White Mountain National Forest

United States
Department of
Agriculture

Forest
Service

Eastern
Region

Monitoring and Evaluation Report 2011

Cover: Monitoring water quality in Meserve Brook. WMNF photo by Chris Mattrick.

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Forest Supervisor's Note

I am pleased to share with you the most recent White Mountain National Forest Monitoring Report, which summarizes many of our monitoring efforts in fiscal year 2011 (FY11). As always, this report considers how well we are implementing the management direction in the Forest Plan, what effects our management is having on natural, cultural, and social resources, and how those resources are being affected by other factors. We continue to be committed to identifying what is working well in our programs and what isn't, sharing the results, and learning from all that we do.

In August, 2011, Tropical Storm Irene swept through, dumping several inches of rain across the Forest in just a few hours. Fortunately no one was hurt on the Forest, but many of our roads, trails, and campgrounds sustained heavy damage. We spent the fall assessing the impacts, repairing high priority sites so they could reopen, and determining what additional repair work is needed in coming years. We have added a new section to this monitoring report on Tropical Storm Irene. In it we share some of our initial observations about the storm and its impact. In future years, we will examine long-term effects on resources and how the Forest recovers from the storm.

Our monitoring shows that we are largely implementing the Forest Plan as written and intended. Working with our partners, we manage all the resources on the White Mountain National Forest in an integrated way, ensuring that meeting objectives in one area doesn't adversely affect another. I am proud of our many successes and confident we will find solutions where monitoring shows a new approach is needed.

I find that the monitoring we did in FY11 and this report meet the intent of both the Forest Plan (Chapter 4) and the planning regulations at 36 CFR 219. No need to amend the Forest Plan was identified as a result of this monitoring. In future years we will review our monitoring program in light of the recently updated planning regulations and make any necessary adjustments.

Introduction

Effective monitoring and evaluation helps the Forest Service and the public determine how well a Forest Plan is being implemented, whether Plan implementation is achieving desired outcomes, and whether assumptions made in the planning process are valid. It helps us improve our management and determine when we need to adjust desired conditions, goals, objectives, standards, and guidelines.

The White Mountain National Forest's Monitoring Plan (Chapter 4 of the Forest Plan) describes what we will monitor and what we expect to learn from that monitoring. The Monitoring Plan identifies several types of required monitoring, including monitoring of sustainability, outputs, services, and costs, management indicator species, objective attainment, standard and guideline implementation, and effects of management practices (pages 4-8 to 4-10). Our Monitoring Plan also identifies the need to conduct monitoring on a variety of topics or resources to evaluate resource conditions and ecosystem health, and help answer the question "Are we accomplishing the overall goals of the Forest Plan?"

Monitoring is not performed on every activity, nor is most of it expected to meet the statistical rigor of formal research. Some monitoring we do, such as construction and timber sale contract administration, is an integral part of daily activities. Some monitoring is conducted weekly or annually, some is done at longer intervals to track changes over time, and other items are monitored when funds and staffing are available.

The annual monitoring report summarizes and, at scheduled intervals, evaluates monitoring results. It also provides the public and Forest personnel with updated information about Forest Plan and project implementation. Some monitoring leads to immediate conclusions while other topics require a decade or more of data collection to produce informative results. As a result, our annual monitoring report changes every year and the level of detail provided varies by topic.

Although the Forest Service's budget continues to be constrained in response to national economic concerns, monitoring remains an important part of our annual program of work. We expect to continue funding all the monitoring items identified as required in the monitoring guide, and as many high priority items as budgets allow each year.

We are fortunate to have many partners who are willing to work with us to maintain our roads, trails, and facilities, develop and implement projects, and monitor the status of our resources and effectiveness of our management. As funding available to the Forest and many of our partners declines, it is critical for us to continue to work together to identify needs and priorities across the landscape and keep important programs and projects moving ahead. We look forward to working with our current partners and developing new relationships in the coming years.

Required Monitoring

Management Indicators Species (MIS)

The Forest Plan identifies several Management Indicator Species (MIS) to help evaluate effects of forest management. The chestnut-sided warbler and magnolia warbler are two birds chosen to represent species that use regenerating hardwoods and softwoods, respectively. This habitat is produced primarily by clearcutting and provides distinct structural components not found in mature forest stands. Biennial monitoring of these species allows managers to determine if timber harvest prescriptions are providing appropriate habitat conditions, and track population trends of these key species.

Chestnut-sided warbler. Photographer unknown.

The monitoring protocol consists of a series of three consecutive bird point counts conducted in recent (<10 years old) clearcuts during the month of June. Each of the three point counts is five minutes long, for a total survey time of 15 minutes. All birds seen or heard within the clearcut are counted. In 2011, surveys were completed on 87 clearcuts, totaling approximately 1,000 acres and with an average size of 12 acres.

A total of 1,319 observations of 55 species were recorded, which is comparable to data collected in 2009, the last time this monitoring was completed. Forty percent of the observations were from just two species, the chestnut-sided warbler (26%) and the common yellowthroat (15%). Both of these species are strongly tied to regenerating hardwood habitats and considered good indicators of this habitat type. Thirty-seven species had observations that made up less than one percent of the total observations. The majority of these species are most closely associated with mature forest habitats. Anecdotally, many of these clearcuts have large reserve patches within them, which may prove attractive to these species. The species are obviously not abundant in this habitat because they prefer mature forest stands, but it is interesting to note these species' consistent presence in regenerating clearcuts.

To compare trends over time, data was analyzed further using methods described in Donovan and Alldredge (2007) to determine the probability of detection and rates of occupancy for each species. These statistics help show how each species is distributed within regenerating habitats based on the likelihood that they will be detected during the monitoring surveys. Only those species that were recorded in at least 10 percent of the sampled clearcuts were evaluated. Most of these species were the same as those identified in a similar analysis in 2009.

Table 1. Occupancy rate metrics for selected species, comparison between 2009 and 2011

Species	occupancy rate (SE)		p=probability of detection (SE)	
	2009	2011	2009	2011
Alder flycatcher	0.31(0.05)	0.31(0.05)	0.78 (0.05)	0.56 (0.07)
Black-and-white warbler	0.31 (0.06)	0.35 (0.06)	0.47 (0.08)	0.42 (0.08)
Cedar waxwing	0.43 (0.17)	0.32 (0.07)	0.17 (0.09)	0.35 (0.09)
Common yellowthroat	0.77 (0.04)	0.72 (0.04)	0.57 (0.05)	0.61 (0.04)
Chestnut-sided warbler	0.90 (0.02)	0.84 (0.03)	0.80 (0.02)	0.72 (0.03)
Magnolia warbler	0.25 (0.05)	0.33 (0.05)	0.64 (0.07)	0.56 (0.07)
Mourning warbler	0.49 (0.05)	0.38 (0.05)	0.61 (0.05)	0.57 (0.06)
Rose-breasted grosbeak	0.15 (0.05)	0.19 (0.05)	0.44 (0.11)	0.50 (0.09)
Ruby-throated hummingbird	0.53 (0.12)	0.29 (0.11)	0.23 (0.08)	0.23 (0.11)
Dark-eyed junco	0.24 (0.06)	0.17 (0.04)	0.40 (0.10)	0.56 (0.10)
White-throated sparrow	0.46 (0.05)	0.42 (0.05)	0.60 (0.06)	0.67 (0.05)

These statistics evaluate two factors, the probability that a particular clearcut is occupied by a bird and the probability that that bird is actually detected by the surveyor. Derived occupancy rates were stable for most species, with 2009 rates within the 95% confidence intervals for the 2011 numbers. The only exception to this was the chestnut-sided warbler, which was lower than in 2009. Its occupancy rate of 0.84 is still very high, though, indicating good use of regenerating clearcuts by this species. Detection rates also remained relatively high in 2011, over 50% for most species, which means our ability to identify these birds is adequate. Having high detection rates increases confidence in the accuracy of the occupancy analysis. Additional surveys in 2013 may help define trends.

The other MIS, the magnolia warbler, had a much lower occupancy rate than the chestnut-sided warbler, but this is likely because all but one of the clearcuts were in hardwood habitats. The magnolia warbler will use hardwoods, but was selected to represent regenerating softwoods. Conditions appropriate for softwood clearcutting are so limited on the WMNF that it may be difficult to determine trends for the magnolia warbler for this habitat type.

Outputs and Services

Appendix B of the Forest Plan identifies expected outputs and accomplishments for the first decade, as well as some limits. Most of these measures can be found in the resource goals and objectives in Chapter 1 of the Plan. Table 2 shows the accomplishment for each measure in fiscal year 2011 and the status to date for the first six years of Forest Plan implementation. Additional information on identified activities and, where appropriate, why accomplishments are different from estimates in Appendix B, is provided below the table.

Table 2. Estimated Management Practices and Accomplishments

Activity or Product	Unit of Measure	Estimate for First Decade	FY11 Accomp.	FY06-FY11 Accomp.
Aquatics				
Stream habitat restoration	Miles	30	0	10.1
Restore fish passage	Road crossings	10	1	8
Fire Management				
Unplanned wildfire managed for resource benefit (Wildland Fire Use)	Fires	4 – 8	0	1
Forestry				
Volume Sawtimber Harvested	MMBF	137	4.3	29.3
Volume Pulp Harvested	MMBF	106	6.5	38.0
Volume of Timber Sold	MMBF	240	11.5	59.9
Even-aged regeneration harvest	Acres	9,400	332	1,734
Even-Aged Intermediate harvest	Acres	5,600	250	2,575
Uneven-aged Harvests	Acres	19,300	1,415	6,103
Total harvest	Acres	34,300	1,997	10,412
Recreation				
Net increase hiking trail construction	Miles	Up to 25	0	0
Net increase snowmobile trail construction	Miles	Up to 20	1.2	1.4
Net increase developed campground sites	Sites	Up to 32	0	0
Net increase backcountry facility capacity	PAOT	Up to 40	0	0
Soils				
Improved Watershed/Soil Conditions	Acres	At least 250	35	185.5
Transportation				
Road construction	Miles	10	1.0	4.9
Road reconstruction	Miles	70	2.8	35.6
Classification of unclassified roads	Miles	N/A	9.2	11.1
Road decommissioning	Miles	5 - 40	0	0.83
Unclassified road decommissioning	Miles	N/A	4.4	12.0

Aquatics

There were no funded stream improvement projects in FY11. Stream connectivity work continued in the headwaters of the Upper Ammonoosuc River (Bog Dam Loop Road).

Fire Management

In 2011 there were no unplanned fires on the Forest in management areas that allow management of wildfire for resource benefits.

Forestry

Harvest accomplishments were below the estimated annual output. While the acres of even-aged regeneration and total harvest in FY11 were the second highest since the Forest Plan was revised in 2005, even-aged intermediate harvest acres were the second lowest. This shift toward acres of regeneration harvest is likely due to choices by timber sale purchasers regarding which units to cut.

Harvested and sold volumes were at about the average for the last six years. The Forest sold the volume that we were funded to produce in 2011, but that remains just under half the allowable sale quantity identified in the Forest Plan. It remains our goal to gradually increase the acres harvested and volume sold to better meet forestry and wildlife objectives from the Forest Plan.

Recreation

The management objectives for recreation allow for limited construction or expansion of trails and facilities in order to maintain the overall recreational experience, minimize resource effects, and keep a system that can be properly cared for over time. In FY 2011, the Pipeline-Haystack Connector Snowmobile Trail added 1.2 miles to the motorized trail system. Another 0.1 mile was added as part of the Bradley Brook Snowmobile Trail relocation project. Closure of the Jack Knife Field Spur eliminated 0.1 mile of trail, resulting in a net increase in motorized trails of 1.2 miles across the Forest.

To date, the Forest has decommissioned more miles of hiking trail than we have constructed, resulting in a net loss of trails across the Forest. Therefore the net increase in hiking trails, which is what Forest Plan objectives limit, remains at zero miles after six years of implementation.

Soils

The predicted accomplishment of at least 250 acres of watershed and soil improvement work was based on the average annual accomplishment before the revised Forest Plan was signed. It was identified as a minimum to allow for as much of this type of work as is needed and feasible with available funding. Our annual accomplishments are on target to exceed the minimum identified in the Forest Plan.

As in previous years, watershed improvement activities in FY11 included replacing culverts to restore aquatic habitat and species passage, establishment of water bars and rock steps on trails to address erosion concerns, and installing bridges across streams on snowmobile trails to eliminate impacts to streambanks.

Transportation

See objectives section for discussion of how the Forest ensures this work moves us toward Forest Plan objectives. More than half the unclassified road miles evaluated in project-level analyses to-date have been identified as unnecessary and decommissioned. Just over half of the miles of unclassified road that were classified and added to the Forest road system are needed to provide access to a private inholding; the remaining miles were identified as necessary for long-term management efforts.

Recreation

Off-road vehicle (ORV) effects

Monitoring of ORVs is required by regulation. In particular, the Monitoring Guide requires monitoring of the "effects of ORV use on snowmobile trails during early and late winter on forest resources such as soil, water, vegetation, fish and wildlife, forest visitors, and cultural and historic resources." The results of this monitoring will help identify if there are problems in the "shoulder" seasons when there is higher risk of damage, and will help determine if management action is needed. This monitoring has not been occurring on a systematic basis. In FY11, the whole recreation monitoring program was reviewed and recommendations made for areas of improvement. Protocols were established and a database for tracking the OHV monitoring was developed. This monitoring will start in fiscal year 2012. It will take a few years of monitoring to evaluate the need for management action.

Sustainability

This section addresses topics in Table 4-02 of the Forest Plan. This year's report considers the two annual items, restocking success and insect and disease levels.

Are lands adequately restocked following harvest?

Within five years following regeneration harvests such as clearcut, shelterwood seed cut, single tree or group selection cut, we must certify that we expect an adequate number of seedlings to be established to restock the stand.

Usually about three years after harvest, a field survey is conducted by Forest staff. Surveyors establish several sample plots and make visual observations as they walk throughout the area to see if desirable seedling species are present. In 2011, 727 acres were surveyed and all were certified as having adequate stocking.

Typically, our temperate climate ensures adequate restocking after regeneration harvests. Some portions of stands that are very wet, or areas with summer skid trails, may take longer to regenerate; however, these areas are usually a minor part of any harvested area, so the overall stand qualifies as being adequately restocked. Over the past five years, all stands have been certified as adequately restocked within 3-5 years of harvest.

To what extent have destructive insects and disease organisms increased?

Monitoring destructive insects and disease organisms is required annually to track trends and identify concerns as early as possible. The results can be used to determine when management action may be appropriate to control an outbreak.

The Forest Health Protection Office of the State and Private Forestry branch of the Forest Service, in Durham, New Hampshire, conducts an aerial detection survey over the

WMNF annually. The 2011 survey detected more defoliation than in 2010, but much less than in 2009. There were more than ten areas of defoliation on the Forest in New Hampshire and Maine, affecting a total of about 1130 acres. About 900 acres of the defoliation (79%) occurred in northern red oak and was caused by oak leaftier. The remaining defoliation was from balsam wooly adelgid. Spruce beetle, white pine blister rust, and wind caused mortality on nearly 100 acres in five locations on the Forest.

Objective Attainment

Lands

Forest Plan, Page 1-7

Develop and accomplish a land corner and property line maintenance program to ensure high visibility of property lines to prevent encroachments and the need for costly resurveys.

In recent years, efforts have been made to increase property line maintenance. High quality paint in the best of conditions will remain highly visible for no more than twenty years; therefore it is necessary to maintain lines on a 10-15 year schedule. With roughly 700 miles of boundary line on the Forest, we should be maintaining 47-70 miles annually to ensure high visibility and avoid the need to resurvey. If tracts along the Appalachian Trail outside the proclamation boundary are included, there are about 1200 miles of boundary line, which would require that 80-120 miles be maintained annually.

Funded boundary line maintenance activities over the previous 10 years averaged less than 15 miles per year. In FY11 our funded target was 20 miles; we maintained 21 miles of boundary line to standard. Recent efforts have increased results, but we are still falling substantially short of the mileage needed to meet this objective due to limited funding and other priority work in the lands program.

Forest Plan, Page 1-7

Mark property lines on newly acquired tracts within a two-year period after the date of acquisition, or sooner if funds are available.

Most lands acquired since the Forest Plan was revised have been marked and posted within a two year period. On rare occasion, land is acquired using a survey that is not paid for by the White Mountain National Forest. In these instances, marking property lines can require resurveying the tract to ensure that marking and posting is accurate. Because of the added cost, some of these tracts are not marked within two years of acquisition.

Boundary line of recent acquisition in Chatham, NH. WMNF photo by James Detzel.

Recreation

Forest Plan, Page 1-13

The Forest Service will emphasize concentrating use at specific sites or locations rather than dispersing use within the area or to other areas.

As one of the few large, contiguous tracts of publicly owned forest in New England, the White Mountain National Forest is an extremely popular destination for hikers and backpackers. Contained within its roughly 800,000 acres are breathtaking alpine vistas, lush forest canopy, and numerous opportunities to observe wildlife or water features. At any point in time, especially during a bluebird summer day, there are also a lot of people recreating in the backcountry. While we understand that many people take to the woods to find some degree of solitude, it is also important to provide access to these public lands to the myriad visitors who want to experience the backcountry. This objective is an attempt to provide the best of both worlds: unlimited access to many visitors while preserving areas of remote, seldom visited forest.

There are many thousands of acres in which visitors can hike and camp wherever they please. These unrestricted areas tend to be seldom visited, and therefore less in danger of resource degradation from the trampling of thousands of feet. In other, more highly visited areas, the Forest has restricted camping opportunities in order to concentrate use and preserve the resources that draw the people in. The primary management strategy is to restrict camping to specific shelters or tent sites in extremely popular or fragile areas. We work closely with a number of partners to provide these camping opportunities to the public. In 2011, investments in shelter and tent site maintenance and upgrades were completed on the Gentian, Garfield, Sawyer Pond, Camp Penacook and Flat Mountain Pond shelters.

Forest Plan, Page 1-13

The Forest Service and partner organizations will collaborate to provide recreational opportunities, conservation education, and visitor information programs.

One of the strengths of the White Mountain National Forest is the number of partners we work with and the collaboration that occurs to provide recreational opportunities, conservation education, and visitor information. The celebration of the Weeks Act Centennial in 2011 gave us ample opportunities to share the history of conservation, as well as New England's role in passing one of the most important pieces of American conservation legislation with our public. The wide-spread interest in the Centennial and the involvement of so many varied organizations shows that we can do amazing things when we work together toward common goals. Moreover, it also allows us to continue the legacy of citizen engagement and dialogue in managing our public lands.

A new partnership with the National Park Service and their "teacher-ranger-teacher" program started in 2011. This innovative program links the National Forest or National Park unit with local teachers who work as rangers for the summer giving programs, staffing visitor center desks, developing curriculum-based materials, and taking on special projects. They spend part of their school year presenting programs to students, teachers, and schools about the Appalachian National Scenic Trail and the White Mountain National Forest.

Jen Moulton, the WMNF's first 'Teacher-Ranger-Teacher'. Photo courtesy of Nancy Propfe.

Forest Plan, Page 1-14

The winter motorized trail system will be managed cooperatively with the states of New Hampshire and Maine.

This year, Forest personnel attended the New Hampshire Trailmaster's meeting, a gathering of trail clubs who maintain the snowmobile trail system in the state. At that meeting, we held break out sessions with interested folks to inform them about the Forest Service, trail standards for trails on the Forest, and the environmental analysis process for proposed trail changes. This year we also updated the Memorandum of Understanding (MOU) we have with the State of New Hampshire. This MOU spells out our cooperative relationship and how we will manage the snowmobile trails that are located on the national forest and are integral to the statewide system. The MOU with the State of Maine will be updated in FY 12.

Transportation

Forest Plan, Page 1-17

Construct only those roads necessary to meet the management objectives of the Forest Plan.

Decommission all classified and unclassified roads not necessary to meet the management objectives of the Forest Plan as funding is available.

These objectives highlight the agency and Forest goal of having a Forest Road system that allows sustainable access for land management and safe access to the public for use and enjoyment of NFS lands. To help achieve this goal, the agency established the travel analysis process. A roads analysis completed in conjunction with Forest Plan revision addressed public roads subject to the National Highway Transportation Safety Act. It did

not evaluate concerns or make recommendations related to Forest Roads with an objective maintenance level of two or below. Instead the stated intent was to use project level roads analyses to determine the final disposition of maintenance level 1 and 2 roads and unclassified roads.

In FY11, the WMNF reviewed and refined our project-level travel analysis process. A site-specific travel analysis is developed by an interdisciplinary team of resource specialists. It assesses the current Forest transportation system in a project area, identifies issues, and assesses any benefits, problems, and risks associated with the current system. Based on that information, the team identifies possible changes, making recommendations regarding road construction, reconstruction, maintenance, and decommissioning. The final report identifies the minimum transportation system necessary to meet immediate and projected long-term resource management and public needs and the work needed to attain that system. The Forest has been conducting these analyses for many years. The review in FY11 identified several ways in which documentation of a site-specific travel analysis could be improved and established a report template that will be used and refined during future projects.

The transportation system needs and associated work identified through the site-specific travel analysis process often form the basis for proposed actions for a project in the area. A project-level travel analysis helps a decision maker ensure their decision will achieve Forest Plan objectives, constructing only those roads needed to meet the Forest's management objectives or decommissioning those that are no longer necessary to meet management objectives.

Table 2, in the Outputs and Services section above, shows that decisions to construct new roads have been limited, which is consistent with Forest Plan transportation objectives and output estimates. While decommissioning of authorized roads (identified as classified in the Forest Plan) has been minimal, more than ten miles of unauthorized (unclassified) roads have been decommissioned in recent years.

Wildland Fire

Forest Plan, Page 1-20

Use prescribed fire and mechanical methods to treat approximately 80-300 acres annually to meet a wide range of Forest objectives.

Determining our success in achieving this objective requires three steps: tallying annual treatment acres, confirming that these methods have been used to meet a wide range of objectives, and consideration of how well these treatments have met those various resource objectives.

During FY11, 142 acres were treated with prescribed fire to meet Forest objectives. This is slightly above the ten year average of 122 acres. In addition, 59 acres were mowed or otherwise mechanically treated to accomplish similar objectives. Table 3 shows the acres treated with prescribed fire and mechanical methods over the past ten years. The way we tally mechanical treatments has not remained consistent over the years due to differing objectives and funding sources, so those acres are not as comparable across the years.

Table 3: Acres burned or mechanically treated under a prescription to meet forest objectives.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Prescribed Burn (acres)	127	103	180	120	122	120	159	101	44	142
Mechanical Treatment (acres)	25	--	--	55	14	112	77	195	57	59
Total Acres	152	103	180	175	136	232	236	296	101	201

The two most common resource management objectives for the prescribed burns and mechanical treatments were to maintain forest openings for wildlife habitat and to prepare sites for the restoration of oak and pine. Specific objectives in the FY11 prescribed burn plans were to:

a. Consume 85% of fine fuels and 60% of 10-hour fuels (common for most wildlife openings); or

b. Consume 50% or more of leaf litter and other surface fuels and girdle or top kill 60% or more of the understory vegetation (Moat burn plan); or

c. Burn to disturb site and create conditions for white pine seed germination (Camp 7 burn plan).

In order to measure success of these burns at meeting the identified objectives, the burn boss and other fire management staff perform periodic observational field trips to inspect burn units. Usually photographs are taken and filed, to be reviewed with pre-burn photographs and observations, and those collected as the site responds over time. This informal monitoring has shown we are meeting the identified broad objectives (e.g. maintenance of openings), but it is not detailed enough to address success at achieving specific objectives (e.g. consumption of 85% of fine fuels).

Pine Bend Site: Photo points show evidence of fuel consumption by documenting the view directly before and directly after burning on May 2, 2011. WMNF photos by John Neely.

FY11, the fire management team pilot tested the "WMNF Prescribed Fire Monitoring Form," which was used to capture burn boss notes related to the meeting of objectives. The form has space to record observations on the day of the burn -- before, during and directly after the fire.

For example, immediately following a prescribed fire, the burn boss can survey the entire unit and estimate the percentage of fine fuel consumption compared with what they

observed earlier in the day, prior to the burn. Similarly, 10-hour fuel reductions can be observed. This form is detachable from the burn plan file and can be stored and revisited during future monitoring efforts, which can also be recorded on the same form. Photo points can be stored with the form with locations and notes included. Site disturbance, establishment of certain species, and the eventual restoration of certain species will typically be revisited and recorded in subsequent reviews of a unit. The new form has the advantage of organizing observational field notes related to monitoring objectives throughout time. Maintaining and reviewing these data will likely help improve prescribed burn development for treatments to meet similar Forest objectives.

During the summer of 2011, the Right Angle unit (burned May, 2009) was examined for established regeneration red oak with evidence of dieback and re-growth; several red oaks were measured. The pre-burn height and diameter was estimated from burned stems, and new growth was measured for comparison. This monitoring showed a good post-fire response by red oak. New stems and sprouting had occurred in the two years since the treatment, indicating some success in meeting the objective of providing conditions for red oak regeneration. Pine seedlings are scattered in pockets in several areas of the unit.

Red oak seedlings re-sprouted with vigor. WMNF photo by John Neely

Using the prescribed burn monitoring form for the Right Angle unit showed that monitoring needs should be considered during the planning process so that measurements can be recorded prior to the burn, if appropriate. Similarly, specific protection objectives that are outlined during planning can be identified for follow-up monitoring. In FY11 and into FY12, the WMNF is working to improve the monitoring form and process, including determining when certain measurements should be recorded to better determine the success of each treatment in relation to specific objectives.

Standard and Guideline Implementation

Geologic and Mineral Resources

Forest Plan, Page 2-5, Mineral Materials (Common Variety)

S-2 Sites must be stabilized between periods of use.

S-3 Sites must be stabilized and, if needed, revegetated when closed.

In 2011 a review of all active and several inactive mineral materials sites was conducted. There are five active mineral material sites currently used for administrative purposes. These sites are:

- Bartlett Pit in Bartlett, NH
- Fifield Pit, York Pond Pit, and Pit at 2 Mile in Berlin, NH
- Bull Brook Pit in Batchelder's Grant, ME

Bartlett Pit.
WMNF photo by Roger Simmons.

All of the sites appeared to be stabilized. Several of the pits appear to have little useable material on hand, but they are being used to stockpile materials that may have been purchased from vendors. Only the York Pond pit has an operating plan.

Several inactive or closed mineral materials sites also were visited during the summer:

- Livermore Road Pit in Waterville Valley, NH
- Upper Sawyer River Road Pit in Livermore, NH
- Lower Sawyer River Road Pit in Harts Location, NH
- Rob Brook Road Pit in Albany, NH

Lower Sawyer River Road Pit.
WMNF photo by Roger Simmons.

The Livermore Road pit was in excellent condition. The other three pits appeared stable but needed additional vegetation to ensure there would not be a risk of erosion in the case of a large storm.

All of these pits were in the belt of highest precipitation during Tropical Storm Irene and should be reinspected.

Forest Plan, Page 2-5, Recreational Rock and Mineral Collecting

S-1 The collection of mineral specimens for personal use is allowed without a permit, as long as there is no surface disturbance, except within officially designated fee collecting areas, closure areas, and other restricted areas.

Recreational collecting at the Moat Mountain Smokey Quartz site continues to create surface disturbance, exceeding this standard. The FY10 Monitoring Report acknowledged that budgets would not allow designation of this area as a permitted collecting area and stated that site visits to inform collectors about the rules and monitor impacts would continue. Patrols of the area by Forest personnel and Forest Service law enforcement were reduced in 2011 due to budget reductions and staffing shortfalls.

Lands

Forest Plan, Page 2-9, Survey/Landline/Title Claims

S-1 Boundaries shall be surveyed, marked, and posted prior to implementing land-disturbing activities adjacent to Wilderness or private lands.

Most land-disturbing activities that need boundary marking are vegetation management actions such as timber harvest and prescribed fire. Staffing and funding limitations require that boundary line maintenance needs be planned well in advance to prevent land-disturbing activities adjacent to unmarked wilderness or private boundaries. To ensure this occurs, foresters reviewing future project areas to determine which stands may be suitable for vegetation management activities also look at nearby boundaries. If the boundary markings are not readily visible and harvest or burning may be considered, the need for boundary line maintenance is identified. Every year, members of the lands and forestry staffs meet to discuss identified boundary maintenance or survey needs. As a result, boundary work is identified and planned far enough in advance to ensure this standard is met.

Recently marked boundary line. WMNF photo by James Detzel.

Non-Native Invasive Species

Forest Plan, Page 2-12

G-1 Roadside clearing widths should be minimized (without compromising safety standards) to retain shade for invasive plant suppression.

G-2 If non-native invasive plants are present, roadside maintenance operations should be scheduled to minimize spread into new areas (e.g., prior to seed set).

These guidelines would be important aspects of NNIS control if roads in the WMNF were heavily infested. Fortunately the level of infestation on the WMNF is relatively low when compared with surrounding areas to the south and west of the Forest. Instead of specifying a maximum road clearing width to retain shade (which is not helpful with many of the shade tolerant NNIS that occur on the WMNF) or attempting to time road maintenance to minimize spread, an alternative approach of early reporting, temporary avoidance, and rapid treatment has been developed to meet the intent of these guidelines: controlling NNIS plants along roadsides.

The WMNF has provided its field going and other critical staff with training on the identification and reporting of commonly occurring non-native invasive plant species. Permanent and seasonal crews responsible for road maintenance activities have received extensive training in identification, reporting, and the methods required to minimize the spread of NNIS. The result has been a highly efficient early detection and rapid response system on the Forest.

The level of training and expertise found in the road maintenance crew has allowed the WMNF to rely on the discretion of those staff members to report infestations to the Forest Botanist as observed. This reporting typically occurs at the moment of observation

(via radio) or by day's end (via phone or e-mail). Under the 2007 Forest-wide Invasive Plant Control decision, these newly reported infestations can be assessed and controlled immediately, often the next day. Once reported, newly discovered infestations are avoided during roadside maintenance or mowing activities until control measures can be implemented or at the very least until the infestation can be assessed and mitigation measures applied. By applying these guidelines and measures, we ensure invasive species will not be spread into new areas.

This Early Detection Rapid Response System has been in place for the past six years and the continued low level of infestation along roadways managed by the Forest Service attests to the success of this approach in preventing the spread of invasive species.

Rare and Unique Features

Forest Plan, Page 2-13

S-2 Unless conservation approaches have already been developed for a species, individual site prescriptions must be developed for each identified TES plant species occurrence to provide specific habitat conservation actions for those plant species. Individual site prescriptions must similarly be developed for all fixed TES wildlife habitat features (e.g., den sites, nest sites, or other features necessary for the reproductive success of the animal). Until conservation approaches or specific site prescriptions are developed, new management actions that would negatively alter habitat conditions necessary to support the species must not be allowed within 100 feet of the plant(s) or within one quarter mile of the wildlife habitat feature(s).

This Forest Plan standard requires that all Regional Forester sensitive plant species (RFSS) without existing species-level conservation approaches have specific site prescriptions developed in order to prevent negative impacts resulting from ground-disturbing activities. Only ten of the 57 RFSS plants occurring on the Forest have species level conservation approaches in place. These are the result of the publication of Conservation and Research Plans at the regional level by the New England Wild Flower Society. Twenty-five additional RFSS, mostly alpine species, have species conservation approaches in development at the Forest level. Conservation approaches for alpine species are being developed collectively. Any perceived or actual threats would likely affect all species equally with only subtle variations in the risk or degree of impact.

For the remaining species, individual site prescriptions are required when project activities have the potential to negatively impact species or habitat conditions. Most site prescriptions involve avoidance via buffering or the creation of reserves around plant occurrences.

Physical protection through avoidance is not the only type of prescription that can be applied. The only extant occurrence of Bailey's sedge (*Carex baileyi*) known on the Forest occurs in a rarely used Forest Service road on the Pemigewassett Ranger District. This population occupies moist ground in full shade and occurs directly in the overgrown roadbed. The population is small, consisting of only a handful of reproductive individuals. The current site conditions are marginal and the habitat is likely too shady to support a viable population in the long term.

Bailey's sedge (Carex baileyi). USDA NRCS photo by Robert Mohlenbrock.

This road is proposed for use as a haul road for timber harvest activities as part of an upcoming integrated resource project. The road was originally proposed to be used as a three season truck road. This proposed use coupled with the presence of the RFSS plant triggered the development of a site-specific prescription under this standard. Truck and heavy equipment traffic would likely have a negative impact on the Bailey's sedge population if conducted over non-frozen ground. A specific site prescription was developed that allowed truck hauling only in winter after the road is adequately frozen. Pre-haul maintenance, brushing, and the removal of trees in and along the roadbed will increase sunlight penetration. This increase in sunlight will improve habitat suitability for the Bailey's sedge. Seed was collected to ensure that an adequate seed source will exist following project implementation. The site prescription for this rare plant supports the timber management aspect of the integrated project while simultaneously seeking to improve habitat and population conditions for Bailey's sedge by removing competing vegetation and reducing canopy cover over the population.

Recreation

Forest Plan, Page 2-23, Special Uses – Recreation Specific

S-4 Recreation special uses must not be dispersed from high-use to low-use areas, as identified in the current Trail Use Inventory. (p. 2-23).

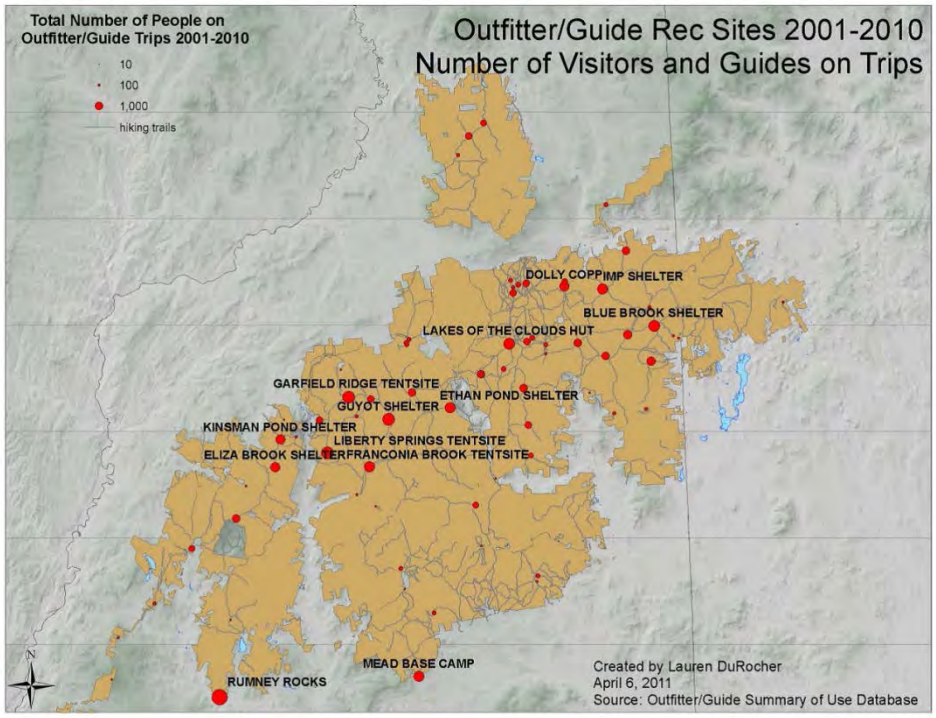
All outfitters and guides who charge visitors a fee for a service they provide on the Forest are required to obtain a special use permit. The number of outfitters/guides operating on the WMNF has stayed between 150 and 165 permit holders over the past decade. As required by the permit, they submit a summary of when and where their trips took place each year. In 2011 the outfitter/guide use data was analyzed to look at where and how much backcountry use is attributed to outfitters and guides.

Outfitter/Guide Use of Recreation Sites

On the summary of use forms, outfitters and guides report which recreation sites, particularly overnight camping spots, they visited. Using this information, the total number of people (clients and leaders) on trips from 2001-2010 was summed by recreation sites.

In Figure 1, recreation sites are shown with their relative use. The sites with the most use are labeled on the map. Generally, the sites listed are known to be popular areas on the Forest. Blue Brook shelter no longer exists and is now a tentsite area, which could change the amount of outfitter/guide use in the future. Another noteworthy area is the Rumney Rocks climbing area. It receives by far the most use by outfitter/guide groups of any recreation site. Annually there are between 120,000 and 200,000 people visiting all recreation sites on outfitter/guide trips.

Figure 1.



Outfitter/Guide Use of Trail

The trails that are used during outfitter/guide trips are also recorded on the summary of use forms. Using this information, the total number of people (clients and leaders) on trips from 2001-2010 was summed by trail. This includes all types of trail use such as hiking, mountaineering, cross country skiing and snowmobiling. The numbers were broken into ten classifications based on the natural breaks of the data. The trails with the most use are labeled on Figure 2. The trails listed are not particularly surprising and are generally recognized as higher use trails on the Forest.

The analysis of the outfitter and guide data indicates that use is not generally being dispersed from high use to low use areas, although it was noted that there are a few discrepancies with the trail use level designations. It appears from both trail register data and the outfitter/guide data that some of the initial classifications may be incorrect. Particular trails that need to be re-examined based on the outfitter/guide data include Kinsman Ridge (currently listed as low use), Bondcliff trail, and the Wilderness trail. A closer look at the historic use of these trails will be necessary to determine if they were misclassified or we have in fact moved use to a low use area.

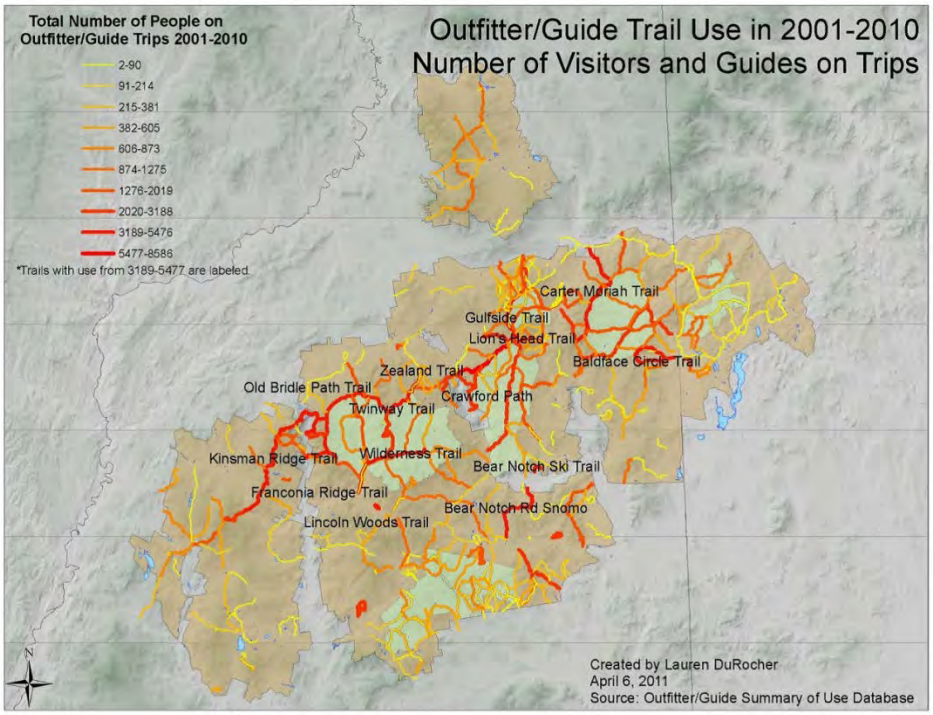


Figure 2.

Water Resources

Forest Plan, Page 2-30 to 2-31, Soil and Water Conservation Practices

S-2 Water quality must be maintained and protected, except that some discharges may be allowed if they are of limited extent and duration and result in no more than temporary and short term changes in water quality. Such activities shall not permanently degrade water quality or result at any time in water quality lower than that necessary to protect the existing and designated uses. Such temporary and short term degradation is only allowed when all practical and appropriate Soil and Water Conservation Practices are used to reduce impacts to water quality.

S-3 Effective, proven methods (e.g., silt fencing) to reduce concentrated runoff and erosion from construction activities must be used.

S-4 Where used, sediment traps must be maintained until disturbed sites and/or cut and fill slopes are stabilized.

G-2 To minimize turbidity where construction activity occurs in intermittent or perennial watercourses, such activity should be isolated from the streamflow or carried out during low flow periods.

The Forest hydrologist evaluated the successful implementation of standards and guidelines related to Soil and Water Conservation Practices for several types of projects in 2011. To address Soil and Water Conservation Practices S-2, the assessment focused on ground-disturbing activities near water that have the potential to affect water quality. Across all project types, best management practices (BMPs) for erosion control were consistently implemented and maintained. This summary provides a discussion of projects by type.

Timber sales

Field review of the Upper Ammonoosuc Timber Sale. WMNF photo by Sheela Johnson.

Interdisciplinary team members observed portions of the Upper Ammonoosuc and Rattle River timber sales in March 2011 during operation. The Forest hydrologist observed the Fish Hook Landing sale in July 2011 after close out. For all projects, BMPs prevented runoff from landings from reaching streams. Part of a landing in the Rattle River sale (analyzed prior to the 2005 Forest Plan) was located just within 100 feet of a stream, but the slope of this landing caused all runoff to move away from the stream. All other landings were over 100 feet from water bodies. At bridge, culvert, and pole ford crossings on skid trails, no sediment entered the water from banks or riparian areas. Soil and water conservation practices included appropriate designs and slash or snow covered approaches. A trace amount of sediment was deposited on top of one pole ford, but would not be sufficient to impair water quality if it entered the water during close out. On the Fish Hook Landing sale, approaches to a temporary bridge site were properly closed out with water bars, seeding, and mulch to prevent erosion and runoff into a brook. On all sales, skid trails sufficiently used water bars, slash and seeding, to prevent sedimentation in water bodies.

Construction and recreation projects

Soil and water conservation practices were also observed during the construction of three bridges in the Gale River watershed, a parking area and trail at Rumney Rocks, and a downhill ski trail at Loon Mountain ski resort. All sites had soil and water conservation practices in place, and no areas of active sedimentation or increased turbidity were observed. The Gale River bridge and Rumney Rocks projects contained well-maintained hay bales, silt fences, or rocked drainages downstream from disturbed areas. See “Project Reviews” section below for more information on the Loon Mountain project.

Best management practices in place on the Bend Brook project. WMNF photo by Sheela Johnson.

Two culvert replacements on Bog Dam Loop road were monitored, one in progress and one that was completed in 2010. These projects are intended for long-term improvement of aquatic habitat, but necessitate work in stream beds. The active project on Bend Brook used silt fence and hay bales to prevent sediment from reaching streams. Activity was isolated from stream flow using dewatering pumps and bypass pipes. Turbidity values during excavation increased slightly from 0 NTU (nephelometric turbidity units) upstream to 0.5 NTU immediately below the bypass culvert, but returned to 0 NTU 100 feet downstream from the project. This increase in turbidity is almost undetectable, and is of the limited extent and duration allowable under the Forest Plan and State water quality regulations. Slopes adjacent to the project completed in 2010 were revegetating, though silt fence and hay bales remained in place as additional measures.

Wildland Fire

Forest Plan, Page 2-33

G-4 Best available smoke management practices should be used to assure that prescribed fire will not result in adverse effects on public health and safety, or visibility in Class I airsheds.

There are currently two primary methods of monitoring smoke for prescribed fires: visual photographic documentation and monitoring particulate matter in the atmosphere near the prescribed fire. The WMNF has access to portable smoke monitoring equipment that contains a nephelometer, which measures light scatter. This equipment was set up downwind during one prescribed fire on the Forest in 2011. Unfortunately the instrument did not operate correctly and needed to be sent to the manufacturer for recalibration. Photographic documentation was accomplished this year for two prescribed fires on the WMNF.

The proximity of a prescribed fire in Crawford Notch to the Class I Presidential Range-Dry River Wilderness Area was identified as a potential air quality/visibility concern. The burn plan for this fire recognized that smoke should not go toward the wilderness area. The prescription for conditions on burn day included a mixing height around 1650 feet and prevailing winds that would allow for dispersal sufficient to carry smoke out of the area. During the prescribed burn, the burn boss adjusted firing patterns to include backing fire to maximize fuel consumption and minimize smoke emissions. Multiple photos taken during the prescribed burn documented that these techniques worked and prevailing winds took the smoke away from the Wilderness area.

This photo of smoke rising from a WMNF prescribed fire in Gilead, Maine, shows that conditions were appropriate to allow the smoke to rise into the atmosphere, avoiding potential adverse effects to public health, safety, and visibility. The photo looks southerly, with Route 2 in the foreground.

WMNF photo by Ralph Perron.

Wildlife

Forest Plan, Page 2-35, Wildlife Reserve Trees

S-1 When harvest reduces the basal area of a stand below thirty square feet per acre, uncut patches totaling five percent of the harvested area must be retained, with each at least one quarter acre in size.

G-1 Uncut patches retained under S-1 should be located to encompass as many wildlife trees, snags greater than or equal to nine inches DBH, other trees with cavities or broken tops, and bear-clawed beech as possible. A wildlife tree or snag greater than eighteen inch DBH may be used as a nucleus. In areas lacking suitable cavity trees and snags, trees of the largest available diameters with defects likely to lead to cavity formation should be retained.

Standards and guidelines for reserve trees were originally added to the Forest Plan for the Indiana bat via a Forest Plan amendment in 2000 and simplified during Forest Plan revision. This direction is designed to assure that structural components such as snags and cavity trees are maintained on the landscape during timber harvest. They are especially important when even-aged regeneration treatments, such as clearcuts, are implemented because: 1) they serve as a mechanism to conserve these habitat features when most trees are removed; and 2) clearcuts may increase and improve foraging habitat for woodland bats, other small mammals, and birds, and retaining snags and cavity trees may provide roosting, nesting, perching, or denning habitat in close proximity to foraging habitat.

To evaluate how well these standards and guidelines have been implemented, WMNF biologists instituted a new monitoring protocol in 2011. A total of 20 clearcuts at least 10 acres in size and harvested within the previous 10 years were surveyed. Each clearcut was examined to determine if an appropriate area had been reserved from harvest and if the reserve areas contained wildlife trees[1], snags $\geq$ 9" dbh, trees with cavities or broken tops, and bear-clawed beech, as described in G-1.

Of the 20 clearcuts surveyed, all of them had reserve areas greater than the minimum area required. Seven clearcuts (35%) had at least three of the habitat components in every reserve area within a single harvest unit. Another 10 (50%) had at least three of the components but perhaps not in every reserve area within the unit. One-fourth of the reserve areas reported 'many throughout' for one or more of the components. The least abundant component identified was bear-clawed beech, but this is not surprising as it is a much less common feature on the landscape.

Recognizing that not all clearcut units have the desired reserve tree components even prior to harvest, the 2011 survey sample seems surprisingly good. However, simply counting the number of habitat components only provides a piece of the puzzle. To better understand the overall context and arrangement of these features in the unit specifically as they relate to woodland bat roosting habitat, surveyors were asked to rate the quality of the reserve areas in each clearcut (see Table 4) based on the following definitions:

Excellent = multiple wildlife trees present; many large snags or trees with cavities/defects

Medium = some characteristics present, but trees are relatively small or with few defects

Low = only a few characteristics present, few trees appear to be suitable as roosting habitat

Poor = few or no characteristics present; reserve areas do not appear to provide roosting habitat.

Table 4. Number of clearcuts by bat roosting habitat quality.

EXCELLENT	12 (60%)
MEDIUM	5 (25%)
LOW	3 (15%)
POOR	0

[1] Wildlife tree = a live tree >18" dbh with 2 or more main defects that can be used as cavities. In aspen and paper birch communities, the dbh should be $\geq$ 14".

Although the rating was somewhat subjective, it is encouraging that no unit was marked 'Poor'. Conversely, the fact that 85% of the units were considered 'Medium' or 'Excellent' demonstrates that timber sale markers are doing a good job of identifying quality wildlife habitat features to reserve during timber sale layout and that these are being protected during harvest operations.

Effects of Management Practices

Heritage Resources

An historic building foundation was identified in a forested area proposed for prescribed burning. Protection of this cultural resource was incorporated into the prescription for the Right Angle Burn. On the day of the burn, firefighters cleared all burnable materials within about 50 feet of the edges of the foundation, creating a fireline to protect the foundation. The area was then treated with water to prevent burning. Burning was done very slowly at the edge of the fireline to strengthen it and create a buffer to further protect the historic site when the rest of the stand was burned.

The foundation was photographed before (left), directly after (right), and two years after the prescribed burn. This monitoring documented the successful protection of this cultural resource while implementing a prescribed burn in the surrounding stand.

WMNF photos by John Neely.

Water Resources

Effects of recreation on water quality

Forest staff monitor water bodies near a number of recreation sites each year to determine whether recreation use is impacting water quality. A few sites are selected to represent different types of recreational use, and water samples are taken upstream and downstream of the site when possible. The sites monitored in 2011 included Jigger Johnson, Passaconaway, and Waterville Valley Campgrounds, Waterville Valley ski area, Diana's Baths recreation area, and Tripoli Road dispersed camping area.

Turbidity was at or near the lower detection limit at all sites, indicating that activities at these sites are not contributing to suspended sediment during typical flow conditions.

Conductivity is a measure of charged particles in the water, and values greater than 100 µS may indicate pollution due to road salt, septic systems, or other chemicals. Conductivity values were below 100 µS at all sites. Nutrient concentrations, including nitrate, ammonia, and phosphorus, were comparable to reference sites on the WMNF for all sites.

E. coli bacteria counts are indicators of contamination by human and animal waste. The applicable New Hampshire State standard for Class B waters is less than 406 counts/100 mL in a single sample or 126 counts/100 mL geometric mean value. In the Tripoli Road dispersed camping area, *E. coli* counts exceeded the Class B standard at one site for one date. All other sites were below this threshold. None of the sites exceeded the standard for geometric mean over the sample period. The higher value along the Tripoli Road occurred below a riparian campsite on Tripoli Road. The Forest is currently analyzing a proposal that would reduce streamside impacts and improve sanitation in this area.

Effects of timber harvest on water quality

The water monitoring program includes pre- and post-harvest monitoring in selected vegetation management project areas. Recently, the Forest has focused monitoring in the Stevens Brook, Wild Ammonoosuc and Swift River watersheds in New Hampshire and the Crooked River watershed in Maine. Pre-harvest data collection is underway in most watersheds. Post-harvest monitoring results are provided in this annual report as harvest occurs.

As part of the Stevens Brook project, the harvest occurred in the watersheds of Stevens Brook and an unnamed tributary in 2010 and 2011. Preliminary post-harvest data are available for this partially completed project. A pre- and post-harvest comparison is presented in Table 5.

Stevens Brook had approximately 7.4 percent (159 acres) of the watershed harvested by the end of the monitoring period, while Stevens Unnamed Brook had less than 2 percent (6.4 acres) harvested. Neither brook had detectable turbidity on any date. Both pH and total aluminum (total Al) met State standards before and after harvest. Inorganic monomeric aluminum is a form of aluminum that can be harmful to aquatic life at concentrations above approximately 100 ppb. Concentrations at these sites were very low before harvest and increased only slightly in both watersheds, remaining well below detrimental levels. Nitrate also increased slightly in both watersheds, but was below the median value for streams on the National Forest and far below the State maximum contaminant level for drinking water (10 ppm). Based on the magnitude of the change and the fact that the less harvested watershed exhibited a greater degree of change, timber

harvest appeared to have little, if any, effect on water chemistry. Seasonal variation, precipitation events, and measurement uncertainty can also contribute to differences in these values.

Table 5. Average values before and after harvest with minimal harvest in the watersheds.

	Turbidity (NTU)	pH	Total Al (ppb)	Inorganic monomeric Al (ppb)	Nitrate (as nitrogen) (ppm)
Stevens Brook at Buffalo Rd					
Pre (5 samples)	0.0	6.5	61	4	0.00
Post (4 samples)	0.0	6.6	61	5	0.01
Stevens Unnamed Brook					
Pre (5 samples)	0.0	6.7	37	4	0.00
Post (4 samples)	0.0	6.6	50	11	0.01

Project Reviews

Loon Mountain Expansion

Construction of new downhill ski trails on South Peak of Loon Mountain Ski Resort was monitored regularly throughout construction to ensure best management practices were being implemented and to gauge the effectiveness of those practices. The Forest has been working with Loon Mountain to ensure the construction of the new trails is done as described in the Loon Mountain Environmental Impact Statement. Each monitoring trip showed that drainage structures were located and constructed to standard, seeding and mulching occurred immediately following construction as required, and straw bales were used as sediment filters where appropriate. Large water bars draining onto well-vegetated ground prevented soil from entering water bodies. All applicable soil and water conservation practices were maintained through project completion, at which point field review showed that all disturbed areas were beginning to revegetate. See the Tropical Storm Irene section below for more detail.

Straw mulch, grass and water bars to prevent erosion on trails 41&42 South Peak, Loon Mountain. WMNF photo by Andy Colter.

Snow's Mountain Trail Drainage Improvement

Many of the nordic skiing trails at the Waterville Valley Ski Resort also are used for mountain biking in the summer. A couple years ago, it was noted that a combination of poor drainage and mountain biking were resulting in resource concerns on the Snow's

Mountain Trail. The trail was closed to mountain biking until the drainage system could be upgraded to handle summer use.

Snow's Mountain Trail in June 2010. WMNF photo by Tom Paquette.

In FY11, hydrology, soil, and recreation specialists visited the site to look at existing drainage structures and provide recommendations for corrective actions. Many of the existing culverts were undersized, not properly located or installed deep enough, or had been shifted by frost or by the snow groomer. These problems resulted in water on the trail tread and saturated soils. This created a situation where mountain bike tires were rutting the trail, which led to the trail closure.

Based on input from the resource specialists, work began to repair the trail drainage system. New larger culverts were installed, ditches and waterbars were repaired or maintained, a minor relocation was completed, and altered areas were reseeded. Implementation monitoring showed that all work was consistent with guidance from resource specialists and identified best management practices were used.

Work was halted when Tropical Storm Irene moved through the area and the resort's priorities shifted elsewhere. Completed work on the Snow's Mountain Trail was not affected by the storm, even though the Waterville Valley area sustained heavy damage, so the new and repaired structures appear to be effective. Work on this trail should be completed in 2012.

Tropical Storm Irene

Background

On August 28, 2011, Tropical Storm Irene arrived in New England. The Forest had braced itself for hurricane winds, but it was water that came with a vengeance. The storm brought less than an inch of rain to some areas; to others it brought more than 10 inches within a couple hours. Three nearby USGS rain gauges showed that the discharge of water at these sites was above the 100 year flood estimate.

In areas that received heavy rains, streams swelled. The massive movement of water carried with it woody debris and sediment, rolling boulders downstream, carving out wider banks, and "jumping" streambanks to find new routes. Rocks, logs, and soil caught up in the high waters created debris jams, clogged culverts, and backed up behind bridges, causing bridges to fail, rivers to divert, and flooding in areas that are normally high and dry. Streams suddenly flowed down adjacent roads and trails, washing away soil, destroying pavement, and leaving piles of debris where hikers, vehicles, and campers used to go. Bridge abutments were exposed and undermined, leaving potentially unstable and unsafe crossings.

In some places, just the intensity of the rain caused extensive erosion. Roads and trails were washed away, leaving behind gaping holes in the path. Erosion in rock staircases along trails loosened stones and created instability for hikers. Trail tread and road prisms slumped and sinkholes appeared. Whole sections of roads and trails just gave way to the massive flow of water.

Tunnel Brook Road after the brook was back in its banks. WMNF photo by Chris Mattrick.

Perhaps some of the most dramatic changes were to the river beds themselves. The massive amounts of water moved boulders, gravel, sediment, and debris. This shift of materials created new pools, changing and creating fish habitat. Stream channels were built up by the deposition of gravel and sediment, and are now literally higher in elevation than adjacent lands, trails, or roads. Streams are wider or in a new alignment in some places. Many bridges and culverts that remained in place just don't "fit" like they did before because conditions around them have changed.

The Forest Service dedicated a lot of time in September to assessing the damage on the ground, focusing primarily on impacts to roads, trails, and campgrounds. Approximately $10 million of damage was sustained to the Forest's infrastructure. The emphasis in FY11 was on ensuring employee and visitor safety and determining which areas could be stabilized or fixed quickly and which would require more time to identify and implement the most appropriate solution.

Initial Observations

The amount of water an area received obviously influenced where damage occurred, and impacts were greatest close to streams and rivers, which collected rainwater from across their watershed. With that context in mind, which sites or resources were affected can tell us a lot about the effects of management and the importance of Forest Plan standards and guidelines and other best management practices.

Alpine Ski Areas

Alpine ski areas on National Forest lands withstood the storm's high waters well. There was trenching along the inside ditchline of work roads at each area and some culverts were plugged or undersized, resulting in minor damage to roads and trails. However there were no large drainage or slope failures, even on the steepest ski slopes. It is clear that use of best management practices when roads and trails were developed minimized damage from this storm.

New construction on 16 acres of National Forest land on South Mountain at Loon Mountain Resort was completed and seeded the week before Tropical Storm Irene hit, so there was very little time for vegetation to become established on these steep slopes. Given the freshness of the construction, the impacts of Irene were surprisingly small.

One waterbar blew out as a result of the rain waters. That single failure created a cascading situation that affected four or five waterbars below it and caused some gullying of the new trail surface. There were also a couple of small places where the lower trail

edge slumped slightly. All totaled, roughly one-quarter of an acre of the 16 acre project area was negatively affected by storm waters. Proper application of the design standards, best management practices, and other mitigation measures outlined in the EIS prevented the damage from being considerably worse. Repairs began almost immediately.

Newly constructed trail at Loon Mountain, undamaged after T.S. Irene. WMNF photo by Joe Gill.

Single failed waterbar on newly constructed trail at Loon Mountain. WMNF photo by Joe Gill.

Parts of the Brookway Trail/Road were eroded when Boyle Brook and its tributaries jumped their banks and high waters were funneled through a steep-sided, narrow area adjacent to Boyle Brook. The large waterbars on other slopes and roads across the resort successfully withstood Tropical Storm Irene and preserved the condition of the roads and trails on the mountain in good form.

Nordic Ski Areas

Nordic ski trails on and off National Forest lands received more damage because they are closer to streams. Nordic areas had bridges washed from abutments, culverts overtopped or washed out, and sections of trail tread surface removed. The initial damage assessment determined that many of the bridges were too short and culverts too narrow to allow passage of the water and debris associated with flood events. Most of these structures were put in place before there were requirements that they allow passage of bankfull flows. Where culverts were recently replaced (see Project Reviews section above), they functioned properly and were undamaged by the storm.

Kilkenny Snowmobile Trail

In 2010, work on the Kilkenny Snowmobile trail (Corridor 11) was completed to address the narrowing trail width, numerous standing dead trees, bridge design and condition issues, and poor drainage that created rider safety, erosion, maintenance, and quality of experience concerns. This work included:

- Tree removal and tread construction to widen the corridor to an average of 14’ with additional clearing for turns, installation of side ditching, and improved sight lines
- Construction and improvement of side ditches, cross drains, and drainage dips

- Replacement of 31 existing bridges, construction of 7 new bridges, and removal of 3 culverts
- Installation of new sign posts.

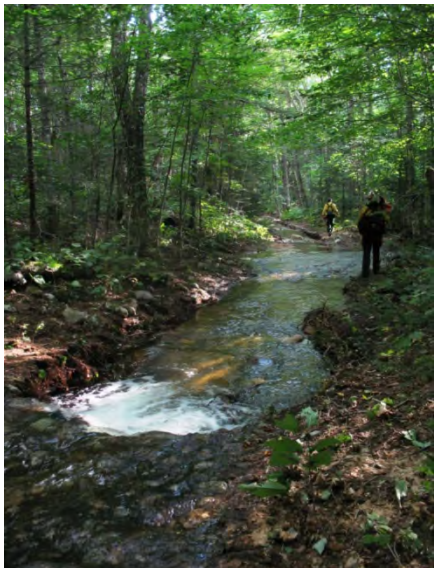
New bridge on Kilkenny Snowmobile Trail. WMNF photo by Jen Olmsted

In September 2011, following Tropical Storm Irene, the Kilkenny Snowmobile trail was evaluated for storm related damage. Along the length of the trail from Pond of Safety to South Pond Recreation area only one of the 38 bridges sustained any damage. This bridge was reset using local operators. All drainage features and side ditches established on the trail worked as designed. The tread of the trail was not washed out anywhere.

Based on the need stated above, it is clear that the work completed on the trail was done well and has been a success. Drainage structures established on the trail were successful during Tropical Storm. The resetting of only one of 38 total bridges is a major accomplishment given the high water flows seen throughout the area.

Stream-side Roads and Trails

It came as no surprise that some of the greatest damage occurred on trails and roads that are in floodplains. Historically roads were often built in valley bottoms, usually paralleling streams, because that is where the ground is flattest, where homes and towns occurred, and where construction was easiest. For both roads and trails, running adjacent to a river affords beautiful views and an enjoyable recreation experience. Tropical Storm Irene reminded us that there is a trade-off associated with these attractive, convenient locations.



Mad River flowing down the Greely Ponds Trail. WMNF photo

As mentioned previously, older bridges and culverts were often too small to allow flood waters and the debris they carried to flow downstream. Roads and trails that run near or adjacent to streams and rivers are susceptible to other impacts from floods. Rivers eroded and undermined their banks, causing trail and road tread to fall into the river and leaving an unstable slope in its place. Elsewhere streams overflowed or were diverted by debris jams and ended up flowing down roads and trails. In some of these spots, sediment deposits in the river have raised the riverbed so it is now higher in elevation than the adjacent road. High spring run-off or storm flows in coming years could cause the stream to move into the roadbed yet again. Where Tropical Storm Irene caused major damage to roads and trails near streams, the Forest Service is considering whether to repair, relocate, or decommission each route. The lessons of this storm will undoubtedly influence future decisions on where to build roads and trails and whether to relocate some of those that run through a floodplain.

Long-term Efforts

In FY12, damage assessments will continue as we explore trails and areas of the Forest that have not been seen since the storm. Our full-time employees, seasonal workforce, partners, and volunteers will repair many trails, roads, and recreation sites. Contracts for additional work will be awarded and analyses will occur to determine how to deal with some areas where the solution isn't obvious.

In 2012, the White Mountain National Forest was selected by the National Forest Foundation to participate in their Treasured Landscapes campaign. Through this campaign the NFF has committed to raising $1 million of private funds to assist restoration efforts on the WMNF.

As all of this occurs, the Forest Service will be monitoring. We will look at the impacts of the storm, the effectiveness of standards and guidelines in reducing damage, and the implementation and effectiveness of repairs. In coming years, this section of the Forest's monitoring report will discuss our findings.

In the meantime, people can help us by having patience, sharing our story with others, and getting directly involved in our restoration efforts (visit our website and NFF's site: http://www.fs.usda.gov/whitemountain and www.nationalforests.org.

Other Monitoring

Air Quality

The WMNF is working with the Northern Research Station and others to increase our understanding of the on-going effects of acid deposition on terrestrial and aquatic systems. This information will enhance our efforts to protect Air Quality Related Values, such as lichens and water quality, in Class 1 airsheds and resources across the Forest.

Lichens are among the most sensitive biological indicators for nitrogen and sulfur deposition in terrestrial ecosystems. In 2011, the WMNF began a lichen monitoring study. This study will accomplish several objectives:

- Establish permanent plots in forested environments for measuring diversity and abundance of lichens and bryophytes
- Provide a sound baseline for lichen and bryophyte diversity and abundance, as well as completing a chemical analysis of two lichen and two bryophyte species to evaluate their exposure to air pollutants and for comparison to future assessments to allow for long-term monitoring
- Revisit a selection of locations, and review lichen data collected by Clifford Wetmore in 1988, in the WMNF, to determine whether this earlier information is comparable enough to be incorporated into the results of this study

Surveys will be conducted according to the Forest Inventory and Analysis (FIA) plot methodology for lichen indicators, making the quality of collected data equivalent to FIA lichen data. Our lichen data will be available to the FIA program.

In addition to establishing permanent plots and gathering baseline data on lichens and bryophytes, data on the abundance and health of calicioid lichens and fungi will be collected for a companion investigation of ecological integrity. These species, also

known as “stubble lichens,” consist of both lichenized and non-lichenized fungi. Because they are particularly sensitive to air pollution, stubble lichens can be used to assess the degree to which that pollution is affecting an ecosystem by analyzing their abundance and certain morphological and anatomical characteristics.

Water quality monitoring in WMNF wilderness areas is gaining an increased focus as part of a national Forest Service program (10 Year Wilderness Stewardship Plan). As part of this program, the WMNF is working to designate water as the recommended air quality related value to be monitored for long-term trend analysis in the Forest’s six wilderness areas. The WMNF is collaborating with the Appalachian Mountain Club and the Northern Research Station to collect and analyze stream water samples to establish the necessary baseline data. To date, stream water data have been collected in the Presidential Range-Dry River and the Great Gulf Wilderness Areas. This program will eventually encompass all WMNF wilderness areas.

Climate Change

The White Mountain National Forest is lucky to have two Experimental Forests to help in monitoring long-term effects of climate change. Recent research and data evaluation at these Experimental Forests include efforts to look at how the climate is changing and whether those changes are affecting forest vegetation.

The Forest is poorly covered by the National Weather Service network, which has concentrated its efforts on populated places. Fortunately the Hubbard Brook Experimental Forest (HBEF) has data that illuminates climatic trends from sites within the National Forest. HBEF has a continuous temperature and precipitation record for the site from 1956 to the present. There are also records available for snow depth, soil temperature, stream flow and wind. HBEF maintains multiple stations that differ by elevation and aspect to collect this data. The stations are also arranged to facilitate the measurement of precipitation and the corresponding stream flow from several small watersheds. All this data is further explained in *GTR NE-305, Hydrometeorological database for Hubbard Brook Experimental Forest: 1955-2000* (Bailey et al, 2003).

Bailey provided several graphs from the HBEF hydrometeorological database that added the last decade’s data to the picture provided by GTR NE-305 for this report *(Amey Bailey, unpublished data).* This data is not yet widely available to the public; the staff at HBEF is developing a publication to provide this update. That publication, also in the form of a General Technical Report, should be available in 2013.

Temperature

The HBEF data is unique in this region for the elevation gradient it provides. There is a limited and discontinuous record available from most monitoring stations in the area and the differences between valley bottoms, where most stations are located, and the uninhabited higher country that makes up the bulk of the National Forest makes interpolation from generally warmer and dryer sites an uncertain exercise at best (Loarie et al, 2009). Use of the records from the Mount Washington Observatory also calls for caution as at least one study (Seidel et al, 2009) indicates that records for temperature and snow days for the summit do not show the same climatic trends apparent in records much closer to sea level. The record from the seven stations located on HBEF (elevation range from 825 feet above mean sea level (msl) to 2970 feet msl) is unique in the Northeast.

As shown in Figure 3, there is a trend of increasing air temperature in the 55 year dataset provided for stations 6 and 14, which are at nearly the same elevation but have different aspects. Data from the NH Climate Office indicates a decadal increase state-wide in annual mean temperature of 0.29 degrees F in the same period (1955-2011). This rate of warming produces a total change in average mean air temperature of 1.5 degrees F.

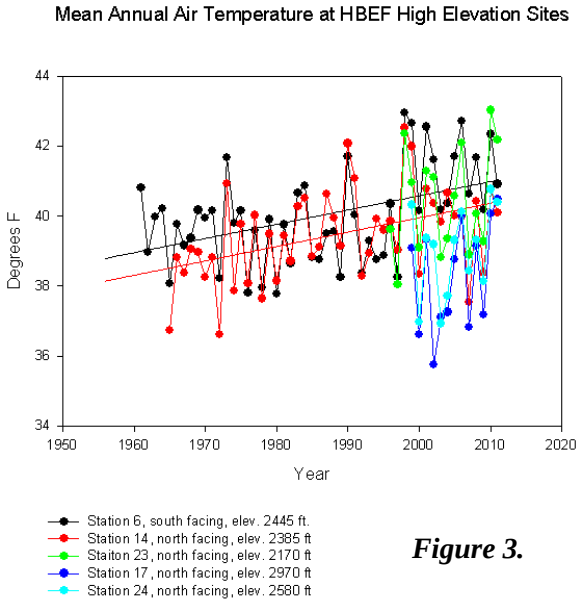


Figure 3.

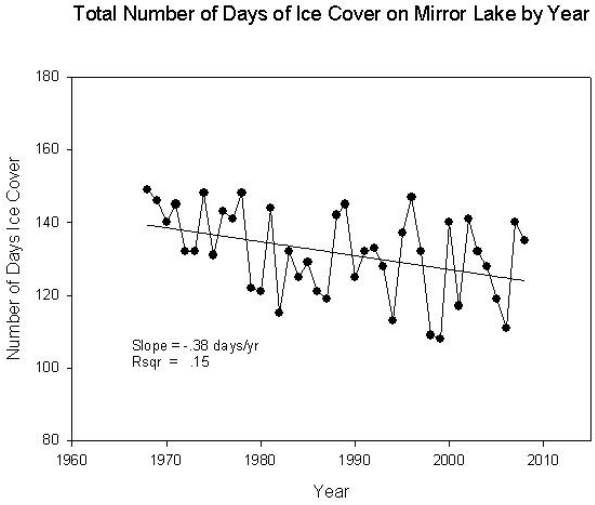


Figure 4.

Another factor related to temperature that provides an indication of climate trends is the number of days of ice cover on ponds and lakes. Gene Likens, a retired Forest Service researcher, has monitored ice cover on Mirror Lake in Woodstock, NH just adjacent to HBEF. His record of days of ice cover from 1968 to 2009 (Likens, 2011) shows a significant decrease in the number of ice cover days for that lake (Figure 4). His analysis points most strongly to increases in air temperature in March and April.

Precipitation

The precipitation record at HBEF provides a useful on-Forest measurement of this key variable in the climate change picture. All models of climate change predict increased precipitation in this region and the data from HBEF bears this out. As shown in Figure 5,

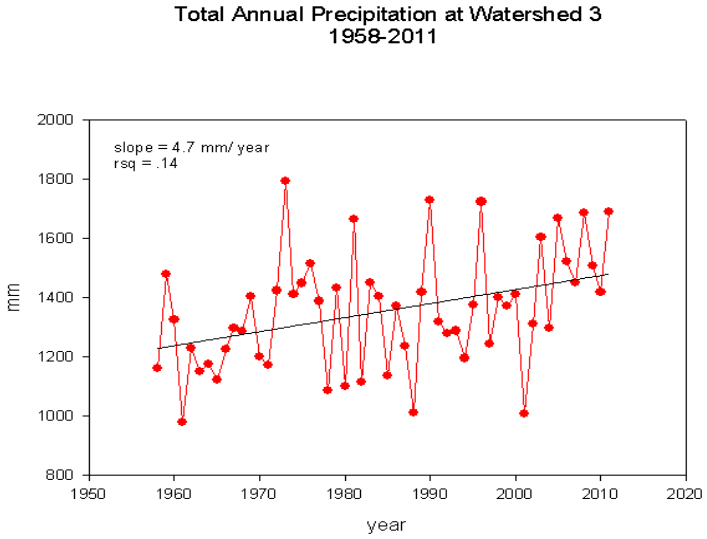
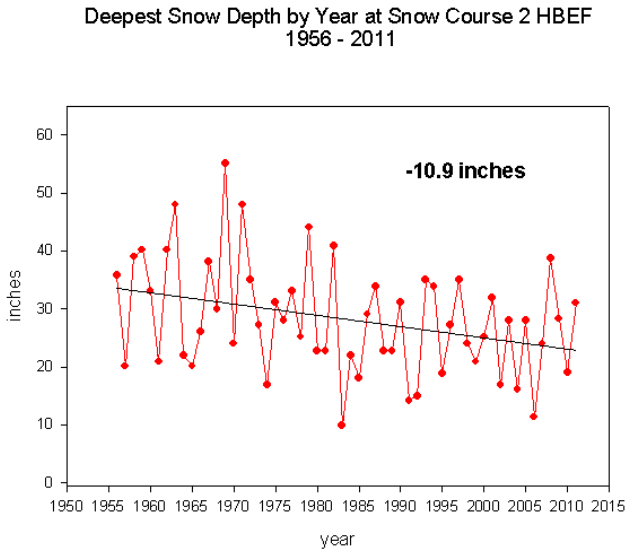


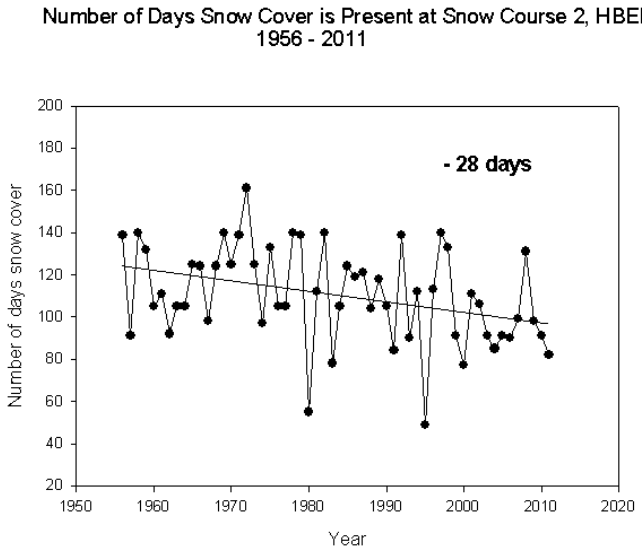
Figure 5.

over the 53 years between 1958 and 2011 annual precipitation measured at Watershed 3 has increased 259mm (10.2 inches). An increase is also seen in state-wide data available from the NH State Climate Office.

The amount of precipitation that falls as snow is also of concern. Climate change models predict decreasing amounts of precipitation occurring as snow and this trend is reflected in the HBEF data. HBEF maintains a snow course (elevation approximately 2000' msl with a south facing aspect) where measurements are taken related to the amount and duration of snow cover. Figures 6 and 7 show that both snow depth at the time of greatest accumulation and days of snow cover have decreased annually between 1956 and 2011.

Figures 6 and 7.





Precipitation is increasing and the type of precipitation that occurs on the WMNF is changing. Additional work is needed to better understand changes in temperature and precipitation seasonally, relationships between elevation and aspect of the different stations on HBEF, and possible correlations with National Weather Service stations in other locations around the area.

Vegetation

In 2002-2003, researchers at Bartlett Experimental Forest remeasured cruise plots that were originally measured in 1931-1932. Two recent publications evaluate the resulting data to assess changes in tree species composition, particularly in the understory over the 70 year period (Leak 2009; Leak and Yamasaki 2010).

Most of the changes in understory composition, especially at lower elevations that were cleared in the 1800s, are consistent with natural succession. Beech and hemlock increased significantly while early to mid-successional species like birches and red maple declined.

Changes in hemlock and red spruce at higher elevations are of particular interest when considering whether climate change is affecting vegetation composition. These species typically grow on similar soils, with hemlock occurring at lower elevations (Leak 2009). The review of plot data shows that hemlock has not increased in abundance at the higher elevations (>1800'), as would be expected if climate change was causing elevational shifts in vegetation. Red spruce remained the dominant species at high elevations though beech, which is not climate limited, is increasing in the understory.

Recreation

Monitoring Guide Recreation Questions

In the summer of 2010 and the winter of 2011, a master's student from Duke University assisted the recreation program by taking a critical look at the recreation monitoring program. Not only did she analyze data collected from monitoring during the past 10 years (or longer where possible), she created a system of databases for the storage of current and future data and made recommendations for improvement in some areas of our monitoring program. One aspect of this look was how well the current monitoring program is addressing the 12 items related to recreation in the Forest Monitoring Guide (see Table 6).

Table 6. Recreation-related Monitoring Items

Monitoring Item	Monitoring Guide Question	Currently Addressed?
Visitor Use		
Rock Climbing Use	11	No
Outfitted/Guide Use on Forest	35	Yes, needs improvement
Off-Road Vehicle Effects	36	Yes
Use at Developed Campground, Day Use Areas, and Ski Areas	37	Yes
Use abd Backcountry Facilities	38	Yes
Use on Forest Trails	39	Yes, needs improvement
Perceived Quality and Crowding	40	No
Wilderness		
Wilderness Trail Use Trends	43	Yes
Wilderness Destination Use	44	Yes
Satisfaction of Wilderness Visitor	45	Yes, needs improvement
Wilderness Campsite Density and Size	46	Yes, needs improvement
Human Littler and Waste in Wilderness	34	Yes

With this information, we are well poised to make some improvements what data we collect and how to ensure that we can better meet one of the primary goals for recreation on the WMNF, to provide "a range of quality recreation activities and opportunities."

Riparian and Aquatic Habitats

One important value of riparian areas along rivers and streams is the shading effect important to the protection of coldwater fish and habitats. Public lands are often valued for coldwater fish habitats due to the continual ownership along streams to ensure continuity of riparian forests for shade. The Forest Plan (p. 1-15) includes the following goal for riparian and aquatic habitats within the Forest:

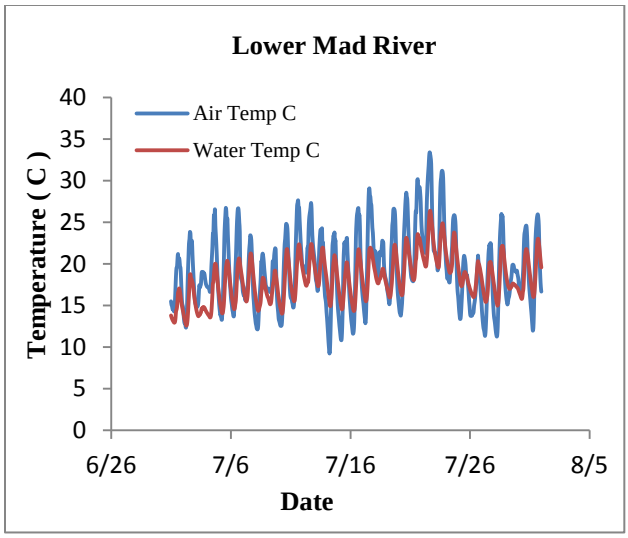
> *Manage riparian areas to provide coldwater, coolwater, and warmwater aquatic communities within the ecological capability of the landscape.*

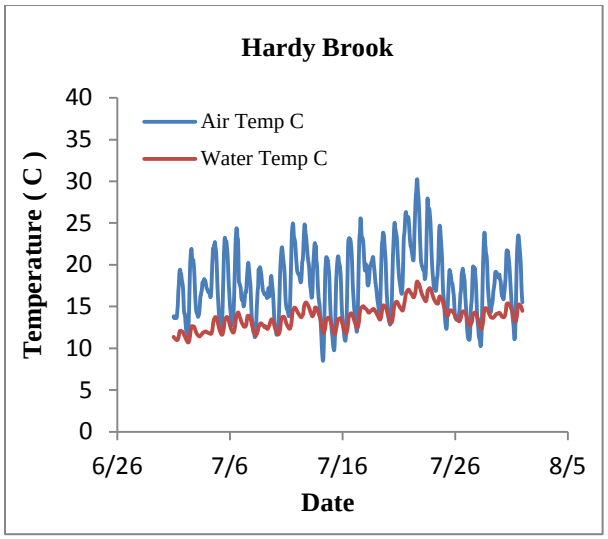
Growing concerns regarding a changing climate have drawn a lot of attention to the potential effects of rising air temperatures on future coldwater fisheries. In 2011, staff from the WMNF began a paired air-water temperature assessment to look at the sensitivity and vulnerability of coldwater stream habitats to climate change. Paired temperature sensors were installed at 39 sites within the WMNF. A stratified sampling approach within randomly selected watersheds was used and adjusted for sampling limitations.

At each site, one sensor was placed in the stream while another was placed no more than 50 meters away in the adjacent riparian area. The pairing of these data loggers allowed a comparison of stream water temperature changes to local air temperature changes. From these paired data sets, a measure of stream water "sensitivity" to air temperature change can be estimated. For each day, the ratio of the rise in water temperature to the rise in air temperature was calculated. One sensitivity value was then calculated for each site by averaging all of the individual daily ratios.

Results

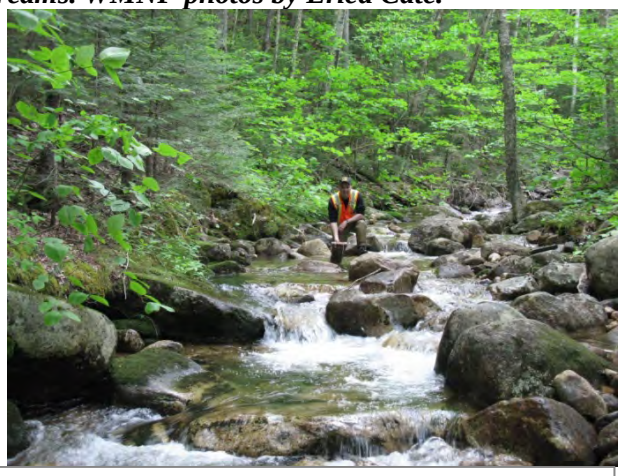
Figures 7 and 8 show plots of hourly air and water temperatures at two sites in the Mad River Watershed. The Lower Mad River site was located on the mainstem Mad River, a third order river that drains 9.8 square kilometers (km^2) of land; the Hardy Brook site was located near this first order stream's mouth, where it drains 2.6 square kilometers of land. These two sites are an example of the variation in stream habitats on the WMNF. Hardy Brook is a steeper and narrower channel that is more heavily shaded than the Lower Mad River site. Hardy Brook averages 13.8°C during July and fluctuates very little between day and night, resulting in a very low sensitivity value of 19%. Brook trout dominate these steeper and colder streams within the White Mountains as shown from our fish sampling at the site (Figure 9). The Lower Mad River site averaged 18.2°C in July, suggesting it is classified as a "coolwater" stream. The site photographs indicate there is far less streamside shading of the water surface as compared to Hardy Brook. The site is also much more sensitive to air temperature changes, as indicated by the daily fluctuations and a sensitivity value of 49%. Brook trout are far less common in these larger rivers with higher water velocities and less riparian shading as other species prefer the warmer temperatures.





Figures 7 and 8. Daily fluctuations in air and stream water temperatures at two sites in the Mad River watershed.

Photos: Placing temperature sensors in the same streams. WMNF photos by Erica Cate.



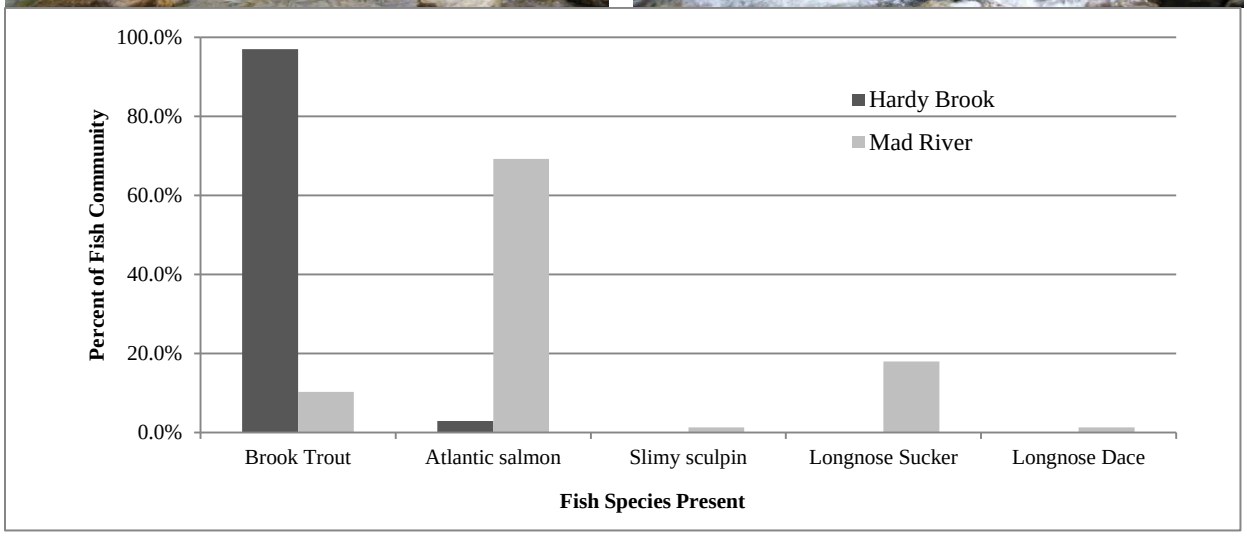


Figure 9. Results of fish sampling in the same two streams, Hardy Brook and Mad River.

Average July water temperature was 15.3 °C and ranged from 10.4 °C to 20.1°C across all 33 sites within the WMNF. Of the 33 sampled sites, 28 were classified as coldwater (<18°C) and five were classified as coolwater (18-21°C). None of the sites classified as warmwater sites (>21°C). Sensitivity values averaged 25% for coldwater sites and 49% for coolwater sites. This would translate into a one degree rise in average water temperature for every four degrees rise in average air temperature for coldwater sites. Coolwater sites would increase two degrees in average water temperature for the same four degrees increase in air temperature.

Many local landscape characteristics may interact to influence water temperatures at a particular sample site, such as elevation, slope, aspect, landform shading, riparian cover, and groundwater sources. While the assessment in 2011 did not investigate all of these metrics, the influence of elevation can be assessed quite easily. The influence of sample site elevation on mean July water temperature (MJWT) was examined for two groups of drainage area sizes; sites draining < 4 km^2 and sites draining > 5 km^2 (Figure 10). While there was a slight increasing influence on MJWT from decreasing elevation for sites draining < 4 km^2, it was not significant and elevation only accounted for 16% of the variation. For larger river sites (>5 km^2), there was a strong influence on MJWT, with temperature increasing as sample site elevation decreased. The effect was significant and explained 82% of the variation in temperature across all sites.

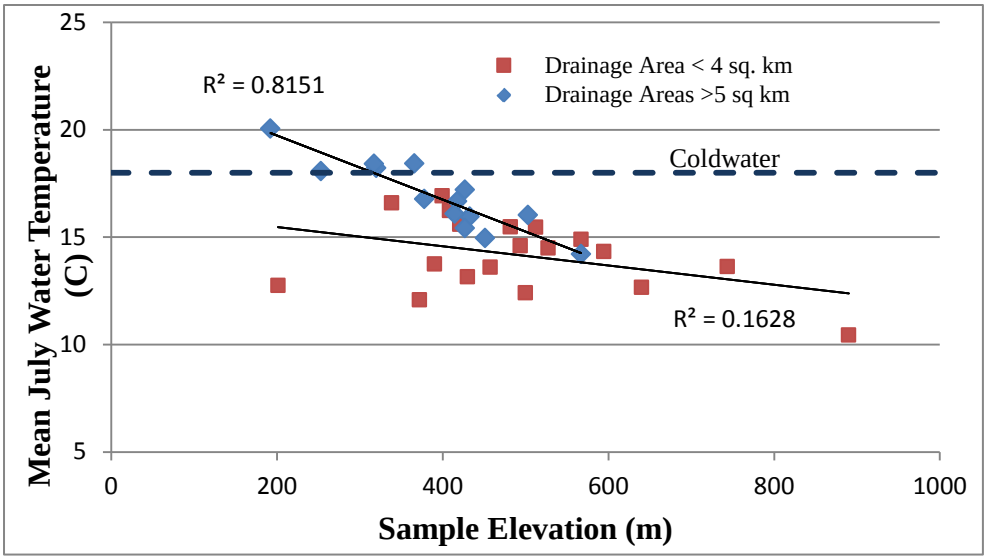


Figure 10. Mean July water temperature plotted against sample site elevation for sites at drainages areas <4 km^2 and sites at drainage areas > 5 km^2.

Conclusions and Recommendations

Overall, streams draining less than four km^2 within the WMNF were classified as coldwater streams and averaged approximately 14°C during the month of July, which is about 4°C below the coolwater classification threshold. Based on an average sensitivity value of 25%, average air temperatures would need to rise 16°C before these headwater streams would become coolwater streams. This sensitivity data also suggests headwater streams on the WMNF are not vulnerable to increased air temperatures predicted from climate change models under current management practices and Forest Plan riparian and aquatic habitat management guidelines because changes of >16°C are not expected in the foreseeable future.

Coldwater and coolwater aquatic communities in larger streams at elevations less than 400 meters within and downstream of the WMNF boundary may be vulnerable to increases in average summer air temperatures. Smaller tributaries in these areas may provide coldwater refuge if they are accessible to aquatic species. This should be considered when prioritizing aquatic organism passage projects on a larger landscape scale with partners.

This assessment will be repeated in 2012 to determine if sensitivity values are fairly consistent from year to year. Most sites will be repeated and some additional sites at lower elevations will added to determine where current coldwater and coolwater classification thresholds occur at this point in time within the White Mountains region.

Socio-Economic Assessment

The *Socio-Economic Assessment to Provide a Context for the White Mountain National Forest Plan Revision* (RSG 2004) was based primarily on data from 2000 and 2001. Since many aspects of the local and regional economy and use of the WMNF have changed over the last decade, we decided it would be valuable to have an updated assessment. In FY11 Plymouth State University agreed to work with the Forest Service to gather new social and economic data and revised the Forest's socio-economic assessment. The updated assessment will be finalized late in 2012. Key changes in conditions will be discussed in the FY12 Monitoring Report.

Water Resources

Watershed Condition Classification

In 2011, the White Mountain National Forest completed a Watershed Condition Classification. For the first time, a nationally consistent protocol has been used to evaluate the health of all National Forest watersheds at the 6th level HUC (hydrologic unit code) scale. This is the first step in a framework that the Forest Service will use to prioritize, plan, and track watershed improvement activities.

An interdisciplinary team evaluated 24 attributes related to water quality and quantity, aquatic biota, aquatic and riparian habitat, roads, trails, soil, fire regime, forest cover and health, and invasive species. This assessment was primarily based on currently available data sets and geographic information systems analysis. The focus of this process was rating 6th level watersheds containing at least 5% National Forest land. Only National Forest System lands were evaluated. The 71 qualifying watersheds on the WMNF fell into the following classes: 45 Class I (Functioning Properly), 26 Class II (Functioning at Risk), and 0 Class III (Impaired Function).

Overall, the team found that atmospheric deposition, changes in fish communities, modification of aquatic and floodplain habitat, and road/trail density and location were some of the major factors negatively affecting watershed condition on the White Mountain National Forest.

More information on the Watershed Condition Framework is available at: http://www.fs.fed.us/publications/watershed/.

Wildfire

In FY11 the fire team began to investigate current conditions on past wildfires and apply this information to help evaluate the effectiveness of management responses to wildfire -- wildfire suppression and the use of future unplanned ignitions for resource benefit.

The Blueberry Fire was managed for resource benefit as an unplanned wildfire in 2006. During the summer of 2011, this fire was revisited to document post fire vegetative response through photographs. By combining the information gained by examining the photographs with the weather data at the time of the wildfire, we increased our knowledge of likely results when there are similar conditions of fuel and weather. This information may help us determine whether the appropriate management response for a future fire is suppression activities or management for resource benefit.

The Big Brook Fire that occurred, and was suppressed, in July 2011 was later examined using the model FSPro to determine potential spread of the fire if it had not been suppressed. The spread models showed that with weather and fuels as they were for the Big Brook Fire, suppression is a feasible and desirable management option for a wildfire that starts in these fuel types under these weather conditions. The results also helped us monitor the management response, which in this case was suppression. It was determined that the Big Brook Fire was suppressed at the appropriate level. The results were consistent with data from other past fires; photo points were established to facilitate long-term monitoring. These analyses can also be used to improve modeling for more accurate predictions of fire behavior and to develop parameters for future prescribed burns aimed to achieve desired results. We need to know how fire affects the environment so we can integrate this information into planning for projects that may utilize fire. Information from this monitoring helps us decide how to use fire as an appropriate tool in resource management plans.

In order to better support the planning process for future fuel treatments and prescribed burn activities, an improved protocol for monitoring prescribed burns has been developed and will begin testing in FY2012. The new procedure organizes our fire program goals for monitoring, balancing the need for specific and measureable objectives with consideration of the efficiency and practicality of implementing monitoring activities. The proposed plan outlines a tiered approach to monitoring depending on certain elements in the planning process and the availability of funding and labor. The most basic activity includes the Prescribed Fire Monitoring Form that was piloted on some burns in FY11 (See Objectives section). These ocular observations and estimates of fuels consumption will be recorded for every burn. When possible, photo points will be established and periodically revisited to document stages in vegetative development post burn. When desired and practical, certain measurements can be used to determine the success of the burn at meeting specific objectives. The continuation of more inclusive plot data (such as the use of FIREMON or FFI) for particular sites will be necessary to provide a more complete assessment of the effects of our burns. We hope to refine and begin implementation of these protocols in FY2012.

Wildlife

High elevation spruce-fir ecological indicators

Bicknell's thrush. Photo courtesy of Kent McFarland.

The predominantly spruce-fir zone that occurs on White Mountain peaks above 2,500 feet elevation provides a unique habitat type for a number of species. This habitat operates essentially as a series of 'islands' between more common hardwood and mixed wood forests on lower slopes and valleys. The White Mountain National Forest holds some of the largest contiguous blocks of this habitat in the northeast, making it a high conservation priority. In order to track the overall health of this habitat type for wildlife, the WMNF has identified a suite of five bird species to serve as ecological indicators: Bicknell's thrush, blackpoll warbler, boreal chickadee, yellow-bellied flycatcher, and spruce grouse.

This group of species is monitored using a 5-minute bird count on 574 fixed survey points across the Forest's mountains during the month of June. Data has been collected since 1993, although budget and staffing reductions in recent years have limited surveys to every other year. In order to determine trends, data from each point and each year were ranked and then graphed using standard linear regression methods. One year of collected data (2003) was omitted because so few points were surveyed that year.

Only one species, the blackpoll warbler, had a statistically significant trend (upward; p=0.02; Figure 11). This is by far the most common species of the group, occurring on all 574 points at least once during the 12 years of survey data that were analyzed.

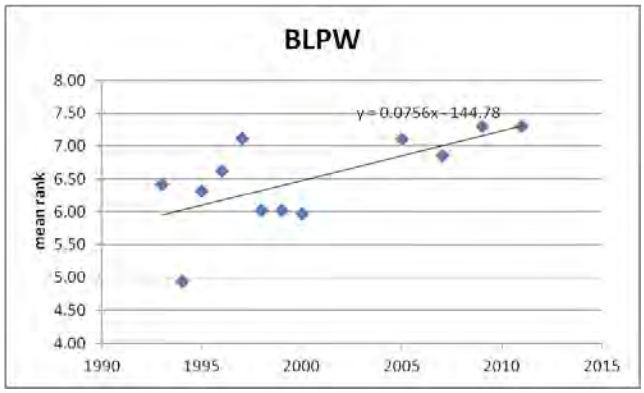


Figure 11. Blackpoll warbler trend.

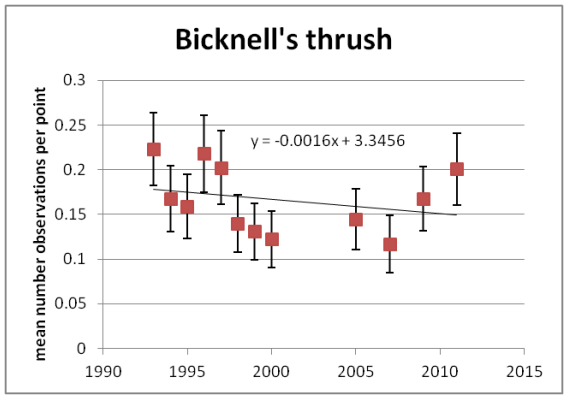


Figure 12. Bicknell's thrush observations.

Another positive finding was the continued recent increase in Bicknell's thrush numbers. Although not statistically significant, 2011 had the third highest number of Bicknell's thrushes recorded in the history of this survey, with 16 observations at points that had not previously recorded Bicknell's thrush. This is encouraging, since significant declines occurred during the years between 1996 and 2007 (Figure 12) and there was concern that mercury deposition or problems on the wintering grounds might be causing an irreversible population decline. Hopefully, this upward trend will continue through the next monitoring period in 2013.

Annual Updates

There are many resources and activities that are monitored every year on the Forest. Some of these are reported on periodically when enough data has been collected to show trends or when a change in conditions is noted. The Monitoring Guide recommends reporting on others annually because the resource can change rapidly or questions on the topic arise regularly from the public. This section provides a brief summary for the annually-reported items. Periodically a more thorough evaluation of each of these topics will be presented under a different heading in the monitoring report.

Candidate Research Natural Area Establishment

During Forest Plan revision, the Forest identified eight areas as candidate Research Natural Areas (cRNAs; MA 9.3). In 2010, a region-wide analysis of cRNAs was conducted that resulted in a decision to move forward with establishment of five of the WMNF cRNAs: Gibbs Brook, Mountain Pond, the Bowl Extension, Shingle Pond, and Peabody Mountain. In FY11, the Forest updated the draft establishment record for the Bowl Extension cRNA to incorporate new information and make it consistent with current requirements. A revised draft establishment record was submitted for required reviews. Work to finalize the record for this cRNA will continue in FY12.

NNIS Eradication

In an on-going effort to meet Forest Plan objectives for non-native invasive species (Forest Plan p. 1-8), Forest staff control invasive plant infestations each year across the Forest. In 2011, approximately 58 acres of NNIS were controlled using an integrated pest management approach. This approach relies on a combination of hand pulling, cutting, biological controls of purple loosestrife through the release of predatory beetles, and herbicide use. Herbicide application was the most utilized control method. The greatest number of sites and the largest total acreage treated both occurred on the Pemigewassett Ranger District.

Table 7. NNIS plant treatments.

District	Pemigewassett	Saco	Androscoggin
Acres	33.5	21.5	2.8
Sites	38	16	10

Most sites treated range from one-tenth of an acre to one-half acre in size. There are a handful of sites that range in size from 20 to 40 acres. Four infestations previously treated were found to be completely eradicated in 2011. Since 2007, a total of eleven infestations have been completely eradicated.

Soil Resource Monitoring

Timber harvest

Every year monitoring occurs while activities are being implemented on the ground to see whether Forest Plan standard and guidelines to minimize soil movement are being followed and track the effectiveness of best management practices (BMPs). In 2011, monitoring took place on the following active timber sales: South Pond and Rattle River on the Androscoggin Ranger District and Kanc 7 on the Saco Ranger District. Post implementation monitoring occurred on the Right Angle and Hatchery sales on the Pemigewasset Ranger District, Popple South sale on the Saco Ranger District and Mill Brook sale on the Androscoggin Ranger District. Standards and guidelines were generally being followed as proposed.

Landing and main skid trail, Rattle River active winter sale. WMNF photo by Andy Colter.

Selecting the right operating season for the ground is a best management practice for minimizing impacts to soil and water resources. As discussed in the 2009 Monitoring Report, climate change predictions indicate that the feasibility of winter logging may eventually decline on the WMNF. Effects of harvest on soils were monitored to determine whether adverse impacts occurred due to the season of operation. Based on the active sales looked at in FY11, impacts matched what was analyzed for in project environmental assessments and were not detrimental. No change to the Forest's operating seasons is needed at this time.

BMP's are designed for "the control and dispersal of water collecting on truck haul roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams." (NH DRED, 2004) On the WMNF, these practices appear to be successful in meeting that objective. None of the monitored sales had any active detrimental erosion occurring where water bars were in place. Where slash was placed in the skid trails, there wasn't any active detrimental rutting that would lead to compaction taking place. Monitoring showed that other BMP's, such as water bars and slash in the trails to prevent compaction, erosion and puddling, were being implemented on harvesting operations when appropriate.

Main skid trail at Right Angle sale 1.5 years after harvest. WMNF photo by Andy Colter.

Prescribed burning

Camp 7 Prescribed underburn with some of the Oi and Oe consumed. WMNF photo by Andy Colter.

Prescribed fire is used on the Forest to reduce hazardous fuel loading, prepare sites for restoration of some species, and create, maintain, or improve wildlife habitat. Prescribed burning was used to promote species variation in the Camp 7 underburn part of the Ellsworth Vegetation Management project. Fire was monitored to determine whether soil organic matter in the Oa horizon was consumed by the fire and whether burning resulted in any erosion. While some surface soil organic matter (Oi horizon) may be lost during a prescribed fire, local experience indicates that prescribed burning does not affect rainfall infiltration rates or soil calcium levels. This is because prescribed fires are typically of low severity so most of each site remains covered by organic matter and mineral soil aggregation is not changed. This was the case in the Camp 7 underburn. No organic matter in the Oa horizon was consumed and only some of the Oi and Oe horizons were affected. Some soil nitrogen is probably lost when any organic matter burns, but nitrogen is not considered a limiting factor in tree growth on the WMNF. As a result, there were no detrimental effects.

TES Plants

Presence in Project Areas

In 2011, project-related surveys for TES plants and habitat revealed one new Regional Forester Sensitive Species population and updated another known TES plant occurrence. Project areas surveyed in 2011 included large integrated projects, such as the North Chatham, Albany South, and Deer Ridge projects, as well as numerous small projects such as the Glen Ellis, Waterville Valley Super G, and Tripoli Campground projects, and several snowmobile trail relocation projects. These are just a few of the specific projects for which TES plant surveys were conducted in 2011. These surveys are conducted each year for ground-disturbing projects across the Forest.

Population Monitoring

Forest staff and partners monitor known occurrences of Regional Forester Sensitive and state listed plant species each year to assess population health and trends. In 2011, the total number of occurrences monitored increased over 50% when compared to 2010. A total of 43 occurrences were monitored by volunteer botanists from the New England Wild Flower Society, New Hampshire Natural Heritage Program, Appalachian Mountain Club, as well as White Mountain National Forest staff. No significant change in any population trends were identified at any of the populations monitored in 2011.

Monitoring and Research by Partners and Cooperators

A wide variety of short- and long-term inventory, monitoring, and research studies are conducted every year on the White Mountain National Forest by individuals, organizations, and universities. In FY11, research considered speciation and gene flow of the White Mountain Arctic (*Oeneis melissa semidea*), effects of whole-tree harvesting on forest productivity, the connections between alpine pond chemistry and amphibian populations, and effects of climate change on phenology of vegetation, white pines, water temperatures, and tree-line, among other topics. All proposals for non-Forest Service research and monitoring on the Forest are reviewed by appropriate specialists before a permit is issued. Often limitations are placed on the location, type of activity, or intensity of work that can occur on the WMNF to ensure that resources are protected and Forest Plan direction is applied. Project proponents are expected to provide a summary of work done or copies of any reports generated by activities on the WMNF so the Forest will have access to any information that could help us in our management.

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