HIGH UINTAS WILDERNESS MONITORING PLAN

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Ashley National Forest

Wasatch-Cache National Forest

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Introduction

Project Area Description

Located in northeastern Utah, the High Uintas Wilderness comprises the wild core of the massive Uinta Mountains. Characterized by the highest peaks in Utah, countless lakes, and a unique alpine ecosystem, it is among the nation's most outstanding wilderness areas. The High Uintas Wilderness is administered jointly by the Ashley and Wasatch-Cache National Forests. The Ashley National Forest manages over 276,000 (60%) of the 456,705 acres included in the wilderness and is designated the lead forest in the cooperative management of the area.

The Uinta Mountains were carved by glaciers from an immense uplift of Precambrian rock. Some of this rock is exposed as colorful quartzite and shales. The main crest of the Uinta Mountains runs west to east for more than 60 miles, rising over 6,000 feet above the Wyoming and Uinta Basins to the north and south. Massive secondary ridges extend north and south from the crest of the range, framing glacial basins and canyons far below. This rugged expanse of peaks and flat-top mountains is the largest alpine area in the Intermountain West and is the setting for Kings Peak, the highest peak in Utah. Hundreds of picturesque lakes, streams, and meadows are nestled within beautiful basins. Cold, clear rivers plunge from the basins into deep canyons that form the headwaters of Utah's major rivers.

The Uinta Mountains rise from 7,500 to 13,528 feet at the summit of Kings Peak, offering diverse habitat for a wide variety of flora and fauna. Above treeline, tundra plant communities thrive in the harsh climate of the highest altitudes. Thick forests of Engelmann spruce, subalpine fir, and lodgepole pine blanket the land below treeline. These forests are interrupted by park-like meadows and lush wetlands. In the lower elevations, aspen groves and countless mixed species offer contrast to the scene. The Uinta Mountains are home to: elk, mule deer, moose, mountain goats, coyotes, black bears, bighorn sheep, ptarmigan, river otter, several species of raptor, pine marten, and cougar, to name a few. Occasionally, rare wolverines are spotted, and these mountains may be home to the elusive lynx.

The High Uintas Wilderness boasts nearly 700 miles of trail, which may be accessed from a number of trailheads surrounding the wilderness near the gateway communities of Duchesne, Roosevelt, and Kamas, UT and Evanston and Mountain View, WY. Approximately 2/3 of these trail miles are located on the Ashley National Forest. This extensive network of trails leads visitors deep into the wilderness, through thick forests, past rushing streams and placid lakes, to sweeping alpine vistas below majestic peaks. The opportunities for exploration are endless.

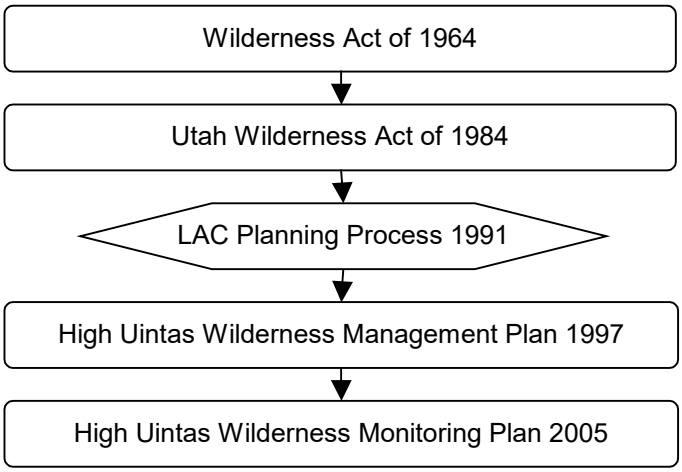
Management & Monitoring

The High Uintas Wilderness was designated as such under the Utah Wilderness Act of 1984, pursuant to the Wilderness Act of 1964. Consequently, management objectives for the wilderness stem from these two acts of Congress. Broadly stated, the High Uintas Wilderness is to be managed for:

- Natural conditions and wilderness character or "wildness"
- Ecological health and integrity
- Education on wilderness values (physical, spiritual, and experiential)
- Opportunities for solitude or primitive and unconfined recreation
- Special provisions found in both acts, such as grazing and water use

Recognizing the need for a comprehensive wilderness management plan, the Ashley and Wasatch-Cache National Forests launched a cooperative planning process using the Limits of Acceptable Change (LAC) model in 1991. The *High Uintas Wilderness (HUW) Management Plan* was the product of this process and it amended both forest plans in 1997. The *HUW Management Plan* prescribes desired conditions within the wilderness, divides the wilderness into three different desired condition classes, and includes 27 standards and guidelines addressing a comprehensive set of physical and social components of wilderness to ensure desired conditions are met. Fourteen standards were identified as key indicators of condition that require regular monitoring. The monitoring plan tiers to the *HUW Management Plan* and is intended to guide the implementation of its monitoring requirements.

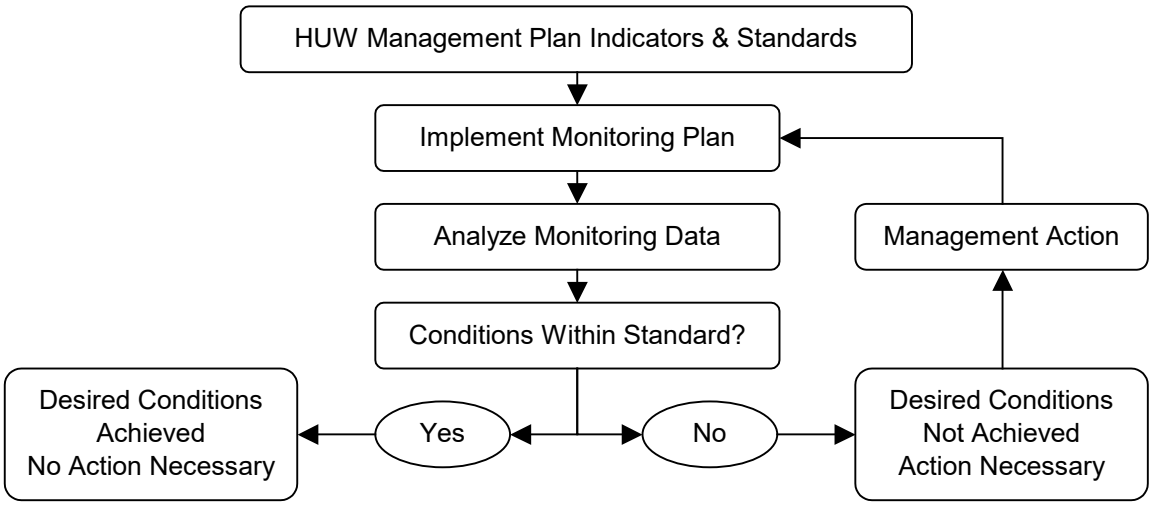
HIGH UINTAS WILDERNESS MANAGEMENT DIRECTION



See Appendix A for a detailed description of desired conditions, wilderness-wide and by desired condition class, and a complete list of the original standards and guidelines included in the *HUW Management Plan.* See Appendix B for the original monitoring table attached to the *Record of Decision*.

Monitoring is integral to wilderness management. It yields information needed by wilderness managers to make informed recommendations regarding actions that may be necessary to restore or preserve natural conditions, wilderness character, and the quality of the wilderness experience. In short, it facilitates desired conditions by alerting managers when standards are not achieved. Monitoring efforts may be expanded in scope and frequency beyond the sampling plan for any indicator whenever there is reason to suspect a change in physical or social conditions between planned sampling events. The monitoring plan itself is intended to be a dynamic document that adapts to new information and evolves as it is implemented.

HIGH UINTAS WILDERNESS MONITORING MODEL



Monitoring is always a function of funding and priorities, both of which are increasingly problematic, so the monitoring plan was written as conservatively as possible while still satisfying the intent of the indicators. It comprises the best available science, practical but proven protocols, and feasible sampling plans to yield meaningful results. The sampling included in the monitoring plan is considered the minimum necessary to capture changes in conditions in time to prevent long-term damage to wilderness resources and experiences. Nevertheless, the monitoring plan will only be implemented to the degree Forest funding and priorities permit.

While developing the monitoring plan, a number of problems were discovered with the standards in the *HUW Management Plan*. The development of the monitoring plan was further complicated by the fact that direction was drawn from two interdependent sources that sometimes conflict: the *HUW Management Plan Record of Decision* and the monitoring table attached to it and incorporated therein. Unfortunately, the standards prescribed by the *HUW Management Plan* cannot be revised for this document. However, the monitoring plan includes a number of recommendations that address advances in science, feasibility issues, and errors, and they are fully integrated into the document. The Wasatch-Cache and Ashley National Forests should consider these recommendations in future planning efforts.

Monitoring Etiquette

To the degree possible, monitoring surveys will be conducted such as to minimize impacts to wilderness visitors. Most monitoring will occur in Condition Class 3 areas, simply due to the degree of impact and likelihood of change associated with high use in these areas. The resulting management presence is consistent with desired conditions for Condition Class 3 and should not substantially affect the wilderness experience for visitors to these areas. However, recreation use and the impacts associated with it are increasingly common in Condition Class 1 and 2 areas, yet desired conditions for these areas prescribe a less apparent management presence. As more monitoring becomes necessary in "wilder" areas, it may result in isolated impacts to wilderness experiences. However, monitoring will yield information necessary to maintain or improve conditions, pursuant to desired condition class prescriptions, thereby protecting the wilderness experience for most visitors in the long-term.

Monitoring that does not depend on the presence of visitors will be completed on weekdays using the least intrusive methods permitted by the monitoring protocol and sampling plan. Surveyors should always be in uniform and maintain as professional an appearance as field conditions permit, so that a respectable image is maintained and the work appears to be of an "official" nature. Furthermore, when visitors are encountered, surveyors should take the time to explain the work being completed and its purposes. This fosters support and stewardship.

All surveyors should be trained in Leave No Trace (LNT) outdoor ethics and skills. This will minimize the physical and social impacts of monitoring activities and set an example for wilderness visitors. All personnel working in the wilderness are expected to "practice what we preach," and LNT is already required training for wilderness rangers and trail crew. As needed and upon request, LNT training can be provided by wilderness managers or qualified rangers in less than an hour.

MONITORING INDICATOR SUMMARY TABLE

INDICATOR		INTENT	STANDARD
Air Quality	MA-01-001 Deposition	Indicator of pollutants in the air.	Nitrate and sulphate loading does not exceed 3-5 kg/ha per year each.
	MA-01-002 Standard Visual Range	Indicator of air quality impacts from human activities outside of the wilderness.	Long-term visual range impairment from human activities does not exceed 10% of the 90th percentile in Class 2 Wilderness Airsheds. Short-term (14-day) visual range impairment from human activities does not exceed 20% of the 90th percentile in Class 2 Wilderness Airsheds.
	MA-01-003 Surface Water Alkalinity	Indicator of watershed ability to neutralize or buffer acids deposited by precip/dust.	Alkalinity falls no more than 10% below baseline in all surface waters.
Water & Soil	MA-01-004 Coliform Bacteria	Indicator of human or livestock waste being introduced into surface waters.	State of Utah water quality standards are met for acceptable amounts of coliform bacteria in waters for their specific beneficial uses, as defined by the *Standards of Quality for Waters of the State*. See Utah Division of Water Quality Rule R317-2-14: www.waterquality.utah.gov.
	MA-01-005 Soil Erosion in Condition Class 1	Indicator of both site productivity and water quality.	No more than 15% of use areas have Erosion Class 1 characteristics. None have Erosion Class 2 or 3 characteristics.
	MA-01-006 Soil Erosion in Condition Class 2	Indicator of both site productivity and water quality.	No more than 25% of use areas have Erosion Class 1 characteristics. No more than 15% of use areas have Erosion Class 2 characteristics. None have Erosion Class 3 characteristics.
	MA-01-007 Soil Erosion in Condition Class 3	Indicator of both site productivity and water quality.	No more than 50% of use areas have Erosion Class 1 characteristics. No more than 25% of use areas have Erosion Class 2 characteristics. None have Erosion Class 3 characteristics.
Vegetation	MA-01-016 Sensitive Plant Habitat	Indicator of sensitive plant species viability (two species).	No more than 10% of the habitat for HUW sensitive plant species (landtypes UB1, 2, and 3) is adversely altered by human uses.
	MA-01-017 Ground Cover	Indicator of desired plant communities and overall condition of the watershed.	At least 85% of potential natural ground cover is maintained in all HUW alpine, aspen, and riparian vegetation types.
Fire	MA-01-018 Natural Fire Regime	Indicator of the natural processes found in wilderness.	Wildland fire is managed to play, to the extent possible, its natural role in the ecosystem. Prescribed fires are managed according to the *HUW Fire Management Plan* found in the *HUW Final EIS*, 1997 (FSM 2324.2).

MONITORING INDICATOR SUMMARY TABLE

	INDICATOR	INTENT	STANDARD
Recreation	MA-01-035 Campsite Density	Indicator of solitude.	Condition Class 1: Occupied campsites are one mile apart. Condition Class 2: Occupied campsites are ¼ mile apart. Condition Class 3: Occupied campsites are 200 feet apart.
	MA-01-036 Campsite Impact Index	Indicator of impacts to vegetation, soils, and aesthetics from human recreation use.	*1) Ashley National Forest* Condition Class 1: No campsites have a site impact index (SII) over 40. Condition Class 2: No more than 10% of campsites have an SII over 40. Condition Class 3: No more than 20% of campsites have an SII of 50 or more. *2) Wasatch-Cache National Forest* Condition Class 1: No campsites have a site impact index (SII) over 40. Condition Class 2: No more than 10% of campsites have an SII of 50 or more. Condition Class 3: No more than 20% of campsites have an SII of 50 or more.
	MA-01-038 Group Size	Indicator of impacts to natural resources and quality of wilderness experience.	Group size does not exceed 14 persons and 15 head of pack and saddle stock. This is a change from the original standard, which varied with condition class, resulting from an appeal of the *Record of Decision* in 1997.
	MA-01-044 Firewood Availability	Indicator of impacts to vegetation, soils, and aesthetics from human recreation use.	*1) Ashley National Forest* None. This indicator is shown on the monitoring table attached to the *Record of Decision (ROD)* and incorporated therein. However, the standard was omitted from the *ROD* text. *2) Wasatch-Cache National Forest* Prohibit campfires where the firewood supply is depleted and continued fire building threatens the wilderness qualities of the area.

MA-01-001 Deposition

Introduction

Deposition is an indicator of air pollutants present. This indicator is primarily concerned with the correlation of air quality and ecological health, though it also relates to visibility, which is addressed by standard visual range (MA-01-002). The extent to which air quality is affected by pollution, from within and without, was identified as a significant issue in the *HUW Management Plan.* The Forest Service has legal responsibility for managing air quality in Wilderness areas on National Forest System lands, but does not have full regulatory authority. As identified in FSM 2580, coordination with federal, State and local air-regulatory agencies is needed to protect resource values, assess monitoring needs, and develop/revise air quality standards and regulations affecting forest resources.

Nitrates and sulfates can contribute to the acidification of sensitive high-elevation surface waters and severely alter natural conditions in aquatic ecosystems. Nitrate and sulfate deposition may also affect high-elevation soils and plant communities, potentially harming terrestrial biota, and cumulative changes in water and soil chemistries can affect ecological integrity. Conversely, pollutant loading is likely to have serious, long-term impacts on both aquatic and terrestrial ecosystems. Moreover, since the HUW is an important watershed for the states of Utah and Wyoming, watershed health is an important consideration as well. Deposition monitoring will yield information needed by wilderness managers to make informed recommendations regarding interagency air quality coordination, wildland fire and smoke management, and other management actions that may be necessary to protect wilderness resources.

Standard

Nitrate loading will not exceed 3-5 kg/ha per year. Sulfate loading will not exceed 3-5 kg/ha per year.

Recommendations

Threshold. Nitrate and sulfate loading do not exceed 5 kg/ha per year. For new sources or modifications of existing sources of deposition, nitrate and sulfate loading do not increase more than 0.005 kg/ha per year.*

> *Clarification regarding the application and monitoring of this threshold is forthcoming. The *HUW Management Plan* does not currently address incremental increases in nitrate or sulfate loading from new or modified sources of deposition. Increases less than 0.005 kg/ha per year are considered insignificant relative to natural baseline conditions for areas West of the Mississippi River. The sensitivity of the ecosystem, as well as the magnitude of the deposition from an individual source, is to be considered. This is a deposition threshold, not necessarily the amount that constitutes an adverse impact to the environment – it is the amount of deposition that triggers a management concern and further evaluation. This level may or may not result in adverse effects and constitute cause for management concern, so a case-by-case approach to permit review is needed. Therefore, the addition of this incremental threshold is recommended. This change is consistent with formal recommendations from the National Park Service and Fish and Wildlife Service and informal recommendations from the Forest Service.

Skills & Tools Required

No specialized skills or tools are required to monitor bulk deposition, other than deposition sampling skills, which may be acquired during training. Experience is helpful but not necessary; science background is needed. The work is somewhat technical, however, and requires initial training to ensure accurate, complete, and consistent data is collected. This indicator is customarily surveyed by trained science professionals or technicians. However, may also be efficient to use wilderness rangers. If committed for the entire field season, volunteers with science background may l also be effective. When alternative or supplemental survey methods are employed, however, monitoring this indicator may require highly specialized skills (lichen surveys), and time researching external or secondary data sources in the office. These skills may not be available internally, and office work may not be desirable to some and can interfere with fieldwork. Contracting the work may be cost effective, particularly if combined with other survey work. In any case, this work must be done under the direction of the Forest air quality program manager (usually the Forest Hydrologist). Currently, the Ashley National Forest coordinates the air quality monitoring for both the Ashley and Wasatch-Cache Forest portions of the High Uintas Wilderness.

Combining this survey work with other work is not recommended, given the unique locations of deposition samples. It is also unlikely that the survey sites for this indicator will coincide with other survey areas.

In some cases, field support may be necessary to expedite the transport of samples to town. Office support may also be necessary to facilitate the delivery of samples to the laboratory via commercial third party.

Tools Required*	Skills Required*
Sampling Plan Survey Forms & Sharpie Sample Bottles, Labels/Marker Others as Required by air quality program manager	Basic Computer & MS Excel Deposition Sampling Science background Others as Required by air quality program manager

* Assumes bulk deposition sampling only.

Monitoring Protocol

A comprehensive protocol for monitoring deposition cannot be described in this document, since it will vary with advances in air quality science, partnership opportunities, and changes in Region 4 and interregional (Regions 1, 2, and 4) protocols. Alternative or supplemental survey methods may be employed, and bulk deposition sampling may eventually be replaced by more sophisticated methods. Additionally, the Wind River Protocol (Bridger-Teton NF) has been used in the HUW, and will likely influence this protocol. Therefore, the Forest air quality program manager will develop an appropriate protocol and provide direction for each monitoring event. Bulk deposition has been monitored on the Ashley National Forest and will continue unless more sophisticated methods are implemented. Lichen monitoring stations have also been established.

1. Bulk Deposition

Deposition is currently monitored by locating the bulk deposition sampling sites established as prescribed by the sampling plan, and collecting air/rain/snow samples for laboratory analysis per Wind River protocol. Once the samples have been collected, they must be delivered to the laboratory under controlled conditions so they are not contaminated. This may be challenging in remote sites.

Deposition samples should be sent to the nearest centralized air quality laboratory, to be consistent with other Forest Service air quality monitoring programs. Currently, this is the Rocky Mountain Research Station in Fort Collins, Colorado, though other facilities may become available in the future.

2. Coordination
Coordination with regional, interregional, national, State, and other agency air quality personnel to identify and address monitoring needs or changes needed based on monitoring.

A *deposition survey form* (Appendix C: 1.2) must be completed at least annually, and optionally for each sampling site. This form is simple and self-explanatory. Most of the entries may be transcribed directly from the survey form(s) and laboratory results. The Forest air quality program manager will likely require additional documentation. However, this form serves to validate the survey.

Photos, maps, and geolocations (GPS) are generally not required annually for this indicator, since the sampling sites are fixed.

After completing a survey or at the end of the season, all data should be filed in the appropriate server location, hard copy file, and/or tracking database (e.g., NRIS). All hardcopies, including all forms and laboratory results, should be retained and filed in a location designated by the Forest air quality program manager.

Sampling Plan

1. Bulk Deposition
Deposition will be surveyed at established bulk deposition sampling sites annually, subject to accessibility. Specific locations and sampling direction will be provided by the Forest air quality program manager. Samples are collected following sufficient precipitation to fill bottles. Bulk deposition sampling may supplemented or eventually replaced by more sophisticated methods, in which case the sampling plan must adapt to satisfy the intent of the indicator and meet the information needs of wilderness managers. Monitoring surveys collecting air or snow samples may be conducted any time of the year, though winter access to sampling sites can be more difficult or present safety concerns. Most recently, surveys have been conducted during the ice-free season, typically June through October, which largely coincides with the peak high-elevation field season (July 1 to Labor Day).

2. Coordination
There is ongoing internal and external communication and an internal educational/awareness effort by Forest air quality program personnel.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from human activities, from within and without, which is a foremost concern of the *HUW Management Plan*. Despite the high cost and level of commitment required to monitor this indicator, acidification can indicate a serious threat to aquatic ecosystems and watershed health and every effort should be made to do so.

MA-01-002 Standard Visual Range

Introduction

Standard visual range (SVR) is an indicator of air quality impacts from human activities outside of the wilderness. This indicator is primarily concerned with the correlation of air quality and visibility, which affects the wilderness experience. The extent to which air quality is affected by pollution, from within and without, was identified as a significant issue in the *HUW Management Plan.*

Studies indicate that many wilderness visitors are sensitive to visibility impairments. Reductions in visual range can affect the quality of the wilderness experience for these visitors. Standard visual range monitoring will yield information needed by managers to make informed recommendations regarding interagency air quality coordination, wildland fire and smoke management, and other management actions that may be necessary to protect wilderness experiences.

Standard

Long-term visibility impairment from human activities will not impair long term baseline visual range more than 10% of the 90th percentile in Class 2 wilderness airsheds. Short-term (14-day) visual range impairment from human activities outside the wilderness will not reduce visual range more than 20% of the 90th percentile in Class 2 wilderness airsheds.

The following "NOTE" appears on the Ashley National Forest standard, but not the Wasatch-Cache National Forest standard:

> 90th percentile is the 90% cumulative frequency of Standard Visual Range from the site or nearest site to be impacted and for the cleanest 10% of all data collected.

Skills & Tools Required

No specialized skills or tools are required to monitor this indicator using computer websites. Experience is helpful but not necessary. The work is somewhat technical, however, and requires initial training to ensure accurate, complete, and consistent data is collected. This indicator is customarily surveyed by trained science professionals or technicians. . It would not normally be prudent to use wilderness rangers for the work is entirely performed in the office, which may not be desirable to some and would interfere with fieldwork. If committed for the entire field season, wilderness volunteers with science background may be effective, though technical office work is unlikely to appeal to them. If alternative or supplemental survey methods are employed, however, monitoring this indicator may require more specialized skills, which may not be available internally. Contracting the work may be cost effective, particularly if combined with other survey work. In any case, this work must be done under the direction of the Forest air quality program manager (usually the Forest Hydrologist). In addition to Internet-based data, modeling of prescribed fire, wildfire or industrial development helps evaluate achievement of air quality standards and may be applied outside the requirements of this monitoring plan.

Tools Required	Skills Required
Sampling Plan Others as Required by air quality program manager	Basic Computer & MS Excel Internet Navigation Others as Required by air quality program manager

Monitoring Protocol

1. Internet-based information

Currently, standard visual range is monitored by researching external, secondary sources of air quality data and extrapolating visual range from the applicable particulate or optical results.

Visibility data is borrowed from Interagency Monitoring of Protected Visual Environments (IMPROVE) Program monitoring stations in the vicinity and the Visibility Information Exchange Web System (VIEWS). Additional sources of proxy data include the Wyoming Visibility Monitoring Network (VISNET) and Environmental Protection Agency (EPA) AirData. See these data sources at:

- IMPROVE www.vista.cira.colostate.edu/improve/ and www.vista.cira.colostate.edu/views/
- VISNET www.wyvisnet.com
- EPA AirData www.epa.gov/air/data/geosel.html

2. Coordination

Coordination with regional, interregional, national, State, and other agency air quality personnel to identify and address monitoring needs or changes needed based on monitoring.

The *HUW Management Plan* prescribed the use of a visibility camera installed in 1987 for standard visual range monitoring. However, the camera revealed that this method does not produce results that are conducive to quantitative analyses, only visual estimates, and it's no longer in service. Lacking scientific equipment for monitoring visibility in the HUW, it is currently not possible to collect quantitative visibility data specifically for the wilderness. Until such time as more sophisticated primary methods are employed, the protocol requires extrapolations from external, secondary sources of air quality data and modeling as needed for analysis. A comprehensive protocol for monitoring standard visual range cannot be described in this document, since it will vary with advances in hydrologic science and changes in Region 4 and interregional (Regions 1, 2, and 4) protocols. Alternative or supplemental survey methods may be employed, and the use of external, secondary data may eventually be replaced by more sophisticated primary methods, such as specialized visibility monitoring equipment (nephelometer or transmissometer). Additionally, the Wind River Protocol (Bridger-Teton NF) has been widely used throughout the West, including the HUW, and will likely influence this protocol. Therefore, the Forest air quality program manager will develop an appropriate protocol and provide direction for each monitoring event.

A *standard visual range survey form* (Appendix C: 2) must be completed at least annually, and optionally for each survey completed. This form is simple and self-explanatory, though it requires careful documentation of the process and data used to arrive at standard visual range, and it may be difficult to correlate the available data with visibility. The Forest air quality program manager will likely require additional documentation. However, this form serves to validate the survey.

Photos, maps, and geolocations (GPS) are generally not required annually for this indicator, since data are from fixed or external sources.

After completing a survey or at the end of the season, all data should be filed in the appropriate server location, hard copy file, and/or tracking database (e.g., NRIS). All hardcopies, including all forms and other documentation, should be retained and filed in a location designated by the Forest air quality program manager.

Sampling Plan

1. Standard Visual Range

Standard visual range will be examined annually. Specific direction will be provided by the Forest air quality program manager. The use of external, secondary data may eventually be replaced by more sophisticated primary methods, in which case the sampling plan must adapt to satisfy the intent of the indicator and meet the information needs of wilderness managers. Monitoring surveys may be conducted any time of the year; surveys conducted during the peak high-elevation field season (July 1 to Labor Day reflect the conditions experienced by most visitors. Data from other seasons is also needed to evaluate the cleanest 10% and trends of best and worst conditions.

2. Coordination

There is ongoing internal and external communication and an internal educational/awareness effort by Forest air quality program personnel.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is " high." The primary intent of this indicator is to measure impacts to the wilderness experience from visibility impairments, which is the most noticeable impairment to visitors (vs. chemical air deposition or surface water alkalinity). The survey costs for Internet data collection costs are currently relatively low and there is unlikely to ever be a reason that it must be forgone, except inadequate personnel or network data availability problems.

If future monitoring includes a national network visibility station or digital monitoring camera technology, these would each have unique protocols and sampling plans.

MA-01-003 Surface Water Alkalinity

Introduction

Surface water alkalinity is an indicator of a watershed's ability to buffer or neutralize acids deposited by precipitation or dust. This indicator is primarily concerned with the correlation of air quality and ecological health. The extent to which air quality is affected by pollution, from within and without, was identified as a significant issue in the *HUW Management Plan.*

Several lakes in the HUW are known to be acid-sensitive. Acid deposition can severely alter natural conditions in aquatic ecosystems, and cumulative changes in water chemistry can affect ecological integrity. Acidification is likely to have serious, long-term impacts on aquatic ecosystems. Moreover, since the HUW is an important watershed for the states of Utah and Wyoming, watershed health is an important consideration as well. Surface water alkalinity monitoring will yield information needed by wilderness managers to make informed recommendations regarding interagency air quality coordination and management actions that may be necessary to protect wilderness resources.

Standard

Alkalinity will not be reduced more than 10% of the baseline levels in all surface waters.

Recommendations

Threshold. Thresholds for reductions in surface water alkalinity below baseline levels vary with acid neutralizing capacity (ANC):

- ANC > 100: No threshold.
- ANC 25-100: Reductions of no more than 10% below baseline.
- ANC < 25: Reductions of no more than 1 ueq/l ANC below baseline.
- ANC 0 or Negative (Impaired): No additional impairment permitted.

The *HUW Management Plan* prescribed a uniform alkalinity standard for all surface waters. A change is recommended to allow for variations in acid neutralizing capacity (ANC) between bodies of water. Waters with a higher ANC are less sensitive to acid deposition than those with a lower ANC. Consequently, the threshold for reductions in surface water alkalinity should vary with ANC.

Skills & Tools Required

Some specialized skills or tools are required to monitor this indicator; some samples are collected in mid-lake using a raft or float tubes, so water safety skills are needed. Water sampling skills may be acquired during training. Experience is helpful but not necessary. The work is somewhat technical, however, and requires initial training to ensure accurate, complete, and consistent data is collected. This indicator is customarily surveyed by trained science professionals or technicians, since they are often experienced and the work is generally considered hydrologic monitoring. Monitoring of long-term lakes is recommended for science-based Forest personnel trained in water safety and monitoring procedures. Contracting the work may be cost effective, particularly if combined with other survey work. In any case, this work must be done under the direction of the Forest air quality program manager (usually the Forest Hydrologist).

Combining this survey work with other work is not recommended, given the highly sensitive nature of water samples. It seems practical to survey this indicator concurrent with coliform bacteria (MA-01-004),

since some of the same tools and skills, are used. However, the time-dependence of this indicator may not be as great as with intestinal bacteria, and long-term lakes require considerable specialized equipment. In many cases, pack support may be necessary to expedite the transport of samples to town. Office support may also be necessary to facilitate the speedy delivery of samples to the laboratory via commercial third party.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade)* Digital Camera* Sampling Plan Survey Forms & Pencil Sample Bottles, Labels/Marker Cooler & Ice Packs Hydro Thermometer Wilderness Field Equipment Raft or float tubes with personal safety equipment (long-term lakes) Kemmerer or other subsurface sampler (long-term lakes) Lake depth monitor (long-term lakes) Others as Required by air quality program manager	Basic Computer & MS Excel GPS Operation* Digital Camera Operation* Water Sampling Wilderness Travel & Orienteering Water safety skills Others as Required by air quality program manager

* Subject to established protocol.

Monitoring Protocol

1. Acid Neutralizing Capacity (ANC)- long-term lakes (trend sampling)

Acid neutralizing capacity is monitored by locating bodies of water to be surveyed, as prescribed in the sampling plan, and collecting water samples for laboratory analysis. Once the samples have been collected, they must be delivered to the laboratory quickly, carefully, and under controlled conditions so they are not contaminated and do not expire. This may be challenging in remote areas. NOTE: Long-term lakes protocol is different than synoptic lake protocol (ref: Wind River protocols).

2. Coordination

Coordination with regional, interregional, national, State, and other agency air quality personnel to identify and address monitoring needs or changes needed based on monitoring.

A comprehensive protocol for monitoring surface water alkalinity cannot be described in this document, since it is complex, and may vary with advances in air quality or hydrologic science and changes in Region 4 and interregional (Regions 1, 2, and 4) protocols. The Wind River Protocol (Bridger-Teton NF) has been used on the HUW, and will likely influence this protocol. Therefore, the Forest air quality program manager will develop an appropriate protocol and provide direction for each monitoring event.
Water samples should be sent to the nearest centralized air quality laboratory, to be consistent with other Forest Service air quality monitoring programs. Currently, this is the Rocky Mountain Research Station in Fort Collins, Colorado, though other facilities may become available in the future. Samples must be sent to the laboratory as quickly as possible, via overnight commercial carrier.

A *surface water alkalinity form* (Appendix C: 3.2) must be completed at least annually and optionally for each survey area. This form is simple and self-explanatory. Most of the entries may be transcribed directly from the survey form(s) and laboratory results, though baseline data must be located in advance. Surface water alkalinity is usually analyzed concurrent with other hydrologic indicators that are not specifically included in the monitoring plan but are of interest (e.g., pH, specific conductance, anions and cations). The Forest air quality program manager will likely require additional documentation. However, this form serves to validate the survey.

Photos and geolocations (GPS) may be required to document sample locations, depending on the protocol established by the Forest air quality program manager. If so, photos must include visual references such as unique features or skyline to assist future surveyors in relocation. All photos must be given discrete numbers on field forms, documented on USGS quad maps and survey forms, and labeled (electronically or hard copy). GPS locations must also be documented on survey forms.

After completing a survey or at the end of the season, all data should be entered into (or received from the lab in) an Excel spreadsheet for analysis. Spreadsheets and digital photos (if taken) should be filed together in the appropriate server location. All hardcopies, including all forms and laboratory results, should be retained and filed together with maps in a location designated by the Forest air quality program manager. If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

1. Acid Neutralizing Capacity (ANC) – long term lake monitoring (trend)

Long-term lakes are sampled 3 times annually according to Wind River protocol:

Spring – right after turnover
Mid-late summer
Fall – just before freezeup.

The mid-summer sample involves going out to mid-lake and sampling at various depths.

2. Coordination

There is ongoing internal and external communication and an internal educational/awareness effort by Forest air quality program personnel.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is "high." The primary intent of this indicator is to measure resource damage resulting from human activities, from within and without, which is a foremost concern of the *HUW Management Plan*. Despite the high cost and level of commitment required to monitor this indicator, acidification can indicate a serious threat to aquatic ecosystems and watershed health and every effort should be made to do so.

MA-01-004 Coliform Bacteria

Introduction

Coliform bacteria are an indicator of human or animal waste being introduced into surface waters. This indicator relates to human waste and campsite setbacks from water sources (MA-01-037), as well as recreation livestock waste and those setback distances (MA-01-041). The extent to which human and animal waste threaten water quality was identified as a significant issue in the *HUW Management Plan.* The science upon which this indicator depends is in a state of change; the bacteria monitored will be guided by State water quality standards.

Coliform bacteria in surface waters, though not necessarily pathogenic, often occur with hazardous bacterial pathogens. Coliform bacteria monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, campsite setbacks, signing, and other management actions that may be necessary to protect wilderness resources. Because intestinal bacteria are contributed by most animals as well as humans, and identification of source requires laboratory analysis, non-bacteriological data will be compiled and analyzed in conjunction with bacteriological findings to help assess sources and possible solutions. Intestinal bacteria concentrations may be readily diluted, particularly in flowing water; the State standard is a 30-day geometric mean. Campsite density monitoring will be the minimum monitoring for this standard, since human contributions of intestinal bacteria at levels exceeding State standards are less likely with low campsite densities. A "FEEDBACK Loop" approach will be used (see Sampling Plan, below).

Standard

State of Utah water quality standards will be met for acceptable amounts of coliform bacteria in waters for their specific beneficial uses, as defined by the State *Standards of Quality for Waters of the State*.

Recommendations

Indicator. MA-01-004 Intestinal Bacteria

Thresholds.

1. Campsite density standard – MA-01-035.

2. *Standards of Quality for Waters of the State* is the scientific and legal threshold for intestinal bacteria, based on 30-day geometric mean, applicable beneficial use category, and use of State sampling protocols. Because of the time-dependent nature of State protocols (delivery to State lab in 6 hours), and the expense of this sampling at present, it would only be accomplished if "coarse filter" indicators warrant (see "Feedback Loop" in Sampling Plan, below). The bacteria being measured, as well as standards, are subject to change by the State of Utah and must be reviewed prior to completing surveys for this indicator. Current bacteriological standards are documented in Utah Division of Water Quality Rule R317-2-14, Numeric Criteria, which may be found at: www.waterquality.utah.gov.

The *HUW Management Plan* prescribed an intestinal bacteria standard expressed in terms of coliform bacteria. A change is recommended to allow other indicator bacteria to be measured and to permit the standard to vary with State requirements. Though the State of Utah currently uses coliform bacteria in its bacteriological standard; *Escherica coli* bacteria has a greater statistical correlation with human illness and will likely replace coliform as a bacterial State standard in the future. Therefore, the intestinal

bacteria standard should remain flexible enough to employ the monitoring parameter approved by EPA and the State.

Skills & Tools Required

For skills needed in monitoring campsite density, refer to MA-01-035. For direct bacteriological sampling, no specialized skills or tools are required to monitor this indicator, other than water sampling skills, which may be acquired during training. Timeliness of sample delivery to State-approved laboratory equipment is critical and may be as short as 6 hours. Experience is helpful but not necessary. The work is somewhat technical, however, and requires initial training to ensure accurate, complete, and consistent data is collected. This indicator is customarily surveyed by hydrological professionals or technicians, since they are often experienced and the work is generally considered hydrologic monitoring. However, it may also be efficient to use trained wilderness rangers, since the work may occur on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire sampling season, trained wilderness volunteers with science background may also be effective. Contracting the work may be cost effective, particularly if combined with other survey work. In any case, this work must be done under the direction of the Forest Hydrologist or air quality program manager (usually the Forest Hydrologist).

Combining campsite survey work with other work may be efficient. Combining water sampling with other work is not recommended, given the highly sensitive nature of water samples. It seems practical to survey this indicator concurrent with surface water alkalinity (MA-01-003), since some of the same tools, skills, and protocols are used. However, this indicator is sampled primarily in high-use areas and is a 30-day geometric mean for State standard evaluation.
In many cases, pack support may be necessary to expedite the transport of samples to town. Office support may also be necessary to facilitate the speedy delivery of samples to the laboratory via commercial third party.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade) Digital Camera Sampling Plan Survey Forms & Pencil Sample Bottles, Labels/Marker Cooler & Ice Packs Hydro Thermometer Wilderness Field Equipment Others as Required byHydrologist or air quality program manager	Basic Computer & MS Excel GPS Operation Digital Camera Operation Water Sampling Wilderness Travel & Orienteering Mandatory State water quality sampling training Others as Required by Hydrologist or air quality program manager

Monitoring Protocol

A comprehensive protocol for monitoring intestinal bacteria cannot be described in this document, since it is complex and may vary with the State bacteriological standard and advances in hydrologic science. Therefore, the Forest Hydrologist(s) will develop an appropriate protocol and provide direction for each monitoring event.

1. Resource uses associated with sampling location

Since intestinal bacteria may be contributed from a variety of human and animal sources, observations on resource uses must be collected along with water samples (for both State water quality protocol and other protocols such as "coarse filter"). Qualitative or quantitative observations on recreationists, livestock, wildlife, land and water conditions, facilities, and other characteristics relating to MA-01-035, -037, -038, -041, -042, -048, -049, and -050 are important in interpreting results.

2. In selecting monitoring sites, consider:

- areas with high campsite density as documented per MA-01-035 protocol
- observed areas of concern or question
- other areas sensitive to recreation, livestock, and/or wildlife use
- include high-use areas and periods; if practicable, also include comparable low-use areas or periods outside high use for baseline comparisons.

Destinations that threaten to exceed standards are typically found within Condition Class 3 areas, but they are increasingly common within Condition Class 1 and 2 areas. Lakes or streams near areas of high use may be surveyed and multiple samples may be necessary, depending on the protocol established by the Forest Hydrologist or air quality program manager. The peak high-elevation field season is July 1 to Labor Day.

3. "Coarse filter" monitoring. In selecting a coarse filter protocol to assess whether monitoring to State water quality standard is warranted, coordinate with the State of Utah and other Forest Service Wilderness areas. Examples may be presence/absence or most probable number.

4. Direct bacteriological monitoring (if warranted after "coarse filter" screening)
Sampling must be accomplished according to State water quality sampling protocols, for which annual training attendance is required. In addition, timely delivery to laboratory equipment is needed; for coliform, the delivery time is 6 hours from collection to delivery at the State Health Lab. For *E. coli*, truck-mounted laboratory equipment may be approved by the State when the standard changes from coliform. The current State sampling method is a 30-day geometric mean. A permanent sampling station will be identified for the State for data entry into the U.S. EPA STORET data repository, even if the station is not intended for long-term monitoring.

Water samples should be sent to the closest State-certified laboratory that accepts outside samples. Currently, this is in Salt Lake City, though local laboratories in Vernal and Duchesne may become available in the future. Forest Service personnel, overnight commercial carriers, or local courier services may be used to transport samples to the laboratory, whichever is most expedient.

An *intestinal bacteria survey form* (Appendix C: 4.2) must be completed at least annually and optionally for each survey area. This form is simple and self-explanatory. Most of the entries may be transcribed directly from the survey form(s) and laboratory results, though the bacteriological standard must be determined in advance. The Forest Hydologist(s) will likely require additional documentation. However, this form serves to validate the survey.

Photos and geolocations (GPS) may be required to document sample locations, depending on the protocol established by the Forest Hydrologist or air quality program manager. If so, photos must include visual references such as unique features or skyline to assist future surveyors in relocation. All photos must be given discrete numbers on field forms, documented on USGS quad maps and survey forms, and labeled (electronically or hard copy). GPS locations must also be documented on survey forms.

After completing a survey or at the end of the season, all data should be entered or downloadable into an Excel spreadsheet, or compiled in a report for analysis. Spreadsheets and digital photos (if taken) should be filed together in the appropriate server location. All hardcopies, including all forms and laboratory results, should be retained and filed together with maps in a location designated by the Forest Hydrologist or air quality program manager. If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Campsite density monitoring (MA-01-035) is considered the minimum monitoring for this standard.

A. "FEEDBACK LOOP"

1. When areas of concern are identified (refer to Monitoring Protocol, #2), a resource assessment will be documented (Monitoring Protocol, #1) and submitted to Forest hydrology staff along with GPS coordinates, map, dates visited, and other relevant information.
    a. If the resource assessment does not support a problem from recreation (humans or livestock), document and file.
    b. If the resource assessment suggests recreation (humans or livestock) are creating an intestinal bacteria problem, continue to "2".

2. "Coarse filter" water quality monitoring will be conducted on areas likely to have intestinal bacterial contamination from humans or recreation livestock (#1 above).
    a. If the coarse filter assessment does not support a recreation problem, document and file. If a non-recreation management problem is suspected, coordinate with appropriate resource specialists.
    b. If the coarse filter assessment suggests intestinal bacteria strong presence or contamination, evaluate results and determine whether the State water quality standard should be monitored (continue to "3).

3. State standard-level water quality monitoring will be conducted in those situations where intestinal bacterial contamination from recreation humans or livestock is strongly suspected. It may also be conducted to validate setback distance requirements.
    a. If monitoring indicates that samples meet State water quality standards, document and file.
    b. If monitoring indicates that samples exceeds State water quality standards, and those samples were collected and analyzed according to State standards, continue to #4.

4. For exceedences of State standards collected according to State protocol and analyzed by a State-certified lab, VERIFY the exceedence as needed. This might require repeat sampling, additional monitoring, or more extensive review. Coordinate with State of Utah Division of Water Quality regarding verification procedures.
    a. If NOT VERIFIED, document the problem and analyze its source.
    b. If VERIFIED, analyze further for possible action. Pinpoint the source, if practicable (laboratory analysis of bacteria for identification may not be practicable). Involve appropriate specialists and line officers. Identify SHORT-TERM solutions to return to

threshold levels, as well as LONG-TERM needs to prevent the problem from recurring. Use the "Feedback Loop" process to revise activities, best management practices, or standards, and continue monitoring.

B. COORDINATION

Coordination is needed between wilderness managers and the Forest hydrologist or air quality program manager regarding changing field conditions that may resource conditions or selection of monitoring sites, including adding new destinations* for monitoring. Wilderness ranger reports, incident reports, violation notices, and any other sources of such information should be reviewed periodically for indications of high or increasing recreation use and chronic campsite or recreation livestock setback violations (at least 200 feet from water).

* For the purposes of monitoring this indicator, a "destination" is defined as a discrete area that includes all overnight use associated with a specific attraction. This is most often a lake or small group of lakes, but it may be any feature that is known to attract visitors as a final destination or serve as a popular overnight "stopover" for visitors en-route to another destination, such as Kings Peak.

C. FREQUENCY

Since campsite density is the minimum monitoring indicator for this standard (MA-01-035), a minimum sampling period of every 5 years is applicable to that information. However, other information may prompt more frequent monitoring (see Monitoring Protocol #2) or different locations. Actual bacteriological sampling may not occur on a regular schedule.

D. PARTNERSHIPS

Partnerships may be available through State of Utah's annual cooperative management agreement which funds laboratory analysis for some water quality samples collected by State-trained personnel each year. Sample locations must be submitted to and approved by the Division of Water Quality (usually due to the State in March). Coordinate with Forest Hydrologist regarding this opportunity.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is " low." The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the *HUW Management Plan*. Recreation use is also monitored by other standards. High cost and current difficulty in sample delivery times are limiting factors. The priority level would increase to "moderate" if truck-mounted laboratory equipment becomes approved by the State (e.g., for *E. coli*) monitoring and that equipment is available to trained Forest personnel.

MA-01-005 Soil Erosion in Condition Class I

Introduction

Soil erosion is an indicator of site productivity and water quality. The extent to which human overuse threatens ecological integrity was identified as a significant issue in the *HUW Management Plan.* Lacking any proven methods of measurement or evaluation, no indicator is as difficult to monitor as soil erosion. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Advanced soil erosion can severely alter natural conditions, and cumulative changes in soil and water quality can affect ecological integrity. Generally, sites with less exposed mineral soil (relative to undisturbed sites), soil movement, and sediment delivery to water have less affect on natural conditions and ecological integrity and are more likely to recover naturally. Conversely, those exhibiting such disturbances to a greater degree are more likely to have serious, long-term impacts and may not recover naturally. Soil erosion monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, signing, trail bridges and drainage structures, and other mitigation or management actions that may be necessary to protect wilderness resources.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with condition class. Unlike other indicators with variable standards, however, it is divided by condition class.

Standard

Condition Class 1: No more than 15% of all use areas have Erosion Class 1 characteristics. None have Erosion Class 2 or 3 characteristics. See MA-01-006 and MA-01-007 for Condition Class 2 and 3 standards.

Recommendations

Indicator. MA-01-005 Soil Erosion

In the *HUW Management Plan*, the standard for this indicator varied with condition class and included indicator numbers MA-01-005, 006, and 007. A variation in a standard does not warrant a separate indicator, and the recommended threshold no longer varies

with condition class. In any case, for consistency purposes, the three indicators should be consolidated under a single number: MA-01-005.

Threshold. There is no threshold for monitoring this indicator. Monitoring data will only be used to alert wilderness managers to soil erosion problems and degrading conditions requiring mitigation or management action.

The *HUW Management Plan* prescribed a specific soil erosion standard expressed in terms of percent area in each of three soil erosion classes within each desired condition class. A change is recommended to reject this entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, survey areas cannot be reasonably defined in a manner that would yield meaningful data. Since no science or protocols exist to support a quantitative threshold, soil erosion will be addressed as follows:

1) Campsites that have a mineral soil exposure class that differs from undisturbed sites by two or more, a soil erosion index of three, or evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

2) Trail approaches on streams that are more than four feet wide and/or six inches deep, have a soil erosion index of three, or show evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

Skills & Tools Required

No specialized skills, tools, or training are required to monitor this indicator. The work can be completed by any forestry technician who has been properly oriented to the task. It is most efficient to use wilderness rangers, since the work requires very little time or effort, generally occurs on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire field season, wilderness volunteers would likely also be effective. Monitoring this indicator requires some time reviewing secondary data in the office, however, which may not be desirable to some and can interfere with fieldwork. Contracting the work would not likely be cost effective, unless combined with other survey work.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade) Digital Camera Survey Tape Sampling Plan Campsite Impact Surveys Survey Forms & Pencil Wilderness Field Equipment	Basic Computer & MS Excel GPS Operation Digital Camera Operation Wilderness Travel & Orienteering

Monitoring Protocol

Soil erosion is monitored in two ways, using both secondary and primary data. First, campsite impact surveys are reviewed for indications of comparatively high mineral soil exposure, advanced soil erosion, and sediment delivery to water on both campsites and associated social trails. Second, perennial stream crossings on system trails are identified and evaluated for sediment delivery to water. These methods are based almost entirely on visual inspection and are somewhat subjective and highly qualitative in nature, however, no standard or commonly accepted methods exist for monitoring soil erosion. This protocol will alert wilderness managers to serious erosion problems and changing conditions that may warrant the development of appropriate mitigation strategies, and it satisfies the intent of the indicator.

The *HUW Management Plan* prescribed the use of soil erosion classes to measure soil erosion within a defined survey area. This protocol was rejected entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, soil erosion survey areas cannot be reasonably defined in a manner that would yield meaningful data. Finally, this protocol failed to include an assessment of trail erosion, which is generally thought to be a much greater contributor to watershed degradation than campsite erosion.

A *soil erosion survey form* (Appendix C: 5) must be completed for each survey area. This form is simple and largely self-explanatory, though one section requires familiarity with the soil erosion indices described in the table below. These indices are not intended to precisely measure soil erosion, only to guide a relative visual assessment of the degree of erosion. Though essentially the same as the soil erosion classes originally prescribed by the *HUW Management Plan* (and subsequently rejected), the soil erosion indices are applied very differently.

SOIL EROSION INDICES

Erosion Index	Description
1	Surface sheeting of fines (sand/silt), little or no evidence of channeling, litter and organics present, limited sediment travel
2	Shallow rills or gullies, exposed gravels and small cobbles, mineral soils and organics may be present, moderate sediment travel
3	Deep/wide channeling, exposed rocks and mineral soils, exposed tree roots, no organics present, extensive sediment travel

The soil erosion survey form has two sections: *campsite-based erosion* and *trail-based erosion*. For campsite-based erosion, secondary data is simply copied directly from the last campsite impact surveys. This presumes, of course, that campsite impact surveys have been completed using the protocol described in this document prior to surveying soil erosion. For trail-based erosion, perennial stream crossings on system trails must be identified and physically surveyed. The trail dimensions requested at the stream crossing should come from the side of the stream showing the greatest impact. These dimensions should consider trail braids, which are often caused by visitors seeking easier crossings. All stream crossings must be identified on USGS quad maps and given a discrete number. If an earlier soil erosion survey exists for the survey area, the crossing numbers or numbering scheme prescribed by the survey should be used to achieve the highest possible level of continuity.

Photos are important to monitoring this indicator and must be taken for trail-based erosion to the degree necessary to support each survey (campsite-based erosion photos are taken for campsite impact monitoring). At least two photos must be taken of each stream crossing: one clearly showing the trail width and depth at the crossing on the most heavily impacted side of the stream, using a survey tape for scale, and one capturing the entire crossing. If a crossing is large or soil erosion (impact) appears to be extensive, additional photos may be necessary. If mitigation measures have already been taken to reduce sediment delivery to water (bridges, water diversion structures, trail re-route and rehab, etc.), it's important to photograph these as well. These may be located at the crossing or a short distance away. All photos must be given discrete numbers and documented on the survey form.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits,

it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Soil erosion will be surveyed on the same sampling schedule as campsite impacts (every 10 years) or no more than one year later, since secondary campsite impact survey data is prerequisite to soil erosion surveys. The campsite-based portion of soil erosion surveys is conducted in the office and may be done at any time of the year. However, the trail-based portion of the surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day).

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the HUW Management Plan. Since there is little additional cost to monitoring this indicator and advanced soil erosion can result in severe long-term damage to natural resources and wilderness character, there is unlikely to ever be a reason that this indicator must be forgone, unless the prerequisite campsite impact survey data is unavailable.

MA-01-006 Soil Erosion in Condition Class II

Introduction

Soil erosion is an indicator of site productivity and water quality. The extent to which human overuse threatens ecological integrity was identified as a significant issue in the *HUW Management Plan.* Lacking any proven methods of measurement or evaluation, no indicator is as difficult to monitor as soil erosion. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Advanced soil erosion can severely alter natural conditions, and cumulative changes in soil and water quality can affect ecological integrity. Generally, sites with less exposed mineral soil (relative to undisturbed sites), soil movement, and sediment delivery to water have less affect on natural conditions and ecological integrity and are more likely to recover naturally. Conversely, those exhibiting such disturbances to a greater degree are more likely to have serious, long-term impacts and may not recover naturally. Soil erosion monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, signing, trail bridges and drainage structures, and other mitigation or management actions that may be necessary to protect wilderness resources.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with condition class. Unlike other indicators with variable standards, however, it is divided by condition class.

Standard

Condition Class 2: No more than 25% of all use areas have Erosion Class 1 characteristics. No more than 15% of all use areas have Erosion Class 2 characteristics. None have Erosion Class 3 characteristics. See MA-01-005 and MA-01-007 for Condition Class 1 and 3 standards.

Recommendations

Indicator. MA-01-005 Soil Erosion

In the *HUW Management Plan*, the standard for this indicator varied with condition class and included indicator numbers MA-01-005, 006, and 007. A variation in a standard does not warrant a separate indicator, and the recommended threshold no longer varies

with condition class. In any case, for consistency purposes, the three indicators should be consolidated under a single number: MA-01-005.

Threshold. There is no threshold for monitoring this indicator. Monitoring data will only be used to alert wilderness managers to soil erosion problems and degrading conditions requiring mitigation or management action.

The *HUW Management Plan* prescribed a specific soil erosion standard expressed in terms of percent area in each of three soil erosion classes within each desired condition class. A change is recommended to reject this entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, survey areas cannot be reasonably defined in a manner that would yield meaningful data. Since no science or protocols exist to support a quantitative threshold, soil erosion will be addressed as follows:

3) Campsites that have a mineral soil exposure class that differs from undisturbed sites by two or more, a soil erosion index of three, or evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

4) Trail approaches on streams that are more than four feet wide and/or six inches deep, have a soil erosion index of three, or show evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

Skills & Tools Required

No specialized skills, tools, or training are required to monitor this indicator. The work can be completed by any forestry technician who has been properly oriented to the task. It is most efficient to use wilderness rangers, since the work requires very little time or effort, generally occurs on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire field season, wilderness volunteers would likely also be effective. Monitoring this indicator requires some time reviewing secondary data in the office, however, which may not be desirable to some and can interfere with fieldwork. Contracting the work would not likely be cost effective, unless combined with other survey work.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade) Digital Camera Survey Tape Sampling Plan Campsite Impact Surveys Survey Forms & Pencil Wilderness Field Equipment	Basic Computer & MS Excel GPS Operation Digital Camera Operation Wilderness Travel & Orienteering

Monitoring Protocol

Soil erosion is monitored in two ways, using both secondary and primary data. First, campsite impact surveys are reviewed for indications of comparatively high mineral soil exposure, advanced soil erosion, and sediment delivery to water on both campsites and associated social trails. Second, perennial stream crossings on system trails are identified and evaluated for sediment delivery to water. These methods are based almost entirely on visual inspection and are somewhat subjective and highly qualitative in nature, however, no standard or commonly accepted methods exist for monitoring soil erosion. This protocol will alert wilderness managers to serious erosion problems and changing conditions that may warrant the development of appropriate mitigation strategies, and it satisfies the intent of the indicator.

The *HUW Management Plan* prescribed the use of soil erosion classes to measure soil erosion within a defined survey area. This protocol was rejected entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, soil erosion survey areas cannot be reasonably defined in a manner that would yield meaningful data. Finally, this protocol failed to include an assessment of trail erosion, which is generally thought to be a much greater contributor to watershed degradation than campsite erosion.

A *soil erosion survey form* (Appendix C: 5) must be completed for each survey area. This form is simple and largely self-explanatory, though one section requires familiarity with the soil erosion indices described in the table below. These indices are not intended to precisely measure soil erosion, only to guide a relative visual assessment of the degree of erosion. Though essentially the same as the soil erosion classes originally prescribed by the *HUW Management Plan* (and subsequently rejected), the soil erosion indices are applied very differently.

SOIL EROSION INDICES

Erosion Index	Description
1	Surface sheeting of fines (sand/silt), little or no evidence of channeling, litter and organics present, limited sediment travel
2	Shallow rills or gullies, exposed gravels and small cobbles, mineral soils and organics may be present, moderate sediment travel
3	Deep/wide channeling, exposed rocks and mineral soils, exposed tree roots, no organics present, extensive sediment travel

The soil erosion survey form has two sections: *campsite-based erosion* and *trail-based erosion*. For campsite-based erosion, secondary data is simply copied directly from the last campsite impact surveys. This presumes, of course, that campsite impact surveys have been completed using the protocol described in this document prior to surveying soil erosion. For trail-based erosion, perennial stream crossings on system trails must be identified and physically surveyed. The trail dimensions requested at the stream crossing should come from the side of the stream showing the greatest impact. These dimensions should consider trail braids, which are often caused by visitors seeking easier crossings. All stream crossings must be identified on USGS quad maps and given a discrete number. If an earlier soil erosion survey exists for the survey area, the crossing numbers or numbering scheme prescribed by the survey should be used to achieve the highest possible level of continuity.

Photos are important to monitoring this indicator and must be taken for trail-based erosion to the degree necessary to support each survey (campsite-based erosion photos are taken for campsite impact monitoring). At least two photos must be taken of each stream crossing: one clearly showing the trail width and depth at the crossing on the most heavily impacted side of the stream, using a survey tape for scale, and one capturing the entire crossing. If a crossing is large or soil erosion (impact) appears to be extensive, additional photos may be necessary. If mitigation measures have already been taken to reduce sediment delivery to water (bridges, water diversion structures, trail re-route and rehab, etc.), it's important to photograph these as well. These may be located at the crossing or a short distance away. All photos must be given discrete numbers and documented on the survey form.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits,

it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Soil erosion will be surveyed on the same sampling schedule as campsite impacts (every 10 years) or no more than one year later, since secondary campsite impact survey data is prerequisite to soil erosion surveys. The campsite-based portion of soil erosion surveys is conducted in the office and may be done at any time of the year. However, the trail-based portion of the surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day).

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the HUW Management Plan. Since there is little additional cost to monitoring this indicator and advanced soil erosion can result in severe long-term damage to natural resources and wilderness character, there is unlikely to ever be a reason that this indicator must be forgone, unless the prerequisite campsite impact survey data is unavailable.

MA-01-007 Soil Erosion in Condition Class III

Introduction

Soil erosion is an indicator of site productivity and water quality. The extent to which human overuse threatens ecological integrity was identified as a significant issue in the *HUW Management Plan.* Lacking any proven methods of measurement or evaluation, no indicator is as difficult to monitor as soil erosion. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Advanced soil erosion can severely alter natural conditions, and cumulative changes in soil and water quality can affect ecological integrity. Generally, sites with less exposed mineral soil (relative to undisturbed sites), soil movement, and sediment delivery to water have less affect on natural conditions and ecological integrity and are more likely to recover naturally. Conversely, those exhibiting such disturbances to a greater degree are more likely to have serious, long-term impacts and may not recover naturally. Soil erosion monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, signing, trail bridges and drainage structures, and other mitigation or management actions that may be necessary to protect wilderness resources.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with condition class. Unlike other indicators with variable standards, however, it is divided by condition class.

Standard

Condition Class 3: No more than 50% of all use areas have Erosion Class 1 characteristics. No more than 25% of all use areas have Erosion Class 2 characteristics. None have Erosion Class 3 characteristics. See MA-01-005 and MA-01-006 for Condition Class 1 and 2 standards.

Recommendations

Indicator. MA-01-005 Soil Erosion

In the *HUW Management Plan*, the standard for this indicator varied with condition class and included indicator numbers MA-01-005, 006, and 007. A variation in a standard does not warrant a separate indicator, and the recommended threshold no longer varies

with condition class. In any case, for consistency purposes, the three indicators should be consolidated under a single number: MA-01-005.

Threshold. There is no threshold for monitoring this indicator. Monitoring data will only be used to alert wilderness managers to soil erosion problems and degrading conditions requiring mitigation or management action.

The *HUW Management Plan* prescribed a specific soil erosion standard expressed in terms of percent area in each of three soil erosion classes within each desired condition class. A change is recommended to reject this entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, survey areas cannot be reasonably defined in a manner that would yield meaningful data. Since no science or protocols exist to support a quantitative threshold, soil erosion will be addressed as follows:

5) Campsites that have a mineral soil exposure class that differs from undisturbed sites by two or more, a soil erosion index of three, or evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

6) Trail approaches on streams that are more than four feet wide and/or six inches deep, have a soil erosion index of three, or show evidence of active sediment delivery to water will be considered “critical” situations requiring mitigation. If two or more of these conditions exist, the situation constitutes an “emergency” which may require management action.

Skills & Tools Required

No specialized skills, tools, or training are required to monitor this indicator. The work can be completed by any forestry technician who has been properly oriented to the task. It is most efficient to use wilderness rangers, since the work requires very little time or effort, generally occurs on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire field season, wilderness volunteers would likely also be effective. Monitoring this indicator requires some time reviewing secondary data in the office, however, which may not be desirable to some and can interfere with fieldwork. Contracting the work would not likely be cost effective, unless combined with other survey work.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade) Digital Camera Survey Tape Sampling Plan Campsite Impact Surveys Survey Forms & Pencil Wilderness Field Equipment	Basic Computer & MS Excel GPS Operation Digital Camera Operation Wilderness Travel & Orienteering

Monitoring Protocol

Soil erosion is monitored in two ways, using both secondary and primary data. First, campsite impact surveys are reviewed for indications of comparatively high mineral soil exposure, advanced soil erosion, and sediment delivery to water on both campsites and associated social trails. Second, perennial stream crossings on system trails are identified and evaluated for sediment delivery to water. These methods are based almost entirely on visual inspection and are somewhat subjective and highly qualitative in nature, however, no standard or commonly accepted methods exist for monitoring soil erosion. This protocol will alert wilderness managers to serious erosion problems and changing conditions that may warrant the development of appropriate mitigation strategies, and it satisfies the intent of the indicator.

The *HUW Management Plan* prescribed the use of soil erosion classes to measure soil erosion within a defined survey area. This protocol was rejected entirely because soil erosion classes are not a commonly accepted monitoring mechanism among soil scientists and they are subjective and somewhat esoteric. In this case, they were also developed for use in Minnesota and are difficult to apply to the thin, rocky soils of the Uinta Mountains. Furthermore, soil erosion survey areas cannot be reasonably defined in a manner that would yield meaningful data. Finally, this protocol failed to include an assessment of trail erosion, which is generally thought to be a much greater contributor to watershed degradation than campsite erosion.

A *soil erosion survey form* (Appendix C: 5) must be completed for each survey area. This form is simple and largely self-explanatory, though one section requires familiarity with the soil erosion indices described in the table below. These indices are not intended to precisely measure soil erosion, only to guide a relative visual assessment of the degree of erosion. Though essentially the same as the soil erosion classes originally prescribed by the *HUW Management Plan* (and subsequently rejected), the soil erosion indices are applied very differently.

SOIL EROSION INDICES

Erosion Index	Description
1	Surface sheeting of fines (sand/silt), little or no evidence of channeling, litter and organics present, limited sediment travel
2	Shallow rills or gullies, exposed gravels and small cobbles, mineral soils and organics may be present, moderate sediment travel
3	Deep/wide channeling, exposed rocks and mineral soils, exposed tree roots, no organics present, extensive sediment travel

The soil erosion survey form has two sections: *campsite-based erosion* and *trail-based erosion*. For campsite-based erosion, secondary data is simply copied directly from the last campsite impact surveys. This presumes, of course, that campsite impact surveys have been completed using the protocol described in this document prior to surveying soil erosion. For trail-based erosion, perennial stream crossings on system trails must be identified and physically surveyed. The trail dimensions requested at the stream crossing should come from the side of the stream showing the greatest impact. These dimensions should consider trail braids, which are often caused by visitors seeking easier crossings. All stream crossings must be identified on USGS quad maps and given a discrete number. If an earlier soil erosion survey exists for the survey area, the crossing numbers or numbering scheme prescribed by the survey should be used to achieve the highest possible level of continuity.

Photos are important to monitoring this indicator and must be taken for trail-based erosion to the degree necessary to support each survey (campsite-based erosion photos are taken for campsite impact monitoring). At least two photos must be taken of each stream crossing: one clearly showing the trail width and depth at the crossing on the most heavily impacted side of the stream, using a survey tape for scale, and one capturing the entire crossing. If a crossing is large or soil erosion (impact) appears to be extensive, additional photos may be necessary. If mitigation measures have already been taken to reduce sediment delivery to water (bridges, water diversion structures, trail re-route and rehab, etc.), it's important to photograph these as well. These may be located at the crossing or a short distance away. All photos must be given discrete numbers and documented on the survey form.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits,

it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Soil erosion will be surveyed on the same sampling schedule as campsite impacts (every 10 years) or no more than one year later, since secondary campsite impact survey data is prerequisite to soil erosion surveys. The campsite-based portion of soil erosion surveys is conducted in the office and may be done at any time of the year. However, the trail-based portion of the surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day).

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the HUW Management Plan. Since there is little additional cost to monitoring this indicator and advanced soil erosion can result in severe long-term damage to natural resources and wilderness character, there is unlikely to ever be a reason that this indicator must be forgone, unless the prerequisite campsite impact survey data is unavailable.

MA-01-016 Sensitive Plant Habitat*

Introduction

Sensitive plant habitat is an indicator of sensitive plant species viability. The extent to which habitat and populations of sensitive plants are protected by wilderness management measures was identified as a significant issue in the *HUW Management Plan.* The two species of sensitive plants found in the HUW are well insulated from human disturbances by the rugged and inaccessible nature of their alpine habitats, so human uses are an unlikely threat, and there are no proven methods of measurement or evaluation with which to monitor this indicator. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Sensitive plants are listed as such by the Forest Service because they are rare and highly susceptible to disturbances. Alterations of sensitive plant habitats can result in impacts to plant populations and can threaten their survival as a viable species. Such a loss would likely be irretrievable and would defeat one of the principle tenets of wilderness. Sensitive plant habitat monitoring will yield information needed by wilderness managers to make informed recommendations regarding changes in commercial livestock grazing permits, use limits, and other management actions that may be necessary to protect wilderness resources.

Standard

No more than 10% of the habitat for sensitive plant species in the HUW is adversely altered by human uses.

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-016. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-014. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Recommendations

Threshold. There is no threshold for monitoring this indicator. Monitoring data will only be used to alert wilderness managers to potential threats to sensitive plant habitat that may require mitigation or management action.

The *HUW Management Plan* prescribed a sensitive plant habitat standard expressed in terms of percent habitat altered by human uses. A change is recommended to reject this entirely because there is no reasonable sampling method that will yield meaningful results. The two sensitive species found in the HUW are both found in landtypes UB1, UB2, and UB3, which collectively comprise much of the wilderness. It is very difficult to perform a quantitative assessment of habitat alteration, because the habitat is simply

too large and the relative amount of human use and disturbance in these areas is very small. Since there is no practical way to formulate a quantitative threshold, sensitive plant habitat will be addressed as follows:

1) Any new human alteration of sensitive plant habitat within ¼ mile of a known population will be investigated for possible mitigation or management action. Such alterations may include, but are not limited to: user-created or livestock trails, camping areas, structures, use or encroachment by non-native species, or other human disturbances.

Skills & Tools Required

No specialized skills or tools are required to monitor this indicator, other than sensitive plant identification skills, which may be acquired during training. Note, however, that non-technical mountaineering skills may be needed to survey some populations. This indicator is customarily surveyed by range or biological technicians, since they are often experienced and the work is generally considered ecological monitoring. However, it is most efficient to use wilderness rangers, since the work requires very little time or effort, generally occurs on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire field season, wilderness volunteers would likely also be effective. Contracting the work would not likely be cost effective, unless combined with other survey work. In any case, this work should be coordinated with the Forest Ecologist(s).

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) Digital Camera Monitoring Plan Sensitive Plant Population Plant Population Folders (Copies) Survey Forms & Pencil Wilderness Field Equipment	Basic Computer & MS Excel Digital Camera Operation Sensitive Species Identification Non-Technical Mountaineering Wilderness Travel & Orienteering

Monitoring Protocol

Sensitive plant habitat is monitored by locating known populations of the two sensitive plant species found within the HUW (see table below), as prescribed in the sampling plan, and assessing any apparent new threats to these populations from human uses. This method is based entirely on visual inspection and is qualitative in nature, however, it is simply not practical, reasonable, or necessary to complete a more thorough quantitative assessment. This protocol will alert wilderness managers to changes in or potential threats to sensitive plant habitat that may require mitigation or management action, and it satisfies the intent of the indicator.

SENSITIVE PLANTS OF THE HUW

Symbol	Common Name	Scientific Name
PARAK	Arctic poppy	Papaver radicatum pygmaeum
DRDEA	Rockcress draba	Draba densifolia apiculata

These plant species are relatively easy to identify, since they prefer sparse alpine habitat and do not closely resemble any other species in the area (Appendix D: 16.2). They are described as follows:

Arctic Poppy

Arctic Poppy is a short tufted perennial herb with stems up to 15 cm high and covered with soft, spreading hairs. Leaves are all basal, the blades blue-green, sparsely hairy, and divided into 3-5 lobes (the lobes sometimes notched). Flowers are solitary at the ends of stems, with two sepals which fall off shortly after the flower opens and four yellow to greenish-yellow petals, each about 1 cm long. Capsules are about 1 cm long and covered with stiff brownish hairs.

Rockcress Draba

Rockcress draba is a mat forming perennial herb with stems 0.5-3 cm tall. Leaves are lance-shaped, 3-6 mm long, less than 3 mm wide, and crowded in a basal rosette. Leaves are glabrous, except for the margins which have unbranched (simple) hairs. The inflorescence consists of 2-5 yellow (rarely white) flowers with 4 petals. Fruits are egg-shaped and glabrous with styles less than 0.5 mm long.

Source: Wyoming Natural Diversity Database

Perhaps the greatest challenge associated with monitoring this indicator lies in reaching and negotiating the rugged and remote habitat preferred by these plants. Topography, altitude, and climate can make surveys difficult and potentially dangerous to complete. Both species occur in the Uinta Bollie (UB) landtype associations: UB1, UB2, and UB3. These landtypes collectively comprise the rocky slopes and summits of fine talus that are characteristic of the high alpine regions of the Uinta Mountains (Appendix D: 16.3). They are described as follows:

Uinta Bollie 1 (UB1)

Colluvial talus slopes consisting of tongue and lobate rock glaciers and other solifluction features associated with freezing and thawing that are currently active, located below UB2 on 5% to 30% slopes above treeline at elevations of 11,000 to 12,000 feet. Dominant vegetation consists of

cushion plant, sedge-geum, sedge-grass, krummholtz, and grayleaf willow wherever pockets of soil have formed. Soils are fragmental, shallow to deep and sandy, and occupy less than 5% of the landform. Lichens are early invaders on this landform.

Uinta Bollie 2 (UB2)

Steep to extremely steep glaciated cirque headwalls and sides in which frost action is currently the major process, as indicated by elongated stone stripes and fresh talus piles at the base. Lithology is of Uinta Mountain quartzite on 50% to 100% slopes above treeline at 11,000 to 12,500 feet along the crest of the Uinta Mountains on both the north and south slopes. Vegetation is mostly lacking and rock outcrops and cliffs dominate. Talus slopes of finer gravels support a number of plants adapted to talus-creep. Pockets of fragmental sandy soils occur on which cushion plant, sedge-geum, sedge-grass, krummholtz fir/spruce, and willow grow. Lichens are invaders on this landform.

Uinta Bollie 3 (UB3)

Periglacial gently to moderately rolling upland surfaces that form the crest of the Uinta Mountains with many freeze-thaw features, such as patterned grown, stone stripes and stone nets, and solifluction lobes. Lithology is of Uinta Mountain quartzite with biscuit board topography where glacier heads carved out cirques. Gradients are typically of 5% to 15% slope but range from 1% to 30% slope above treeline at 11,000 to 13,000 feet. Soils are variable, ranging from sandy-skeletal Entisols to well developed deep fine-loamy Alfisols. Dominant vegetation consists of curly sedge, cushion plant communities on shallow and sandy soils, grass-forbs on deep and fine-loamy soils, and sedge-geum on shallow to moderately deep and sandy-skeletal soils.

Source: Sherel Goodrich, Ashley National Forest

A *sensitive plant habitat survey form* (Appendix C: 16) must be completed for each population. The form is simple and self-explanatory. But first, the population folder should be reviewed carefully for pre-existing habitat alterations within ¼ mile of the population. This is baseline information for identifying new or growing threats to sensitive plant populations. Absent such documentation, all human alterations should be considered "new." If a new population of sensitive plant has been identified, a new folder must be created and the population must be given a discrete identification number using the established numbering scheme. Also, the Forest Ecologist(s) must be notified. Population folders should be updated as surveys are completed and documentation is revised. All sensitive plant population folders are stored in the SO under the stewardship of the Forest Ecologist(s).

Photos are important to monitoring this indicator. At least one photo must be taken of each population of sensitive plants and its surrounding habitat within ¼ mile. These photos are best taken from a distance and must clearly show the presence or absence of nearby habitat alterations, which are generally obvious in UB landtype associations. If this is not possible with a single photo, horizontal or vertical panoramas may be created using a series of two or more photos, until the entire population and surrounding habitat are included. It's also important to include the skyline or other unique features in the photo as a visual reference to assist future surveyors in relocation. Suitable photos may often be taken from a great distance, but closer inspection may be required. All photos must be given discrete numbers and documented on a USGS quad map and the survey form for each population. Series of photos in panoramas should be numbered logically and in order from bottom to top or left to right.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the Forest Ecologist(s). If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

The *HUW Management Plan* prescribed the monitoring of three populations of each sensitive plant species. This was deemed insufficient to ensure the viability of sensitive plant species in the HUW. Therefore, habitat will be surveyed for all known populations of sensitive plants in the HUW at least once every 10 years. There are currently 29 known populations of Rockcress Draba and 19 known populations of Arctic Poppy in the Uinta Mountains (Appendix D: 16.1), but additional populations may be identified at any time. Note that several listed populations are located outside the HUW and are therefore excluded from this monitoring plan.

Given the hostile nature of the UB landtypes, survey days should be selected with care. Surveys should only be attempted during the two-month window after the snow has completely melted in the high altitudes and before it begins to accumulate again, generally mid-July through mid-September. Surveys should be completed early in the day, to avoid afternoon thunderstorms, and should be abandoned if storms threaten or if it is otherwise unsafe to proceed.

Monitoring is always a function of funding and difficult choices must often be made. Despite the relative habitat security of the two sensitive plant species found in the HUW, the priority for monitoring this indicator, relative to other indicators, is "high." The primary intent of this indicator is to measure resource damage resulting from human uses, which is a foremost concern of the *HUW Management Plan*. Due to the low cost and efficiency with which this indicator can be surveyed and the biological value of sensitive plants, particularly in wilderness, there is unlikely to ever be a reason that it must be forgone, except inadequate personnel.

MA-01-017 Ground Cover*

Introduction

Ground cover is an indicator of desired plant communities and watershed condition. Though generally applied to range management (livestock grazing), this indicator is an essential measure of long-term change and has compelling implications for wilderness management. The extents to which human overuse threatens ecological integrity and exotic plants threaten natural ecological functions were identified as significant issues in the *HUW Management Plan.* Furthermore, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Losses in natural ground cover can severely alter natural conditions, impair watershed function, and threaten ecological integrity. Generally, vegetation communities that are reduced to less than 85% of potential natural ground cover are more susceptible to invasion by non-native plants, changes in plant species composition, accelerated soil erosion and reduced productivity, and losses of habitat and forage for native fish and wildlife. Ground cover monitoring will yield information needed by wilderness managers to make informed recommendations regarding changes in commercial livestock grazing permits, recreational livestock restrictions, use limits, and other management actions that may be necessary to protect wilderness resources.

Standard

At least 85% of potential ground cover is maintained in alpine, aspen, and riparian vegetation types.

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-017. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-015. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Skills & Tools Required

No specialized skills or tools are required to monitor this indicator, other than plant identification skills, which may be acquired during training. Experience is helpful but not necessary. The work is somewhat technical and time-consuming, however, and requires initial training to ensure accurate, complete, and consistent data is collected. This indicator is customarily surveyed by range or biological technicians, since they are often experienced and the work is generally considered ecological monitoring. But, it may be most efficient to use wilderness rangers, since the work generally occurs on routine patrol routes with which rangers are familiar. If committed for the entire field season, wilderness volunteers would likely also be effective. Contracting the work may

be cost effective, particularly if combined with other survey work. In any case, this work should be coordinated with the Forest Ecologist(s).

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) GPS (Recreational Grade) Digital Camera Survey Tape (100 Ft) Veg Study Site Folders (Copies) Plumb Bob Survey Forms & Pencil Wilderness Field Equipment	Basic Computer & MS Excel GPS Operation Digital Camera Operation Plant Identification Wilderness Travel & Orienteering

Monitoring Protocol

Ground cover is monitored by locating vegetative study sites to be surveyed, as prescribed in the sampling plan, and measuring the proportion of the soil surface characterized by each of four ground cover categories (see table below). All of these categories, except "bare soil," represent some type of protective ground cover. The percent of ground cover to bare soil is compared to existing baseline information to determine the percent of potential natural ground cover present. Given the vast number of vegetative study sites and their remote locations, the monitoring protocol is a modification of the "point method" for measuring ground cover described in the *Intermountain Region's Rangeland Ecosystem Analysis and Monitoring Handbook (FSH 2209.21).* Despite its departure from the FSH, this method has been used by range programs for many years and has proven to provide precise and accurate survey data at or beyond the level required by this indicator.

GROUND COVER CATEGORIES

A	Vegetation & Litter (Organic Debris)
B	Cryptogams (Lichen & Moss)
C	Rock (>3/4 Inch)
D	Bare Soil (Inc <3/4 Inch Pavement)

Ground cover is defined by what lies at the soil surface and includes the basal area of plants, litter, cryptogams, and rock (over ¾ inch). It should not be confused with the more common definition of "cover", which includes the vertical projection of plants and considers a birds-eye-view of the ground.

A *ground cover survey form* (Appendix C: 17) must be completed for each vegetative study site. This form is simple and largely self-explanatory. From the point of origin of a survey transect (Transect A), a survey tape is stretched 100 feet. Points are taken every foot along the length of the transect by lowering a plumb bob to the ground and

documenting the applicable ground cover category on the survey form. This is done a second time on a new bearing (Transect B) of similar vegetative type, using the same begin point as Transect A. The points taken on each transect should add up to 100, resulting in a total of 200 points for each study site. Non-native plants are currently rare in the HUW. However, the number of these plants included in the points for vegetation and litter should be noted in the "Comments" section of the form, if discovered while completing a ground cover survey.

The existing vegetative study sites have been established over many years and often differ somewhat in layout and documentation. A transect may not be identified in the site folder, or marked on the ground, or the transect's begin point may actually be at the center of the site. Some sites have been geolocated (GPS), making them easy to find, while others may have to be located using only photos and a quad map. And, there may be other incongruities in the site folders. Future surveys of these sites will likely require surveyors to improvise or make assumptions about transects. It's important to locate and survey the established vegetative study sites. However, for the purposes of monitoring this indicator, transects don't need to be precisely duplicated, as long as they represent the same vegetative type. The site folders should be updated as surveys are completed and documentation is revised. All site folders are stored in the SO under the stewardship of the Forest Ecologist(s).

Photos are important to monitoring this indicator. At least one photo must be taken of each transect, from its point of origin. The photo must clearly show the vegetative type and include enough detail so that the percent ground cover is apparent. If this is not possible with a single photo, horizontal or vertical panoramas may be created using a series of two or more photos, until the vegetative type and percent ground cover are reasonably represented. It's also important to include the skyline or other unique features in the photo as a visual reference to assist future surveyors in relocation. All photos must be given discrete numbers and documented on a USGS quad map and the survey form for each transect. Series of photos in vertical panoramas should be numbered logically and in order from bottom to top.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies and document revisions should be retained and filed together in the study site folders at the SO. Photos must be printed and included in the hardcopy files.

Sampling Plan

Ground cover will be surveyed at all existing vegetative study sites within the HUW at least once every 10 years. In 1997, at the completion of the *HUW Management Plan*, there were 304 vegetative study sites, most of which were on the North Slope. Since then, additional study sites have been added and will likely continue to be added as deemed necessary by Forest Ecologists to more accurately reflect the condition and trends of native plant communities in the HUW.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from livestock grazing and other human uses, which is a foremost concern of the *HUW Management Plan*. Despite the potential cost of monitoring this indicator, losses in ground cover can result in severe long-term damage to natural resources and wilderness character and every effort should be made to do so.

MA-01-018 Natural Fire Regime*

Introduction

A natural fire regime is an indicator of the natural processes found within wilderness. The extent to which fire is allowed to play its natural role in the ecosystem was identified as a significant issue in the *HUW Management Plan*. This indicator is perhaps the simplest to monitor, since it generally requires little or no fieldwork, though the results are very difficult to quantify. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character*" and are "*protected and managed so as to preserve its natural conditions,*" and wilderness managers must attempt to satisfy the intent of the law.

Wildland fire is an infrequent yet highly significant natural disturbance to the ecosystems of the HUW. It controls insects and disease, promotes native plant communities and fire-dependent species, improves habitat for nesting birds and mammals, regenerates soil nutrients, and reduces the potential for unnatural and destructive catastrophic fires. A natural fire cycle is important to biological diversity and forest health and helps maintain a mosaic of vegetative patterns that is essential to ecological integrity. Fire regime monitoring will yield information needed by wilderness managers to ensure natural processes are permitted to function and to make informed recommendations regarding wildland fire use and other management actions that may be necessary to restore or preserve natural processes and conditions.

Standard

Wildland fire is allowed to play, to the extent possible, its natural role in the ecosystem. The appropriate suppression response is taken to address fires that are human-caused, escape the wilderness, or threaten life or property, using Minimum Impact Suppression Tactics (MIST). All fires are addressed in accordance with the *HUW Fire Management Plan* found in the *HUW Final EIS, 1997 (FSM 2324.2).*

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-018. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-016. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Skills & Tools Required

This indicator is monitored by wilderness managers. Wilderness program management skills and familiarity with the *HUW Management Plan* and the *HUW Fire Management Plan* are required. Other personnel are unlikely to possess the necessary skills or program knowledge to survey this indicator. Contracting the work would also not likely be a viable option, since this indicator is dependent largely upon unpredictable fire occurrences, it requires very little time or effort to survey, and a contractor is unlikely to possess the necessary skills or program knowledge.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) Survey Forms & Pencil Digital Camera (Optional) HUW Fire Management Plan	Wilderness Management

Monitoring Protocol

The natural fire regime is monitored by examining prescribed fires to ensure they meet wilderness management objectives, assessing the degree to which lightning ignitions are permitted to burn naturally, and reviewing suppression activities (if any) to ensure appropriateness and compliance with MIST. In short, this protocol simply requires all fires to be evaluated for compliance with the *HUW Fire Management Plan*, and it satisfies the intent of the indicator.

A *fire regime survey form* (Appendix C: 18) must be completed for each fire occurrence. This form is simple and self-explanatory, though it requires specific program knowledge to complete. The location and perimeter of the fire should also be noted on a USGS quad map. Photos are not necessary for monitoring this indicator, but a few sample photos may help illustrate the survey. This indicator may be surveyed either by physical observation or by interviewing appropriate Fire Management Officer(s) to acquire the necessary information or, preferably, both.

If taken, digital photos should be printed. All hardcopy survey forms, maps, and photos should be retained and filed together in a location designated by the wilderness manager. Since this data is largely qualitative in nature, there would be little value in converting it to a digital format for analysis.

Sampling Plan

The natural fire regime is surveyed whenever and wherever fires occur within the HUW. Consequently, survey work will vary considerably from year to year. From 1974 to 1998, the average number of lightning-caused fires in the HUW was 0.76 per year, while the average number of human-caused fires was 2.52 per year. Assuming constant rates of ignition, these are the average numbers of fires to be surveyed each year, in addition to prescribed fires.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure the degree to which natural processes are permitted to function, which is a foremost concern of the *HUW Management Plan*. Since there is no additional cost to monitoring this indicator, fires are capable of causing great disturbance, and fires are historically infrequent and small, there is unlikely to ever be a reason that this indicator must be forgone.

MA-01-035 Campsite Density*

Introduction

Campsite density is a tangible indicator of visitor solitude, which affects the quality of the primitive recreation (wilderness) experience. The extent to which this experience is affected by other visitors was identified as a significant issue in the *HUW Management Plan*. Such effects are difficult to quantify, since the wilderness experience is highly subjective and varies among different types of wilderness visitors. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas provide "*outstanding opportunities for solitude or a primitive and unconfined type of recreation,*" and wilderness managers must attempt to satisfy the intent of the law and the diverse expectations of wilderness visitors.

Studies indicate that most wilderness visitors are sensitive to the presence of other visitors and that the number, behavior, density, and distribution of other visitors can affect the quality of wilderness experiences. Generally, lower campsite densities have less impact on wilderness experiences. Campsite density monitoring will yield information needed by managers to make informed recommendations regarding use limits, designated campsites, setbacks, and other management actions that may be necessary to protect wilderness experiences.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with each condition class.

Standard

Condition Class 1: Occupied campsites are at least one mile apart. Condition Class 2: Occupied campsites are at least ¼ mile apart. Condition Class 3: Occupied campsites are at least 200 feet apart.

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-035. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-033. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Skills & Tools Required

No specialized skills, tools, or training are required to monitor this indicator. The work can be completed by any forestry technician who has been properly oriented to the task. It is most efficient to use wilderness rangers, since the work requires very little time or

effort, generally occurs on routine patrol routes with which rangers are familiar, and there is little (if any) additional cost. If committed for the entire field season, wilderness volunteers would likely also be effective. Contracting the work would not likely be cost effective, unless combined with other survey work.

Combining this survey work with other work may be an option, depending on program resources and priorities. If possible, it may be practical to survey this indicator concurrent with other recreation indicators (campsite impacts and firewood availability), since some of the same tools and skills are used and the survey areas are common to these indicators. See MA-01-036 and MA-01-044 for additional requirements and sampling considerations that may be necessary.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) Condition Class Map Ruler or Map Scale Monitoring Plan Digital Camera (Optional) Survey Forms & Pencil Wilderness Field Equipment	Basic Math Basic Computer & MS Excel Wilderness Travel & Orienteering

Monitoring Protocol

Campsite density is monitored by identifying occupied campsites in a survey area, as prescribed in the sampling plan, and estimating the distance between them within one of four predetermined proximity ranges (see table below). For campsites within 100-300 feet of each other, when it's often uncertain which of the ranges applies, distance is estimated by pacing. In all other cases, distance is estimated using USGS quad maps (7.5 minute) and a ruler or map scale. These methods are inexact, but they are the most practical, given the possible distribution of occupied campsites, and they will yield an adequate level of precision for this indicator.

PROXIMITY RANGES

A	0-200 Feet (Illegal)
B	200 Feet – ¼ Mile
C	¼ Mile – 1 Mile
D	Greater Than 1 Mile

A *campsite density survey form* (Appendix C: 35) must be completed for each survey area. This form is simple and self-explanatory. If combined with campsite impact monitoring, the campsite impact survey form should be substituted for the campsite density survey form, since it meets the needs of both indicators. All occupied campsites must also be identified on USGS quad maps and given a discrete number. This number

only serves to distinguish between campsites on the survey map and may be arbitrarily created, unless campsite density monitoring is combined with campsite impact monitoring. Photos are not necessary for monitoring this indicator, but a few sample photos may help illustrate the survey. If taken, photos must also be given discrete numbers and documented on the survey form.

As a secondary monitoring protocol, the *HUW Management Plan* prescribes a review of incident reports and violation notices for *36 CFR 261.58(e), camping within 200 feet of a water source, trail, or occupied campsite*. This protocol was rejected because it only measures illegal camping discovered by an FPO and has no utility when applied to the standard. Strangely, this proximity range (0-200 ft) was omitted from the primary monitoring protocol in the HUW Management Plan, perhaps because camping within it is illegal. However, such violations are common and they can have a negative impact on solitude and the wilderness experience, so it is important to include them when observed during a monitoring survey. Corrective action should also be taken, as appropriate and within employee scope of authority.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos, if any, should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Campsite density will be surveyed at all destinations that threaten to exceed standards at least once every five years. These destinations are typically found within Condition Class 3 areas, but they are increasingly common within Condition Class 1 and 2 areas. Monitoring surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day) on at least 20 randomly selected days at each destination. In the selection of survey days, Saturdays and Sundays will be weighted by a factor of two in order to more accurately represent the conditions experienced by most visitors. When possible, surveys should be completed by 10:00 am, before most camps are broken. If combined with campsite impact index or firewood availability monitoring (MA-01-36 and MA-01-044), however, it may be difficult to complete a meaningful amount of work before 10:00 am in high-use areas or distant destinations. In such cases, campsite density should be surveyed first; campsites may be revisited later in the day to survey campsite impacts and firewood availability.

Since a current list of destinations that threaten to exceed standards is essential to monitoring this indicator, wilderness managers must be alert to changing field conditions that may cause new destinations to be added. Furthermore, this list should be maintained so that trends may be identified. Wilderness ranger reports, incident reports, violation notices, and any other sources of such information should be reviewed periodically for indications of high campsite densities.

For the purposes of monitoring this indicator, a “destination” is defined as a discrete area that includes all overnight use associated with a specific attraction. This is most often a lake or small group of lakes, but it may be any feature that is known to attract visitors as a final destination or serve as a popular overnight “stopover” for visitors en-route to another destination, such as Kings Peak.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “medium.” The primary intent of this indicator is to measure solitude or impacts to the wilderness experience from crowding, which is of relatively less importance in the *HUW Management Plan* than resource damage. Due to the low cost and ease and efficiency with which this indicator can be surveyed, however, there is unlikely to ever be a reason that it must be forgone, except inadequate personnel.

MA-01-036 Campsite Impact Index*

Introduction

Campsite impact indexes are an indicator of cumulative changes to vegetation, soil, and aesthetics caused by human use. The extents to which human overuse threatens ecological integrity and the quality of the primitive recreation (wilderness) experience were identified as significant issues in the *HUW Management Plan*. Though not a perfect science, it is relatively simple to evaluate biophysical impacts. Effects on the wilderness experience, however, are difficult to quantify, since this experience is highly subjective and varies among different types of wilderness visitors. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character,*" are "*protected and managed so as to preserve natural conditions,*" and provide "*outstanding opportunities for solitude or a primitive and unconfined type of recreation,*" and wilderness managers must attempt to satisfy the intent of the law and the diverse expectations of wilderness visitors.

Campsite impacts can severely alter natural conditions, and cumulative changes to vegetation and soil can affect ecological integrity. Combined with the attendant changes in aesthetics, they can also affect wilderness experiences. Generally, campsites with lower campsite impact indexes (less than 40) have less affect on natural conditions and ecological integrity, have less impact on wilderness experiences, and are likely to recover naturally. Conversely, those with higher impact indexes (over 40) are likely to have serious, long-term impacts and may not recover naturally. Campsite impact monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, group size and campfire restrictions, signing, and other management actions that may be necessary to protect wilderness resources and experiences.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with each condition class.

Standard

1) Ashley National Forest
Condition Class 1: No campsites have a site impact index (SII) over 40. Condition Class 2: No more than 10% of campsites have an SII over 40. Condition Class 3: No more than 20% of campsites have an SII of 50 or more.

2) Wasatch-Cache National Forest
Condition Class 1: No campsites have a site impact index (SII) over 40. Condition Class 2: No more than 10% of campsites have an SII of 50 or more. Condition Class 3: No more than 20% of campsites have an SII of 50 or more.

Note that the standard for this indicator varies by National Forest. The standard for the Ashley National Forest is consistent with the *HUW Management Plan Record of Decision*. The standard for the Wasatch-Cache National Forest differs, pursuant to the recently revised *Wasatch-Cache National Forest Plan*.

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-036. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-034. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Skills & Tools Required

No specialized skills or tools are required to monitor this indicator. Experience is helpful but not necessary. The work is somewhat complex and time-consuming, however, and requires initial training to ensure accurate, complete, and consistent data is collected. It is most efficient to use wilderness rangers, since the work generally occurs on routine patrol routes with which rangers are familiar. If committed for the entire field season and properly trained, wilderness volunteers would likely also be effective. Contracting the work may be a cost-effective option.

Combining this survey work with other work may be an option, depending on program resources and priorities. If possible, it may be practical to survey this indicator concurrent with other recreation indicators (campsite density and firewood availability), since some of the same tools and skills are used and the survey areas are common to these indicators. See MA-01-035 and MA-01-044 for additional requirements and sampling considerations that may be necessary.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) Condition Class Map GPS (Recreational Grade) Digital Camera Survey Tape Pin Flags Ruler or Map Scale Sampling Plan Survey Forms & Pencil Wilderness Field Equipment	Public Communications Basic Math Basic Computer & MS Excel GPS Operation Digital Camera Operation Wilderness Travel & Orienteering

Monitoring Protocol

Campsite impact indexes are monitored by identifying campsites to be surveyed in an area, as prescribed by the sampling plan, marking their boundaries, and performing a comprehensive assessment of the biophysical impacts of each site. The results of the assessment are used to calculate the campsite impact index. This is the modified Cole campsite inventory method. Campsite impact surveys are largely based on visual inspection. However, where square footage is required, a survey tape is used. In all other cases, distance is estimated by pacing (up to 300 ft) or using USGS quad maps and a ruler or map scale (over 300 ft). These methods are inexact, but they are the most practical, given the number and distribution of campsites, and they will yield an adequate level of precision for this indicator.

A *campsite impact survey form* (Appendix C: 36.1) must be completed for each campsite. This form is somewhat complex but is accompanied by detailed instructions (Appendix E). If combined with campsite density monitoring, the campsite impact survey form should be substituted for the campsite density survey form, since it meets the monitoring needs of both indicators. All campsites must also be identified on USGS quad maps and given discrete numbers. If an earlier campsite inventory exists for the survey area, the inventory numbers or numbering scheme prescribed by the inventory should be used to achieve the highest possible level of continuity. On an attachment to the survey form (Appendix C: 36.2), the campsite must be sketched. The sketch should include an outline of the site and its barren core as well as developments, natural landmarks, tent pads, damage, and other notable features.

Photos are important to monitoring this indicator and should be taken to the degree necessary to support each survey. At least one photo must be taken of each campsite, looking through the site from a fixed photo point. If an earlier campsite inventory exists for the survey area, existing photo points should be used. If a campsite is large, soil movement (erosion) is evident, or impacts to trees or vegetation are extensive, additional photos may be necessary. Items on the survey form that may require additional photos are marked with the universal recreation symbol of a camera. All photos must be given discrete numbers and documented on the survey form, and all photo points must be shown on the campsite sketch with an arrow showing the direction in which the photo was taken. The photo-numbering scheme is prescribed by the survey form instructions.

After completing a survey or at the end of the season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Campsite impacts will be surveyed at all campsites that receive regular use at all destinations at least once every 10 years. These sites may be recognized by an apparent reduction in ground cover, compacted soil, the presence of social trails, or other notable disturbances. There is little value in surveying campsites that show very little sign of use. Monitoring surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day). Surveys may be completed any time or day of the week, though it is best to limit the work to weekdays and afternoons, when campsites are least likely to be occupied. If combined with campsite density monitoring (MA-01-35), however, it will be necessary to complete surveys during periods of high-use, as prescribed by the campsite density sampling plan.

For the purposes of monitoring this indicator, a “destination” is defined as a discrete area that includes all overnight use associated with a specific attraction. This is most often a lake or small group of lakes, but it may be any feature that is known to attract visitors as a final destination or frequently serve as an overnight “stopover” for visitors en-route to another destination, such as Kings Peak.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the *HUW Management Plan*. Despite the potential cost of monitoring this indicator, campsite impacts can result in severe long-term damage to natural resources and wilderness character and every effort should be made to do so. Also, since campsite impact survey data is prerequisite to MA-01-005, this indicator is integral to the implementation of the monitoring plan.

MA-01-038 Group Size*

Introduction

Group size is an indicator of impacts to natural resources and solitude, both of which affect the quality of the primitive recreation (wilderness) experience. The extent to which this experience is affected by other visitors and resource damage resulting from human use was identified as a significant issue in the *HUW Management Plan*. Such effects are difficult to quantify, since the wilderness experience is highly subjective and varies among different types of wilderness visitors. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character,*" are "*protected and managed so as to preserve natural conditions,*" and provide "*outstanding opportunities for solitude or a primitive and unconfined type of recreation,*" and wilderness managers must attempt to satisfy the intent of the law and the diverse expectations of wilderness visitors.

Studies indicate that most wilderness visitors prefer to encounter smaller groups and that the number, behavior, density, and distribution of other visitors can affect the quality of wilderness experiences. Studies also show that smaller groups create fewer new campsites and social trails and are less likely to enlarge existing campsites, particularly in pristine, low-use areas. Generally, smaller groups have less impact on both natural resources and wilderness experiences. Group size monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, group size restrictions, and other management actions that may be necessary to protect wilderness resources and experiences.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator originally varied with condition class. However, this was cited in an appeal of the *Record of Decision* and the decision was reversed, so the *HUW Management Plan* now includes only one uniform standard.

Standard

Group size does not exceed 14 persons and 15 head of pack and saddle stock.

The standard for this indicator originally varied with condition class. However, this was cited in an appeal of the *Record of Decision* and the decision was reversed, so the *HUW Management Plan* now includes only one uniform standard for all condition classes throughout the HUW.

*According to the text of the *HUW Management Plan Record of Decision (ROD)*, this indicator is MA-01-038. However, the monitoring table attached to the *ROD* shows this indicator as MA-01-036. The indicator number contained in the text of the *ROD* is assumed to be the correct one.

Skills & Tools Required

No specialized skills, tools, or training are required to monitor this indicator. The work requires very little time or effort and should be included in the routine duties of every wilderness ranger. In lieu of wilderness rangers, the work may be easily completed by wilderness volunteers or trailhead hosts. Contracting the work would not likely be cost effective, unless combined with other survey work.

Tools Required	Skills Required
Notebook & Pen or Pencil Sampling Plan Survey Forms or Ranger Reports	Public Communications

Monitoring Protocol

Group size is primarily monitored by simply counting the number of people and pack and saddle animals in each party encountered, as prescribed in the sampling plan. These observations are documented on a *group size survey form* (Appendix C: 38.1) or *wilderness ranger report* (Appendix C: 38.2), depending on who is conducting the survey. Due to the large number of organized groups that visit the HUW and their tendency to travel in larger numbers, it is helpful to wilderness managers if the names of organizations are also noted for outreach purposes. Surveyors should not insist on this information, however, if a group is uncooperative. This protocol is simple but fully satisfies the intent of the indicator.

As a secondary monitoring protocol, the *HUW Management Plan* prescribes an analysis of *trailhead registers* (Appendix C: 38.3). This protocol yields unreliable data, however, since all visitors to the HUW currently register themselves, and many groups fail to register or provide accurate group size information. Nevertheless, this data can be useful and should be routinely collected at all major trailheads using a registration form that includes group size. These should be collected regularly and delivered to the wilderness manager. If a mandatory registration (permit) system is ever implemented, registration data will become far more valuable.

Group sizes in excess of the standard are in violation of 36 CFR 261.58(f), *group size in excess of 14 persons* and/or 36 CFR 261.55(c), *group size in excess of 15 pack or saddle stock*. However, such violations are common and they can have a negative impact on solitude and the wilderness experience, so it is important to include them when observed during a monitoring survey. Corrective action should also be taken, as appropriate and within employee scope of authority.

At the end of the season, all data should be entered into an Excel spreadsheet for analysis, taking care to record physical observations separately from trailhead registrations. Spreadsheets should be filed in the appropriate server location. All hardcopies, including trailhead registrations, should be retained and filed in a location designated by the wilderness manager.

Sampling Plan

Group size is continuously surveyed along all wilderness patrol routes. This work should be included in the routine duties of each wilderness ranger. Monitoring surveys will be conducted on every patrol day during the peak high-elevation field season (July 1 to Labor Day), wherever wilderness rangers are working. Absent wilderness rangers or an otherwise adequate field presence, surveys will be conducted on at least 20 randomly selected days at least once every five years. Surveys should be conducted on corridor trails in each of the 12 major watersheds (see table below) at least one mile from a trailhead. In the selection of survey days, Saturdays and Sundays will be weighted by a factor of two in order to more accurately represent the conditions experienced by most visitors. When possible, surveys should be completed over a period of six hours, preferably between 8:00 am and 2:00 pm, after most visitors have departed the trailhead or their campsite.

MAJOR WATERSHEDS OF THE HUW

South Slope	North Slope
Duchesne River	Burnt Fork
Rock Creek	Beaver Creek
Lake Fork River	Henry's Fork
Uinta River	Smith's Fork
Yellowstone Creek	Black's Fork
	East Fork
	Stillwater Fork

Group size data from trailhead registrations will be collected with at least the same frequency as monitoring surveys. Due to the ease with which it can be collected, however, it should be done annually if possible.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is "medium." The primary intent of this indicator is to measure solitude or impacts to the wilderness experience from crowding, which is of relatively less importance in the *HUW Management Plan* than resource damage. Due to the low cost and ease and efficiency with which this indicator can be surveyed, however, there is unlikely to ever be a reason that it must be forgone, except inadequate personnel.

MA-01-044 Firewood Availability*

Introduction

Firewood availability is an indicator of cumulative changes to vegetation, soil, and aesthetics caused by human use. The extents to which human overuse threatens ecological integrity and the quality of the primitive recreation (wilderness) experience were identified as significant issues in the *HUW Management Plan*. Though not a perfect science, it is relatively simple to evaluate biophysical impacts. Effects on the wilderness experience, however, are difficult to quantify, since this experience is highly subjective and varies among different types of wilderness visitors. Nevertheless, the *Wilderness Act of 1964, Section 2(c),* requires that wilderness areas retain their "*primeval character,*" are "*protected and managed so as to preserve natural conditions,*" and provide "*outstanding opportunities for solitude or a primitive and unconfined type of recreation,*" and wilderness managers must attempt to satisfy the intent of the law and the diverse expectations of wilderness visitors.

Studies indicate that the loss of downed woody debris (including firewood) has detrimental affects on small mammal and bird habitat, native vegetation recruitment, and nutrient cycling. Since visitors typically only collect firewood within a 200-foot radius of their campsite, it also results in damage to standing trees when firewood becomes scarce and visitors begin to strip or fall them. Cumulatively, these impacts can affect natural processes and ecological integrity. Combined with the attendant changes in aesthetics, they can also affect wilderness experiences. Firewood availability monitoring will yield information needed by wilderness managers to make informed recommendations regarding use limits, designated campsites, campfire restrictions, signing, and other management actions that may be necessary to protect wilderness resources and experiences.

Visitors to the High Uintas Wilderness are generally categorized into three groups. Descriptions of these groups may be found in the *HUW Management Plan (III-16).* Different types of wilderness visitors have diverse perceptions of wilderness character and different expectations of a wilderness experience. The *HUW Management Plan* recognizes this by dividing the wilderness into three "desired condition classes" within which different expectations may be satisfied. Consequently, the standard for this indicator varies with each condition class.

Standard

1) Ashley National Forest
None. This indicator is shown on the monitoring table attached to the *HUW Management Plan Record of Decision (ROD)* and incorporated therein. However, the standard was omitted entirely from the *ROD* text, presumably in error, so the document failed to prescribe a standard for this indicator.

2) Wasatch-Cache National Forest
Prohibit campfires where the firewood supply is depleted and continued fire building threatens the wilderness qualities of the area.

Note that the standard for this indicator varies by National Forest. The standard for the Ashley National Forest is consistent with the *HUW Management Plan Record of Decision*. The standard for the Wasatch-Cache National Forest differs, pursuant to the recently revised *Wasatch-Cache National Forest Plan*.

*The monitoring table attached to the *HUW Management Plan Record of Decision (ROD)*, shows this indicator as MA-01-042. However, the text of the *ROD* commits this number to another indicator. Therefore, this indicator was given a number otherwise missing from the sequence: MA-01-044.

Recommendations

Threshold. Condition Class 1: Firewood availability is at least 90% of natural. Condition Class 2: Firewood availability is at least 75% of natural. Condition Class 3: Firewood availability is at least 50% of natural.

The *HUW Management Plan* failed to specify a standard for this indicator. All known research in the area of downed woody debris addresses fuels volume for fire or timber management purposes or, importantly, the role of downed woody debris in ecosystem health. Regrettably, there is no research that supports any kind of standard for firewood availability, so it becomes a matter of professional judgment. Consequently, the HUW Management Team developed the threshold without the benefit of science but based on its collective judgment and experience.

The *HUW Management Plan* prescribed that the firewood availability standard be expressed in terms of tons per acre, presumably because this is consistent with current methods of fuels measurement. However, "firewood" is a subset of fuels and is considered to include only dead and down wood from ¼ to 8 inches in diameter. Firewood surveys conducted during the 2003 and 2004 field seasons revealed that firewood volume is consistently far less than fuels volume and only amounts to fractions of a ton per acre, even under natural conditions. Moreover, natural conditions are highly variable in the HUW. For these reasons, it is of little value to express the threshold in terms of tons per acre.

<u>Skills & Tools Required</u>

No specialized skills or tools are required to monitor this indicator. Experience is helpful but not necessary. The work is somewhat complex and time-consuming, however, and requires initial training to ensure accurate, complete, and consistent data is collected. It is most efficient to use wilderness rangers, since the work generally occurs on routine patrol routes with which rangers are familiar. If committed for the entire field season

and properly trained, wilderness volunteers would likely also be effective. Contracting the work may be a cost-effective option.

Combining this survey work with other work may be an option, depending on program resources and priorities. If possible, it may be practical to survey this indicator concurrent with other recreation indicators (campsite density and campsite impacts), since some of the same tools and skills are used and the survey areas are common to these indicators. See MA-01-035 and MA-01-036 for additional requirements and sampling considerations that may be necessary.

Tools Required	Skills Required
USGS Quad Maps (7.5 Minute) Condition Class Map GPS (Recreational Grade) Digital Camera Survey Tape Sampling Plan Survey Forms & Pencil Wilderness Field Equipment	Basic Math Basic Computer & MS Excel GPS Operation Digital Camera Operation Wilderness Travel & Orienteering

Monitoring Protocol

Firewood availability is monitored by identifying destinations to be surveyed, as prescribed by the sampling plan, establishing linear survey transects through popular campsites, and counting the number of times each 800-foot transect intersects downed woody debris in four predetermined diameter classes (see table below). The results of the survey are used to calculate volume, in tons per acre. The volume found in the first 600 feet of each transect, which includes the camping and firewood collection zones, is compared with the volume found in the last 200 feet of the transect, which includes the control zone (natural condition) from which firewood is rarely collected. This relationship determines "percent natural." No established or well-accepted methods exist for monitoring firewood availability, but this protocol was successfully tested in 2003 and 2004 on the Duchesne Ranger District and it satisfies the intent of the indicator to the greatest extent possible.

DIAMETER CLASSES

A	¼ Inch – 1 Inch
B	1 Inch – 3 Inches
C	3 Inches – 4 Inches
D	4 Inches – 8 Inches

The *HUW Final EIS* suggests the measurement of downed woody debris of ¼ inch to four inches in diameter. However, the protocol includes material up to eight inches in

diameter. While backpackers are rarely equipped to cut wood of this size, horse groups often pack handsaws or axes and have little difficulty with it. Therefore, an additional diameter class (4-8 inches) was added to include larger material. While intended to better represent firewood availability to most HUW visitors, adding this diameter class may yield survey results that overstate availability when, in fact, smaller diameter wood may be totally depleted and only well-equipped horse groups may find adequate firewood. Although, results of the 2003 and 2004 firewood surveys on the Duchesne Ranger District suggest that this is unlikely.

The *HUW Management Plan* also prescribes the use of James Brown's *Handbook for Inventorying Downed Woody Material* to guide firewood availability surveys. While this publication remains the foundation for surveying downed woody debris, it was written to facilitate fuels management, which is generally concerned with much larger material than firewood and in varying stages of decomposition. Consequently, Brown's method is unnecessarily complex for the purposes of monitoring this indicator. This protocol is a simplification of Brown's method.

A *firewood availability survey form* must be completed for each survey transect (Appendix C: 44). This form is somewhat complex but is accompanied by detailed instructions (Appendix E). All survey transects must also be identified on USGS quad maps and given discrete numbers. If an earlier firewood availability survey exists for the area, the transect numbers or numbering scheme prescribed by the survey should be used to achieve the highest possible level of continuity.

Photos are important to monitoring this indicator. One photo must be taken every 100 feet along each transect (two photos per zone), in the direction opposite the point of origin. Additional photos should be taken of significant resource damage that likely resulted from firewood collection, such as cut or damaged trees. All photos must be given discrete numbers and documented on the survey form. The photo-numbering scheme is prescribed by the survey form instructions.

In order for the wilderness manager to analyze the data collected, one final step is required: the volumes must be calculated. It is easiest to do this digitally after the data has been entered into an Excel spreadsheet. This may also be done manually, but it is time-consuming and requires strong math skills. In any case, the Brown formulas below must be used. These calculations have been simplified somewhat by using an average specific gravity for materials over three inches in diameter, using an average squared diameter within each class, assuming a slope of less than 20 percent, and assuming a non-Ponderosa pine species correction factor. Brown acknowledges that such simplifications are appropriate and sometimes necessary to more efficiently collect area-specific information. For further explanation of these formulas, see James Brown's *Handbook for Inventorying Downed Woody Material*.

VOLUME FORMULAS

Diameter Class	Brown Formula
Twigs: 1/4"-1"	(11.64 x n x d^2 x s x a x c)/(N x l)
Small Branches: 1"-3"	(11.64 x n x d^2 x s x a x c)/(N x l)
Large Branches: 3"-4"	(11.64 x SUMd^2 x s x a x c)/(N x l)
Small Tree Trunks: 4"-8"	(11.64 x SUMd^2 x s x a x c)/(N x l)

FORMULA VARIABLES

Diameter Class	d^2	s	a	c
Twigs: 1/4"-1"	0.391	0.48	1.13	1.00
Small Branches: 1"-3"	4.000	0.40	1.10	1.00
Large Branches: 3"-4"	12.250	0.35	1.00	1.00
Small Tree Trunks: 4"-8"	36.000	0.35	1.00	1.00

KEY TO VARIABLES

n	No of Intersections	c	Slope Correction
d	Ave Diameter	N	No of Transects
s	Specific Gravity	l	Length of Transect
a	Species Correction		

After completing a survey or at the end of the field season, all data should be entered into an Excel spreadsheet for analysis. Spreadsheets and digital photos should be filed together in the appropriate server location. All hardcopies should be retained and filed together with maps in a location designated by the wilderness manager. If time permits, it is advisable to print photos for the hardcopy files and create digital copies of the maps for the server files, so that both file sets are complete.

Sampling Plan

Firewood availability will be surveyed at all destinations that threaten to exceed standards at least once every five years. These destinations are typically found within Condition Class 3 areas, but they are increasingly common within Condition Class 1 and 2 areas. Monitoring surveys must include at least three transects per destination. In larger or more popular destinations with many campsites, the number of transects must be increased to the degree necessary to reasonably represent firewood availability at the destination. Surveys will be conducted during the peak high-elevation field season (July 1 to Labor Day). Surveys may be completed any time or day of the week, though it is best to limit the work to weekdays and afternoons, when campsites are least likely to be occupied. If combined with campsite density monitoring (MA-01-35),

however, it will be necessary to complete surveys during periods of high-use, as prescribed by the campsite density sampling plan.

Since a current list of destinations that threaten to exceed standards is essential to monitoring this indicator, wilderness managers must be alert to changing field conditions that may cause new destinations to be added. Furthermore, this list should be maintained so that trends may be identified. Wilderness ranger reports, campsite surveys, and any other sources of such information should be reviewed periodically for indications of firewood depletion.

For the purposes of monitoring this indicator, a “destination” is defined as a discrete area that includes all overnight use associated with a specific attraction. This is most often a lake or small group of lakes, but it may be any feature that is known to attract visitors as a final destination or frequently serve as an overnight “stopover” for visitors en-route to another destination, such as Kings Peak.

Monitoring is always a function of funding and difficult choices must often be made. The priority for monitoring this indicator, relative to other indicators, is “high.” The primary intent of this indicator is to measure resource damage resulting from recreation use, which is a foremost concern of the *HUW Management Plan*. Impacts to the wilderness experience are of relatively less importance.