cassette in position 3. The position 3 cassette has a black O-ring attaching it -- the only one that can be removed without a special tool.)
- Transfer the cassette and install a new cartridge. After the initial readings are taken, the sampler will resume collection on the filters in position 3.

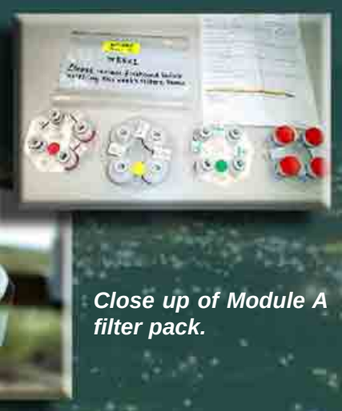
The field blanks in position 4 are transparent to the operator and sampler controller. Flow rate measurements are not taken for these.

If for any reason you or your backup cannot make a change on a particular Tuesday or the "blue box" is late, or for any problem or question, immediately call UCD's General Lab at (530) 752-1123. Discussing a problem first will avoid confusion, and a proper diagnosis is more likely to be made. NO problem is too small; it could be a sign of bigger problems, such as unusual readings.

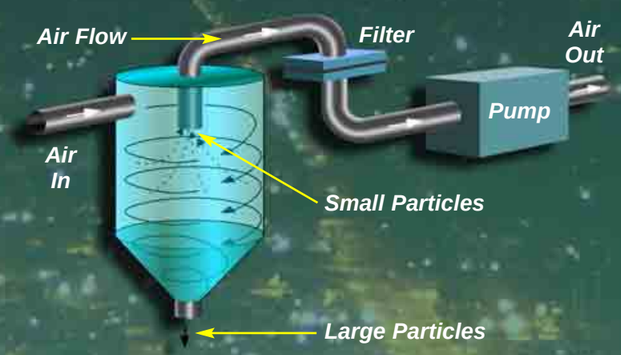
The "blue box" has three dates listed on it. These are the dates (all Tuesdays) on which the filters must be installed.

Each blue box contains:
- 1 flash memory card
- 3 labeled Ziploc© bags
- 1 bag/week labeled with install date and 4 color-coded cartridges, one for each module.

Four filter cartridges:
Red for Module A
Yellow for Module B
Green for Module C
Blue for Module D



*Close up of Module A filter pack.*




The IMPROVE fine particle modules employ a cyclone at the air inlet which spins the air within a chamber. Fine particles are lifted into the air stream where they will be siphoned off and collected on a filter substrate for later analysis. The large particles impact on the sides of the chamber and fall into a collection cup at the bottom.

The Arizona desert was once the destination for people with respiratory problems ranging from allergies to asthma to tuberculosis. Since the early 1990's a "Brown Cloud" of pollutants has settled over the desert consisting mostly of tiny particles of carbon and nitrogen dioxide gas. Power plants, cars, diesels, construction equipment, and other industries that burn fossil fuels contribute most of the particles that make up the cloud. The weather that attracts residents to the area also traps the particles and gasses that create the pollutant cloud that reduces visibility and contributes to a higher incidence of respiratory ailments. In typical desert fashion, an inversion layer forms at night, as cool west mountain air flows over the warm desert floor trapping the day's emissions near the ground. As the day heats up, pollutants rise forming a haze that expands as the day progresses.

Phoenix, the nation's 7th most populated city, is home to a dozen air quality sites. It is also part of Arizona's comprehensive air quality program. Arizona Department of Environmental Quality (ADEQ) monitors Arizona's air quality in urban centers and remote areas of the state. ADEQ implemented a long-term urban visibility monitoring network in 1992. In addition to IMPROVE sampling, many sites include optical monitoring with nephelometers or transmissometers and color photography to document scene appearances. Monitoring is conducted in cooperation with the National Park Service and the USDA Forest Service at Grand Canyon NP, Petrified Forest NP, Saguaro NP, Organ Pipe NM, Chiricahua NM, and wilderness areas including Mt. Baldy, Sycamore Canyon, Mazatzal, Sierra Ancha, Superstition, and Galiuro, as well as other sites at Hillside and Meadview.

IMPROVE data from 1994-2002 indicate average visibility in the Phoenix-Tucson area is about 30 miles. 20% of the time visibility is 58 miles or better and 20% of the time visibility is less than 19 miles. During the summer months visibility reducing haze in southern Arizona deserts is composed of almost equal amounts organic particles, sulfates, dust, and elemental carbon. Half of the haze can be attributed to byproducts of fuel combustion, especially automobiles and diesel engines. Fine dust is mostly wind blown dust from roads, construction activities, and soil erosion. Nitrates are the result of fuel combustion activities involving the transportation sector. High ozone concentrations are also a summer phenomena, low at night, rising rapidly through the morning, and peaking in the afternoon.

The greatest visibility impairment occurs during the winter months when inversions are common. During these months, haze in the Phoenix metropolitan area is 40-60% organics with some days exhibiting a nitrate component above 50%, indicating an accumulation of local emissions.

## Phoenix

# March

"A man who has lost his sense of wonder is a man dead."
William of Saint Thierry

Arizona's comprehensive air quality program requires constant watch, and Terry Taflinger makes certain that 15 monitoring sites are up and running as much as possible. Terry, an air quality instrumentation specialist for the Arizona Department of Environmental Quality (ADEQ), assists site operators in Phoenix and around the state. His assistance and experience in troubleshooting all those systems pays off. With his efforts and those of primary site operator Warren Mason, the Phoenix IMPROVE aerosol site collected 92% of all data from the primary sampler during 2004, and 100% of all data from the collocated sampler.

Terry joined the ADEQ in 1985. "I worked on a little bit of everything back then," said Terry, "gaseous samplers, particulate samplers, and different types of visibility instrumentation. Now I primarily troubleshoot systems, perform instrument calibrations, and install monitoring stations." He installed the newest IMPROVE protocol aerosol site in Douglas, AZ, in June, for which Jose Rodriguez will be the primary operator. The site includes an IMPROVE aerosol sampler and two R&P 2000 particulate matter samplers on a monitoring support structure.

Terry gained his troubleshooting experience in the U.S. Air Force, where he served as a radar maintainance and electronics technician. After discharge he spent 14 years installing and maintaining cable TV lines. He then got into the air quality field by operating a monitoring site near a copper mine in Arizona for several years. When the mining industry fell economically, Terry moved to Phoenix and joined the ADEQ.

While not too fond of the Phoenix heat, Terry visits his grandchildren as much as he can in the city. He also likes to travel to the mountains, take an ocean vacation, and visit relatives in California and his native Indiana.

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| Feb 2005<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 | | 1<br>*60 Julian day*<br>Yellowstone Natl. Park established, 1872<br>Change IMPROVE particle cartridges. | 2<br>*61*<br>IMPROVE particle sampling day | 3<br>*62* | 4<br>*63* | 5<br>*64*<br>IMPROVE particle sampling day |
| 6<br>*65* | 7<br>*66* | 8<br>*67*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 9<br>*68* | 10<br>*69* | 11<br>*70*<br>IMPROVE particle sampling day | 12<br>*71* |
| 13<br>*72* | 14<br>*73*<br>IMPROVE particle sampling day | 15<br>*74*<br>Change IMPROVE particle cartridges. | 16<br>*75* | 17<br>*76*<br>St. Patrick's Day<br>IMPROVE particle sampling day | 18<br>*77* | 19<br>*78* |
| 20<br>*79*<br>Spring Begins<br>Spring begins<br>IMPROVE particle sampling day | 21<br>*80* | 22<br>*81*<br>Change IMPROVE particle cartridges. | 23<br>*82*<br>IMPROVE particle sampling day | 24<br>*83* | 25<br>*84* | 26<br>*85*<br>IMPROVE particle sampling day |
| 27<br>*86* | 28<br>*87* | 29<br>*88*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 30<br>*89* | 31<br>*90* | Apr 2005<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30 | |

"Operator Involvement -- The Key to Network Success"

# TROUBLESHOOTING THE FILTER CHANGE

# BRIDGER WILDERNESS AREA

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 logsheet 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 logsheet.

## 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 logsheet.**

* 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 logsheet 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:
Filter boxes, flashcards, and sample changes: **contact Sujan Bhattarai, Joan Hancock, Jose Avena, Jose Mojica, or Steven Ixquiac at (530) 752-1123.**

Controllers, equipment malfunctions, sampler maintenance, and flow adjustments: **contact Jose Mojica at (530) 752-9044 [cell: (530) 867-4391], or Steven Ixquiac at (530) 752-4108 [cell: (530) 304-1468].**

Sampler audits: **Steven Ixquiac (see above).**

The Bridger Wilderness is located in west-central Wyoming, in the Bridger-Teton National Forest in the Wind River range. The area is intricately faulted and carved by glaciers creating 13,800-foot Gannett Peak, the highest mountain in Wyoming. This is where the headwaters of the mighty Green River originate, and 7 of the 10 largest glaciers in the lower 48 states are located here. Adjacent to the Bridger Wilderness on the eastern side of the divide are the Fitzpatrick Wilderness, the Popo Agie Wilderness, and the Wind River Indian Reservation.

The Pinedale Ranger District operates an IMPROVE site and transmissometer, both of which are located in the Bridger-Teton National Forest about 10 miles from Pinedale, Wyoming. The IMPROVE site was established in early 1988 as a part of an overall monitoring program for the Wind River Range. Visibility in the wilderness is usually excellent. Trend data show a slight improvement in visibility on hazy days, but no similar trend emerges for the clear days. Visibility has remained basically the same since the late 1980s; however, as development continues and the population increases, it will be important to continue monitoring for changes in air quality levels and haze composition. 2002 data show current annual average visibility to be about 125 miles, with 76-mile visibility on the haziest days and 180-mile visibility or greater on the clearest days.

Due to its geologic make-up, which is mostly granite, the Wind River Range is highly susceptible to acid deposition. IMPROVE data indicate that nitrates have increased over time and sulfates have decreased, both of which are consistent with national trends in the West.

Air quality is a big concern in southwestern Wyoming. The Jonah Oil and Gas field is less than 40 miles from the Bridger-Teton National Forest. Prevailing winds transport emissions from the southwest quadrant of Wyoming into the Bridger and Fitzpatrick Class I wilderness areas. The southwest quadrant of Wyoming is relatively highly industrialized, with a group of five large trona plants, several gas plants, two coal-fired power plants, and a large number of oil and gas wells. Proposals are being considered for as many as 11,000 new natural gas wells, expansions of three large soda ash processing facilities, new gas treatment plants, mines, and chemical plants in southwest Wyoming.

# Bridger Wilderness Area

# April

"Find your place on the planet. Dig in, and take responsibility from there."
Gary Snyder

Ted Porwoll **is the primary operator of the IMPROVE site. He has lived in Pinedale since 1997. His hobbies include fishing and skiing, and he is an experienced outdoorsman, which is why this job is perfect for him. His other duties include NADP analysis, lake sampling, coordinating other sampling programs around the region, and managing the permit for the local ski area.**

Sonia Otteman **helps Ted collect data from the IMPROVE and transmissometer sites on occasion. She has lived in Pinedale her entire life, and also loves the outdoors. Her hobbies include skiing, horseback riding, and writing. Currently, Sonia works as an information assistant for the Forest Service and during the winter months she is active in the ski patrol.**

*Fayette Lake Fire*

*Transmissometer*

*Fremont Peak*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| **UC-Davis**: *Sampler*: General Lab (530) 752-1123<br><br>**ARS**: *Optical*: Carter Blandford or Karen Rosener<br>*Photography*: Karen Fischer (970) 484-7941<br><br>Mar 2005<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31<br><br>May 2005<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31 | | | | | 1<br>*91 Julian day*<br>IMPROVE particle sampling day | 2<br>*92* |
| 3<br>*93*<br>Daylight Savings Time Begins | 4<br>*94*<br>IMPROVE particle sampling day | 5<br>*95*<br>Change IMPROVE particle cartridges. | 6<br>*96* | 7<br>*97*<br>IMPROVE particle sampling day | 8<br>*98* | 9<br>*99* |
| 10<br>*100*<br>IMPROVE particle sampling day | 11<br>*101* | 12<br>*102*<br>Change IMPROVE particle cartridges. | 13<br>*103*<br>IMPROVE particle sampling day | 14<br>*104* | 15<br>*105* | 16<br>*106*<br>IMPROVE particle sampling day |
| 17<br>*107* | 18<br>*108* | 19<br>*109*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 20<br>*110* | 21<br>*111* | 22<br>*112*<br>Earth Day<br>IMPROVE particle sampling day | 23<br>*113* |
| 24<br>*114* | 25<br>*115*<br>IMPROVE particle sampling day | 26<br>*116*<br>Change IMPROVE particle cartridges. | 27<br>*117* | 28<br>*118*<br>IMPROVE particle sampling day | 29<br>*119* | 30<br>*120*<br>Arbor Day |

"Operator Involvement -- The Key to Network Success"

# OPERATOR SUPPORT

# WAMPANOAG TRIBE, MARTHA'S VINEYARD

Air Resource Specialists, Inc. (ARS), supports visibility-monitoring networks for federal land management agencies, state agencies, municipalities, Indian nations, and private industry. ARS currently supports over 75 visibility monitoring sites nationwide and has been the prime contractor to the IMPROVE program, and the National Park Service and Forest Service Visibility Monitoring and Data Analysis Programs.

ARS strongly encourages operators to call if there are any questions about parts, supplies, or instrument operations. It may be wise to call for instructions and troubleshooting advice before attempting to solve any problems. For questions or problems with IMPROVE sites, call 800-344-5423. For issues concerning special studies or non-IMPROVE sites, call 970-484-7941.

*Carter Blandford, senior data analyst, performs data collection, validation, and provides operator support for transmissometers and nephelometers.*

*Karen Rosener, data analyst, performs data collection, validation, and provides operator support for transmissometers and nephelometers.*

*Jared Merk, data analyst, performs data collection, validation, and provides operator support for transmissometers.*

*Karen Fischer, photographic specialist, performs image collection and system trouble-shooting, and provides operator support for photographic systems.*

*Marty Mills, electronics technician, performs servicing of transmissometers and nephelometers and troubleshooting of power-related instrument problems.*

The University of California at Davis (UCD) supports the particulate measurements for the IMPROVE program. The network of samplers provides aerosol data for the federal, Indian, state, and local agencies. UCD supports over 180 monitoring sites nationwide, including processing over 6,000 filters each month. Handling large volumes of filters and associated data requires carefully designed operating procedures that minimize errors between site operators and UCD. As with any well-crafted plan, things can go wrong and that is where UCD's operator support staff steps in to help.

No problem is too big or small for the operator support staff at UCD. For any problem or question, call UCD's General Lab at 530-752-1123.

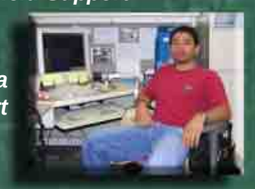
*Sujan Bhattarai*
*Operator Support*
*Laboratory Support*

*Joe Carle*
*Operator / Field Support*

*Pat Feeney*
*Analytical and Data Support*

*Joan Hancock*
*Operator Support*
*Senior Laboratory Support*

*Steve Ixquiac*
*Operator Support*
*Technical and Field Support*



*Jose Mojica*
*Operator / Field Support*

*Brian Perley*
*Analytical and Data Support*

Three miles off the coast of Cape Cod is the island of Martha's Vineyard. Here you can find the ancestral lands of the Wampanoag tribe. Wampanoag means "eastern people" or "people of the dawn". All Mayflower descendants owe a debt of gratitude to the Wampanoag. Without their help the Pilgrims would have likely starved to death the first winter. Mixed descendants of these early Nantucket Indians survive today, particularly on Martha's Vineyard. In 1987 the tribe received federal recognition and is the only federally recognized Native American tribe in the state of Massachusetts. A federal program insures that 500 acres of tribal lands and those that directly impact it are preserved.

The tribe has many environmental concerns. In 1991 an environmental laboratory was created to assure that each and every tribal member on the island had clean drinking water. The laboratory is also the center for environmental studies assessing the health of tribal wetlands, including a study of surface water quality on Menemsha and Squibnocket ponds. These ponds are important tribal heritage sites to a culture that depends on resources of the land, air, and fresh and salt water to harvest fish, animals, and plants for consumption. Heavy nitrogen loading in local watersheds has led to a 50% loss of eel grass beds, a critical scallop and oyster habitat. Nitrogen seeping into ponds is 10 to 100 times the level sensitive species can tolerate.

In 2000 the tribe's Natural Resources Department instituted a program to assess the current state of air quality by measuring the atmospheric deposition of mercury and various other pollutants to determine the potential threat to the tribal community through consumption of locally harvested food. In 2003 an IMPROVE aerosol monitor was purchased to collect air quality and visibility data and the site was added to the IMPROVE monitoring network. IMPROVE data shows annual average visibility to be about 50 miles. During the summer months visibility is at its lowest, dropping to about 30 miles. On the clearest days, about 20% of the time, you can see 95-100 miles. The tribe partners with the Mid-Atlantic / Northeast Visibility Union (MANE-VU), as well as federal and state agencies, to share data and participate in regional haze planning activities for the region.


*Aerial photo of the western tip of Martha's Vineyard*

# Wampanoag Tribe, Martha's Vineyard

Hilary Crook is the laboratory manager of the Department of Environmental Protection's certified lab. One of her many projects is the successful monitoring and maintenance needs of the IMPROVE air sampler. She installed the unit during early January of 2002 and has been tending to it ever since.

One of the many reasons she believes in the project is that since the early 1990s the Natural Resources Department within the tribe has been actively monitoring water quality. With this amount of data available and the same monitoring program still being successfully implemented, the site is now able to add another key measurement to better understand environmental impacts. The IMPROVE system offers a chance to begin to understand the impact that transported pollutants may be having on the lands and waters of the community at large.

Hilary began working with the tribe during the spring of 2000. At first her main project was to collect water quality samples from Menemsha and Squibnocket Ponds. Additionally, with a laboratory facility being made available, she began the long process of certification of the lab. This has led to a wonderful job position that allows her the freedom to do the environmental research that she enjoys as well as provide a much-needed service to tribal members and everyone who calls the Vineyard home.

*Herring Creek*

# May

"If future generations are to remember us with gratitude rather than contempt, we must leave them more than the miracles of technology. We must leave them a glimpse of the world as it was in the beginning, not just after we got through with it."

President Lyndon B. Johnson, upon signing of the Wilderness Act, 1964

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

Apr 2005

| 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 2005

| 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 | | |

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

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# MONITORING NETWORKS COMPLEMENTING IMPROVE

# SAN GORGORNIO WILDERNESS AREA

The NPS visibility monitoring program started in 1978 without particulate measurements. Some instruments used in the early network currently operate at some sites according to IMPROVE protocols. Data from the aerosol network, the optical network, and the scene network are compiled to better understand and document visibility events and trends.

The optical monitoring network uses transmissometers and nephelometers to measure the ability of the atmosphere to scatter and absorb light. Transmissometers measure the extinction properties of the atmosphere. Extinction is a measure of the light scattered and absorbed over a known distance through the atmosphere. Extinction data is useful for relating visibility directly to particle concentrations. Visibility results are calculated and reported as visual range or extinction. There are currently 19 transmissometers operating under IMPROVE guidelines.

Nephelometers measure the amount of light scattered by particles and gasses in the atmosphere. Estimates of scattering combined with estimates of the absorption coefficient (from aerosol monitoring filters) can be used to determine total light extinction. Temperature and relative humidity sensors are often installed as part of the standard nephelometer configuration. There are currently 43 nephelometers operating under IMPROVE guidelines.


In the scene monitoring network, film and digital camera systems are used at a number of IMPROVE monitoring sites to document the appearance of a view as sun angle, cloud, vegetative cover, and visibility levels change.


There are currently 13 standard camera systems operating within the IMPROVE network. Images from monitoring sites with over five years of data were selected to capture the range or "spectrum" of visual conditions at each site. Visibility photographs can be viewed at: http://vista.cira.colostate.edu/views/Web/IMPROVE/Data_IMPRPhot.htm. To view USDA Forest Service visibility photographs go to http://www.fsvisimages.com/all.html.


Web camera systems are useful for documenting the occurrence of haze episodes. Live pictures of current visibility, weather conditions, and ozone data are transmitted to the web. Views are usually updated at 15-minute intervals. There are currently 47 web camera systems operating in conjunction with the IMPROVE monitoring network. Links to the real-time internet cameras in the Class I areas can be found at:http://vista.cira.colostate.edu/views/Web/WebcamsClass1/webcam.htm.


To access the most current data from all three networks, go to the VIEWS website: http://vista.cira.colostate.edu/views/. Under “Data and Metadata”, click on “Query Wizard”. Select the network, site, and time frame to retrieve your data.

The area now encompassed by the San Gorgonio Wilderness was originally part of the San Bernardino Forest Reserve set aside in 1893. In 1964 it was officially designated the San Gorgonio Wilderness. The wilderness is located east of Los Angeles in the San Bernardino Mountains, encompassing a number of ridges and peaks that rise above tree line. The mountains form a wall along the eastern edge of the Los Angeles Basin and on a clear day there are exquisite views of the Sierra Nevadas and much of the Mojave Desert.

Because of its proximity to the Los Angeles Basin, this area is impacted by some of the highest ozone and nitrate deposition in the U.S. since the 1950s. Research has shown that ecosystem function, growth, and composition have been altered and forest health weakened. In 2002 an episode of forest mortality occurred, in part due to air pollution effects. This massive mortality has endangered tens of thousands of mountain residents and has cost over a half billion dollars to remove dead and dying trees.

IMPROVE data show that some of the greatest visibility impairment due to regional haze occurs in southern California, primarily attributable to nitrates. Visibility is quite high during the winter months, usually in the range of 100 to 200 miles. However, due to the large population of southern California and the high temperatures, summer months are problematic. Because the site is located in the mountains just east of San Bernardino, the winds tend to blow much of the pollution from the Los Angeles area basin into the mountain valley where the site is located. Visibility typically starts to drop in the late morning or early afternoon and can drop quite quickly to less than 3 miles. Trend data indicate there has been a significant decrease in visibility on the hazy days.

Servicing the site is rarely a problem; occasionally there is enough snow to make getting there an inconvenience, but with the warmer climate it rarely lasts long. The fact that there are several monitoring programs operating at the site makes troubleshooting and repairs a challenge at times. The site is still growing, with plans to add additional instrumentation that will broaden the scope of the studies and increase the site's value as a research tool.

In addition to IMPROVE there is a CASTNet station and several types of ozone monitors. Systems are collocated so that active and passive monitoring data can be compared.

# San Gorgornio Wilderness Area

# June

"Living wild species are like a library of books still unread. Our heedless destruction of them is akin to burning the library without ever having read its books."
Rep. John Dingell of Michigan

David Jones, a chemist, has been employed with the USDA Forest Service in the Riverside Forest Fire Laboratory in Riverside, California for the last 13 years. He graduated in 1990 from the University of California - Riverside with a B.S. degree in environmental science.

Aside from operating the monitoring site, David is responsible for daily operations in their chemistry laboratory. He tracks samples as they are processed in the laboratory, and operates much of the equipment used for sample analysis (ion chromatograph, continuous flow analyzer, combustion analyzer, etc.). He also organizes the data and prepares the data reports that are sent out to customers, so his days in the lab encompass all aspects of laboratory operation.

David says, "I have been married to my beautiful wife, Susan, for over six years. We have two amazing boys. Mason is four and Colby is two. We also have a third child on the way. We are expecting a daughter, Zoey, in early December. One of our favorite things to do with the kids is to go to Disneyland. We are looking forward to future traveling (around the U.S.) once the kids get a little older, but right now trips to see Mickey Mouse are about as much as we can handle. Right now my main hobby is fixing up our house. It was built in 1952 and needs a lot of tender loving care. I also enjoy reading, although it is much harder to find the time these days."

*Seven Oaks, south of Big Bear Lake*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| May 2005<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31<br><br>Jul 2005<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30<br>31 | | | 1<br>*152 Julian day* | 2<br>*153* | 3<br>*154*<br>IMPROVE particle sampling day | 4<br>*155* |
| 5<br>*156*<br>National Trails Day | 6<br>*157*<br>IMPROVE particle sampling day | 7<br>*158*<br>Change IMPROVE particle cartridges. | 8<br>*159* | 9<br>*160*<br>IMPROVE particle sampling day | 10<br>*161* | 11<br>*162* |
| 12<br>*163*<br>IMPROVE particle sampling day | 13<br>*164* | 14<br>*165*<br>Flag Day<br>Change IMPROVE particle cartridges. | 15<br>*166*<br>IMPROVE particle sampling day | 16<br>*167* | 17<br>*168* | 18<br>*169*<br>IMPROVE particle sampling day |
| 19<br>*170*<br>Father's Day | 20<br>*171* | 21<br>*172*<br>Summer begins<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 22<br>*173* | 23<br>*174* | 24<br>*175*<br>IMPROVE particle sampling day | 25<br>*176* |
| 26<br>*177* | 27<br>*178*<br>IMPROVE particle sampling day | 28<br>*179*<br>Change IMPROVE particle cartridges. | 29<br>*180* | 30<br>*181*<br>IMPROVE particle sampling day | | |

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# COOPERATING PROGRAMS:
## NPS Gaseous Pollutant and Meteorological Monitoring

## ROCKY MOUNTAIN NATIONAL PARK

*Yosemite gaseous monitoring site*

In support of mandated air resources management responsibilities, the Air Resources Division of the National Park Service maintains a network of air quality monitoring stations to determine trends and current concentrations of air pollutants.


The Gaseous Pollutant Monitoring Network seeks to:

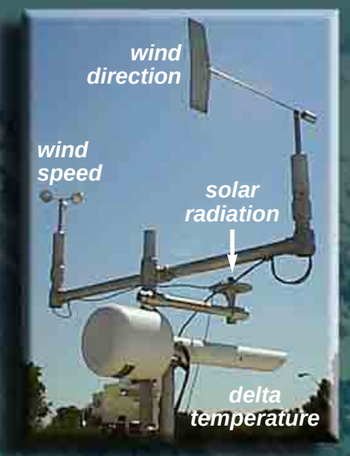
- establish base concentrations of pollutants
- determine compliance with national air quality standards (NAAQS)
- provide data for national and regional air pollution control policies
- provide data for atmospheric modeling
- relate effects on resources to ambient levels of pollutants.

Ambient air gaseous analyzers continuously monitor for:

- ozone
- nitrogen dioxide
- sulfur dioxide
- carbon monoxide.

Meteorological parameters measured in the network include:

- wind speed
- wind direction
- temperature
- delta temperature (lapse rate)
- solar radiation
- precipitation
- relative humidity.



*flow meter*

These parameters enhance the understanding of variations in pollutant concentrations and are useful in estimating deposition rates.

Final validated data can be obtained from these databases:

- EPA Aerometric Information and Retrieval System (AIRS). This data base is a national repository for validated federal, state, and local government air quality data. AIRS data is available on the internet at: http://www.epa.gov/air/data/.
- Gaseous monitoring data is also maintained by the National Park Service Air Resources Division and made available on the internet at: http://www2.nature.nps.gov/air/data/index.htm#packaged.

Rocky Mountain National Park straddles the Continental Divide in the northern Front Range of the Colorado Rocky Mountains. Glaciation produced a wealth of lakes and streams with the majority of these surface waters found in alpine and subalpine settings.

In 1985 the park began monitoring visual air quality with a 35 mm camera. Monitoring continues today with a transmissometer and an IMPROVE aerosol sampler. The IMPROVE aerosol monitoring site is integrated into Rocky Mountain National Park's ozone/weather station near Long's Peak (14,259 feet above sea level) in the southeastern portion of the park. Unlike some other sites in the park, accessing the IMPROVE site is a breeze because it is within 100 yards of a maintained road. With a backdrop of Long's Peak framed with aspens, it is one of the more beautiful sites in the network.

The park's visibility is usually excellent with many sparkling clear blue Colorado days. During the winter months you can often see 180 miles. Trend data indicate a slight improvement in visibility on hazy days, but no similar trend on clear days. Average visibility in the park is about 108 miles, with visibility dipping to about 50 miles at times during the summer. Metropolitan and agricultural areas along the eastern edge of the Colorado Front Range are a significant source of pollutants that may affect the park. Sulfates are the largest contributor to haze at 55-75%, but nitrates and organic compounds also play a significant role. Metropolitan Denver and other Front Range urban areas are growing rapidly and increasing emissions compromise air quality in the park, depending on wind direction and other weather factors. Denver often violates federal clean air standards for ozone.

About one third of the Park is in the alpine zone (above tree line), creating a fragile ecosystem that can be very sensitive to any changing conditions. The trends in Rocky's air quality are monitored closely and help to gauge more populated areas' standards. Long-term research and monitoring indicate nitrogen deposition is affecting terrestrial and aquatic ecosystems. There is more nitrogen deposited in high elevation ecosystems in the park than plants can use, and excess nitrogen is leaking into park lakes and streams. Chemical changes are occurring in surface waters, soils, and trees on the east side of the park. Seasonal ozone exposures have frequently been high enough to cause concern about sensitive plant species, and ozone concentrations are higher on the east side of the park. Generally, ozone concentrations increase with elevation.

# Rocky Mountain National Park

# July

"Why is it that we judge development on what we have built rather than what we have preserved? We strive to protect what was built by man, but give little thought to protecting what was made by God."
Juanito G. Cambangay - Provincial Planning Officer Bohol Province, Philippines

Laura Wheatley, a biological science technician, began her National Park Service career while in college in 1999 with a summer wildlife internship at Rocky Mountain National Park in Estes Park, Colorado. Over the years, as a part of the Natural Resources Management Division, she has participated in diverse work such as wildlife surveys, fishery studies, forestry issues, pest management, and exotic/revegetation projects. Currently, she operates the greenhouse and nursery at the park, her primary duty, along with being the main air quality site operator. Not many parks have their own greenhouse, so the facility is fairly unique to the National Park Service. Thousands of native plant species are collected from seeds in the park and grown in the greenhouse during the winter months for revegetation projects in the summer and fall.

Laura loves the challenge of monitoring air quality because it is so relevant to many other terrestrial environmental issues and trends. When not at work she enjoys living the relaxed mountain life with husband Zach, hiking, running, and assistant coaching the local high school cross country and track team.

*Chasm Lake*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | Jun 2005<br>S M T W T F S<br>1 2 3 4<br>5 6 7 8 9 10 11<br>12 13 14 15 16 17 18<br>19 20 21 22 23 24 25<br>26 27 28 29 30 | Aug 2005<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | | | 1<br>182 Julian day | 2<br>183 |
| 3<br>184<br>IMPROVE particle sampling day | 4<br>185<br>Independence Day | 5<br>186<br>Change IMPROVE particle cartridges. | 6<br>187<br>IMPROVE particle sampling day | 7<br>188 | 8<br>189 | 9<br>190<br>IMPROVE particle sampling day |
| 10<br>191 | 11<br>192 | 12<br>193<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 13<br>194 | 14<br>195 | 15<br>196<br>IMPROVE particle sampling day | 16<br>197<br>National Parks Day |
| 17<br>198 | 18<br>199<br>IMPROVE particle sampling day | 19<br>200<br>Change IMPROVE particle cartridges. | 20<br>201 | 21<br>202<br>IMPROVE particle sampling day | 22<br>203 | 23<br>204 |
| 24<br>205<br>IMPROVE particle sampling day | 25<br>206 | 26<br>207<br>Change IMPROVE particle cartridges. | 27<br>208<br>IMPROVE particle sampling day | 28<br>209 | 29<br>210 | 30<br>211<br>IMPROVE particle sampling day |
| 31<br>212 | | | | | | |

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# COOPERATING PROGRAMS: CASTNet

## Clean Air Status and Trends Network

# OLYMPIC NATIONAL PARK

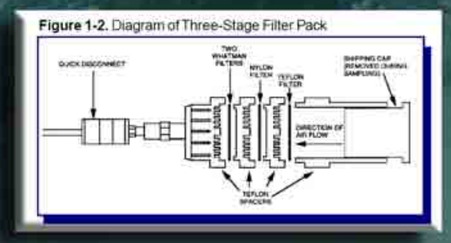
CASTNet is the nation's primary source for data on dry acidic deposition and rural, ground-level ozone. Operating since 1987, CASTNet is used in conjunction with other national monitoring networks to provide information for evaluating the effectiveness of national emission control strategies. CASTNet consists of over 80 sites across the eastern and western United States and is cooperatively operated and funded by the National Park Service and the Environmental Protection Agency.


Monitoring site locations are predominantly rural by design to assess the relationship between regional pollution and changes in regional patterns in deposition. CASTNet also includes measurements of rural ozone and the chemical constituents of PM2.5


Each CASTNet dry deposition station measures:

- weekly average atmospheric concentrations of sulfate, nitrate, ammonium, sulfur dioxide, and nitric acid.
- hourly concentrations of ambient ozone levels.
- meteorological conditions required for calculating dry deposition rates.

Atmospheric concentration data are collected at each site with open-faced, 3-stage filter packs. The filter pack contains a teflon filter for collection of particulate species, a nylon filter for nitric acid, and a base-impregnated cellulose (Whatman) filter for sulfur dioxide. Dry deposition rates are calculated using atmospheric concentrations, meteorological data, and information on land use, vegetation, and surface conditions. CASTNet complements the database compiled by NADP. Because of the interdependence of wet and dry deposition, NADP wet deposition data are collected at all CASTNet sites. Together, these two long-term databases provide the necessary data to estimate trends and spatial patterns in total atmospheric deposition.




Ozone data collected by CASTNet are complementary to the larger ozone data sets gathered by the State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS) networks. Hourly ozone measurements are taken at each of the sites operated. Data from these sites provide information to help characterize ozone transport issues and ozone exposure levels.

For more information about CASTNet, see: http://www.epa.gov/CASTNET/.

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CASTNet data resources:

EPA Aerometric Information and Retrieval System (AIRS): http://www.epa.gov/air/data/.

NPS Air Resources Division: http://www2.nature.nps.gov/air/data/index.htm#packaged.

Olympic National Park is a large wilderness park in the Northwest, bordered by the Pacific Ocean on the west, the Strait of Juan de Fuca to the north, and Puget Sound to the east. The Olympic Mountains intercept moisture-laden Pacific winds, resulting in a rain shadow effect more pronounced than any other in North America. One of the few temperate rain forests in the world blankets the western slopes of the mountains, the wettest spot in the continental United States, receiving more than 200 inches of precipitation per year.

Dominant weather patterns originate over the Pacific Ocean, ensuring that some park areas remain relatively unaffected by local or regional emissions. Coastal and rain forest areas (west side) of the park have cleaner air than many ecosystems in the continental U.S. Conditions here are often used as a background reference for larger studies.

Local sources of pollutants can affect park resources, especially during summer and fall when northeast winds transport air masses from the large urban centers of Seattle and Vancouver, British Columbia, and from the shipping lanes in the Strait of Juan de Fuca. In addition, slash burning activities, paper, pulp, lumber mills, and residential wood stoves in local communities all contribute smoke and industrial emissions. Visibility averages about 85 miles with hazy days of 43 miles and clear days of 130 miles.

The Georgia Basin / Puget Sound International Airshed Working Group has been studying the transport of air pollution between Canada and the United States. Air quality models indicate that the north and east sides of Olympic National Park may be more affected by international air pollution than previously thought. Preliminary data from the IMPROVE monitor and the seasonal portable ozone monitor at Hurricane Ridge appear to support the modeled analysis. There is also concern about growth in marine vessel traffic through the Strait of Juan de Fuca. In the future, data on potential ecosystem impacts of these emissions will be needed to drive the development of international treaties needed to limit these emissions.

Ongoing studies are investigating whether or not the mountainous core of the park may be affected by long-range transport of persistent airborne pollutants from Asia and other global sources.

# Olympic National Park

# August

"The Bible declares that on the sixth day God created man.
Right then and there, God should have demanded a damage deposit."
From Jim Hightower's book "There's Nothing in the Middle of the Road But Yellow Stripes and Dead Armadillos"

Bill Baccus has worked at Olympic since 1986. He has a Bachelor's degree in environmental studies from the University of California, Santa Cruz. He's had a variety of responsibilities over the years, but spent much of his time deep in the backcountry of the park monitoring human impacts to wilderness and running ecological restoration projects. Bill oversees all air quality monitoring efforts including IMPROVE, NADP, ozone, and several airborne contaminants studies. He also maintains a network of remote climate stations, conducts snow surveys, and monitors water quality and quantity for the North Coast and Cascades Vital Signs monitoring program.

Bill lives in Port Angeles with his wife Jessica (a former Mt. Rainier ranger) and his up and coming field crew, Elijah (6) and Sadie (2) Baccus.

Patte Danisiewicz was the primary air quality technician at Olympic between 1997 and 2003. She now serves as the backup operator after accepting a permanent job-share position as the superintendent's secretary.

She attended Northeastern University in Boston where she studied anthropology. Patte started working for the National Park Service in 1979 cataloguing collections at national historic sites. Her experience with air quality related projects began at Saguaro National Park where she was a resource management specialist from 1990-1993.

Patte lives in Port Angeles with her husband Mike, a backcountry ranger at Olympic, and their 12-year-old son Ryan.

*Old growth forest*

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

Jul 2005

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Sep 2005

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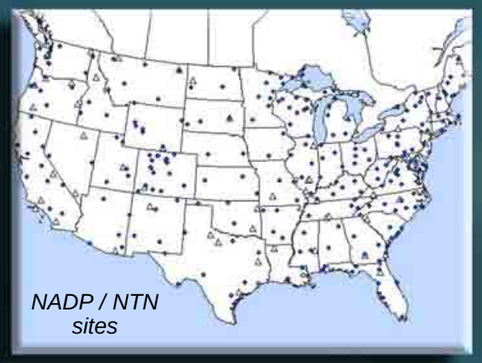
"Operator Involvement -- The Key to Network Success"

# COOPERATING PROGRAMS:
# NADP / NTN

**National Atmospheric Deposition Program / National Trends Network**

# GREAT BASIN NATIONAL PARK

The **National Atmospheric Deposition Program / National Trends Network (NADP / NTN)** is a nationwide network of precipitation monitoring sites. The network is a cooperative effort between many different groups, including the State Agricultural Experiment Stations, U.S. Geological Survey, U.S. Department of Agriculture, and numerous other governmental and private entities. The NADP / NTN has grown from 22 stations at the end of 1978, its first year, to over 200 sites spanning the continental United States, Alaska, Puerto Rico, and the Virgin Islands.



*NADP / NTN sites*

The purpose of the network is to collect data on the chemistry of precipitation and wet acidic deposition. The precipitation at each station is collected weekly according to strict clean-handling procedures. It is then sent to a laboratory where it is analyzed for hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations (such as calcium, magnesium, potassium and sodium).

*Rain bucket*

*Wet deposition collectors*

The National Atmospheric Deposition Program has also expanded its sampling to two additional networks. The **Mercury Deposition Network (MDN)**, with over 35 sites, was formed in 1995 to collect weekly samples of precipitation which are analyzed by Frontier Geosciences for total mercury.


*MDN sites*

The objective of the MDN is to monitor the amount of mercury in precipitation on a regional basis, information crucial for researchers to understand what is happening to our lakes and streams.

Another network, the **Atmospheric Integrated Research Monitoring Network (AIRMoN)**, was formed for the purpose of studying precipitation chemistry trends with greater temporal resolution. Precipitation samples are collected daily from a network of sites and analyzed for the same constituents as the NADP / NTN samples.


*AIRMoN sites*

For more information on the NADP monitoring program and to access data from these networks on the internet, go to **http://nadp.sws.uiuc.edu/** and click on:

- NADP / NTN : National Trends.
- NADP / AIRMoN : Atmospheric Integrated Air Monitoring Network, or
- NADP / MDN : Mercury Deposition Network.

Great Basin National Park is situated in a rugged region of alternating mountain ranges and low basins running parallel north and south between the Rocky Mountains and Sierra Nevada range. The name Great Basin derives from the fact that drainage of the area's streams and rivers finds no outlet to the sea. All water stays in the basin, collecting in marshes, mud flats, and shallow salt lakes where it evaporates into the air or filters into underground aquifers. Near the summit of Wheeler Peak is a small glacier and groves of ancient bristlecone pines, the oldest of which is about 4700 years old. Great Basin National Park is one of the newest national parks in the United States, set aside in 1986 by President Ronald Reagan.

Great Basin NP is located in middle of this region and has been a visibility monitoring site since 1982. Aerosol monitoring over the last few decades indicates that the cleanest air in the lower 48 states extends from the southern Cascades, across the Great Basin and the Snake River Plain, to the central Rockies and the northern Colorado Plateau. Great Basin NP, located near the middle of this region, typically records pollutant concentrations that are among the lowest in the nation. In 2002 the median annual non-weather-related standard visual range in the park was about 120 miles. Values rarely fell below 70 miles and rarely exceeded 185 miles.

The clear air in this region is largely due to low population density and the lack of large point sources of pollution. Visibility declines after periods of sustained northeasterly winds, when a brown-yellow haze can obscure the mountains east of the park. Haze may come from wildfires, the Salt Lake City area, and the Intermountain Power Plant near Delta, Utah. Fortunately, winds are seldom northeasterly for long periods.

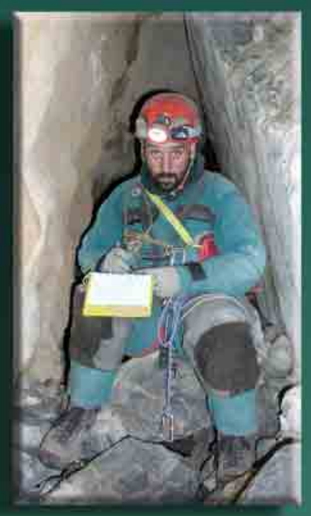
Changes in air quality are of great concern here; the pristine air of the Great Basin can be easily marred. The smallest increases in pollution are much more noticeable and objectionable against these clear skies. There is a proposed coal-fired power plant to begin operation in 2008. If this plant and other similar sources are built to the west, the park's visibility will be affected more frequently. IMPROVE data will provide the basis for National Environmental Policy Act analysis. The Great Basin site supplies visibility and deposition data, providing a baseline to measure changes that have already taken place in other parts of the country.

# Great Basin National Park

# September

"The wilderness holds answers to more questions than we have yet learned to ask."
Nancy Newhall

Ben Roberts, physical science branch chief, has been with the NPS for five years, all at Great Basin National Park. He's happily married to Brandi, who works as the education specialist for the park, and has a four month old son, Sam. Their home is off the electrical grid, so they generate their own power with photovoltaics and wind.



Matthew Reece, physical scientist, has been working with the NPS on-and-off since beginning to volunteer at Mammoth Cave NP in 1989. He's been the physical scientist at Great Basin since April 2004, arriving there after three years at Lava Beds National Monument in northern California. When he's not tending to the IMPROVE, CASTNet, NADP, or transmissometer, he's hanging out in one of the many incredible caves in the park.

*Transmissometer*

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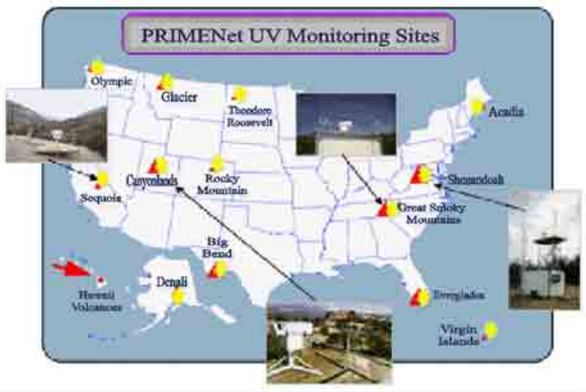
| Aug 2005<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31<br><br>Oct 2005<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 31 | | | | 1<br>*244 Julian day*<br>IMPROVE particle sampling day | 2<br>*245* | 3<br>*246* |
| 4<br>*247*<br>IMPROVE particle sampling day | 5<br>*248*<br>Labor Day | 6<br>*249*<br>Change IMPROVE particle cartridges. | 7<br>*250*<br>IMPROVE particle sampling day | 8<br>*251* | 9<br>*252* | 10<br>*253*<br>IMPROVE particle sampling day |
| 11<br>*254* | 12<br>*255* | 13<br>*256*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 14<br>*257* | 15<br>*258* | 16<br>*259*<br>IMPROVE particle sampling day | 17<br>*260* |
| 18<br>*261*<br>National Public Lands Day | 19<br>*262*<br>IMPROVE particle sampling day | 20<br>*263*<br>Pollution Prevention Week<br>Change IMPROVE particle cartridges. | 21<br>*264* | 22<br>*265*<br>Autumn begins<br>IMPROVE particle sampling day | 23<br>*266* | 24<br>*267* |
| 25<br>*268*<br>IMPROVE particle sampling day | 26<br>*269* | 27<br>*270*<br>Change IMPROVE particle cartridges. | 28<br>*271*<br>IMPROVE particle sampling day | 29<br>*272* | 30<br>*273* | **UC-Davis**: *Sampler*:<br>General Lab<br>(530) 752-1123<br><br>**ARS**: *Optical*:<br>Carter Blandford or<br>Karen Rosener<br>*Photography*:<br>Karen Fischer<br>(970) 484-7941 |

"Operator Involvement -- The Key to Network Success"

# COOPERATING PROGRAMS: PRIMENet

## Park Research and Intensive Monitoring of Ecosystems Network

## SNOQUALMIE PASS, ALPINE LAKES WILDERNESS AREA




Many national parks participated in a joint Environmental Protection Agency (EPA) and National Park Service (NPS) program to assess the effects of environmental stressors on ecological systems nationwide. The Park Research and Intensive Monitoring of Ecosystems Network (PRIMENet) began operation in 1999. Data collected at PRIMENet sites included air quality monitoring (visibility, ozone, wet and dry deposition, and climate) with a focus on measurement of changes in ultraviolet (UV) radiation. Monitoring was performed in 14 national parks and operated by National Park Service employees. An additional set of seven sites were located in urban areas. Data provided researchers an opportunity to assess UV effects on various park ecosystems and human health, as well as providing useful information about the global environment. Monitoring was coordinated with measurement programs of other federal agencies through the U.S. Global Change Research Program. PRIMENet funding was discontinued last year and the program was completely phased out by the end of 2004. Although data is no longer being collected, PRIMENet datasets continue to provide university, national park, and EPA researchers a unique opportunity to access how increased ultraviolet radiation affects the environment.

*Brewer spectrophotometer*

Each PRIMENet site was equipped with a Brewer spectrophotometer, an instrument designed to measure different wavelengths of light, with a focus on the ultraviolet spectra (UV-B radiation is in the 300-320 nm range of light). Instruments track the sun and monitor the variation in solar irradiance throughout the day; in addition, total column ozone and optical density can be calculated. A "UV dose" at the earth's surface is calculated using these measurements.

The amount of UV radiation reaching the parks is an area of special concern. Since the 1970s, ozone high in the atmosphere has been decreasing. This allows more ultraviolet (UV) radiation to reach the earth's surface, and the effects of this increased UV radiation are not well known. Scientists are exploring how living organisms respond to increasing UV radiation. There is evidence that higher levels of UV-B radiation can be detrimental to human health and biological resources. Resources that have been identified as sensitive to increased UV-B include amphibians, arid-land reptiles, and marine and freshwater plant and animal populations. In human populations, increases in UV-B are linked to higher incidence of skin cancer, cataracts, and immune system disorders.

*Yellow-legged frog*

EPA intramural research focuses on the interactive effects of climate change and UV radiation on nutrient and carbon cycles in coastal waters of the Southeast, and the role of UV exposure in amphibian deformities and declines through laboratory and field studies. The EPA intramural research program involves collaborations on research supported by the National Science Foundation, the Office of Naval Research, the National Oceanic and Atmospheric Administration, the National Park Service, and the U.S. Geological Survey.

Data and graphs from the PRIMENet monitoring program can be obtained at the National UV Monitoring Center: http://oz.physast.uga.edu/ or from the EPA's UV-Net monitoring center: http://www.epa.gov/uvnet/.

The Snoqualmie Pass site is located in the rugged central Cascades region of Washington State and is administered by the USDA Forest Service. It was chosen for its proximity to the Alpine Lakes Wilderness Area which takes its name from the nearly 700 jewel-like mountain lakes nestled among the high rock peaks and timbered valleys of the region.

The monitoring site, at 3600 feet, is reasonably accessible from the summit of the Snoqualmie ski area in the Mt. Baker-Snoqualmie National Forest. With an average snowfall of almost 500 inches a year, the trip can be a harrowing one. Although the sampler is located in a building, an adjacent microwave tower is always caked with rime ice. Working in the area can be very dangerous because of huge falling icicles. The summit is often still buried under 10 to 20 feet of snow in May!

IMPROVE data analysis indicates average visibility is about 80 miles while the clearest days exceed 150 miles 10% of the time. The haziest days occur in the spring and summer when visibility is about 40 miles. Ammonium sulfate is generally responsible for 40-50% of the visibility impairment, nitrates contribute 25-30%, and organics 20%. On the highest haze days sulfates, nitrates, and organic compounds contribute equally. Trend data indicated declining visibility on the clear days between 1994 and 1998. In 2001 and 2002 there was a marked increase in visibility on the clearest days.

Sulfates are created in the atmosphere from emissions of sulfur dioxide, resulting from the combustion of fossil fuels. Nitrates and organics come primarily from wild and prescribed fires and other biogenic emissions, as well as from automobile emissions, diesel engines, and industrial processes. It's important to note that Snoqualmie Pass is a 45-minute drive from metropolitan Seattle and over half of the state's population lives within an hour's drive.

# Snoqualmie Pass, Alpine Lakes Wilderness Area

# October

"God has cared for these trees, saved them from drought, disease, avalanches and a thousand tempests and floods. But He cannot save them from fools."
John Muir

"It's a spiritual thing" says Mike Ames, primary operator of the Snoqualmie Pass IMPROVE monitor, about his duties at the site every Tuesday. Mike is so committed to doing the very best job possible, he was crestfallen when the Snoqualmie Pass site fell off the Sites-of-Distinction for one quarter last year. The fact that he still had a 98% recovery rate and that the one lost sample was due to a power outage which was out of his control didn't console him. "It needs to be perfect", insists Mike.

As the developed recreation specialist for the Cle Ellen Ranger District, 75 miles west of Seattle, Mike has been a site operator since 2002. A bear of a man, Ames looks forward to braving the elements to keep the IMPROVE sampler running well. "It's my favorite thing to do", he says, clearly influenced by the energy and professionalism imparted by the UC-Davis team and the recent visits from agency air experts Scott Copeland, Bob Bachman, and Janice Peterson.

Mike's boss, Floyd Rugalski, was primary site operator from 1995 until Mike took over, and is now Mike's back-up. "It's so peaceful up there," says Floyd. "Now I only get to go to the site about 4 times a year but I look forward to every trip."

Mike and Floyd are world-class in their commitment. It's without question that they change the filter on Veteran's Day (a day they have off) or on a day when federal employees were furloughed, and in the worst weather conditions.

*Alpine Lakes Wilderness*

Sep 2005

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Nov 2005

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| | | | | | | 1<br>*274 Julian day*<br>IMPROVE particle sampling day |
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| 9<br>*282* | 10<br>*283*<br>Columbus Day (Observed)<br>IMPROVE particle sampling day | 11<br>*284*<br>Change IMPROVE particle cartridges. | 12<br>*285* | 13<br>*286*<br>IMPROVE particle sampling day | 14<br>*287* | 15<br>*288* |
| 16<br>*289*<br>IMPROVE particle sampling day | 17<br>*290* | 18<br>*291*<br>Change IMPROVE particle cartridges. | 19<br>*292*<br>IMPROVE particle sampling day | 20<br>*293* | 21<br>*294* | 22<br>*295*<br>IMPROVE particle sampling day |
| 23<br>*296* | 24<br>*297* | 25<br>*298*<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 26<br>*299* | 27<br>*300* | 28<br>*301*<br>IMPROVE particle sampling day | 29<br>*302* |
| 30<br>*303*<br>Daylight Savings Time | 31<br>*304*<br>Halloween<br>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

"Operator Involvement -- The Key to Network Success"

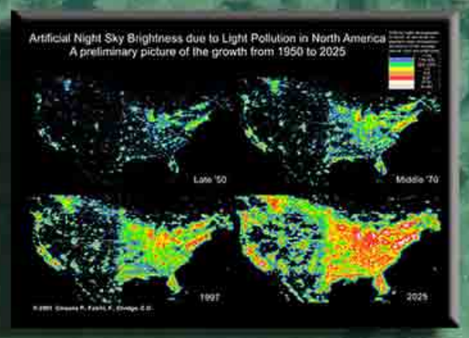
# OTHER PARK-RELATED PROGRAMS: NIGHT SKY

## JOSHUA TREE NATIONAL PARK

*"The Sky at Night" -- Woodruff T. Sullivan*

Our national parks contain some of this country's most spectacular landscapes and diverse ecologies and wildlife habitats. These natural resources have enjoyed decades of protection under the stewardship of the National Park Service but as the interest of the public changes and the natural landscape is altered, what is valued as a park resource also changes. Today, the National Park Service is adapting its management toward the protection of dark night skies.

The night sky is a timeless and boundless resource, possessing value as a cultural, scenic, natural, and scientific resource. We humans often take this resource for granted which is at great risk for losing views of the pristine night sky even in once-remote areas. National parks harbor many of these last portals to a dark night sky. The NPS in cooperation with non-profit organizations such as the George Wright Society and the International Dark Sky Association has initiated a small but aggressive program to measure light pollution levels at numerous parks throughout the country. In early 2000, the National Park Service funded a Night Sky Team. Using Natural Resource Preservation Program and Fee Demonstration funds, the team set out to standardize methods for measuring and monitoring night skies and to employ these methods at several parks.




*Cinzano et al.*

The Night Sky Team is based out of Pinnacles National Monument and Sequoia and Kings Canyon national parks, with support from the NPS Air Quality Division. Several studies provide examples of good science and leadership in night sky management.

Bryce Canyon National Park examined the potential impact from a planned coal mine, as well as the human perception of light pollution. Perception of sky glow is an important component of night sky protection since aesthetics and the wilderness experience are often cited as core values. In another study by NPS, Organ Pipe Cactus National Monument conducted complete sky surveys in which light pollution contributions from near and distant cities were mapped. In 2001, these measurements were repeated, giving the park long-term monitoring data and the ability to detect small changes in night sky brightness over time.

The Night Sky Team is nearing standardization of methodologies and completion of a pilot study at four national parks, but the task remaining is tremendous. At the time NPS was created, the night skies above our national treasures were not impacted by light pollution. Today, only about 1% of parks are free from this problem. Many flagship parks in the national park system have substantial degradation, but fewer than a dozen parks have any data whatsoever on the quality of their night skies.

The task of promoting the value of dark skies above national parks has only just begun. Activities focused on public enjoyment of dark skies are likely to spread throughout the entire national park system. Special programs can be established on an ongoing basis without a major impact to limited park budgets by forming partnerships with local and national groups engaged in the study and enjoyment of the night sky. Amateur and professional astronomers can be purposefully invited to visit the parks with the express objective of sharing knowledge and equipment with a curious public.

To learn more about the International Dark Sky program, see their web site at: http://www.darksky.org/. To access links to national parks participating in Dark Sky, see the links page at: http://www.darksky.org/links/preserves.html.

Joshua Tree National Park is located approximately 120 miles east of downtown Los Angeles, California. Prevailing winds from the west deposit the worst of Los Angeles' air pollutants directly onto the higher westerly elevations of the park. Joshua Tree National Park is bounded on the south by the Coachella Valley, home to Palm Springs, Palm Desert, and Cathedral City. The Coachella Valley is also in direct receipt of the smog from the Los Angeles Basin. During the afternoon hours, smog from the Coachella Valley is brought into the midsection of the park by southerly winds as the valley floor temperature increases. On the worst summer days, the visual impacts of smog can be seen as far as the Coxcomb Mountains located on the eastern edge of the park. Because of the far-reaching effects of smog throughout the park, Joshua Tree has earned the dubious distinction of being one of the nation's worst parks for air quality.

The air station at Joshua Tree is located in the Mojave Air Quality Management District and is just a few miles north of the county line that separates Mojave from the South Coast Air Quality Management District. Aerosol monitoring began in 1992 and Joshua Tree is currently in negotiations with the South Coast Air Basin to help support a second air monitoring station. In addition to ozone monitoring, this second station is slated to incorporate real-time PM10 monitoring.

Visibility in the park is often obscured by haze from high concentrations of fine particles. In 2002, average visibility in the park was about 60 miles. On hazy days, visibility dropped to 30 miles, while the clearest days had 110-mile visibility. Sulfates cause 65-75% of the visibility problem in the park. Power plants and fossil fuel burning activities emit particles that form sulfates.

Joshua Tree NP experiences very high ozone, with peak concentrations and cumulative doses that are some of the highest in the national park system. Nitrogen deposition is an order of magnitude higher than pre-1900 conditions, and sulfur deposition is about twice natural conditions. Mobile sources (e.g., autos) are the most significant contributors to high levels of ozone and nitrogen compounds.

Joshua Tree National Park is working with the U.S. Forest Service Fire Lab and University of California-Riverside in a three-year study to assess the ecological effects of nitrogen deposition on park soils. The study will assess how fire regimes may be changing as a result of exotic grasses. Data show the spread of fire is becoming worse in recent years. In 1995, 6000 acres were burned in Covington Flats and in 1999 just under 14,000 acres were burned in Juniper Flats. Preliminary analysis suggests exotic grass species are being fertilized, promoting rapid growth as a result of nitrogen deposition.

# Joshua Tree National Park

# November

"One touch of nature makes the whole world kin."
William Shakespeare

Luke Sabala **came to the National Park Service in May of 2003. As the park's physical scientist, he is responsible for managing water resources, geologic resources, and abandoned mine land, and operating the air quality station. He came to the park service after a 17-year career in the geotechnical engineering industry. He is currently working on his Masters degree in geology and expects to finish in January of 2006.**

**Luke was born and raised in Torrance, California, educated through the California State University system, and is currently attending Cal-State - Fullerton. When free time permits his hobbies include flying, scuba diving, guitar, snowboarding/skiing, water skiing, and surfing.**

*Luke at sampler site*

*Christine Wilson, backup operator*

*Air Station 2*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
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| **UC-Davis**: *Sampler*: General Lab (530) 752-1123<br><br>**ARS**: *Optical*: Carter Blandford or Karen Rosener<br>*Photography*: Karen Fischer (970) 484-7941 | | 1<br>*305 Julian day*<br>Change IMPROVE particle cartridges. | 2<br>*306* | 3<br>*307*<br>IMPROVE particle sampling day | 4<br>*308* | 5<br>*309* |
| 6<br>*310*<br>IMPROVE particle sampling day | 7<br>*311* | 8<br>*312*<br>Election Day<br>Change IMPROVE particle cartridges. | 9<br>*313*<br>IMPROVE particle sampling day | 10<br>*314* | 11<br>*315*<br>Veterans Day | 12<br>*316*<br>IMPROVE particle sampling day |
| 13<br>*317* | 14<br>*318* | 15<br>*319*<br>America Recycles Day<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 16<br>*320*<br>National Park Service established, 1916 | 17<br>*321* | 18<br>*322*<br>IMPROVE particle sampling day | 19<br>*323* |
| 20<br>*324* | 21<br>*325*<br>IMPROVE particle sampling day | 22<br>*326*<br>Change IMPROVE particle cartridges. | 23<br>*327* | 24<br>*328*<br>Thanksgiving<br>IMPROVE particle sampling day | 25<br>*329* | 26<br>*330* |
| 27<br>*331*<br>IMPROVE particle sampling day | 28<br>*332* | 29<br>*333*<br>Change IMPROVE particle cartridges. | 30<br>*334*<br>IMPROVE particle sampling day | | | |

Oct 2005

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Dec 2005

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"Operator Involvement -- The Key to Network Success"

# OTHER PARK-RELATED PROGRAMS: SOUNDSCAPES

## YELLOWSTONE NATIONAL PARK

**National Park Service Nature and Science** **Soundscapes Program**

### Natural Sounds

**Natural sounds are part of the special places we preserve. Rustling winds in the canyons and the rush of waters are the breath and heartbeat of some of our most valuable resources.**

A natural soundscape is a resource component of any park setting associated with natural sounds. Sounds made by wind, birds, geysers, elk, wolves, waterfalls, and many other natural phenomena are associated by visitors with unique features and resources of national parks. "Soundscape" refers to the total ambient acoustic environment, which is made up of both natural and human-caused sounds. Human-caused sounds are not just the sounds that people themselves produce, such as talking, but also the many varied sounds that attend the presence of people such as autos, aircraft, radios, and pets. People experience soundscapes by hearing, in the same way that they view landscapes by seeing. Soundscapes may vary in their character from day to night, from season to season, and by changes in numbers of visitors who also introduce sound into the environment.

> "How great are the advantages of solitude! How sublime is the silence of nature's ever-acting energies! There is something in the very name of wilderness, which charms the ear and soothes the spirit of man."
>
> *Estwick Evans, 1818*

In the wild, sound is a matter of life and death. Birds, insects, mammals, and amphibians rely on complex communication networks to live and reproduce. In habitats where wildlife vocalizations signify mating calls, danger from predators, or territorial claims, hearing these sounds is essential to animal survival. Scientists can discern details about animal populations and behavior by recording sounds in the wild.

The NPS Soundscapes Program Center was officially established in October 2000, primarily to assist park and regional staffs in working with the FAA to develop air tour management plans for the more than 50 parks experiencing commercial air tour intrusions.

The Soundscapes program is predicated on:

- Natural sounds are a natural resource to be conserved for enjoyment of present and future visitors.
- Natural sounds are essential for the good health of ecosystems.
- Natural sounds are essential to survival of species.
- Natural sounds are integral to the park experience for visitors.

Congress has mandated that it's important to protect and manage soundscapes. The Soundscape program mission is to assist and support national park units in preserving and restoring the natural resources of the parks, including the natural soundscape resources and to eliminate or minimize noise intrusions in units of the national park system.

*Trail maintenance*

Since parks were created in part for enjoyment by people, present and future generations, the element of human sound is necessarily present. The key analysis issue is in determining what levels and types of noise are appropriate or acceptable for different management areas throughout a park. Areas of concern include:

- air tour management planning
- oversnow motorized vehicle use in national parks
- personal water craft use in national parks
- noise caused by park operations
- military overflights

For more information about the Soundscape Program see: http://www.nature.nps.gov/naturalsounds/index.htm.

Yellowstone National Park, established in 1872, has the distinction of being the world's first national park. The park preserves nearly two million acres, providing protection for wildlife as well as numerous geysers, hot springs, lakes, waterfalls, archaeological sites, and historic structures. Located in the central Rocky Mountains in northwestern Wyoming and extending into Montana and Idaho, most of the park is above 7,500 feet in elevation. The park was designated an International Biosphere Reserve in 1976 and a World Heritage Site in 1978 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Although visibility in the park is still superior to that in many parts of the country, haze often impairs many scenic vistas. As part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network, visibility in Yellowstone NP has been monitored using an aerosol sampler (1988-present), a transmissometer (1989-1993), a nephelometer (2002-present), and periodic use of an automatic 35mm camera.

IMPROVE data from 1990-1999 indicate improving visibility on both the clearest and haziest days. 2002 data show average visibility is about 120 miles, while clear days often reach 168 miles. On very hazy days visibility can drop to 72 miles or less.

In addition to baseline visibility, park personnel monitor particulates, sulfur oxides, nitrogen dioxide, total suspended particles, carbon monoxide, mercury in rain fall, and ozone, as well as meteorological conditions at the Lake Village Ranger Station on the northwest shoreline of Yellowstone Lake.

Because of their low acid neutralizing capacity, some headwater lakes in the park are potentially sensitive to atmospheric deposition of sulfur and nitrogen compounds. Spring snowmelts make them vulnerable to episodic acidification. High-elevation soils may also be poorly buffered and sensitive to acidification. Monitored ozone levels showed a significant increasing trend from 1990-1999.

A variety of regional air pollution sources affect air quality in Yellowstone, including electric utility power plants, oil and gas processing, coal bed methane wells, industrial fossil-fuel combustion, and agriculture. Motor vehicle traffic and forest fires impact summertime visibility. In the winter, the city of West Yellowstone is a popular staging area for some of the nation's most concentrated snowmobile touring. Future haze levels will likely by impacted by the recently approved construction of a 780-megawatt, coal-fired power plant just north of the park.

# Yellowstone National Park

# December

"We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity."
from the book "The Diversity of Life" by Alabama native E.O. Wilson

Alice Siebecker has been an air quality operator since 1987, supported by numerous seasonal and temporary operators who fill in during her absences. The station has been moved once since its installation because the original site was too close to Yellowstone Lake. The station now sits on what they refer to as "Water Tank Hill". There are two large water tanks on the side of Elephant Back Ridge, one of which is buried. The station is located on the hillside right next to the buried tank. Alice says it's a steep road to get to it and when it gets snowy you have to 4-wheel-drive for awhile and then snowmobile. She operates the station from May to mid November, and Brad Ross, Boone Vandzura, and Pat Perotti operate it from mid-November through April.

Alice is a law enforcement supervisory ranger in the Lake Sub District of Yellowstone NP, in the central portion of the park. Because Yellowstone is exclusive jurisdiction, the rangers do all of the law enforcement, EMS, structural fire protection, and search and rescue. They also respond to some wildland fires as needed.

Alice was at Yellowstone year around up until 1994, but since then has been furloughed in the winters. She has a family in Bozeman MT. Her background is formally in plant and soil science. With her deep interest in the environment, she feels that the air quality monitoring in Yellowstone and other national parks and forests is extremely important.

*Tower Falls*

*Mammoth Hot Springs*

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| **UC-Davis**: *Sampler*: General Lab (530) 752-1123<br><br>**ARS**: *Optical*: Carter Blandford or Karen Rosener<br>*Photography*: Karen Fischer (970) 484-7941<br><br>Nov 2005<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30<br><br>Jan 2006<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31 | | | | 1<br>335 Julian day | 2<br>336 | 3<br>337<br>IMPROVE particle sampling day |
| 4<br>338 | 5<br>339 | 6<br>340<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 7<br>341 | 8<br>342 | 9<br>343<br>IMPROVE particle sampling day | 10<br>344 |
| 11<br>345 | 12<br>346<br>IMPROVE particle sampling day | 13<br>347<br>Change IMPROVE particle cartridges. | 14<br>348 | 15<br>349<br>IMPROVE particle sampling day | 16<br>350 | 17<br>351 |
| 18<br>352<br>IMPROVE particle sampling day | 19<br>353 | 20<br>354<br>Change IMPROVE particle cartridges. | 21<br>355<br>Winter begins<br>IMPROVE particle sampling day | 22<br>356 | 23<br>357 | 24<br>358<br>IMPROVE particle sampling day |
| 25<br>359<br>Christmas | 26<br>360 | 27<br>361<br>IMPROVE particle sampling day<br>Special IMPROVE particle change. Move cassette #3 from old cartridge to new cartridge. | 28<br>362 | 29<br>363 | 30<br>364<br>IMPROVE particle sampling day | 31<br>365<br>New Year's Eve |

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# Sites With >90% Data Completeness in 2003

| Site | | Completeness (%) |
|---|---|---|
| BOND9 | PM-10 Speciation | 100 |
| BRID9 | PM-10 Speciation | 100 |
| BRIG9 | PM-10 Speciation | 100 |
| CHIC1 | Chicago | 100 |
| DETR1 | Detroit | 100 |
| ELLI1 | Ellis | 100 |
| HEGL1 | Hercules-Glades | 100 |
| JARI1 | James River | 100 |
| LOST1 | Lostwood | 100 |
| MOMO1 | Mohawk Mountain | 100 |
| OKEF1 | Okefenokee | 100 |
| STAR1 | Starkey | 100 |
| THSI1 | Three Sisters | 100 |
| UPBU9 | PM-10 Speciation | 100 |
| WARI1 | Walker River Pauite Tribe | 100 |
| WHRI1 | White River | 100 |
| ACAD1 | Acadia | 99 |
| ADPI1 | Addison Pinnacle | 99 |
| AREN1 | Arendtsville | 99 |
| BADL1 | Badlands | 99 |
| ELDO1 | El Dorado Springs | 99 |
| GRSM9 | PM-10 Speciation | 99 |
| HANC9 | PM-10 Speciation | 99 |
| HILL1 | Hillside | 99 |
| LIVO1 | Livonia | 99 |
| MACA1 | Mammoth Cave | 99 |
| MOHO1 | Mount Hood | 99 |
| MOOS1 | Moosehorn | 99 |
| OLYM1 | Olympic | 99 |
| PMRF1 | Proctor Research Center | 99 |
| QUVA1 | Queen Valley (Superstitio | 99 |
| SAWE1 | Saguaro west | 99 |
| SIKE1 | Sikes | 99 |
| SNPA1 | Snoqualamie Pass | 99 |
| TRCR1 | Trapper Creek-Denali | 99 |
| ZION1 | Zion | 99 |
| BLMO1 | Blue Mounds | 98 |
| CABA1 | Casco Bay | 98 |
| CABI1 | Cabinet Mountains | 98 |
| CHAS1 | Chassahowitzka | 98 |
| CHIR1 | Chiracahua | 98 |
| COHI1 | Connecticut Hill | 98 |
| CORI1 | Columbia Gorge East | 98 |
| DENA1 | Denali | 98 |
| GRSA1 | Great Sand Dunes | 98 |
| HANC1 | Grand Canyon | 98 |
| HAVO1 | Hawaii Volcanoes | 98 |
| HOOV1 | Hoover | 98 |
| JOSH1 | Joshua Tree | 98 |
| LABE1 | Lava Beds | 98 |
| LAVO1 | Lassen Volcanic | 98 |
| LYBR1 | Lye Brook | 98 |
| PINN1 | Pinnacles | 98 |
| QURE1 | Quabbin Reservoi | 98 |
| SENE1 | Seney | 98 |
| TALL1 | Tallgrass | 98 |
| WHPA1 | White Pass | 98 |
| WIMO1 | Wichita Mountain | 98 |
| BRID1 | Bridger | 97 |
| CACR1 | Caney Creek | 97 |
| FLAT1 | Flathead | 97 |
| ISLE1 | Isle Royale | 97 |
| OLTO1 | Old Town | 97 |
| ORPI1 | Organ Pipe | 97 |
| PASA1 | Pasayten | 97 |
| ROMO2 | Rocky Mountain | 97 |
| ULBE1 | UL Bend | 97 |
| UPBU1 | Upper Buffalo | 97 |
| VOYA1 | Voyageurs | 97 |
| FOPE1 | Ft Peck | 96 |
| GRGU1 | Great Gulf | 96 |
| GRSM1 | Great Smoky Mtns | 96 |
| MKGO1 | MK Goddard | 96 |
| PRIS1 | Presque Isle | 96 |
| QUCI1 | Quaker City | 96 |
| SULA1 | Sula | 96 |
| WEMI1 | Weminuche | 96 |
| BALD1 | Mount Baldy | 95 |
| BOND1 | Bondville | 95 |
| IKBA1 | Ike's Backbone | 95 |
| KALM1 | Kalmiopsis | 95 |
| LIGO1 | Linville Gorge | 95 |
| PEFO1 | Petrified Forest | 95 |
| ROMA1 | Cape Romain | 95 |
| SACR1 | Salt Creek | 95 |
| SAGA1 | San Gabriel | 95 |
| SEQU9 | PM-10 Speciation | 95 |
| WICA1 | Wind Cave | 95 |
| CRLA1 | Crater Lake | 94 |
| DOME1 | Dome Land | 94 |
| DOSO1 | Dolly Sods | 94 |
| HALE1 | Haleakala | 94 |
| MEAD1 | Meadview | 94 |
| MORA9 | PM-10 Speciation | 94 |
| BIBE1 | Big Bend | 93 |
| BRIG1 | Brigantine | 93 |
| CANY1 | Canyonlands | 93 |
| CLPE1 | Cloud Peak | 93 |
| CRES1 | Crescent Lake | 93 |
| GRRI1 | Great River Bluffs | 93 |
| MONT1 | Monture | 93 |
| SAGO1 | San Gorgonio | 93 |
| SAGU1 | Saguaro | 93 |
| TRIN1 | Trinity | 93 |
| TUXE1 | Tuxedni | 93 |
| WHIT1 | White Mountain | 93 |
| YOSE1 | Yosemite | 93 |
| BRCA1 | Bryce Canyon | 92 |
| BRLA1 | Brooklyn Lakes | 92 |
| COGO1 | Columbia Gorge West | 92 |
| GAMO1 | Gates of the Mountains | 92 |
| LASU1 | Lake Sugema | 92 |
| MELA1 | Medicine Lake | 92 |
| PHOE1 | Phoenix | 92 |
| SAFO1 | Sac and Fox | 92 |
| VILA1 | Viking Lake | 92 |
| NEBR1 | Nebraska | 91 |
| NOCH1 | Northern Cheyenne | 91 |
| PUSO1 | Seattle | 91 |
| WASH1 | Washington DC | 91 |
| JARB1 | Jarbidge | 90 |
| NOCA1 | North Cascades | 90 |
| SIME1 | Simeonof | 90 |
| SIPS1 | Sipsey | 90 |
| TONT1 | Tonto | 90 |