INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

Volume 2, No. 3 Summer 1993 October 1993

IMPROVE MONITORING UPDATE

Preliminary data collection statistics for the Summer 1993 season (June - August 1993) are:

Data Type	Collection Percentage
Aerosol Data	95%
Optical (transmissometer) Data	93%
Scene (photographic) Data	85%

Figure 1 is a map of the current IMPROVE and IMPROVE Protocol sites including the CASTNet sites and three newly installed Forest Service sites. The CASTNet program has adopted IMPROVE optical and scene monitoring protocols, but is using different aerosol monitoring techniques. The new Forest Service sites are configured with aerosol, scene, and optical (nephelometer) components. The Forest Service Network is further described in the Feature Article of this issue.

Other network changes from the last quarter include the installation of a NGN-2 ambient nephelometer at the Lye Brook Wilderness IMPROVE monitoring site.

All IMPROVE transmissometer data from December 1987 through May 1993 have been reprocessed to incorporate enhanced data processing and plotting procedures. A comprehensive data report was submitted to the NPS in August 1993. (See "Comprehensive Transmissometer Data Report Now Available" in this issue.)

Special Studies Update

Field monitoring data from project MOHAVE are currently being analyzed by project participants. Results of preliminary analyses are expected in early 1994.

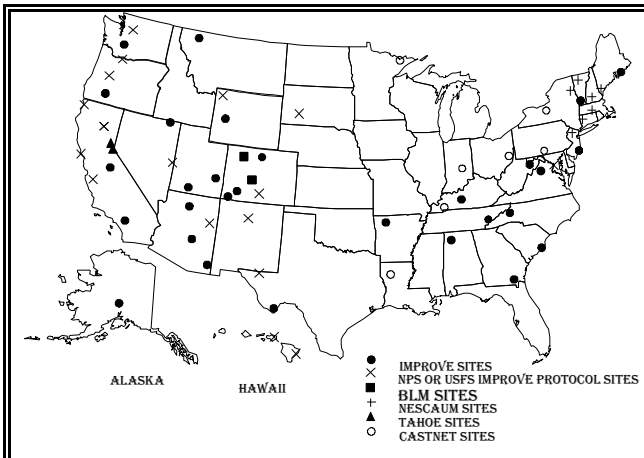


Figure 1. IMPROVE and IMPROVE Protocol Sites October 1993.

VISIBILITY NEWS....

IMPROVE Meeting

A meeting of the IMPROVE steering committee was held on September 23, 1993 in Fort Collins, Colorado. The meeting focused on program administration and documentation requirements. Individual subcommittees were assigned to :

- Develop a memorandum of agreement among participating agencies.
- Update the IMPROVE monitoring strategy documentation.
- Compile information for a monitoring guidance document.

The committee also discussed reconfiguring two existing monitoring sites to include all monitoring components (a transmissometer, ambient nephelometer, aerosol sampler, camera, and standard support systems). Grand Canyon and Shenandoah National Parks are being considered as the primary candidates for these monitoring "super" sites.

REGIONAL VISIBILITY EXPERIMENTAL ASSESSMENT IN THE LOWER FRASER RIVER VALLEY (REVEAL)

A comprehensive air quality field monitoring program was conducted in the Fraser Valley, British Columbia during Summer 1993. IMPROVE aerosol samplers, ambient nephelometers, a transmissometer, cameras, and a wide array of other air quality monitoring instruments were used to assess the visual air quality during the study. For more information contact Steve Sakiyama at 604-387-9942 (Air Resources Branch, Environmental Protection Division, Ministry of Environment, Lands and Parks).

VISIBILITY INTERPRETIVE DISPLAY INSTALLED AT GRAND CANYON NATIONAL PARK

An automated interpretive display that graphically presents the current visibility to Grand Canyon visitors was installed at Yavapai Museum in September 1993. The hourly data from the south rim transmissometer are radio-linked to the display. A moving scale on the display is automatically updated each hour. The display relates the standard visual range monitored by the transmissometer to observed conditions within the Grand Canyon. Though visibility-related interpretive displays exist at a number of National Parks, this Grand Canyon display is the first one that provides real time visibility data to park visitors. The display has attracted a lot of visitor attention during its first month of operation.

Feature Article

USFS Enhances Monitoring Program

The USDA Forest Service Visibility Monitoring Program began in the Pacific Northwest in the Summer of 1983. To date, the Forest Service has collected photographic visibility monitoring data at more than 74 sites across the United States. In addition, the Forest Service provides operational support of optical, aerosol, and scene instrumentation at nine IMPROVE Program monitoring sites located at Forest Service Wildernesses.

The Forest Service is now in the process of restructuring and enhancing its visibility monitoring program by incorporating new technologies to better meet the needs of forest land managers.

Visibility data are used by federal land managers to protect visibility in many of the 88 class I areas managed by the Forest Service. These data are also used to help characterize and manage the visibility impacts of forest and agricultural burning.

The remote nature of most Forest Service Wildernesses requires the application of a low maintenance, low-power, and reliable monitoring approach. In the past, the primary data analysis technique used by the Forest Service has been 35mm slide densitometry. In fiscal year 1993, the Forest Service undertook an agency-wide evaluation of visibility monitoring procedures, objectives and accomplishments. From this evaluation and with the active involvement of participating regional and forest supervisor's offices across the country, a five-year monitoring strategy was drafted in January 1993.

The Forest Service Strategy defines monitoring site configurations that compliment IMPROVE and other monitoring networks. Aerosol, optical, scene and meteorological components are all included in the monitoring strategy. Cooperation and coordination with IMPROVE and other monitoring networks is essential to ensure the collection of high quality and spatially representative visibility data. Implementation of the Forest Service Strategy began in June 1993.

During the Summer 1993 season, the first three fully configured Forest Service Program sites began operating in the Pacific Northwest Region. Five additional enhanced monitoring sites are planned for installation in fiscal year 1994. Scene monitoring will continue at 33 additional sites, but quantitative analysis of 35mm slides will no longer be performed. Figure 2 lists the locations of each existing and proposed monitoring site. Table 1 details the proposed USFS fiscal year 1994 monitoring configurations by region and site.

Forest Service staff are working to integrate the Forest Service strategy and philosophy with the goals, objectives and operational strategy of the IMPROVE program. A primary objective of the Forest Service Strategy is to ensure that the critical data user, the land manager, receives interpreted data on time and in a format that can support informed decisions on critical issues.

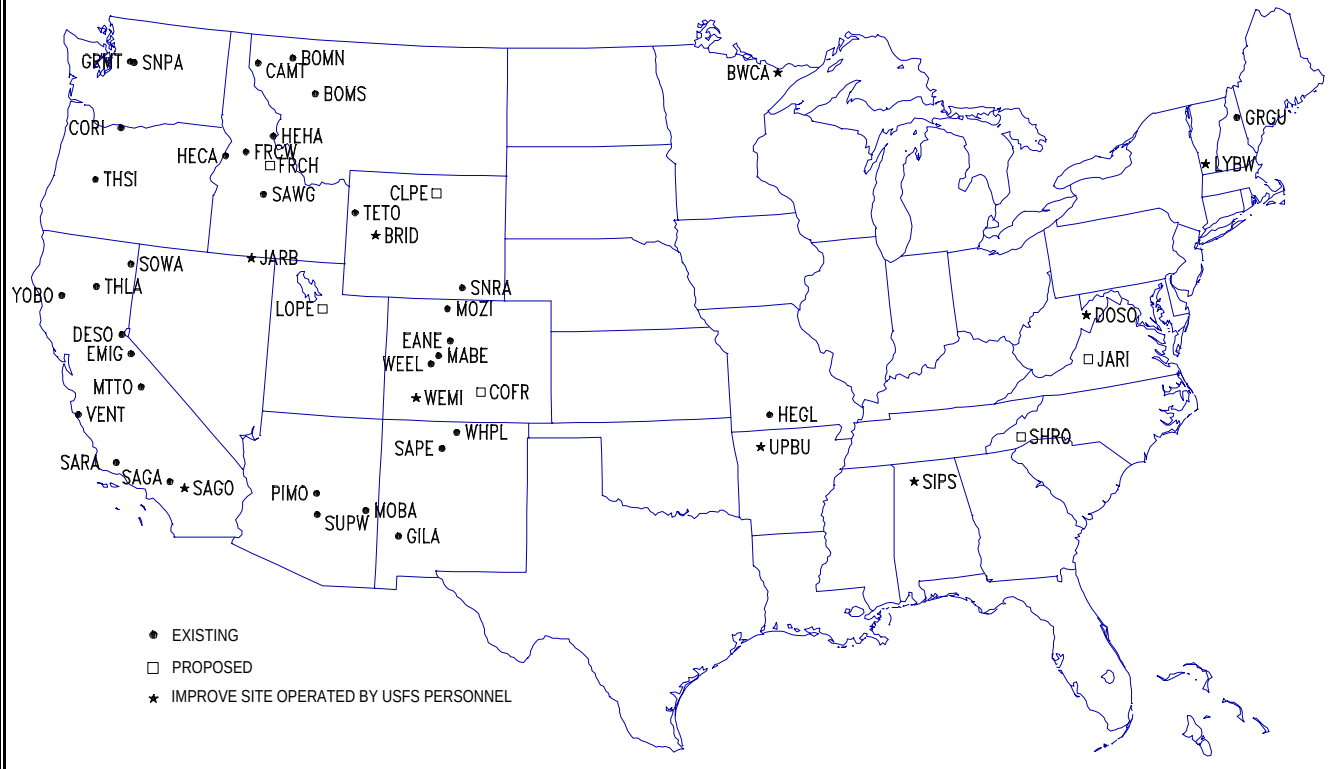


Figure 2. USDA Forest Service Visibility Sites - October 1993.

Table 1
Proposed USDA Forest Service
Visibility Monitoring Site Configurations
Fiscal Year 1994

Reg.	Site	Site Abbr.	Aerosol Sampler Module A-D	Aerosol Sampler Module A	Instrumentation			Period	
					Nephelo-meter	Transmis-someter	Auto. Camera	Year-Round	Special Period
1	Bob Marshall (MT) North	BOMN					1		1
	Bob Marshall (MT) South	BOMS					1		1
	Cabinet Mtns. (MT)	CAMO					1		1
	Hells Half Acre (MT)	HEHA					1		1
2	Cloud Peaks (WY)	CLPE					1	1	
	Colorado Front Range (CO)	COFR					1	1	
	Eagles Nest (CO)	EANE					1	1	
	Mt. Zirkel (CO)+	MOZI	1	1	1		1	1	
	Maroon Bells (CO)	MABE		1			1	1	
	Snowy Range (WY)	SNRA					1	1	
	Weminuche (CO)*	WEMI	1				1	1	
	West Elk (CO)	WEEL					1	1	
3	Gila (NM)+	GILA	1		1		1	1	
	Mount Baldy (AZ)	MOBA					1		1
	Pine Mountain (AZ)	PIMO					1	1	
	San Pedro Parks (NM)	SAPE					1	1	
	Superstition (AZ)	SUPE					1	1	
	Wheeler Peak (NM)	WHPE					1		1
4	Bridger (WY)*	BRID	1			1	1	1	
	Frank Church (ID)	FRCH		1			1	1	
	Frank Church-West (ID)	FRCW					1		1
	Hells Canyon (ID, OR, WA)	HECA					1		1
	Jarbidge (NV)*	JARB	1		1		1	1	
	Lone Peak (UT)+	LOPE	1		1		2	1	
	Sawtooth (ID)	SAWT		1			1		1
	Teton (WY)	TETO					1		1
5	Desolation (CA)	DESO					1	1	
	Emigrant (CA)	EMIG					1		1
	Mt. Tom (CA)	MTTO					2		1
	San Gabriel (CA)	SAGA					1	1	
	San Gorgonio (CA)*	SAGO	1			1	1	1	
	San Rafael (CA)	SARA					1	1	
	South Warner (CA)	SOWA					1		1
	Thousand Lakes (CA)	THLA					1		1
	Ventana (CA)	VENT					1	1	
	Yolla Bolly (CA)	YOBO					1		1
6	Columbia River (WA)+	CORI	1		1		2	1	
	Granite Mtn. (WA)	GRMT					1		1
	Snoqualmie Pass (WA)+	SNPA	1		1		1	1	
	Three Sisters (OR)+	THSI	1		1		1	1	
8	James River Face (VA)	JARI		1			1	1	
	Shining Rock (NC)+	SHRO	1		1		1	1	
	Sipsey (AL)*	SIPS	1				1	1	
	Upper Buffalo (AR)*	UPBU	1		1		1	1	
9	Boundary Waters (MN)*	BWCA	1		1		1		1
	Dolly Sods (WV)*	DOSO	1		1		1		1
	Great Gulf (NH)+	GRGU	1				1		1
	Hercules-Glades (MO)	HEGL					1	1	
	Lye Brook (VT)*	LYBR	1		1		1	1	
TOTALS			17	5	12	2	52	30	19

\+ USFS IMPROVE Protocol monitoring site.
* IMPROVE Sites operated by USFS personnel.

COMPREHENSIVE TRANSMISSOMETER DATA REPORT NOW AVAILABLE

The following comprehensive optical monitoring data report is now available from the IMPROVE program:

Summary of Revised
Transmissometer-Based Visibility Data,
Winter 1987 Through Spring 1993 Seasons.

This report provides a ready reference to all transmissometer data collected at IMPROVE and IMPROVE Protocol sites from the inception of the monitoring program in 1987 through May 1993. A primary advantage of having all data in a single document is that the data user can more conveniently review the spatial and temporal characteristics of the monitored visual air quality. The report also presents all of the data in a new, more modern, format that includes more information about the monitoring sites and incorporates the new visual indices. The results of intensive transmissometer testing over the years were also incorporated into the data analysis routines to enhance the quality of all transmissometer data. These new presentation and processing procedures include:

- Presentation of data using the traditional atmospheric extinction coefficient (b_{ext}) and standard visual range (SVR) scales, and a new haziness (dv) or deciview scale. The deciview is an easily understood visibility index which is linear with respect to perceived visual changes over its entire range.
- Reversal of the cumulative frequency distribution definitions. The 10% cumulative frequency value now reflects the 10% best visibility and the 90% value reflects the 10% worst visibility. Cumulative frequency information are also presented in the new visibility metric format.
- Improved estimates of the transmissometer lamp drift correction factor were incorporated into the data analyses to further enhance the quality of transmissometer data.

To generate this report, all transmissometer and associated meteorological data were reprocessed. Everyone who uses transmissometer data is urged to replace previously reported data with this enhanced data set. Because all data were reprocessed with refined analytical procedures, slight variations from previously reported data do occur at specific sites during specific seasons.

The report consists of 593 pages that present data from the sites listed in Figure 3. Following a discussion of data collection, reduction, and analysis procedures, site specifications and transmissometer data are graphically presented by site. Examples of the principle presentation formats are provided in Figures 4, 5, and 6.

The report was delivered to the IMPROVE Steering Committee and IMPROVE program participants in August 1993. Additional copies of the report and/or associated digital data files can be obtained by a written request to William Malm (see last page of newsletter). You will be contacted regarding the reproduction cost and delivery schedule.

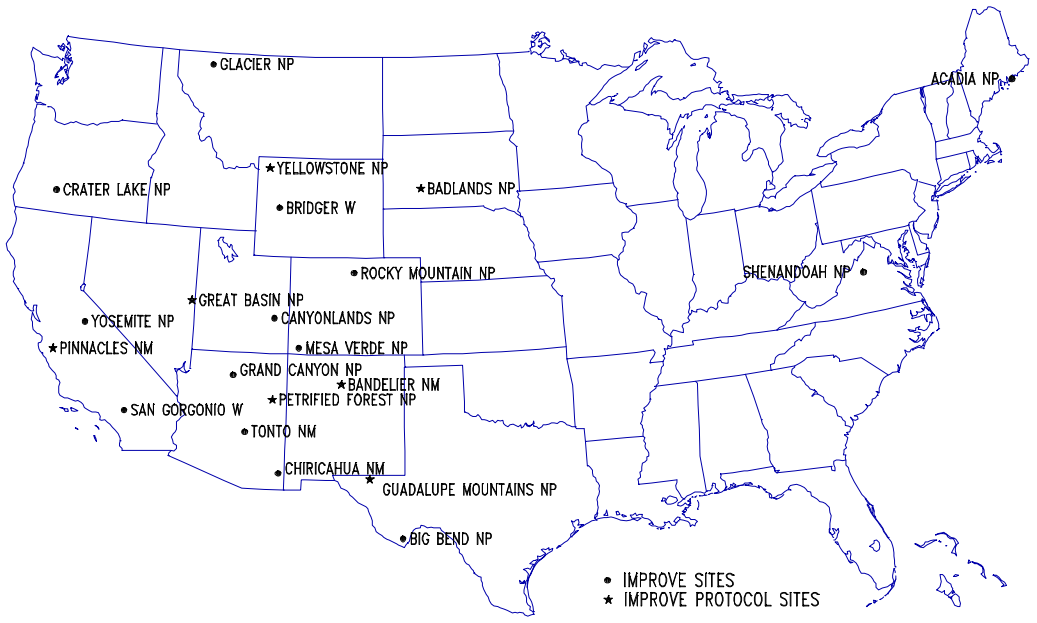
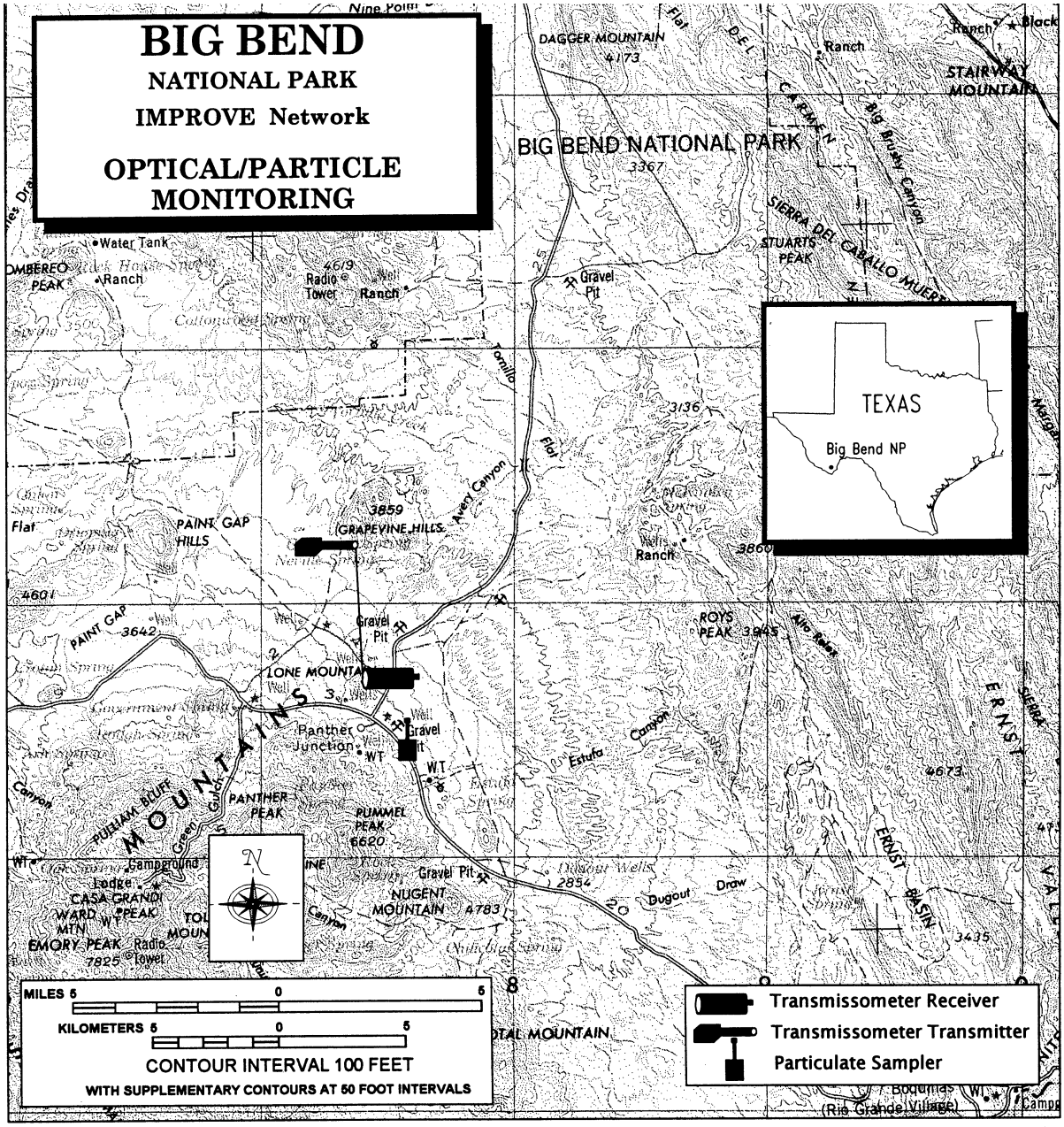


Figure 3. Transmissometer Visibility Monitoring Sites Included in "Summary of Revised Transmissometer-Based Visibility Data, Winter 1987 Through Spring 1993 Seasons".



SITE SPECIFICATIONS

Transmissometer

Site Abbreviation: BIBE

Receiver		Site Path	
Elevation:	1082 m	Mean Elevation:	1058 m
Longitude:	103° 12' 24"	Elevation Angle:	-0.59°
Latitude:	29° 20' 38"	Distance:	4.7350 km
Bearing:	353 °		

Transmitter	
Elevation:	1033 m
Longitude:	103° 12' 45"
Latitude:	29° 23' 12"

Particulate Sampler

Site Abbreviation: BIBE1

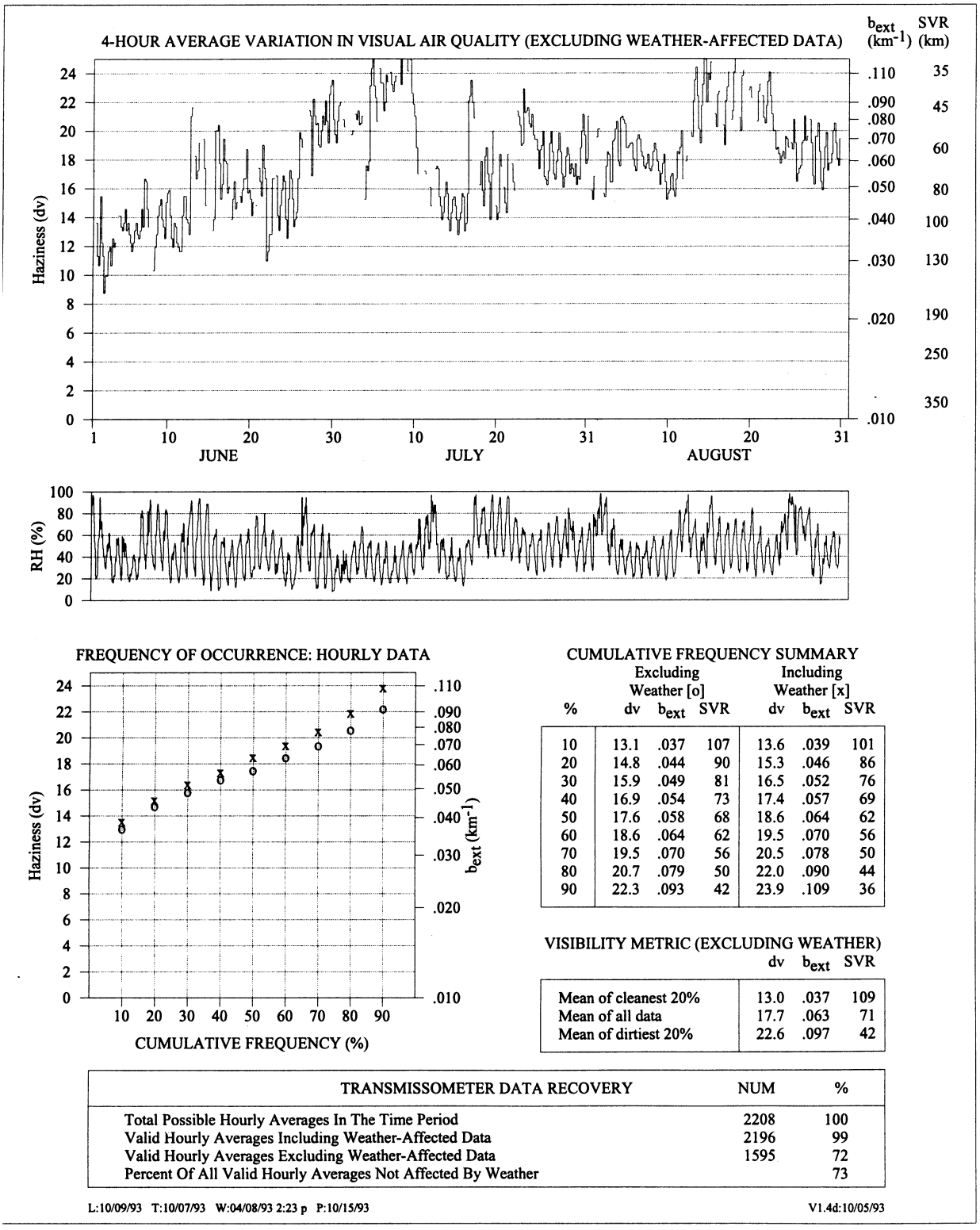
Elevation:	1067 m
Longitude:	103° 11' 22"
Latitude:	29° 19' 39"
Map Reference:	Emory Peak, Texas 1:250,000 1959 Revised 1977 NH 13-9

Figure 4. Example Transmissometer Site Map (Big Bend National Park).

BIG BEND NATIONAL PARK, TEXAS

Transmissometer Data Summary

Summer Season: June 1, 1992 - August 31, 1992



CUMULATIVE FREQUENCY SUMMARY

%	Excluding Weather [o] dv	b_{ext}	SVR	Including Weather [x] dv	b_{ext}	SVR
10	13.1	.037	107	13.6	.039	101
20	14.8	.044	90	15.3	.046	86
30	15.9	.049	81	16.5	.052	76
40	16.9	.054	73	17.4	.057	69
50	17.6	.058	68	18.6	.064	62
60	18.6	.064	62	19.5	.070	56
70	19.5	.070	56	20.5	.078	50
80	20.7	.079	50	22.0	.090	44
90	22.3	.093	42	23.9	.109	36

VISIBILITY METRIC (EXCLUDING WEATHER)

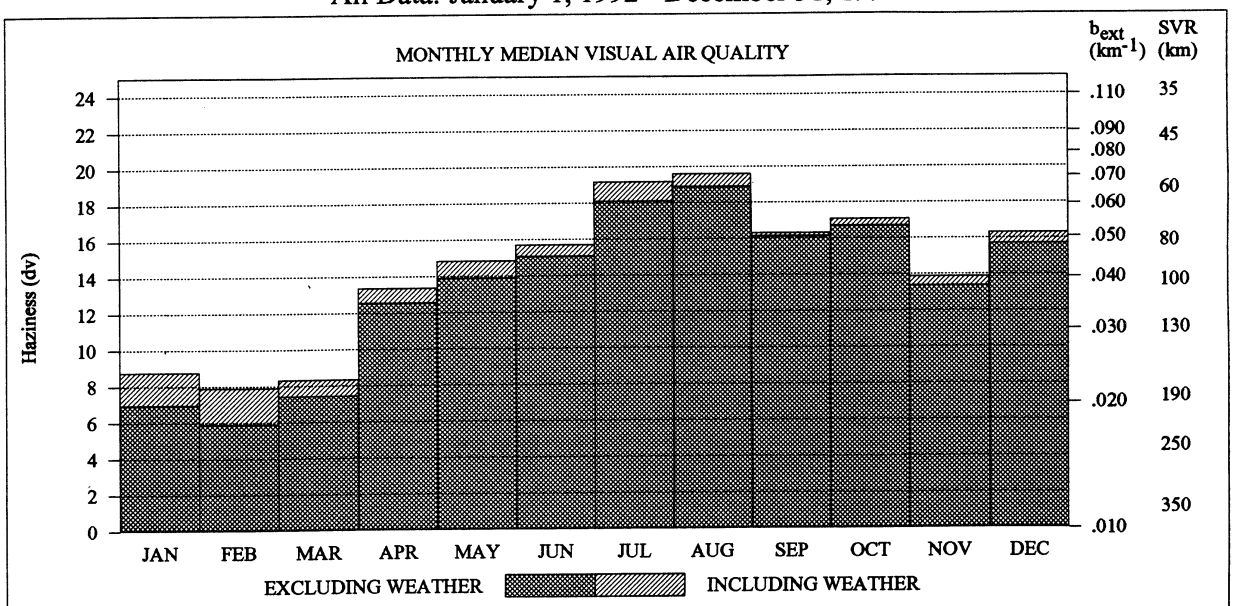
	dv	b_{ext}	SVR
Mean of cleanest 20%	13.0	.037	109
Mean of all data	17.7	.063	71
Mean of dirtiest 20%	22.6	.097	42

TRANSMISSOMETER DATA RECOVERY	NUM	%
Total Possible Hourly Averages In The Time Period	2208	100
Valid Hourly Averages Including Weather-Affected Data	2196	99
Valid Hourly Averages Excluding Weather-Affected Data	1595	72
Percent Of All Valid Hourly Averages Not Affected By Weather		73

L:10/09/93 T:10/07/93 W:04/08/93 2:23 p P:10/15/93 V1.4d:10/05/93

Figure 5. Example Seasonal Transmissometer Data Summary (Big Bend National Park, Texas - Summer 1992).

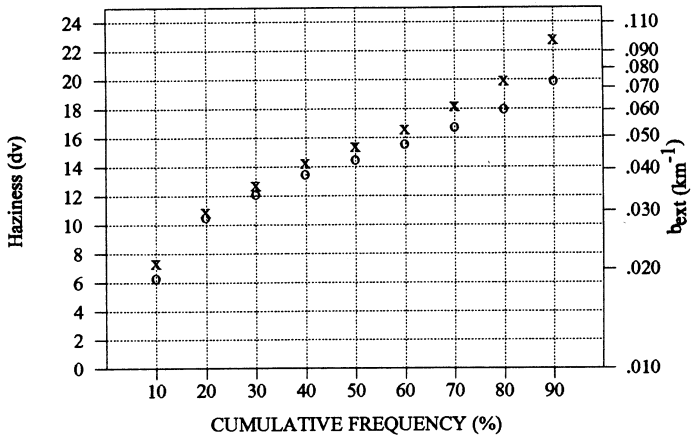
BIG BEND NATIONAL PARK, TEXAS
Annual Transmissometer Data Summary
All Data: January 1, 1992 - December 31, 1992



MONTHLY CUMULATIVE FREQUENCY SUMMARIES

		EXCLUDING WEATHER						INCLUDING WEATHER						DATA RECOVERY STATISTICS							
		10%		50%		90%		10%		50%		90%		POSS.	COLLECTED		VALID:IN. WX.		VALID:EX. WX.	
MONTH	YEAR	bext	dv	bext	dv	bext	dv	bext	dv	bext	dv	bext	dv	NUM	NUM	%	NUM	%	NUM	%
JAN	1992	0.015	4.1	0.020	6.9	0.031	11.3	0.016	4.7	0.024	8.8	0.159	27.7	744	744	100	730	98	387	52
FEB	1992	0.013	2.6	0.018	5.9	0.029	10.6	0.014	3.4	0.022	7.9	0.147	26.9	696	693	100	608	87	324	47
MAR	1992	0.014	3.4	0.021	7.4	0.038	13.4	0.014	3.4	0.023	8.3	0.054	16.9	744	728	98	709	95	500	67
APR	1992	0.026	9.6	0.035	12.5	0.055	17.0	0.026	9.6	0.038	13.4	0.082	21.0	720	710	99	710	99	508	71
MAY	1992	0.028	10.3	0.040	13.9	0.065	18.7	0.030	11.0	0.044	14.8	0.094	22.4	744	744	100	744	100	454	61
JUN	1992	0.033	11.9	0.045	15.0	0.076	20.3	0.034	12.2	0.048	15.7	0.084	21.3	720	720	100	718	100	542	75
JUL	1992	0.042	14.4	0.061	18.1	0.102	23.2	0.044	14.8	0.068	19.2	0.110	24.0	744	744	100	740	99	514	69
AUG	1992	0.051	16.3	0.066	18.9	0.098	22.8	0.053	16.7	0.071	19.6	0.119	24.8	744	744	100	738	99	539	72
SEP	1992	0.040	13.9	0.050	16.1	0.074	20.0	0.041	14.1	0.051	16.3	0.080	20.8	720	708	98	704	98	599	83
OCT	1992	0.036	12.8	0.053	16.7	0.077	20.4	0.037	13.1	0.055	17.0	0.089	21.9	744	735	99	729	98	565	76
NOV	1992	0.030	11.0	0.038	13.4	0.050	16.1	0.031	11.3	0.040	13.9	0.069	19.3	720	714	99	714	99	537	75
DEC	1992	0.036	12.8	0.048	15.7	0.070	19.5	0.037	13.1	0.051	16.3	0.102	23.2	744	735	99	730	98	529	71
ALL DATA		0.019	6.4	0.043	14.6	0.074	20.0	0.021	7.4	0.047	15.5	0.098	22.8	8784	8719	99	8574	98	5998	68

ANNUAL FREQUENCY OF OCCURRENCE: HOURLY DATA



ANNUAL CUMULATIVE FREQUENCY SUMMARY

%	Excluding Weather [o] dv	b_{ext}	SVR	Including Weather [x] dv	b_{ext}	SVR
10	6.4	.019	211	7.4	.021	190
20	10.6	.029	137	11.0	.030	132
30	12.2	.034	117	12.8	.036	110
40	13.6	.039	101	14.4	.042	94
50	14.6	.043	92	15.5	.047	84
60	15.7	.048	82	16.7	.053	74
70	16.9	.054	73	18.2	.062	64
80	18.1	.061	65	20.0	.074	53
90	20.0	.074	53	22.8	.098	40

FOR A GIVEN % OF THE TIME THE HAZINESS IS LESS THAN OR EQUAL TO THE CORRESPONDING dv VALUE.

D:07/28/93 11:59 a P:10/18/93

V1.02:07/27/93

Figure 6. Example Annual Transmissometer Data Summary (Big Bend National Park, Texas - 1992).

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525

TO:

First Class Mail

IMPROVE STEERING COMMITTEE

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

U.S. EPA
Marc Pitchford
Environmental Monitoring Systems Lab
1.O. Box 93478
Las Vegas, NV 89193-3478
702/895-0432 (Phone)
702/895-0496 (Fax)

U.S. EPA
Joe Elkins
MD-14
OAQPS
Research Triangle Park, NC 27711
919/541-5653 (Phone)
919/541-2357 (Fax)

NPS
William Malm
NPS-AIR
Colorado State University
CIRA - Foothills Campus
Fort Collins, CO 80523
303/491-8292 (Phone)
303/491-8598 (Fax)

BLM
Scott Archer
Service Center (SC-212A)
1.O. Box 25047
Denver, CO 80225-0047
303/236-6400 (Phone)
303/236-3508 (Fax)

USFS
Rich Fisher
Air Specialist, Wash. Office
Rocky Mtn. Experiment Sta.
240 W. Prospect
Fort Collins, CO 80526
303/498-1232 (Phone)
303/323-1010 (Fax)

FWS
Sandra Silva
Fish and Wildlife Service
1.O. Box 25287
Denver, CO 80225
303/969-2814 (Phone)
303/969-2822 (Fax)

NESCAUM
Rich Poirot
VT Agency of Nat. Res.
103 South Main Street
Building 3 South
Waterbury, VT 05676
802/241-3840 (Phone)
802/244-5141 (Fax)

STAPPA
Dan Ely
Colorado Dept. of Health
Air Pollution Control Div.
4300 Cherry Creek Drive S.
Denver, CO 80222-1530
303/692-3228 (Phone)
303/782-5493 (Fax)

WESTAR
John Core
Executive Director
1001 S.W. 5th Ave.,
Suite 1100
Portland, OR 97204
503/220-1660 (Phone)
503/220-1651 (Fax)

PREVIEW OF UPCOMING ISSUE . . .

The next IMPROVE Newsletter will be published in January 1994, and will include:

- Network Status for the Fall 1993 Season.
- **FEATURE ARTICLE:** Computer Imaging.

PUBLISHED BY:

Air Resource Specialists, Inc.

1901 Sharp Point Drive
Suite E
Fort Collins, CO 80525

The IMPROVE Newsletter is published four times a year (April, July, October, & January) under NPS Contract CX-0001-1-0025.

Your input to the IMPROVE Newsletter is always welcome.

For more information, address corrections, or to receive the IMPROVE Newsletter, contact:

Air Resource Specialists, Inc.
303/484-7941 Phone
303/484-3423 Fax

IMPROVE Newsletter text is also available on the **EPA AMTIC Electronic Bulletin Board:**

919-541-5742
(1200 or 2400 baud)
919-541-1447
(9600 baud)


printed on recycled paper