USDA FOREST SERVICE

HIGH UINTAS WILDERNESS
AIR QUALITY RELATED VALUES
ACTION PLAN

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INTRODUCTION

The High Uintas Wilderness, established by Congress in 1984, includes 456,704 acres on the Wasatch and Ashley National Forests located in northern Utah. The High Uintas have outstanding wilderness qualities and are geologically unique. The Uinta Mountains are the highest range in Utah and the most prominent east-west trending range in the contiguous United States. The core of the range is Precambrian rock, over 600 milliom years old, composed primarily of quartzite, and metamorphised sandstone. Elevations range from 7,000 feet in forested glaciated canyons to above timberline reaching elevations of 13,528 feet atop Kings Peak. Below the main ridges, the range is divided into numerous alpine basins, dotted with picturesque lakes and meadows.

During the 1984 Western Lake Pilot Study and the 1985 Western Lake Survey the EPA and Forest Service, in cooperation with the National Acid Precipitation Assessment Program, sampled 46 lakes in the Uinta Mountains. Twenty one of these lakes are located within the High Uintas Wilderness. Phase I of the National Surface Water Survey was designed to quantify the chemistry of lakes believed to contain low acid neutralizing capacity (ANC) water throughout the United States. Results indicated all 21 Wilderness lakes as "sensitive" with 14 of the 21 lakes sampled classifying as "ultra-sensitive" to potential acidification due to extremely low acid neutralizing capacity.

In November of 1985, Utah's Governor Norm Bangerter requested that an acid deposition task force be organized to study the acid deposition issue. The Acid Deposition Technical Advisory Committee (ADTAC) was organized to include experts from universities and state and federal agencies. As a result of several hearings held during 1986 ADTAC released a report which included the recognition of the High Uintas as a known sensitive area to acid deposition. The ADTAC Committee recommended monitoring of air pollutant sources and Air Quality Related Values.

The Regional Forester's responsibilities as the designated Federal Land Manager include implemention of the 1964 Wilderness Act and the 1977 Clean Air Act, and compliance with Air Quality State Implementation Plans. Forest Supervisors are delegated the responsibility to take action to protect resources of the National Forest System lands from adverse impacts which may result from air pollution including atmospheric deposition.

This action plan specifies the Forest Service air resource management program for the High Uintas Wilderness. The objectives of this action plan are to define Forest Service Policy, identify Air Quality Related Values (AQRV's), select sensitive receptors, outline action for monitoring selected sensitive receptors, and define methods to determine Limits of Acceptable Change. By meeting these objectives the Forest Service will provide a database for use in reviewing Prevention of Significant Deterioration (PSD) permit applications, developing associated adverse impact determinations, and provide timely meaningful recommendations to regulators.

Cooperation with Federal, State, local agencies, and private groups and individuals is an important aspect of the air management program. The action plan will be used as the basis for information exchange and in developing cooperative monitoring.

ACTION PLAN OBJECTIVES

This Action Plan provides a mechanism to implement the policies outlined in the 1964 Wilderness Act, 1977 Clean Air Act, Utah Air Quality Implementation Plan, and the Wasatch and Ashley National Forest Plans. The objectives of the Action Plan are as follows:

1. Define Forest Service Wilderness Air Resource Policy.

2. Define Air Quality Related Values (AQRV's) and possible air pollution impacts.

3. Identify sensitive receptors, if any, for each AQRV.

4. Develop action items which outline direction for establishing detailed AQRV Monitoring Plans which will determine baseline conditions and impacts on selected sensitive receptors.

5. Discuss the process for determining the Limits of Acceptable Change for air quality sensitive receptors.

6. Document existing data available which establishes baseline physical, chemical, and/or biological conditions of identified sensitive receptors. Establish format for documentation and analysis of future monitoring activities.

7. Identify Forest Service cost for the Air Resource Program and for the implementation of monitoring AQRV's as outlined in the action plan.

8. Cooperate with Federal, State, and local agencies and develop contacts with various private and public organizations to determine areas of mutual concern, including possible cooperative monitoring programs.

WILDERNESS AND AIR RESOURCE MANAGEMENT POLICIES

The 1964 Wilderness Act directs the Forest Service to protect National Forest System Wildernesses from any man-caused degradations not specifically allowed by law. The Wilderness Act gives the Forest Service the ability to take action against sources of air pollution affecting a wilderness but, probably only after an effect has occurred.

The statutes specifically providing for pre-emptive protection of Air Quality Related Values (AQRV's) from air pollution are the Clean Air Act Amendments of 1977. The 1977 Federal Clean Air Act in its Prevention of Significant Deterioration (PSD) section authorizes Federal Land Managers (FLM) to make recommendations to state and federal permitting agencies regarding applications for air polluting activities before permits are issued. It also requires the states in their State Implementation Plans and the EPA to consider recommendations of the FLM.

Wildernesses established prior to enactment of the 1977 Federal Clean Air Act are designated Class I areas. Wilderness areas established after September 1977 are Class II areas. Forest Service policy calls for affirmative protection of Air Quality Related Values (AQRV's) in Class I wilderness areas, maintenance of air quality in Class II wilderness areas, and minimizing deterioration of air quality in non-wilderness Class II areas (all remaining National Forest lands).

The Regional Forester is the nondelegable Federal Land Manager (FLM) responsible to implement the 1977 Clean Air Act and comply with the State Air Quality Implementation Plans.

Forest Supervisors are responsible to take action to protect resources of the National Forest System lands from adverse impacts which may result from air pollution including atmospheric deposition.

Forest Service Manual. 2120.43 and 2323.64 states the following policy for Class I areas and Class II wildernesses:

1. Define Air Quality Related Values (AQRV's) and initiate action to protect those values.

2. For each AQRV, establish cost effective sensitive receptors for long term monitoring.

3. Recommend the Limit of Acceptable Change (LAC) for air quality sensitive receptors to the Regional Forester.

4. Monitor sensitive receptors to establish the Limits of Acceptable Change needed to prevent adverse impacts to AQRV'S.

5. Consult with local air regulatory authorities on air pollution activities which have potential to impact National Forest resources.

6. Assist the Regional Air Quality Officer in determining the potential impacts of proposed facilities in coordination with State air quality management agencies.

7. Make appropriate recommendations in the permitting process following established Prevention of Significant Deterioration (PSD) application review procedures for major emission sources.

8. Develop and integrate a Forest Air-Resource Management Program into the Forest planning and budgeting process.

AIR QUALITY RELATED VALUES and SENSITIVE RECEPTORS

The only Air Quality Related Value (AQRV) identified in the Clean Air Act is visibility. However, other Air Quality Related Values identified by the Forest Service are flora, fauna, soil, water, aquatic life, geologic and cultural features. Flora and fauna may be affected by changes in growth, mortality, reproduction, diversity, visible injury, succession, and productivity. Soils may experience changes in cation exchange capacity, base saturation, pH, structure, and metals concentrations. Water may change in pH, total alkalinity, metal concentrations, and anion/cation concentrations. Aquatic organisms are impacted by changes in water chemistry. Visibility contrast, visual range, and coloration may be affected. Cultural and archaeologic decomposition rates may change.

Sensitive receptors are those AQRV's that are first affected by changes in air quality. By monitoring these sensitive receptors, the Forest Service can detect impacts of changing air quality, estimate effects of proposed PSD sources, and use them as indicators of effects on non-monitored AQRV'S. Sensitive receptors are identified for each AQRV.

A. VISIBILITY

Visibility is the dominant and most detectable AQRV to many wilderness users and the general public. Visibility parameters include contrast, coloration, and visual range. Impairment to visibility involves, changes in contrast, atmospheric discoloration, and reduction in visual range. Degradation of visual sight distances has occurred since the industrial development of the Western United States.

The scattering of light by air-borne particulate matter is the cause of visibility impairment. The coarse particles are dominated by the soil-derived elements; silicon, aluminum, calcium, iron, potassium, and titanium. The relative composition of these elements within an airshed is similar to that for the local soils. The fine particles (0.2 to 1.0 microns) are the most efficient in light scattering and play a much larger role in visibility impairment. The major fine particle groups are ammonium sulfates, soil, and soot. The remaining fine particle mass consist mostly of organic material, hydrocarbons, and nitrates.

Visibility range can be quantitatively measured with teleradiometer readings or by the use of an automated camera system. Teleradiometers measure contrast between the sky and a selected target. Automated camera systems provide photographs which can be digitized to characterize impacts of haze and plume. Criteria for selection of instrumentation sites should include accessibility, view of at least 20 miles, protection from vandalism, view of wilderness area, including a dark foreground with a sky background.

An automatic visibilty camera site was established atop Lake Fork Mountain on the Ashley National Forest on September 17, 1987. Standard visual range and changes in contrast during the visitor use season will be used as a sensitive receptor.

Particulate samples are usually collected by means of using dichotomous stacked filter units. Particulate data is essential for establishment of source-receptor relationships to help identify those existing pollutant sources whose emissions are impacting visibility and other AQRV'S.

Identification of pollution sources can be made through elemental analyses. Some known source tracers include:

Particle Elements	Pollution Source
Lead plus bromine	- automotive
Vanadium and nickel	- combustion of fuel oil
Copper, zinc, arsenic, lead	- copper smelters
Fine potassium	- smoke from open fires
Selenium, sulfur, fine soil	- coal combustion
Postassium, chlorine	- potash industries
Zinc	- industrial, urban

B. ATMOSPHERIC DEPOSITION

The three major processes affecting air pollutant compounds in the atmosphere include air transport, transformation, and deposition. Air transport and dispersion of airborne pollutants are contolled by windspeed, wind direction, atmospheric stability, thermal structure, and topography. Sulfur dioxides, nitrogen oxides, and chlorides are transformed by complex chemical reactions within the atmosphere to sulfuric, nitric, and hydrochloric acids. After the pollutant material is transported and possibly chemically transformed, it is deposited either in the dry form (gases and fine particles) or in the wet form (rain, snow, ice, and fog).

The primary source of wet deposition monitoring data in the United States is the National Trends Network (NTN). This weekly sampling network involves 150 stations including many of the stations in the National Atmospheric Deposition Program (NADP). NADP stations in Utah are located in Logan, Green River, and Bryce Canyon. Additional nearby stations in adjacent states include Dinosaur (Colo), Fremont Lake (Wyo), Crater of the Moon (Id), and Lehman Caves (Nev). Some sampling has been done at Mirror Lake in conjunction with Utah Power and Light/University of Utah Research Institute studies. Data from the NADP stations verify that acid depostion in Utah does occur, but the full extent of that deposition is not fully known.

Wet deposition monitoring involving collection of precipitation and analysis of acidity (pH) and the major inorganic chemical constituents are extremely important. The current NADP/NTN stations are primarily located at low elevation sites. Long term monitoring should be expanded to include the sensitive area near the High Uintas Wilderness.

Under sponsorship of the National Acid Precipitation Assessment Program (NAPAP), the U.S. Environmental Protection Agency (EPA) has begun deploying the nationwide National Dry Deposition Network (NDDN). The goal of NDDN is to estimate dry deposition fluxes

and spatial and temporal trends of selected air pollutants throughout the United States. In addition, wet deposition samples will be collected and analyzed at the NDDN sites. The goal is to have a nationwide network of 100 stations deployed by the end of FY-89. The Yellowstone Guard Station has been selected as a tentative NDDN site.

Eighty percent of the annual precipitation within the Wilderness is received in the form of snow. Snowpack can be sampled throughout the season to determine what amount of atmospheric deposition has taken place. This is especially important due to the concern of concentrating acid deposition throughout the ecosystem during spring snowmelt. The Soil Conservation Service will collect snowcore samples from four SNOTEL sites in Uinta Mountains starting in 1988. These samples will be analyzed by the Utah State Water Laboratory. Snowpack chemistry from the SNOTEL sites listed in the monitoring section will be used for long term deposition monitoring.

C. WATER

The High Uintas contain over 500 lakes and innumerable ponds located in glacial basins. Many of the lakes support grayling and golden, rainbow, cutthroat, and brook trout fisheries. Most of the natural lakes and ponds are found at elevations above 10,000 feet. The geology of the watershed above the lakes consist primarily of Precambrian quartzites.

In 1984, the Forest Service, EPA, and USGS conducted the Western Pilot Study, prior to the initiation of the 1985 Western Lake Survey. Twenty lakes were selected on the basis of accessability and probable sensitivity to acid deposition. Results described all 20 lakes sampled as "sensitive" because acid neutralizing capacity (ANC) were less than 200 micro equivalents per liter (ueq/1). 25% of the sensitive lakes were designated as "very sensitive" with ANC's between 70-100 ueq/1. 65% of the lakes were designated "ultra-sensitive" with ANC's less than 75 ueq/1.

The 1985 Western Lake Survey sampled 26 lakes located in the Uinta Mountain Range. These lakes were selected randomly as part of the 888 lakes sampled throughout the Western United States. Again, all 26 lakes sampled were classified as "sensitive". Five of the lakes were designated "very sensitive", and eleven of the lakes were designated "ultra-sensitive".

The extremely low acid neutralizing capacity of the lake water indicates that the aquatic ecosystems in the High Uintas may have little buffering capacity for protection from acid deposition.

A major concern for the lake ecosystems is possible "acid shock" during snowmelt. Acid material in the snow causes a freezing point depression which can result in the hydrogen ion concentration of the first melt water, being 5-10 times that of the bulk snowmelt. It is possible that the first snowmelt would have little to no interaction with the frozen soils before it enters the lake systems. As a result, the lake chemistry may end up being the same as the initial snowmelt chemistry for a short time period.

The long-term effect of acidic deposition upon the ability of a watershed to continue to generate buffering capacity is a major AQRV concern.

Measurements of water chemistry including acid neutralizing capacity should reflect changes from acid deposition and should be considered a primary sensitive receptor.

D. AQUATIC LIFE

Biotic impacts to lake ecosystems caused by pH change include changes in reproduction, growth, mortality and species diversity of phytoplankton, zooplankton, macroinvertebrates and fish. Phytoplankton, zooplankton and macroinvertebrates--major fish foods--are impacted by changes in pH before fish, therefore, they may be better sensitive receptors.

Over 400 lakes in the High Uintas have been stocked with rainbow, cutthroat, or brook trout. Golden trout and arctic grayling have also been stocked in certain localities. Nineteen of the 20 lakes sampled during the Western Pilot Study and 20 of the 26 lakes sampled during the Western Lake Survey, are known to maintain populations of fish.

Diatoms surveys undertaken in the Uinta Mountains show the encroachment of acidobiontic species in some lakes. These species have a pH preference for lakes with pH less than 5.5. Since the historical pH data from these lakes are usually higher than 5.5, it has been proposed that the extreme sensitivity of these lake systems and the presence of acid loving species of diatoms indicate that a slight increase in acid loading would acidify the lake.

The ultra-oligotrophic lakes characteristic of sensitive areas harbor ecosystems which are unique. These ecosystems may be damaged by levels of acidification (pH <6.5) that may not affect fish at all. Acidic water reduces the bacterial decomposition of debris. Amphipods cannot tolerate pH below 6.0. Many species of stoneflies (Plecoptera), mayflies (Ephemeroptera), and caddisflies die at pH less than 5.0.

Species diversity of phytoplankton, zooplankton, diatoms, and macroinvertebrates are determined by water quality characteristics. Since these biological indicators are always present within the aquatic ecosystem they have a tendency to react to year round water quality conditions. Quantitative analyses of these biological aquatic sensitive receptors should be conducted.

E. SOILS

The consequences of chemical inputs to soils vary greatly, depending upon the rates of deposition, the character of the vegetation, and the physical and chemical properties of the soil.

Both dry and wet deposition may affect the soils within the High Uintas Wilderness by changing:

1. Cation exchange capacity
2. Leaching rates of plant nutrients
3. Rates of microbial processes, e.g., nitrogen fixation
4. Decay rates of forest floor materials
5. Availability of phosphorus to plants
6. Solubility of elements toxic to plants
7. pH
8. Sulfate absorption capacity

F. FAUNA

Terrestrial fauna have been identified for the Uinta Mountain Range. Most of the terrestrial species are thought -to be relatively insensitive to the potential air pollutants.

G. FLORA

Acid deposition may affect young plant tissues and the process of photosynthesis. Plants require their embryonic tissues throughout their lives for the formation of new leaves and buds. When tissues are damaged, a plant's developmental power is diminished, gross deformations occur, vitality is sapped, and chances for survival are lessened. Chlorophyll becomes bleached when exposed to low pH values, prohibiting the photosynthesis process.

Various kinds of plants (pine needles, lichens, grasses, twigs, etc.) have been used to measure the impacts of air pollution and acid deposition. The best flora list available for the High Uintas was prepared by Mont E. Lewis, Range Conservationist in his publication titled "Alpine Rangelands of the Uinta Mountains". The Bridger-Teton is in the process of identifying plant species that may be sensitive to acid deposition . Once sensitive plants are identified they will be used as sensitive receptors.

Lichens, a symbiotic association between algae and fungi, are possibly the plant group most sensitive to air pollution. Lichens have no root system and receive all their nutrients and moisture from the atmosphere. They have no excretion systems and as a result may concentrate both beneficial and phytotoxic materials. Gases such as sulfur dioxide, when dissolved in water, will attack the algae symbiont in the thallus resulting in chlorosis, phaeophytin formation or plasmolysis. Such injury can result in death.

Dr. Larry St. Clair, Department of Botany and Range, Brigham Young University conducted a reconnaissance lichen survey on the Ashley National Forest in September 1987. Lichen samples were collected near Walk-Up Lake, Heart Lake, Moon Lake, and Swasey Hole. Physiological measurements will be made on collected lichen species for membrane permeability and chlorophyll content. In addition, thallus content for Pb,S, and Cu will be determined using atomic absorption spectrophotometry.

Lichens have been used as bioindicators to determine severity and extent of air pollution around numerous pollution sources. The varying sensitivity of different lichen species to air

pollution and their long life span (100+ years) make them an ideal bioindicator and sensitive receptor for this study.

MONITORING ACTION PLAN

A. VISIBILITY

1. Visibility Camera

An Automatic Camera Visibility Monitoring Site, located on Lake Fork Mountain (10,900 Feet in elevation) on the Roosevelt Ranger District of the Ashley National Forest became operational on September 17, 1987. The visibility target is Ostler Peak located 20 miles away within the High Uinta Wilderness. The objective is to establish baseline visual record of visibility events, quantitative standard visual range, and contrast for the airshed within the Wilderness. Baseline data will be established by operating the camera site for at least 5 years. (See Visibility Monitoring Plan for details).

Upon review of data analyzed from the Lake Fork Mountain Visibility Camera Site an assessment will be made in 1988-89 for the need of a visibility monitoring site located at the Bear River Ranger Station.

2. Particulate Sampler

Seek installation of Particulate Sampler near the High Uintas Wilderness. Potential sites that include year round access and 120 volt power include: 1) Bear River Guard Station on the Evanston District and 2) Yellowstone Guard Station on the Roosevelt District. Lake Fork Mountain site could be operated and maintained in conjunction with the visibility camera if 120 volt power is not required. (See Wet/Dry Deposition).

B. ATMOSPHERIC DEPOSITION

1. Snow Core Sampling

Snow core samples will be collected by the SCS at four SNOTEL sites surrounding the Wilderness Area. The Utah State Laboratory will conduct the chemical analysis. Starting in 1988, samples will be collected 4 times at each stations once a month from January through April. To provide quality assurance the Ashley National Forest will collect samples at Lake Fork Mountain and at Chepeta Lake. Samples will be analyzed by the USGS National Water Quality Laboratory in Denver.

SNOTEL Site Name	Section	Township	Range	Elevation
Chepeta-Whiterocks Lakes	3	4N	1W	10,350
Lake Fork Mountain	2&3	2N	5W	10,200
Steel Creek Park	17	2N	13E	10,100
Trail Lake	5	2S	9E	9,960

2. Wet/Dry Deposition

Pursue establishment through cooperative monitoring of both Wet and Dry Deposition sites. Both Utah Power and Light and EPA's NDDN program have expressed interest in establishing a Wet/Dry Deposition site in the Uintas. The Forest Service would be willing to operate and maintain sites if cooperators can be found who will provide equipment and laboratory analysis.

Criteria for NADP wet deposition type sites and NDDN dry deposition type sites include weekly year round access for operation and maintenance and 120 volt electric power for site operation. Recommended sites include the Bear River Ranger Station located on north slope of the Uinta Mountains on the Wasatch National Forest and the Yellowstone Ranger Station (near visibility camera site) located on the south slope of the Uinta Range on the Ashley National Forest.

In addition, bulk deposition monitors and Hubbard Brook precipitation monitors should be established at Lake Fork Mountain SNOTEL site near the visibility monitoring site, at Britton Meadows Wilderness Guard Station near Dean and Marsell indicator lakes, and at the Chepeta Lake SNOTEL site near Walk-Up Lake.

Deposition Sites	Elevation	Type	Cooperator
Bear River Ranger Station	8,444	Wet	UP&L/FS
Yellowstone Ranger Station	7,800	Wet/Dry	NDDN(EPA)/FS

Bulk Deposition Sites	Elevation	Winter Access	Power Source
Lakefork Mtn. SNOTEL Site	10,200	Snowmobile	Solar/battery
Britton Meadows Station	10,000	Wilderness	None
Chepeta-Whiterocks SNOTEL	10,350	Snowmobile	Solar/battery

C. WATER

1. Indicator lakes will become the foundation for a long term monitoring program to quantify future changes in the chemistry and biology of aquatic ecosystems. Criteria for lake selection for long term monitoring include acid neutralizing capacity (ANC) less than 75 ueq/L, small affected watershed area, low watershed-to-lake volume ratio, aquatic species diversity, and reasonable access.

Four "ultra-sensitive" indicator lakes have been selected for long term monitoring starting in 1988. The lakes will be sampled twice a year, once in the spring immediately after snowmelt and once in the fall after mixing.

Dean Lake and Marsell Lake are located within the Wilderness will be jointly sampled by personnel from the Ashley and Wasatch National Forests. These two lakes were sampled in 1984 during the Western Pilot Study. Dean Lake was also sampled in 1985 during the Western Lake Survey.

Bluebell Lake was sampled during the 1985 Western Lake Survey and is located in the same watershed as the NDDN site and the visibility camera.

Walk-Up Lake was sampled in 1984 and is located outside the Wilderness and accessed from the Chepeta Lake Road at the head of the Whiterocks River.

ID. NO.	NAME	LATITUDE LONGITUDE	ANC (ueg/L)	ELEV (feet)	DEPTH (meter)	WILDERNESS
4D2-054	Dean Lake(85)	40-40’43"110-45'39”	60.4	10753	13.2	Yes/Ashley
UT1006	Dean Lake(84)		56.2	10753	10.5	
4D2-038	Bluebell Lake	40-40’15"110-16'30"	53.8	10900	11.0	Yes/Ashley
UT1002	Marsell Lake	40-37'00"110-50'00"	56.2	10380	16.5	Yes/Wasatch
UT2003	Walk-Up Lake	40-48’41”110-02’118”	46.9	11100	30.0	No/Ashley

Twenty four lakes sampled within the Uinta Mountains during the 1984 and 1985 surveys were classified as "ultra-sensitive" to acid deposition based on acid neutralizing capacity less than 75 ueq/L. In addition to the four indicator lakes the following lakes are recommended for possible future and/or cooperative monitoring. ID numbers starting with "UT" were sampled during the 1984 Western Pilot Study and lakes starting with the "4D" were sampled during the 1985 Western Lake Survey. Lakes without an ID number have not been sampled. but should meet the ctiteria as potential indicator lakes.

ID. NO.	NAME	LATITUDE LONGITUDE	ANC (ueg L)	ELEV. (feet)	DEPTH (meter)	WILDERNESS AND FOREST
4Dl-044	Upper Coffin	40-50'03"110-14’15"	58.9	11027	3.5	Yes/Wasatch
4Dl-043	Cliff Lake	40-47'30"110-24'25”	80.2	11450	19.8	Yes/Wasatch
	Naturalist B.	40-43’110-48’?		11800	?	Yes/Wasatch
4D2-039	Albert Lake	40-41’45"110-29'1”	53.1	10830	4.2	Yes/Ashley
UT1007	Heart Lake	40-35'39"110-48'37”	45.1	10515	5.0	Yes/Ashley
4D2-040	No Name	40-40’15"110-04'30”	44.9	10486	2.7	No/Ashley
UT2007	Taylor Lake	40-48’41”110-02'18”	49.0	11220	11.0	No/Ashley
	Survey Lake	40-35'15"110-47,45”	66.9*	10650	3.0	No/Ashley

*ANC at Arta Lake the next lower lake

2. The Wasatch National Forest will evaluate lakes located on the west and north slope of the Uinta Mountain Range during the summer of 1988 as potential indicator lakes. In addition to lakes sampled in 1984 and 1985, new "ultra-sensitive" lakes with better

access may be selected. The goal is to identify two lakes on the Wasatch National Forest for possible long term monitoring starting in 1989.

3. Develop detailed monitoring plan including quality assurance and sample protocol for indicator lakes.

4. Seek cooperative long term monitoring with EPA on WLS-Phase III lakes.

5. Direct research and other acid deposition monitoring activities such as soils, lichens, macroinvertebrate, etc. toward the watersheds of the selected indicator lakes.

D. AQUATIC LIFE

1. Macroinvertebrates will be sampled twice a year at the inlet and outlet of Dean Lake, Marsell Lake, Bluebell Lake, and Walk-Up Lake.

2. Dr. Fred Mangum, Aquatic Ecologist, USDA-Forest Service, will conduct a 3-year study to determine the effects of pH depression upon aquatic macroinvertebrate species and communities. In addition, to the above sampling sites, controlled pH depression will be conducted on two streams outside the Wilderness.

3. Encourage participation from Utah Division of Wildlife Resources (UDWR) on fish population and habitat surveys for each indicator lake.

4. Pursue monitoring with UDWR and/or universities of diatoms, phytoplankton, and zooplankton for each of the indicator lakes.

E. SOILS

1. An Order I Soil Survey for the Dean Lake, Marsell Lake, Walk-Up Lake, and Bluebell Lake watersheds will be conducted by the Ashley Forest Soil Scientist during the summers of 1988-89.

2. Samples from each major soil horizon will be analyzed for pH, cation exchange capacity, exchangeable bases, exchange acidity, organic matter, texture, and sulfate absorption capacity.

3. Encourage university research on the effects of acid deposition and soil buffering capacity on indicator watersheds in the High Uintas.

F. FLORA

1. Dr. Larry St. Clair, Department of Botany and Range, Brigham Young University conducted a reconnaissance lichen survey on the Ashley National Forest in September 1987. Lichen samples were collected near Walk-Up Lake, Heart Lake, Moon Lake, and

Swasey Hole. Physiological measurements will be made on collected lichen species for membrane permeability and chlorophyll content. In addition, thallus content for Pb, S, and Cu will be determined using atomic absorption spectrophotometry.

2. Lichen samples will be collected at the Dean Lake, Marsell Lake, and Bluebell Lake watersheds and elemental content of thallus tissues will be analyzed for Pb, S, Zn, and Cu.

3. A floristic lichen survey will be conducted for the High Uintas Wilderness. Work will be done through the Forest Service volunteer program by a botany graduate student. Sensitive lichen species will be identified and monitored as a sensitive receptor.

4. Plant community types will be inventoried within the indicator watersheds in conjunction with the soil surveys. Sensitive flora species will be identified and monitored as secondary receptors.

LIMITS OF ACCEPTABLE CHANGE

The concepts of Limits of Acceptable Change is a process that requires decisions on what kind of wilderness conditions are acceptable, then prescribing actions to protect or achieve those conditions. An important step in the process is to identify the issues and concerns and to seek public involvement. Air Quality Related Values should be identified and baseline conditions established. Air Quality sensitive receptors which are measurable should be identified. Specifications of these air resource sensitive receptors for acceptable resource conditions need to be established. It is necessary to identify management actions needed to achieve these conditions. And finally, a program is needed to monitor and evaluate the management effectiveness.

Air Quality Related Values within the Wilderness has been identified as major resource issue. This Action Plan defines the AQRV's and the possible air pollution impacts. Air quality sensitive receptors have been identified which will be inventoried to establish baseline conditions, then monitoried to evaluate management effectiveness.

Public involvement plays an important role in the LAC concept. Input from the public will be sought through the overall Wilderness LAC process. In addition, this Action Plan will be sent out to the interested public, agencies, and officials as part of an information packet. Once public input has been received an interdisciplinary team will be formed to establish the LAC's for AQRV sensitive receptors.

LACs will be developed using the following inter-related wilderness premises:

1. All components of the wilderness resource are equally important.

2. A wilderness component is important even if the users of the Wilderness are unaware of its existence.

3. All trophic levels are equally important. For example, micro-organizms are as equally important as elk or grizzly bears.

4. The most sensitive component is to be protected. not just those of flaverage" or "normal" sensitivity.

5. Each wilderness component is important for itself, as well as for how it interacts with other components of the ecosystem.

6. Wilderness components are to be protected from man-caused change rather than damage.

The Forest Service as the Federal Land Manager is responsible for reviewing and providing recommendations to PSD permit applications. Within the PSD's advance air quality modeling

should be used to address the impacts of major air pollutant emissions on the biological, physical, and social resources of the Wilderness area.

IMPLEMENTATION COST

Forest Service Chief Dale Robertson has given direction that Air will be recongized as a basic resource which will be given the same management emphasis as all other forest resources. National funding levels approved by the Chief and Staff for the next 3 years include $2.5 million in FY 1988, $3.7 million in FY 1989, and $5.2 million in FY 1990. Region 4 expects their share to be $250,000 in FY 1988, increasing to $500,000 in FY 1990.

The Ashley National Forest ranked fourth and the Wasatch-Cache National Forest ranked ninth in air resource management workload of the sixteen National Forests within the Region. Workload analysis was based on number of acid rain sensitive lakes, acres of wilderness, number of air resource data monitors, prescribed and brush disposal fire activity, and number of potential PSD permit reviews. The Regional Office recommended 1990 air resource program funding for the Ashley National Forest is $27,000 and $22,400 for the Wasatch-Cache National Forest.

The following table estimates implementation cost outlined in the High Uintas Wilderness AQRV Action Plan. Costs covered by cooperators are not included. Forest Service committment to obligate funds is dependent on priorities and appropriations.

ASHLEY NATIONAL FOREST ACTIVITIES COST ($M)	1988	1989	1990	1991	1992
Lake Fork Mountain Visibilty Camera (D3)	$6.5	$6.0	$6.0	$6.0	$6.0
Bulk Deposition	--	--	$4.0	$4.0	$4.0
Snow Core Sampling (D3)	$1.0	$1.0	$1.0	$1.0	$1.0
Wet/Dry Deposition (EPA-Funding)	--	--	--	--	--
Indicator Lake Monitoring	$6.5	$6.5	$6.5	$6.5	$6.5
Macroinvertebrate Sampling	$1.0	$1.0	$1.0	$1.0	$1.0
Order I Soil Survey	$2.0	$2.0	--	--	--
Lichen Studies	$2.0	$2.0			
Flora Surveys	--	--	--	$2.0	$2.0
Supervisor's Office Administration	$7.0	$8.0	$8.0	$8.0	$8.0
Districts Offices Administration	$3.0	$3.0	$3.0	$3.0	$3.0
Totals	$29.0	$29.5	$29.5	$31.5	$31.5

WASATCH NATIONAL FOREST ACTIVITIES COST ($M)	1988	1989	1990	1991	1992
Visibility Camera	--	--	$9.5	$6.0	$6.0
Wet/Dry Deposition (possible funding by others)		($7.0)	($7.0)	($7.0)	($7.0)
Indicator Lake Monitoring	$2.0	$3.0	$3.0	$3.0	$3.0
Order I Soil Survey	--	$2.0	--	--	--
Lichen Studies	$2.0	$2.0	--	--	--
Supervisor's Office Administration	$3.0	$5.0	$5.0	$5.0	$5.0

Districts Offices Administration	$2.0	$3.0	$3.0	$3.0	$3.0
Totals	$9.0	$15.0	$20.5	$17.0	$17.0

DOCUMENTATION

Master copies of the High Uintas Wilderness Air Quality Related Value Program will be kept on file at the Supervisor's Offices on the Ashley National Forest in Vernal, Utah and the Wasatch National Forest in Salt Lake City, Utah.

Development of detailed monitoring plans, preparation of reports, and updating the bibliography will be a continuous process. Documentation of the AQRV program will consist of different sections, bound in a 3-ring notebook, allowing additions as the project proceeds. Section II, will contain detailed monitoring and quality assurance plans. Section III, will consist of individual reports including documentation and analysis of monitoring data. Section IV, will contain a bibliography list of associated and/or pertinent reports and articles. Additional sections may be added as needed.

Documentation of the High Uintas Air Quality Related Values Program notebook will be updated once a year. Additional monitoring plans, data documentation, or completed reports will be added to the appropriate sections. The Table of Contents will reflect any additional reports to the program.

COORDINATION

Cooperation with Federal, State, local agencies and private and public organizations is an important part for a successful AQRV program. Primary coordinating activities with various agencies will be conducted through Utah's Acid Deposition Technical Advisory Committee (ADTAC). Utah's Governor Norm Bangerter requested that the ADTAC task force, involving experts from universities and state and federal agencies., study the acid deposition issue. The Forest Service will also deal directly with various agencies, cooperators, and concerned publics.

Current cooperators in monitoring or management of AQRV's within the High Uinta Wilderness are listed:

Name and Address	Work Agreements or Cooperative Studies
Bureau of Air Quality Div. of Environmental Health Utah Department of Health 288 North 146o West P.O. Box 16690 Salt Lake City, Utah 84116-0690	-Lead air quality agency for State. -Chairs ADTAC committee.
Bureau of Water Pollution Control Utah Department of Health P.O. Box 2500 Salt Lake City, Utah 84110	-State water quality management. -Coordinates chemical analysis of water and snow core samples at State Lab.
Dr. Larry St. Clair Department of Botany and Range Science Brigham Young University 40l WlDlB Provo, Utah 84602	-Lichen Studies.
USDA - Soil Conservation Service Utah Snow Surveys 4418 Federal Bldg. 125 South State Street Salt Lake City, Utah 84147 (80l)-524-5213	-Collects snow core samples for chemical analysis.
Utah State Laboratory 44 Medical Drive Salt Lake City, Utah 84113 (80l)-533-6131	-Conducts chemical analysis of snow core samples collected by SCS.

U.S. Enviromental Protection Agency
Region 8
Denver Federal Center
PO Box 25366
Lakewood, CO 80225

-1984 Western Pilot Study
-1985 Western Lake Survey

U.S.Geological Survey
National Water Quality Laboratory
5293 Ward Road
Arvada, Colorado 80002

-Conducts chemical water analysis on lake and deposition samples.

U.S. Geological Survey
Water Resource Division
1745 West 1700 South
Salt Lake City, Utah
(80l)-534-4249

-1984 Western Pilot Study.

U.S. Geological Survey

Attention: Howard Taylor
Denver Federal Center
MS 407
Lakewood, Colorado 80225
(303) 236-1928

-Snow Core Analyses.

MAILING LIST

In addition to the current cooperators the following organizations will be provided a copy of the Action Plan and included on the mailing list. If organizations, groups, or individuals would like to be added or removed to/from the mailing list please contact the Supervisor's Office at either the Ashley or Wasatch-Cache National Forests.

Daggett County Commission
Laray Sadlier, Chairman
Manila, UT 84046

Duchesne County Commission
Lee Nelson
50 East 100 South
Duchesne, UT 84021

The Nature Conservancy
2225 South Highway 89-91
Wellsville, UT 84339

Sierra Club
Attn: Jim Catlin
736 S. McClellan
Salt Lake City, UT 84102

Summitt County Commission
Attn: Dale J. Leavitt
Kamas, UT 84036

USDA, Forest Service
Bridger-Teton Natl. Forest
342 Cache Street
Jackson, WY 83001

USDI, Bureau of Land Mgmt.
Planning and Env. Affairs
324 S. State St.
Salt Lake City, UT 84111

USDI, Fish & Wildlife Service
Ecological Services
206O Ad. Bldg.,1745 S 1700 W
Salt Lake City, UT 84l04-5110

USDI, National Park Service
Dinosaur National Monument
P.O. Box 210
Dinosaur, CO 81610

U.S. Enviromental Protection Agency
Environmental Monitoring Systems Laboratory
Attention: Steven M. Bromberg
Reasearch Triangle Park
North Carolina 27711

U.S. Enviromental Protection Agency
Environmental Services Division
Attention: Denise Link
8ES-ES
Denver Federal Center
PO Box 25366
Lakewood, CO 80225

Uintah County Comm.
County Bldg 152 E.100 N.
Vernal, UT 84078

Uintah Mountain Club
c/o Will Durant, President
3264 W. 500 S.
Vernal, UT 84078

Utah Dept of Health
Bureau of Water Pol. Control
Attn: C.K. Sudweeks
150 N. Temple
Salt Lake City, UT 84110-2500

Utah Div Wildlife Resources
Attn: Maureen Wilson
1596 W. North Temple
Salt Lake City, UT 84116

Utah Power & Light
Attn: Dee Reese
P.O. Box 899
Salt Lake City, UT 84110

Utah Wilderness Assoc.

455 E. 400 S., B-40
Salt Lake City, UT 84111

Ute Indian Tribe
Attn: Jason Cuch
Resource Administration
Ft. Duchesne, UT 84026

The Wilderness Soc.
Attn: Mike Medberry
436 Alameda Ave.
Salt Lake City, UT 84111