White Mountain National Forest

United States
Department of
Agriculture

Forest
Service

Eastern
Region

Monitoring and Evaluation Report

FY 2014

Cover: Water quality monitoring. WMNF photo by Erica Roberts.

This document is available in large print. Contact the White Mountain National Forest Supervisor's Office 603-536-6222

For TTY call 711 to be connected to a Forest Service number

Contents

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 most recent monitoring efforts. 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.

Our monitoring shows that we are largely implementing the Forest Plan as written and intended. We consistently work with local, state and federal agencies and many other partners to manage all resources on the White Mountain National Forest. That management is done in an integrated way to ensure 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.

In 2014, a joint Natural Resources Conservation Service (NRCS) - Forest Service initiative provided funding to NRCS and the WMNF to improve water quality in New Hampshire. Projects on the Forest are designed to improve roads, trails, and other infrastructure to reduce sedimentation and improve the hydrologic and biological function of streams and wetlands in headwaters above public drinking water sites. The Forest expects to work with NRCS and other partners to develop and implement projects under this initiative for three years, 2014-2016.

Work on a Forest-wide travel analysis continued in 2014 and will be completed by the end of September 2015. The effort has involved: considering the natural, social and economic resources affected by our road system; gathering input from interested publics; and determining the long-term benefits, risks, and opportunities associated with our existing road network. Recommendations for which roads are likely needed or not needed will be implemented through integrated resource management projects and smaller road and trail projects with available funding. The Forest's long-term goal is to identify a recommended minimum road system that can be maintained with expected funding.

I find that our monitoring and this report meet the intent of the Forest's Monitoring Plan. No need to amend the Forest Plan was identified as a result of recent monitoring. We are currently reviewing our monitoring program in light of the updated planning regulations (36 CFR 219; http://www.fs.usda.gov/detail/planningrule/home/). Between now and May of 2016 we will work with interested partners and individuals to identify needed changes and update the monitoring plan that is in the Forest Plan (Chapter 4).

I appreciate your interest and ongoing commitment to the White Mountain National Forest and look forward to working with you in the future.

THOMAS G. WAGNER
Forest Supervisor

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 adapt our management approaches 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. 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 as an integral part of daily activities, such as construction and timber sale contract administration. 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 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 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 help maintain our roads, trails, and facilities, develop and implement projects, and monitor the status of our resources and effectiveness of our management. In some areas however, our overall funding is not keeping pace with resource requirements or public expectations. An example of this is increasing needs for road and trail maintenance that will require new approaches to ensure safe and sustainable access. We look forward to working with our current partners and developing new relationships in the coming years to address issues and opportunities as we move to our second hundred years.

Outputs and Services

Appendix B of the Forest Plan identifies a specific set of expected outputs and accomplishments for the first decade, as well as some limits. Most of these measures come from the resource goals and objectives in Chapter 1 of the Plan. Table 1 shows the accomplishment for each measure in fiscal year 2014 and the total for the first nine years of Forest Plan implementation. Additional information on the activities and why some accomplishments are different from estimates in Appendix B also is provided. For activities implemented through contracts, the accomplishment is reported in the year the contract is awarded because most accomplishment reporting is tied to funding.

In previous years, this section summarized our success at achieving those outputs and services identified in Appendix B of the Forest Plan, which are a small part of our annual work. This year it includes information on other accomplishments in some program areas.

Aquatics

In FY14, the Forest awarded two contracts for roads damaged in Tropical Storm Irene. Decommissioning Tunnel Brook Road and relocating East Side Road will restore habitat in adjacent streams that were adversely impacted by the storm damage. These two projects were the result of a challenge cost-share agreement with Trout Unlimited. Costs for both designs and new bridges were shared by the Forest Service and Trout Unlimited. Work on the East Side Road includes replacing three culverts with bridges, which will restore fish passage to three tributaries of the East Branch of the Pemigewasset River. Several aquatic organism passage projects that were implemented shortly after Plan revision and careful planning of projects to repair damage from Tropical Storm Irene enabled us to restore fish passage in more locations than estimated in the Forest Plan. Additional work will be implemented as integrated resource projects move forward or funding is available for stand-alone aquatic organism passage projects.

Culvert replacement to improve fish passage. WMNF photo.

Fire Management

No wildfires occurred in areas where wildland fire use is permitted and conditions allowed for its safe use to meet other resource benefits. See the Objective Attainment section below for information on accomplishments using prescribed fire and mechanical treatments.

Forestry

As in previous years, harvested and sold volumes remain below Forest Plan estimates. Harvested volumes and acreages fluctuate from year to year based on markets for various products and choices by sale purchasers on which units to cut. Given anticipated agency budgets and national priorities for funding, our forestry and wildlife habitat accomplishments are likely to remain at similar levels in the next few years, though it remains our goal to gradually increase the volume sold and acres treated.

Table 1. Estimated Management Practices and Accomplishments

Activity or Product	Unit of Measure	Estimate for First Decade	FY14 Accomp.	FY06-FY14 Accomp.
Aquatics				
Stream habitat restoration	Miles	30	5.7	18.8
Restore fish passage	Road crossings	10	3	12
Fire Management				
Unplanned wildfire managed for resource benefit (Wildland Fire Use)	Fires	4 – 8	0	1
Forestry				
Volume sawtimber harvested	MMBF	137	3.9	44.6
Volume pulp harvested	MMBF	106	5.2	59.4
Volume of timber sold	MMBF	240	11.6	97.5
Even-aged regeneration harvest	Acres	9,400	238	2691
Even-Aged Intermediate harvest	Acres	5,600	254	3904
Uneven-aged harvests	Acres	19,300	569	8203
Total harvest	Acres	34,300	1061	14798
Recreation				
Net increase hiking trail construction	Miles	Up to 25	0	0
Net increase snowmobile trail construction	Miles	Up to 20	0	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 and Watershed				
Improved Watershed/Soil Conditions	Acres	At least 250	195	796.6
Transportation				
Road construction	Miles	10	0.5	5.4
Road reconstruction	Miles	70	5.7	63
Classification of unclassified roads	Miles	N/A	0	16.3
Road decommissioning	Miles	5 - 40	1.2	3.9
Unclassified road decommissioning	Miles	N/A	0	13.1

Recreation

New trail segments are constructed in most years to get existing trails on more sustainable ground or improve access to key areas. Relocation projects to address resource concerns always include decommissioning the segment that is moved; some of these projects result in a net increase in mileage, others a net decrease. In recent years, the Forest implemented two non-relocation projects that resulted in trail decommissioning. One removed a segment of trail that accessed a bridge that was removed from wilderness to be more consistent with wilderness requirements. The other decommissioned sections of five trails on the Saco District (8.7 miles total) that were in unsustainable locations, impractical to maintain or provided redundant access to an area. As a result, the Forest has decommissioned more miles of hiking trail than we have constructed, resulting in a net loss of trails. Therefore the net increase, which is what Forest Plan objectives limit, remains at zero.

Overall recreation-related outputs and services provided across the Forest are not apparent from the numbers presented in Table 1. Every year a great deal of energy and expertise goes into maintaining and improving sites and trails, helping and educating visitors, managing Wilderness areas, and working with partners. In FY14, we completed major projects at several sites, including the reconstruction of Lower Falls Day Use area and the rehabilitation of the Mountain Pond shelter. With the help of partners and volunteers, trail crews completed 410 miles of trail maintenance and tackled numerous trail reconstruction and relocation projects. A trailhead steward program was started with a grant from the Waterman Fund to educate visitors about hikeSafe and hiking on the Forest. The program stewards talked to over 16,000 visitors at three major trailheads throughout the summer, resulting in some visitors changing their plans based on their level of preparedness. Permanent, seasonal, and volunteer staff maintained and managed day use sites, visitor centers, dispersed campsites, and other developed facilities. The WMNF again hosted several interns and crews of teenagers, working with them to accomplish valuable recreation and Wilderness projects and helping them learn leadership skills and how to work as teams. Forest staff administered permits for four alpine and six nordic ski areas, approximately 25 single-day recreation events, 160 outfitter/guide permits, AMC huts and other facilities, and concessionaire management of 22 campgrounds.

Lower Falls Day Use Area after reconstruction. WMNF photo by Sheela

Soils/Watershed

FY14 saw 195 acres of soil and water improvement activities. Work included closing and rehabilitating campsites in riparian areas, improvements to bridges and culverts, improvements to reduce erosion on Forest roads, decommissioning of roads, trail relocation and drainage improvements, invasive plant control, and prescribed burning.

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. Accomplishments in 2014 were higher than predicted during Forest Plan revision due to the ability to include multiple program activities in accomplishment reporting, opportunities to increase resiliency as part of Tropical Storm Irene recovery, and landscape-scale conservation efforts such as the Two Chiefs' Joint Landscape Restoration Partnership and National Forest Foundation's Treasured Landscapes program.

Transportation

With one year left in the first decade of Forest Plan implementation, all mileages remain within the accomplishments projected in the Plan. As in previous years, the Forest implemented several road reconstruction projects to repair damage to roads and bridges from Tropical Storm Irene. Recovery projects also included decommissioning of damaged classified road segments. In FY14 there were no NEPA decisions that resulted in classification or decommissioning of unclassified roads.

Work continued on a Forest-wide travel analysis that will recommend which National Forest System roads are likely to be needed in the future and which are not. In future years, these recommendations will be ground-truthed and final decisions made during site-specific NEPA analyses.

Forest road crews spent the snow-free months cleaning culverts and ditches so they function properly, grading road surfaces, and mowing brush on roadsides to provide safe visibility and prevent encroachment of vegetation. These types of maintenance activities occurred on about 157 miles of National Forest system roads.

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?

During FY14 WMNF staff surveyed 1475 acres of land harvested within the past 3 years on the Forest. All acres surveyed were certified as adequately restocked.

To what extent have destructive insects and disease organisms increased?

The Forest Service, Forest Health Protection (FHP) staff completed an aerial detection survey for the WMNF on June 6 and 13, 2014. Approximately 5,150 acres of damage were mapped throughout, and adjacent to, the WMNF. Damage mapped in 2014 was down significantly from the 14,377 acres mapped in 2013, and was at the lowest level since 2011.

White pine discoloration. USFS photo.

Damage included:

- 4,529 acres of white pine needle discoloration from foliar diseases,
- 351 acres of wind damage in spruce-fir forest, and
- 270 acres of defoliation in oak forest types.

Adult emerald ash borer. Photo by Andrew Storer, MI Technical University.

The emerald ash borer (EAB), *Agrilus planipennis*, was discovered in Concord, NH in April 2013 and is considered a pest of concern for the ash resource on the WMNF. Forest staff, in an ongoing partnership with State and Private Forestry Forest Health Protection and the State of New Hampshire, again established white ash trap trees adjacent to and in campgrounds across the WMNF. These locations were chosen because of the amount of firewood typically imported to campgrounds by visiting campers. EAB has somewhat limited flying capacity and is typically transported longer distances through the moving of firewood. Therefore, foresters and entomologists reasoned that the most likely location for an EAB infestation on the WMNF is in or around one of the campgrounds.

Trap trees were girdled in June of 2014. Girdling, which involves removing a band of bark and phloem around the trunk of a tree, interrupts the ability of the tree to transport carbohydrates – the food needed by the tree. Girdled trees become increasingly stressed over the summer. As stress increases, the chemicals emitted from the foliage, bark, or wood of the tree change. The wavelengths of light reflected by the leaves also differ between healthy and girdled trees. Female beetles are attracted to stressed ash trees and tend to lay more eggs on stressed trees than on healthy trees.

Trap trees were felled, cut into bolts (3’ sections), and had the bark peeled in late November of 2014 (photo below). EAB eggs hatch in July and early August, at which point the larvae start to feed. As they feed and grow, galleries (chambers or passages in wood tissue made by feeding larvae) are formed under the bark. By September these galleries are visible to the naked eye once the bark is peeled.

No EAB larvae were discovered. The WMNF plans to repeat monitoring efforts through use of trap trees again in 2015.

Peeling bark to look for emerald ash borers. WMNF photo.

Objective Attainment

Wildland Fire

Forest Plan, Page 1-20, Objective 1

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

The WMNF conducted 9 prescribed burns for a total of 95 acres in 2014. Prescribed fire was used in the NH towns of Albany, Chatham, and Stark; and in Gilead, ME. An additional 148 acres was burned through partnerships on Department of Defense land in

Prescribed burn in Albany, NH to maintain open wildlife habitat and reduce hazardous fuels. WMNF photo by Ralph Perron.

New Boston, NH and The Nature Conservancy's land in Madison, NH. These cooperative projects are a goal of the Wildland Fire program (Forest Plan, page 1-18), and are tied to the National Cohesive Strategy which recognizes the need to address wildland fire challenges across all lands regardless of ownership.

The WMNF used mechanical methods to treat 88.4 acres in 2014.

Total acres treated on the WMNF in 2014 was 183.4 acres. Management objectives for these activities included fuels reduction, enhancement of blueberry fields, wildlife habitat maintenance, and site prep for restoration of species.

Pre and post mechanical treatment to maintain an orchard in Wentworth, NH. WMNF photos by Jay Milot.

Standard and Guideline Implementation

National BMP Monitoring

In 2013, the Forest Service began implementing a national Best Management Practices (BMP) program, which includes a National Core BMP Technical Guide and monitoring protocols for various activities. The national core BMPs tier to state BMPs and Forest Plan standards and guidelines, allowing these items to be monitored in an integrated fashion. Results of both BMP and standard and guideline monitoring are discussed here.

Forest Plan, Page 2-24 to 2-26, Riparian and Aquatic Habitats

G-1 Tree cutting and harvest should not occur within 25 feet of the bank of mapped perennial streams, the high water mark of a pond, or natural vernal pool, unless prescribed to benefit hydrological or ecological function of the associated stream, pond, or riparian area. Exceptions to this include…

G-2 Uneven-aged silvicultural practices should be used within the Riparian Management Zone (RMZ) along all perennial streams, lakes, ponds, and vernal pools. Cuts should be should be designed to maintain a relatively continuous forest canopy for the protection and maintenance of water quality, dead wood recruitment, hydrologic function, wildlife habitat, and scenic values. Regeneration group cuts should be limited to less than one acre in size. Exceptions may apply…

G-6 New timber log landings, developed campsites, and permanent facilities should not be located within 100 feet of a perennial stream or the high water mark of a pond. If they need to be located within 100 feet, additional measures to prevent direct runoff into surface waters and to minimize sedimentation should be taken.

G-15 Trees that directly provide structure to the streambanks and channels of intermittent streams should be retained.

Forest Plan, Page 2-30 to 2-31, Water Resources, 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-5 Permanent stream crossings must be designed to pass the bankfull discharge unimpeded.

Timber sales

Interdisciplinary teams observed portions of the Sebosis, Douglas, and Hogsback sales during implementation. The Sebosis and Douglas sales were randomly selected sites on which the national BMP monitoring protocols were followed.

On streams observed in all sales, no tree cutting or harvest occurred within 25 feet of the bank of mapped perennial streams, as specified in Riparian G-1. Either no harvest or uneven-aged harvest were prescribed in the Riparian Management Zone of all perennial streams, meeting Riparian guideline G-2.

An intermittent stream adjacent to a clearcut unit was evaluated in the Hogsback sale. The unit was delineated to leave a 50 to 100-foot buffer between the stream and the adjacent cut. This buffer was more than adequate to maintain shoreline stability and prevent sedimentation. No sediment movement or gully erosion was observed entering or within the buffer. The treatment did not remove trees that directly provided structure to streambanks or the channel, in compliance with G-15.

Intermittent stream on Hogsback sale looking toward adjacent clearcut. WMNF photo by Sheela Johnson.

Landings were evaluated on the Sebosis and Douglas sales. The two landings on the Sebosis sale were over 100 feet from perennial streams. While no erosion came from the surface of either landing, disturbance within an adjacent ditch moved sediment through a drainage culvert. Sediment extended into the woods and became dispersed by leaf litter; no sediment reached a buffer zone or water body. A small portion of the landing on the Douglas sale was within 100 feet (minimum distance 83 feet) of a perennial stream. As a result of appropriate grades and drainage, there was no evidence of sediment entering the stream from the landing. While BMPs, including landing location, prevented sediment from reaching streams in all cases, monitoring has identified ditches draining log landings as an important area to employ BMPs and maintain an adequate distance between ditch outlets and water bodies.

Eleven stream crossings were evaluated for compliance with Water Resources standards S-2 and S-3. Stream crossings are areas with high risk of sedimentation, and temporary, localized sediment movement at stream crossings is an effect disclosed in environmental documents. Of the nine skid trail crossings observed, seven had had crossing structures removed and two bridges were still in use. BMPs employed included gradual slopes, water bars, slash and corduroy on approaches, silt fence in ditches, and winter operation. Sedimentation was generally limited to minor movement of exposed soil at the water's edge within the trail or material falling off the side of the bridge. At one site, a larger amount of sediment was introduced to an intermittent stream during ongoing close-out activities. Though the amount and frequency of such an introduction does not exceed analyzed limits, consideration of BMPs employed during final close-out could further reduce sedimentation. Two road crossing sites were visited. Both had used temporary

culverts which had been removed. BMPs similar to those for skid trail crossings were applied on the closed roads, and no ongoing erosion or sedimentation was observed.

Roads

Skid trail crossings. Left photo shows site with disturbance from Sebosis sale close-out activities. Right photo shows temporary bridge site on Douglas sale after close-out is completed. WMNF photos by Sheela Johnson.

Rocky Branch Road (FR27) reconstruction and FR 6160 road/trail construction were randomly selected and evaluated using the national BMP monitoring protocol. Rocky Branch Road repairs in response to Tropical Storm Irene included resurfacing, ditch maintenance, culvert cleaning, and bank stabilization. No evidence of erosion or sedimentation was present on the monitoring date. BMPs such as check dams had worked effectively and were no longer needed due to revegetation. It was noted that a lack of erosion control had been identified by an inspector and corrected during operation. No lasting impacts were apparent.

New construction on FR 6160 was in progress. Connecting roads were evaluated informally. The route was currently being used as a skid trail, which complicated the evaluation. BMPs for temporary erosion control, temporary revegetation, road location, construction techniques, and spill prevention and containment were implemented and had recently been maintained. BMPs for placement and storage of stockpiled materials were not properly implemented in one location. BMPs for temporary erosion control required frequent monitoring and maintenance during the course of the project to remain effective. In one location, a silt fence was undercut and sediment moved from the work area into the woods. Corrective actions were implemented by the contractor following this evaluation. The interdisciplinary review team recommended management actions that should reduce similar concerns in future projects. These included alternative erosion control methods, earlier installation of erosion control, more detailed provisions for erosion control in the contract, and better coordination during implementation among staff members involved in the project.

Hiking trails

Interdisciplinary teams reviewed the Champney Brook Spur A and Lincoln Woods hiking trail reconstruction projects, both completed in 2013. These trails were randomly selected

and evaluated using the national BMP monitoring protocol. On Champney Brook Spur A, 0.3 miles of trail adjacent to a water body had rock steps added to steep trail tread.

On the Lincoln Woods Trail, approximately 0.25 miles of hiking trail were relocated after Tropical Storm Irene caused stream flow in the trail, slumping, and bank erosion. A hardened dip was constructed adjacent to an undersized crossing where there was a desire to protect the historic structure while managing high flows. Prescribed measures to protect soil and water, such rock steps, rehabilitation of rock quarry sites, and appropriate grades for new trail segments were implemented and were effective in preventing erosion and sedimentation over the majority of both trails. The hardened dip on the Lincoln Woods Trail washed out in the spring following construction due to use of smaller

Lincoln Woods Trail hardened crossing during monitoring (left) and after repairs (right). WMNF photos.

anchoring material than called for in the design. The design and construction methods were recognized to present a challenge due to the desire to protect historic resources and lack of equipment access to that point in the trail. Solutions involving use of larger material and more gradual slopes were proposed and implemented by the trail crew in 2014. Impacts from trail tread construction were nonexistent; those from the hardened dip failure were very small in comparison to the impacts of taking no action, and were in compliance with Forest Plan standard S-2 for Water Resources.

Although not part of the BMP monitoring, staff on the Lincoln Woods Trail trip also identified a bridge abutment that had eroded during high stream flows. It was putting sediment in the stream and at risk of failing. The District's trail crew repaired that site as well shortly after the monitoring trip.

Bridge access on Lincoln Woods trail before (left) and after (right) repair. WMNF photos.

Developed Recreation

Wildwood Campground was randomly selected and evaluated using the national BMP monitoring protocol. Soil and water protection provisions in the Operating Plan and Concessionaire permit were fully implemented and were effective in preventing erosion or waste issues on campsites, roads, parking areas and sanitation facilities. Though campsites were present within 100 feet of a perennial stream, erosion, sedimentation and bank damage were negligible in the riparian zone. Inspections were adequate to identify and address maintenance needs. The effects of this campground on water quality were monitored separately and are discussed below under the "Effects of Management Practices" heading.

Wildland Fire

Forest Plan, Page 2-33, Wildland Fire

S-2 All ignitions must receive an appropriate management response (suppression or wildland fire use) according to the Fire Management Plan.

G-2 Fire suppression and prescribed fire impacts should be minimized by implementing Minimum Impact Suppression Tactics as described in the Interagency Standards for Fire and Aviation Operations.

In 2014 the WMNF responded to 5 wildland fires. Four were human caused and one caused by a tree impacting a powerline; none were appropriate for wildland fire use. Two of the fires were suppressed by local fire departments through cooperative agreements and the other three fires were suppressed by WMNF personnel.

Two were escaped campfires in the Sandwich Wilderness. These fires typically occur in the summer and fall during periods when the soil duff layer is dry enough to ignite. They can burn 1-3 feet below the ground surface, as shown in the photo. During these droughty periods the WMNF Fire Management Officer adjusts the staffing matrix to align with the higher possibility that wildfires may be more difficult to suppress.

Escaped campfire, Black Mountain Pond, Sandwich Wilderness. WMNF photo by John Neely.

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.

Due to concerns about public safety along the Kancamagus Highway, the Regional Air Quality Specialist monitored air quality and visibility along the highway near the 40 acre Hotel Field prescribed burn. Little to no impacts were observed on the highway.

Good smoke dispersion observed along Kancamagus Highway. WMNF photo by Ralph Perron.

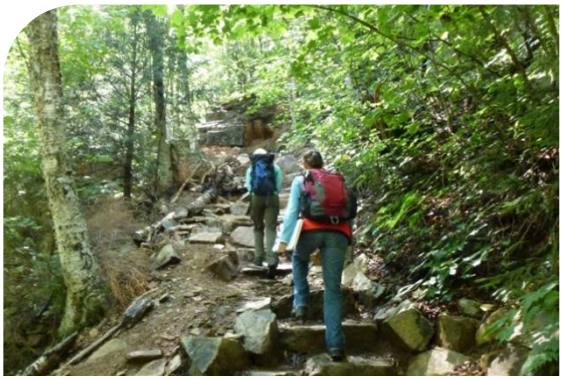
Effects of Management Practices

Soil Productivity

Every year monitoring occurs to see whether Forest Plan standard and guidelines to minimize soil movement are being followed and track the effectiveness of best management practices (BMPs). During the national BMP monitoring described under Standards and Guidelines above, the Forest Soil Scientist evaluated the Sebosis Stewardship Project during harvest, the Douglas Brook sale post-harvest, and work completed on the Champney Brook Spur A and Lincoln Woods hiking trails.

Effects from Trail Reconstruction

Reconstruction of sections of the Champney Brook Spur A and Lincoln Woods trails were monitored to ensure BMP's were being implemented and the effectiveness of the BMP's. The work took place in the summer. Monitoring showed that BMP's, such as water bars in the trails, were implemented where appropriate and installed in ways that should be effective at minimizing erosion into the future.



Champney Brook Spur A Trail, Saco Ranger District. WMNF photo by Andy Colter

Effects of Timber Harvest

Standards and guidelines were generally followed as proposed on both timber sales.

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 2012 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. Impacts from the Sebosis sale in 2014 were not detrimental and were consistent with what was analyzed for and disclosed in the environmental assessment. No change to the Forest's operating seasons is needed at this time.

Skid trail on Sebosis Timber Sale after winter harvest. WMNF photo by Sheela Johnson.

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." (New Hampshire Best Management Practices: A Pocket Field Guide, 2004) Based on many years of monitoring, these practices appear to be successful in meeting that objective on the WMNF. Monitoring showed that BMP's such as water bars and slash in the trails to prevent compaction, erosion and puddling, were implemented on Sebosis and Douglas Brook sales when appropriate. Neither of the 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. Therefore BMP's were applied appropriately and effective on these sales.

Water Quality

Effects from Recreation

Forest staff monitored water bodies near recreation sites to determine whether recreation use is impacting water quality. Monitoring 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 2014 included Loon Mountain Ski Area and Wildwood Campground, in Lincoln and Easton, New Hampshire, respectively.

Loon Mountain Ski Area

At the Loon Mountain Ski Area the East Branch of the Pemigewasset River (EB Pemi) flows from East to West past the ski area. In 2013 and 2014 we sampled the EB Pemi above the ski area and below the ski area (at South Mountain). We also sampled the two perennial streams that run through the ski area, Boyle Brook and Loon Pond Brook. Access issues limited sampling to only one date in 2014, April 14th, during the spring runoff period. In 2013 sampling occurred

on January 14th, March 12th, and July 13th. The values in Table 2 are an average of the 2013 and 2014 data.

Turbidity increased very slightly (0.4 NTUs) from above to below the ski area, remaining at low levels well below the threshold for concern (>10 NTUs above normal). Conductivity values were well below 100 µS at all sites. The highest readings below the ski area were captured during spring runoff and ranged from 33 - 46 µS as compared to above the ski area which ranged from 22 – 38 µS. Loon Pond Brook's conductivity levels were lower than those of the main stem. Boyle Brook typically had higher conductivity than the EB Pemi above the ski area. This could be influencing the conductivity of EB Pemi below the ski area, but the increase is minimal and well below Class B NH Surface Water Quality Standards.

Nutrients concentrations, including nitrate, ammonia, and phosphorus, stayed approximately the same from above the ski area to below (Table 2), indicating that the recreational use was not having an influence on nutrient levels at this location.

All samples were within the Class B NH Surface Water Quality Standards[1].

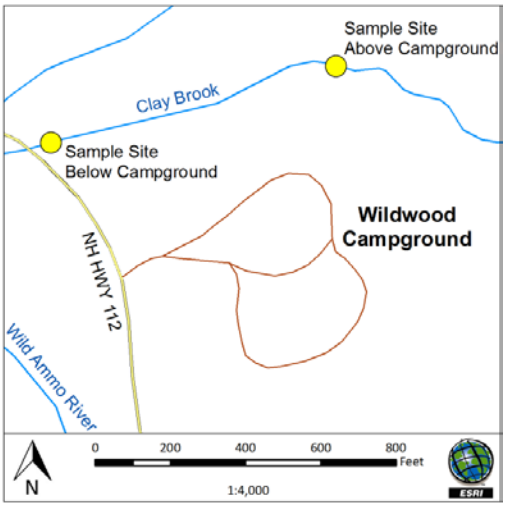
Table 2. Average water quality values from the Loon Mountain Ski Area and Wildwood Campground.

Location	Sample Point	Turbidity *NTU*	Conductivity *uS*	E. coli *Counts/ 100ml*	Nitrate (as Nitrogen) *ppm*	Phos-phorus *ppm*	Ammonia (as Nitrogen) *ppm*
Loon Mountain Ski Area	EB Pemi River above Ski Area	0.1	24.0	-	0.22	0.01	0.005
	EB Pemi River below Ski Area	0.5	33.0	-	0.23	0.01	<0.005
	Boyle Brook	0.3	30.8	-	0.37	0.02	<0.005
	Loon Pond Brook	0.2	17.1	-	0.18	0.05	0.008
Wildwood Campground	Clay Brook above Campground	0.3	12.9	7	0.08	0.02	<0.005
	Clay Brook below Campground	0.4	12.9	9	0.10	0.01	<0.005

** Loon Mountain Ski Area values are presented as 2013 – 2014 annual averages*
** Wildwood Campground values are presented as 2014 annual averages*

[1] New Hampshire Volunteer River Assessment Program. 2008. Interpreting VRAP Water Quality Monitoring Parameters. New Hampshire Department of Environmental Services. Accessed April 13, 2011 at http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/vrap_parameters.pdf

Wildwood Campground



Clay Brook runs adjacent to the northern boundary of Wildwood Campground. The entirety of the brook is on National Forest, with the exception of the Route 112 right-of-way. It joins an unnamed perennial downstream of the campground before entering the Wild Ammonoosuc River. Clay Brook was sampled on four occasions above and below the campground between June and September 2014.

Water quality was well within acceptable levels at Clay Brook. Upstream and downstream samples were very similar (Table 2), indicating that activities at the campground are not contributing to any changes in water quality during typical flow conditions.

Effects from Timber Harvest

The water monitoring program includes pre- and post-harvest monitoring in selected vegetation management project areas. Recently, the Forest has focused monitoring in the 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 Four Ponds Integrated Resource Management Project in Mason and Albany Township, Maine, harvest occurred in the watersheds of the East Branch Pleasant River (EB Pleasant), Donahue Brook, and Patte Brook in 2014. Preliminary post-harvest data are available for this partially completed project. A pre- and post-harvest comparison is presented in Table 3.

The EB Pleasant monitoring site is located downstream of the Kennison Timber Sale area and had approximately 4 percent (42 acres) of the watershed harvested with overstory removal, shelterwood, and group selection treatments[2] by the end of the monitoring period. The Patte Brook monitoring site is located downstream of the Four Ponds and Edwards Timber Sale areas and includes flows from a large land area including the Donahue Brook watershed. Patte Brook had approximately 5.3 percent (120 acres) of the total watershed harvested with group selection and shelterwood cuts; this included harvest of approximately 39.4 percent (66 acres) of the Donahue Brook watershed.

Turbidity and pH were within their normal ranges and changed very slightly, if at all, from pre- to post- harvest levels (Table 3). The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which

[2] Area estimates in this analysis include 20% of the total unit acreage for group selection cuts and 100% of the total unit acreage for overstory removal and shelterwood cuts; it is important to note that although these cuts are spread over the entirely of a unit, not all stems are cut and some level of basal area remains on site after all types of harvest.

Table 3. Four Ponds Project: Average values before and after harvest to-date

	Number of Samples	Turbidity (NTU)	pH	Total Al (ppb)	Inorganic monomeric Al (ppb)	Nitrate (as nitrogen) (ppm)
East Branch Pleasant River						
Pre	10	0.1	6.5	103	2	0.01
Post	8	0.4	6.5	123	5	0.00
Patte Brook						
Pre	8	0.4	6.4	124	3	0.02
Post	12	0.4	6.3	99	5	0.01
Donahue Brook						
Pre	7	0.4*	6.3	141	3	0.01
Post	11	0.5	6.1	112	4	0.00

*Turbidity in Donahue Brook does not include two pre-harvest outliers of 4.5 and 8.4

an aquatic community can be exposed indefinitely without resulting in an unacceptable effect[3]. Total aluminum concentrations exceeded the CCC (87 ppb) in all watersheds but never approached the CMC level (750 ppb); this was true for both pre- and post- harvest monitoring. In the Patte and Donahue watersheds total aluminum concentrations actually decreased after harvest, and increased only slightly in the EB Pleasant watershed. 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 all watersheds post-harvest, remaining well below detrimental levels. Nitrate decreased slightly in all watersheds after harvest, and remained below the average 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 in some cases the direction, particularly in aluminum concentrations, 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. Post-harvest monitoring will continue and results will be provided in future monitoring reports as harvest occurs.

Harvest also has taken place in part of the North East Swift Integrated Resource Management Project in Albany and Bartlett, New Hampshire. Harvest occurred in the watersheds of Douglas Brook, Falls Brook, and 209 Brook. Preliminary post-harvest data are available for this partially completed project. A pre- and post-harvest comparison is presented in Table 4.

By the end of the 2014 monitoring period, approximately:

[3] Maine Department of Environmental Protection. Surface Water Quality Criteria for Toxic Pollutants; Chapter 584. Accessed March 28, 2014 at https://www.maine.gov/dep/water/rules/index.html

- 2.2 percent (71.1 acres) of Douglas Brook watershed had been harvested with single tree selection, clearcut, and group selection treatments,
- 4.5 percent (28.5 acres) of Falls Brook watershed was harvested with group selection cuts and thinning, and
- 1.5 percent (4.5 acres) of 209 Brook watershed was harvested with group selection cuts. [4]

Turbidity was absent or remained very low and pH showed a slight increase from pre- to post- harvest conditions in all watersheds. Total aluminum exceeded the NH Freshwater Chronic Criterion for Class B waters (87 ppb) at all sites both pre- and post- harvest, with the exception of Falls Brook which fell below this threshold after harvest. Inorganic monomeric aluminum concentrations at these sites were very low before harvest. After harvest these concentrations decreased in Douglas Brook and 209 Brook and increased slightly in Falls Brook, remaining well below detrimental levels. Nitrate levels increased very slightly in Falls Brook and 209 Brook and remained constant in Douglas Brook. All watersheds were near or below the average nitrate value for streams on the National Forest and far below the state maximum contaminant level for drinking water (10 ppm).

Table 4. North East Swift Integrated Resource Management Project: Average values before and after harvest with minimal harvest in the watersheds

Sample Point and Sampling Period	Number of Samples	Turbidity (NTU)	pH	Total Al (ppb)	Inorganic monomeric Al (ppb)	Nitrate (as nitrogen) (ppm)
Douglas Brook						
Pre	6	0.2	6.6	121	11	0.05
Post	14	0.3	6.7	119	9	0.05
Falls Brook						
Pre	12	0.0	6.3	95	14	0.07
Post	5	0.0	6.6	74	15	0.08
209 Brook						
Pre	12	0.0	6.0	171	39	0.07
Post	6	0.0	6.1	128	23	0.08

**All data is presented as an average over the entire sampling period*

Like the results for the Four Ponds Integrated Resource Management Project, the magnitude of the change and in some cases the direction suggest that timber harvest has had little, if any, effect on water chemistry. Seasonal variation, precipitation events, and measurement uncertainty can also contribute to differences in these values, especially due of the small number of samples. Post-harvest monitoring will continue and results will be provided in future monitoring reports as harvest occurs.

[4] Area estimates reflect 20% of the total unit acreage for group selection cuts and 100% of the total unit acreage for clearcuts, single tree selection, and thinning cuts; it is important to note that although single tree selection and thinning can be spread out over the entirely of a unit, not all stems are cut leaving some level of basal area on site after harvest.

Project Reviews

Monitoring of objective attainment, standard and guideline implementation and effectiveness, and the effects of management practices on resources discussed above all involved project-level monitoring. In addition to those efforts, project monitoring is a regular part of business on the White Mountain National Forest. Whether through contractor and permit inspections or interdisciplinary site visits, Forest staff monitor project implementation and effectiveness on innumerable projects each year. This section of the report summarizes a small portion of those reviews.

Prescribed Burning to Regenerate Oak and Pine

WMNF fire staff revisited three oak-pine prescribed burn units (Right Angle, Clifford Brook, and Camp 7) in 2014 to monitor progress toward long-term vegetation goals. These changes often do not appear until several years after the initial treatment. A good response of red oak and white pine was observed in two of the three units.

In the Right Angle unit burned in 2009, successful oak regeneration was noted in 2011 and by 2014 it had reached a point where a further release treatment was appropriate. The Forest's fire staff and Youth Conservation Corps crew removed sapling of other species that were competing with red oak saplings. Further treatments are likely to be needed to mimic the disturbance oak-pine usually requires to do well. Ultimate success will be a component of healthy, pole sized (4-7" DBH) red oak throughout the stand.

Left: Red flagging is 3-4' red oak stems competing successfully in understory layer in 2011. Right: Red oak stems have increased to 6-9' in 2014 and are released to further improve growth. WMNF photos by John Neely.

The Clifford Brook unit burned in 2012 in Warren, NH also showed a good response of oak and pine species in the understory. Oak and pine seedlings are present in the understory and will be monitored for an eventual release similar to Right Angle unit.

The Camp 7 unit in Ellsworth, NH was burned in 2011. Due to wetter site conditions, it was a low intensity fire. The site does have some oak and pine trees, but most of the overstory is northern hardwood species, spruce, and fir. The prescribed burn reduced the fine dead fuels and increased browse but, as of the 2014 monitoring visit, not many oak or pine seedlings were visible. Given the species present and the effect of site conditions on fire intensity, another prescribed burn is not planned for this unit.

Left: Low intensity fire behavior on Camp 7 in 2011. Right: Increased growth but little oak or pine observed 2014. WMNF photos by John Neely.

Fiber Optic Cable to Mt. Tecumseh

The Mt. Tecumseh Communication Site is located within the Waterville Valley Ski Resort Special Use Permit Area at an elevation of about 3800 feet. A tower and associated facilities on the site provide TV, radio and high speed internet and cell phone service for the surrounding geographical area. To ensure that reliable communications will be available into the future, about 2500' of fiber optic cable was installed in conduit from Waterville Valley to the Communication Site. A site visit during installation showed good implementation of best management practices. The trench was narrow to minimize disturbance and backfilling, seeding, and mulching occurred almost immediately to prevent erosion. In the photo (right; WMNF photo by Tom Paquette) the upper equipment is digging the trench, the lower equipment is backfilling after conduit is installed, and mulch and erosion control devices can be seen immediately behind that.

Other Monitoring

Forest Regrowth

Photo monitoring of clearcut, group selection, and salvage treatment areas continued in FY14. Monitoring of 16 locations across the Forest began in 2012. The primary intent of the monitoring is to provide a visual display of the various stages of natural regeneration/revegetation of harvest areas over time on the White Mountain National Forest. The intended audience is any member of the public who may not be familiar with how stands grow back following clearcutting, group selection, and salvage treatment. Many folks are familiar with what a clearcut looks like at year one; fewer are familiar with what the same piece of ground looks like after three, five, ten, twenty years.

Base Road Salvage sale in 2012 immediately after harvest. WMNF photo by Steve Jones.

Base Road Salvage sale in 2013. WMNF photo by Steve Jones.

Base Road Salvage sale in 2014. WMNF photo by Roger Boyer.

Large Mammal Surveys

Since the 1990s, the WMNF has implemented various survey methods to determine winter trends of various mammals. Target species include Canada lynx, marten, fisher, coyote, and snowshoe hare, among others. In recent years, technological advances and reduced staffing levels have led to another method being tried. Over the past two winters, Forest biologists, along with partners at the NH Fish and Game Department and volunteers, have used trail cameras, along with traditional snow tracking surveys, to collect information on mammals in high elevation habitats.

American marten near Mt. Jefferson. WMNF camera photo.

At various high elevation sites on the Forest, cameras were deployed along with a stake to measure snow depth throughout the winter. Stakes were baited with skunk lure and visual attractants such as feathers. Hanging, shiny CDs were also used to lure in curious animals. Along with the cameras, biologists and volunteers traveled predetermined routes and noted all carnivore tracks crossing each route. Many of the routes were paired in conjunction with the cameras, to allow for comparison of both methods.

Surprisingly, each method yielded similar results. Generally, the species captured on a camera were also noted on the fixed routes. Costs for both methods also were similar since camera sites were rebaited periodically. However, at the end of the winter, cameras were left on and collected data throughout the rest of the year, providing additional information.

Preliminary results indicate marten are doing quite well in deep snow habitats. Other carnivores were encountered more frequently at lower elevation sites where the snowpack is less deep. Once the snowpack recedes, more generalist species such as bobcat, coyote, and fisher are once again seen at higher elevations.Camera surveys will continue in the future to monitor these species.

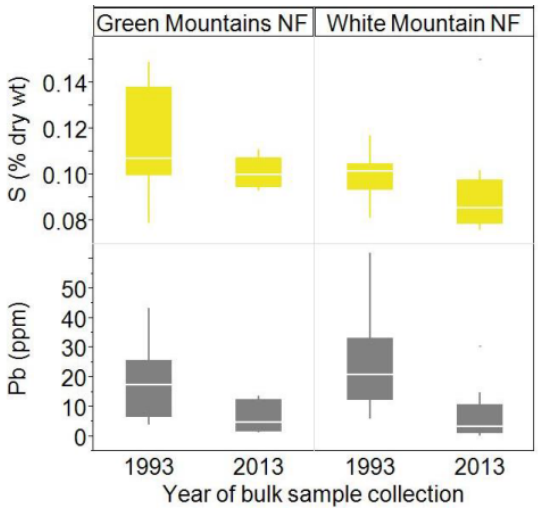
Lichens and Air Quality

Over the preceding three years, the WMNF worked with the Northern Research Station and others to monitor lichens in Class I airsheds. Lichens are valued for monitoring air quality because they can concentrate air- and precipitation-borne elements within the lichen thallus, and lichen species have different and characteristic responses to pollutants such as sulfur (S) and nitrogen (N).

Lichen monitoring. USFS photo by Ralph Perron.

Lichens were collected in 1993 to assess the pollutant concentrations in lichens residing in Class I Wilderness areas of the White Mountain National Forest in NH (Presidential Range-Dry River Wilderness and Great Gulf Wilderness) and the Green Mountain National Forest in VT (Lye Brook). In 2011-2013, we re-sampled for lichen chemical concentrations and surveyed for diversity and health of epiphytic lichens at four stands in each Class I Wilderness Area. The plots followed the size and time constraints of the Forest Inventory Analysis plots (McCune et al. 1997): a 34.7m radius plot with a one-hour timed survey and a collection of one specimen for each species found on the plot. Bulk samples were collected off-plot due to the amount of lichen required (several grams of dry weight).

Concentrations of two pollutants considered harmful to public health and the environment, sulfur and lead, have decreased in lichen thalli since 1993. This reduction in pollutants is in agreement with aerosol data collected at our IMPROVE (Interagency Monitoring of Protected Visual Environments) site in Greens Grant, NH. Comparison to data from 1993 was complicated by the lack of archived material, which could have been run in conjunction with present day samples using current methods and equipment. Samples collected in 2011-2013 are being processed for archiving so that current lichen chemical concentrations can be compared with future lichen chemical concentrations using appropriate future methodologies for long term lichen thalli comparisons.



A four point scale was applied to assess thallus health on all collections:

0 = thallus in very poor condition (more than one of the following symptoms: convoluted lobes, bleaching, black speckles, pink blotchy areas; or extensive other discoloration
1 = thallus in poor condition (one or two of the previously listed symptoms, but not as extensive on the thallus surface);
2 = within the normal range for the species
3 = robust specimen

The specimen on the left received a health score of 2 (normal) while the specimen on the right received a health score of 0 (poor condition). Photos taken by Patricia Hinds on specimens collected for this project and scored by Jim Hinds.

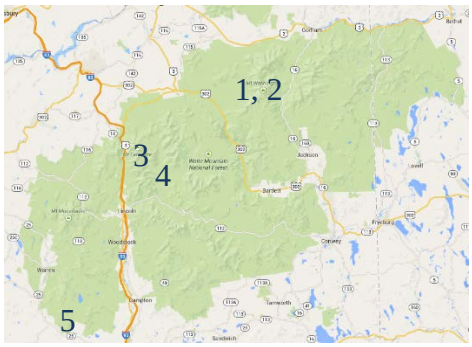
The photos above demonstrate the differences in the thallus health of a common species *Parmelia sulcata*. Both photos were taken at 14X magnification. The decreased size of the poor specimen in the photos is actual size difference.

Mean thallus health scores in the Great Gulf and Presidential Range-Dry River Wildernesses were between 1.5 and 2.0. Despite improving air quality, average thallus health range between poor and normal condition. The health scores of lichen thalli from the plots correlated well to the lichen richness of the plots and patterns in pollution, suggesting species richness is linked to damage from pollution.

Recreation

In 2014 the WMNF partnered with the Park Studies Laboratory (PSL) in the Rubenstein School of Environment and Natural Resources at the University of Vermont to conduct recreation and wilderness monitoring and evaluation. Research conducted by the PSL over the next few years will help answer the Forest's monitoring questions on recreation use and visitor satisfaction. Results will inform recreation planning and management efforts. Collaboration between WMNF and PSL identified an appropriate set of recreation areas and experiences to monitor. These locations and experiences were chosen because they represent exemplary, iconic, or characteristic recreational experiences in the WMNF, have potential for visitor capacity (experience) related management concerns, and span a diverse range of geographies and recreational activities.

Site	Recreation Area	Recreation Experience Concern
1	Crawford Path	Trail crowding & conflict
2	Gulfside Trail, Mt. Jefferson	Trail crowding & conflict; Summit crowding & conflict
3	Franconia Ridge Trail, Mt. Lafayette	Trail crowding & conflict; Summit crowding & conflict
4	Pemigewasset Wilderness	Wilderness camping use & capacity
5	Rumney Rocks Climbing Area	Parking capacity & route displacement



The summer field season of 2014 was dedicated to documenting and quantifying recreation use occurring at the selected areas to help answer the Forest's monitoring questions related to trail and climbing use and the level of visitor satisfaction on the Forest as measured by quality of experience and perception of crowding.

Field data collection began July 1 and concluded November 21, 2014. Primary data collection included the deployment and calibration of trail counters, photography of trail use, counts of mountain summit use, collection of travel times and group sizes, counts of cars in parking lots at Rumney Rocks, self-reports of climbing displacement at Rumney Rocks, and counts of campers in the Pemigewasset Wilderness.

Counting summit visitors on Gulfside Trail. Photo by Nathan Reigner, PSL.

Preliminary results from a single year of monitoring indicate that the Crawford Path and Franconia Ridge Trails were both used by more than 400 hikers per day on the busiest 10% of days during the summer, and saw maximum use of about 1,000 hikers/day. Not surprisingly, Saturdays were the busiest day on these trails, with greatest use during the mid-day.

Three of the four tent campsites (Liberty Springs, Garfield Ridge, and Guyot) monitored in the Pemigewasset Wilderness exceeded capacity every Saturday night in the survey window and were at or above capacity many other nights. Only Thirteen Falls tent site was regularly below the designed capacity.

On weekend afternoons visitation at Rumney Rocks often met or exceeded the physical parking capacity of the two parking lots. Weekdays and even weekend mornings saw fewer visitors, with sufficient parking available in the two lots. Based on self-reporting, climbers were displaced from their desired route because it was already in use by others about 16% of the time.

The preliminary results describe current condition and the relationships between use levels and recreation conditions (e.g. the relationship between trail counters and parking occupancy at Rumney Rocks). However, monitoring data alone is insufficient to complete the evaluation of recreation and wilderness conditions identified in the WMNF Monitoring Guide. Monitoring describes what *is*. Evaluation considers what *ought to be* and compares current conditions against benchmarks to determine if management objectives are being achieved. No evaluative benchmarks exist for many key recreation qualities. Generation of these benchmarks and subsequent comparison to monitoring data is the focus of work with the Park Studies Lab in future years.

Rumney Rocks parking on a busy day. WMNF photo.

In future years, collected data will be evaluated further, and computer simulation and statistical models will be used to estimate levels of crowding on trails and mountain summits. Occurrences of climbing displacement at Rumney Rocks will be further analyzed to identify locations, times, and levels of use at which displacement is more or less likely to occur. Monitoring will be repeated to begin developing trends in recreation use and generate data that can be used to validate statistical and simulation models. PSL and the WMNF also intend to design, gain approval for, and administer a visitor survey to gather input directly from recreationists on the quality of their experience and our management. Based on the accumulation of information, we will work together to identify ways to know whether our recreation management objectives are being achieved.

Riparian and Aquatic Habitats

The Forest Plan includes a goal to "Manage riparian areas to provide coldwater, coolwater, and warmwater aquatic communities within the ecological capability of the landscape." Given concerns related to a changing climate, there is value in knowing the status of stream temperatures within the WMNF where some of the highest elevations east of the Mississippi occur. There is also value in understanding the relationship of air temperature and stream temperature within the WMNF to provide insight on how potential warmer temperatures may influence stream temperatures thoughout the landscape of the White Mountains. Beginning in 2011, sampling of summer stream and air temperatures was initiated to assess the current condition of stream thermal conditions across the WMNF and to establish baseline conditions for future assessments.

Paired air and water temperature sensors (thermographs; WMNF photo to left) were installed and recovered at 35 stream sites in six watersheds across the Forest. Watersheds were randomly selected from those that are dominated by the General Forest Management Area (MA 2.1). Within each watershed, site selection was stratified to provide a range of stream sizes and elevations. At each site, one sensor was placed in the stream while another was placed to measure air temperature within 50 meters in the adjacent riparian area. The pairing of loggers allowed a comparison of stream water temperature changes with local air temperature changes.

Average July water temperature (AJAT) is the metric used to classify streams into thermal classifications, as follows:

- Coldwater <18C (65F)
- Coolwater >18C and <21C (>65F and < 70F)
- Warmwater >21C (>70F)

Water temperature logger installation. WMNF photo by Erica Roberts.

Figure 1 shows AJAT averaged for 2011 to 2014 for all 35 monitoring sites on the WMNF. Sites are listed from smallest to largest drainage area. Of the 35 temperature monitoring sites, 28 are classified as coldwater streams, six as coolwater streams, and no warmwater temperatures occurred. The six coolwater sites were among the nine largest drainage area sites. None of the sites averaged 19 C or more, which is the midpoint of the coolwater classification. Half of the coldwater sites averaged <15 C, well below the threshold for coolwater classification.

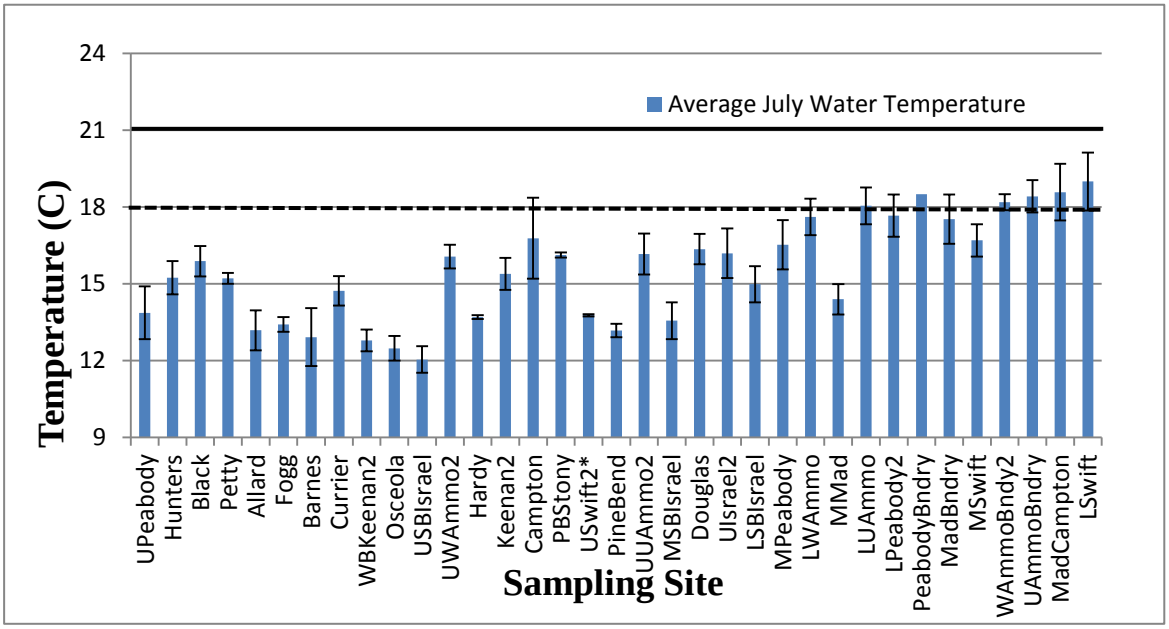


Figure 1. Average July Water Temperature averaged for 2011-2014 for sampling sites in six watersheds within the WMNF. Sites are shown from smallest to largest drainage areas. Solid line is warmwater threshold and dashed line is coolwater threshold.

Fish were collected at 15 of the temperature monitoring sites in 2012 and 2013. Fish community composition was in strong agreement with the scientific literature based on stream temperature classification (Figure 2). Brook trout and slimy sculpin dominated all 12 of the coldwater sites (<18 C), while minnow species were more common in the three coolwater sites (>18 C <21 C). Brook trout are generally rare in streams that average over 21 C. Although no sites with average temperatures >21 C were sampled, brook trout were certainly less represented at the warmer sites.

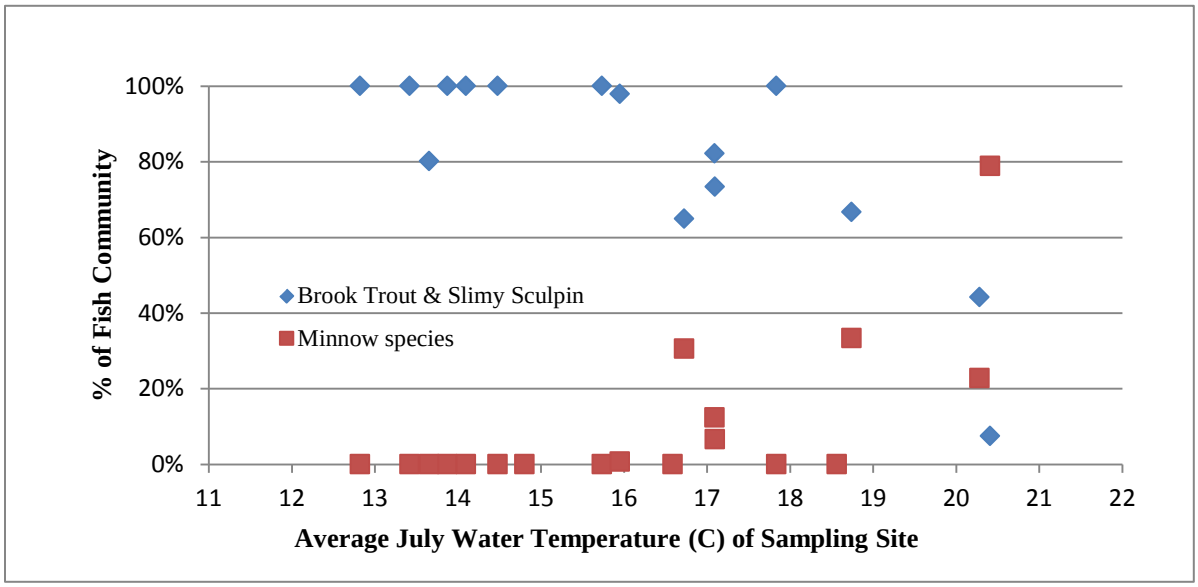


Figure 2. Percent of the fish community comprised of coldwater species (brook trout and slimy sculpin) and minnow species (coolwater or warmwater species) in 2012 and 2013 relative to the average July water temperature of the sampling location from 2011-2013.

Air temperature varied significantly with elevation in the WMNF (Figure 3). Air temperature in July decreases approximately one degree C for every 500' increase in elevation, between 500' and 2000'. The highest average air temperature in July was 20.5 C, which is lower than the threshold for warmwater streams (21 C). Clearly, the high elevations within the WMNF, combined with a heavily forested landscape, provide an ideal environment for coldwater streams.

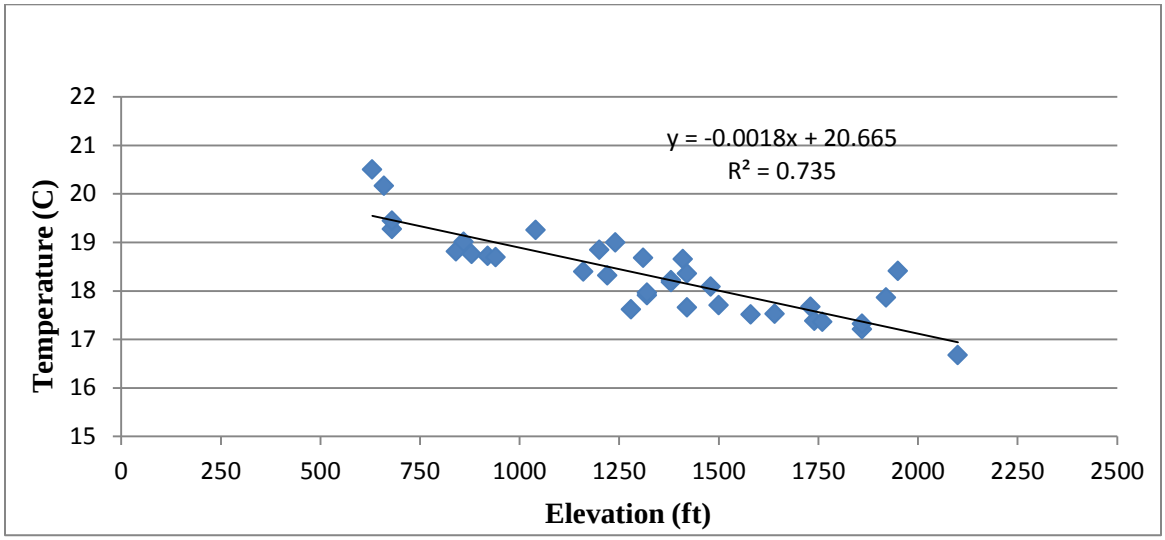


Figure 3. Average air temperature in July, averaged for the years 2011-14, compared to sampling site elevation, for sampling sites in six watersheds within the WMNF.

Timber Cruising

In FY14 WMNF forestry program staff worked with timber industry representatives to monitor the Forest's timber cruising process and volume estimation procedures. A collaborative effort was made to cruise standing and felled timber and to destructively sample logs to check the accuracy of the volume estimations on an active WMNF timber sale. Overall the goal was to monitor and improve processes used on the Forest. The purpose of doing the monitoring collaboratively was to help members of the New Hampshire Timberland Owners Association (NHTOA) and the local forest products industry gain a better understanding of the processes, procedures, and quality control mechanisms used by the Forest Service in determining timber volumes for timber sales. All trees sampled were found to be within tolerance as described in Forest Service Handbook 2409.12, the Timber Cruising Handbook.

Forest Service personnel and local timber industry representatives examine downed logs for defect. WMNF photo by Roger Boyer.

Woodland Bat Acoustic Surveys

In 2014, WMNF staff completed both driving and stationary acoustic surveys in an effort to learn more about the 8 bat species that use the White Mountain National Forest (WMNF), especially the five species that hibernate on or near the WMNF and have been afflicted by white-nose syndrome.

Driving Surveys

Since 2009, WMNF biologists have annually surveyed a series of driving transects as part of a large, multi-agency, regional survey covering the eastern U.S. Five transects were set up during the initial year, with four more added in 2010 and the latest transect established in 2013. Nine of 10 transects were completed in 2014. Table 5 displays all transect locations.

Table 5. WMNF Woodland bat driving acoustic survey locations.

District	Route Name	Starting County	Distance (miles)	Starting year
Androscoggin	Bog Dam Loop	Coos, NH	19.7	2009
Androscoggin	Greenwood[5]	Oxford, ME	25.1	2010
Pemigewasset	Tripoli Road	Grafton, NH	20.1	2009
Pemigewasset	Stinson Lake Road	Grafton, NH	22.1	2009
Pemigewasset	Canterbury[5]	Belknap, NH	27.2	2010
Pemigewasset	Base Rd/Jefferson Notch	Coos, NH	34.2	2010
Pemigewasset	Zealand	Grafton, NH	17.8	2013
Saco	Highway 113	Oxford, ME	28.2	2009
Saco	Kancamagus Hwy	Grafton, NH	21.7	2009
Saco	Rob Brook Road	Carroll, NH	23.7	2010

Transects were surveyed 2-3 times in June and early July using Anabat SD-1 and SD-2 bat detectors (Titley Scientific, Columbia, Missouri). Consensus among bat biologists is that local bat pups will not yet be able to fly before July 15. Therefore, counts will be based only on adults and not be biased by young of the year.

Following the survey, each call was evaluated using AnalookW, a proprietary software program developed by the creators of the Anabat detector system. Although many bat calls were identified to species level, in order to perform a complete analysis using all of the data, all calls were categorized into three groups based on minimum characteristic frequencies: low, medium, and high. The low frequency group included the hoary bat, the silver-haired bat, and the big brown bat, as well as any calls with characteristic minimum frequencies that fell below 30kH. Within this group, only the big brown bat is affected by white-nose syndrome, but with mortality rates that have been much lower than the other four affected species.

The medium frequency group included calls generally ranging from 30-35kH. This would include most red bat calls, but could also potentially include little brown bats, silver-haired or big brown bats. Because of the combination of bats that could potentially fall into this category, it is the least useful for analysis purposes.

All of the bats in the high frequency group (little brown bat, northern long-eared bat, eastern small-footed bat, and tri-colored bat) are species affected by white-nose syndrome, so it is this category that is most useful for evaluating changes as a result of the disease. In addition, a few red bat calls may be included if these bats were navigating around a lot of clutter, but these are expected to be few.

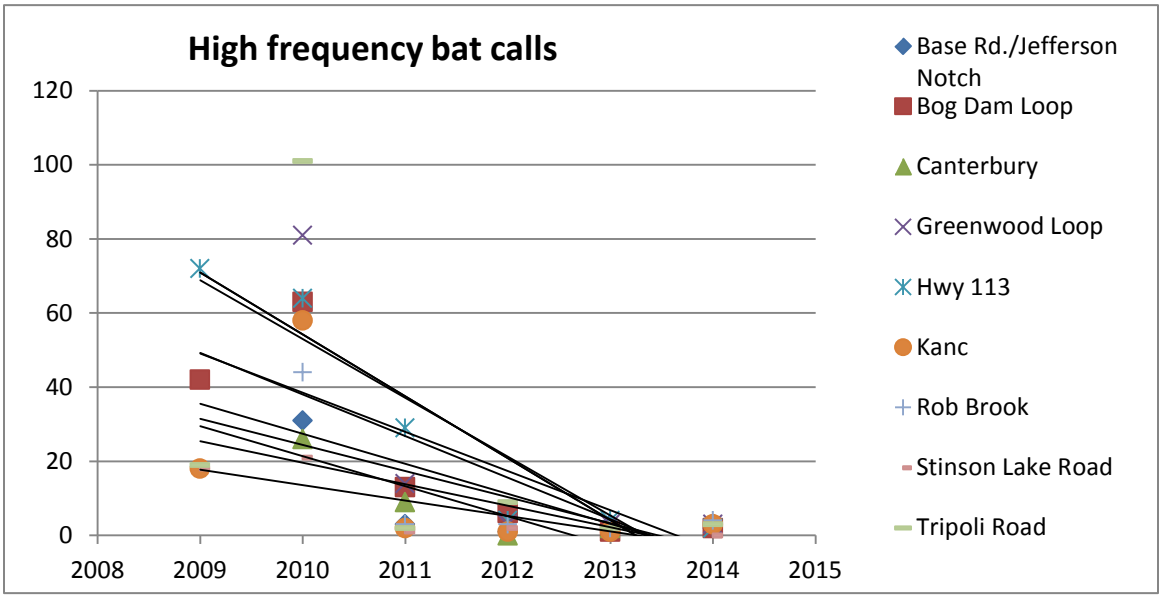
A total of 920 bat calls were collected on driving surveys in 2014. Of these, approximately 2% were categorized as unknown (usually call fragments) and not used in the analysis. For analysis purposes, the replicate with the highest number of calls by species was used.

[5] These routes are located off of the WMNF for comparison. Canterbury was not surveyed in 2014.

Table 6. Driving survey results: High frequency (40kH+ only)

Transect	2009	2010	2011	2012	2013	2014	% change[6]
Base Rd./Jeff. Notch		31	3	1	3	2	-93.5%
Bog Dam Loop	42	63	13	6	1	2	-95.2%
Canterbury		26	9	0	2	N/A	-92.3%
Greenwood Loop		81	14	3	3	3	-96.3%
Hwy. 113	72	64	29	4	4	2	-97.2%
Kancamagus Hwy	18	58	2	1	1	3	-83.3%
Rob Brook		44	3	3	2	4	-90.9%
Stinson Lake Road	18	21	1	2	2	0	-100.0%
Tripoli Road	19	101	2	9	2	3	-84.2%
Average	**33.8**	**54.3**	**9.4**	**3.2**	**2.2**	**2.4**	**-92.6%**

Although previous analyses documented substantial declines in the high frequency bats (93% between 2009 and 2013), overall numbers for this group remained similar from 2013 to 2014 (20 bats counted on nine routes in 2013, 19 bats counted on eight routes in 2014), so overall decline between 2009 and 2014 remains at 93% (Table 6). Although the absolute numbers are very low compared to those of earlier surveys, all but one transect surveyed in 2014 had high frequency bats present, and the average number of bats per transect increased slightly in 2014, which may indicate some of these bats are persisting on the WMNF.

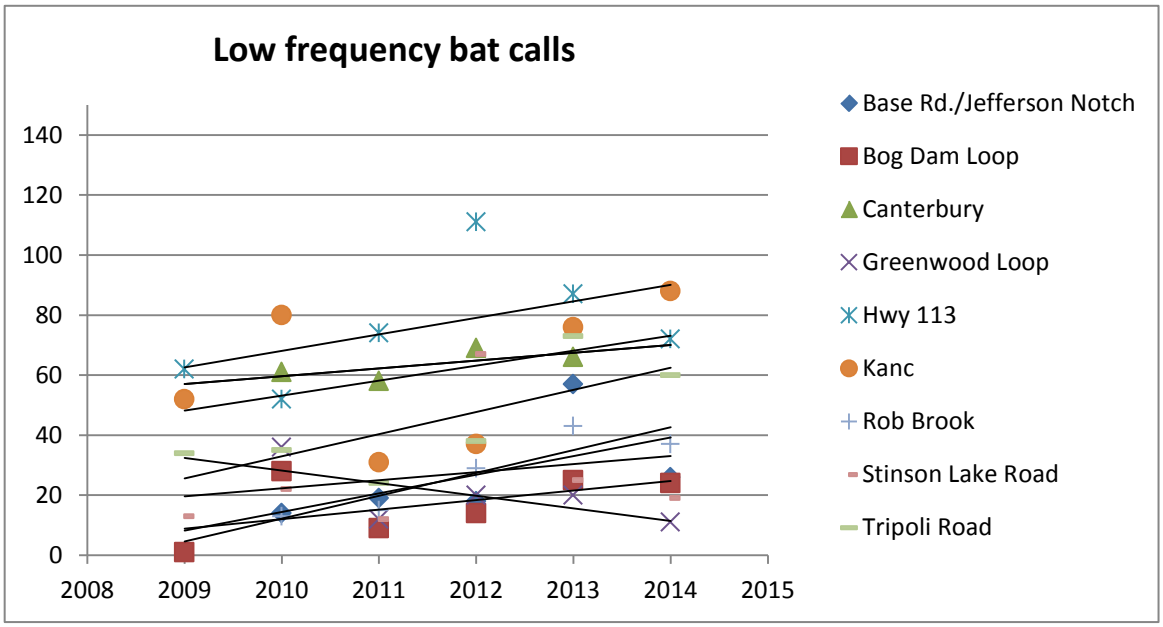


[6] Because the Zealand transect has only been surveyed for 2 years, it was not included in this analysis.

Table 7. Driving survey results: Low frequency (<30kH only)

Transect	2009	2010	2011	2012	2013	2014	% change
Base Rd./Jeff. Notch		14	19	18	57	26	85.7%
Bog Dam Loop	1	28	9	14	25	24	2300.0%
Canterbury		61	58	69	66	NA	8.2%
Greenwood Loop		36	12	20	20	11	-69.4%
Hwy 113	62	52	74	111	87	72	16.1%
Kanc	52	80	31	37	76	88	69.2%
Rob Brook		13	15	29	43	37	184.6%
Stinson Lake Road	13	22	12	67	25	19	46.2%
Tripoli Road	34	35	24	38	73	60	76.5%
Average	32.4	37.9	28.2	44.8	52.4	42.1	**301.9%**

For comparison, data from low frequency calls were also analyzed in a similar way (Table 7). On average, low frequency bats increased 302% over the same survey period. All but one of the nine transects evaluated had overall increasing trends of low frequency bats.

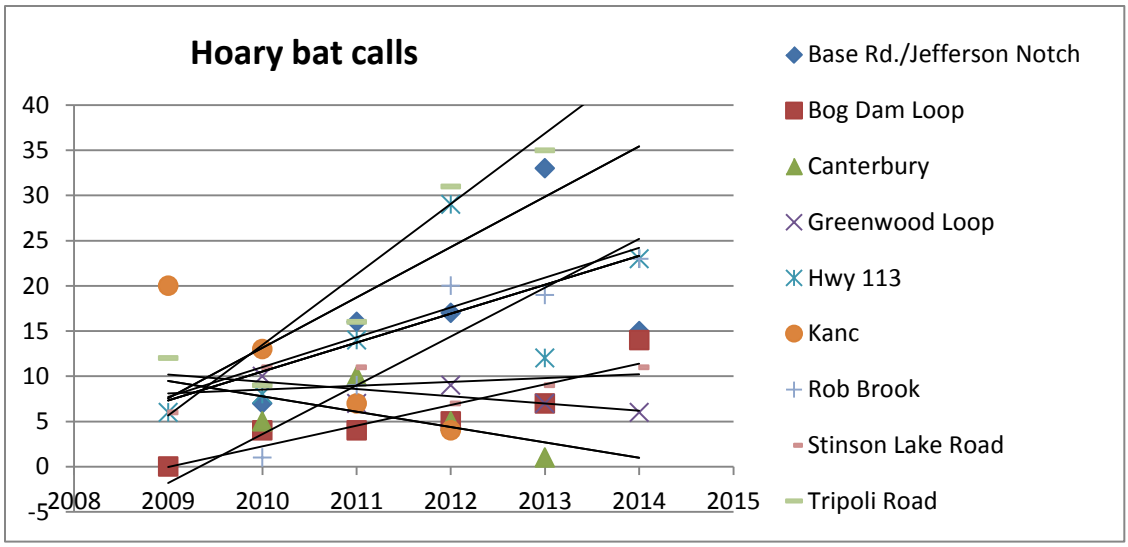


Because there may be some overlap of different species calls between the above analysis categories, a separate analysis was completed for the hoary bat. The calls of this species are perhaps the most readily identifiable, i.e., hoary bat calls are less likely to be confused with any other species. Therefore analysis might illustrate the population trend of a species that is unaffected by white-nose syndrome.

Transect trends were quite variable for the hoary bat, ranging from an 80% decline on the Canterbury transect (through 2013) to a 2200% increase on the Rob Brook Road transect (Table 8). Interestingly, the only two transects with negative trends are the two located off of the WMNF, although the change in absolute numbers is not great.

Table 8. Driving survey results: Hoary bat

Transect	2009	2010	2011	2012	2013	2014	% change
Base Rd./Jeff. Notch		7	16	17	33	15	114.3%
Bog Dam Loop	0	4	4	5	7	14	1400.0%
Canterbury		5	10	5	1	NA	-80.0%
Greenwood Loop		10	7	9	7	6	-40.0%
Hwy 113	6	8	14	29	12	23	283.3%
Kanc	20	13	7	4	44	41	105.0%
Rob Brook		1	9	20	19	23	2200.0%
Stinson Lake Road	6	11	11	7	9	11	83.3%
Tripoli Road	12	9	16	31	35	48	300.0%
Average	**8.8**	**7.6**	**10.4**	**14.1**	**18.6**	**22.6**	**485.1%**



Overall results clearly indicate that local populations of at least 4 of the 5 bat species affected by white-nose syndrome have declined considerably in the last six years, which is consistent with population declines reported by a number of other sources. Survey data show a shift in proportions of high frequency and low frequency bats. On the positive side, high frequency bats are still present on the Forest. Results from the hoary bat analysis indicate that populations may fluctuate considerably from year to year, which is probably true of the other bat species as well. Further monitoring will help determine if populations stabilize or if losses from white-nose syndrome continue to occur.

Project acoustic surveys

In 2013, the U.S. Fish and Wildlife Service proposed the northern long-eared bat for listing under the Endangered Species Act; the species was listed in April 2015. In an effort to collect more information on where this species occurs on the Forest, WMNF biologists implemented acoustic surveys across a number of projects in 2014. Based on concerns identified by the Fish and Wildlife Service in their listing proposal, surveys focused on timber sales and prescribed burn areas. In addition, detectors were placed in

the vicinity of two historic northern long-eared bat maternity colony sites that were active in the 1990s prior to white-nose syndrome. Surveys primarily followed the recommended Indiana bat survey protocol (FWS 2014).

Parts or all of 11 project areas, encompassing approximately 40,000 acres, were surveyed between May 15 and August 31, 2014. In total, detectors were deployed at 153 unique locations. Three types of acoustic detectors were used: the Anabat SD-2, Song Meter SM2BAT, and Pettersson D500x. In all but one case, directional microphones were oriented horizontally and raised on external cables to better sample the bats' airspace (see photo, right).

Stationary bat detector setup. WMNF photo by Leighlan Prout

All detectors were set to turn on at 6:00 pm and stop recording at 5:00 am the following morning. A total of 706 detector nights of data were collected. However, only 491 nights met required survey parameters for temperature, wind, and precipitation. A number of surveys had to be repeated due to interference by bears or rodents, because of high water flooding the setup, or because analysis indicated the memory card filled up before the end of the survey period (usually because of a rain event). In some cases no calls were recorded, but log files were reviewed to make sure the detectors were working properly.

Upwards of 17,000 possible bat file recordings were collected. To analyze the data, all files were processed through two of three available automated acoustic analysis programs: Kaleidoscope Pro (v. 1.1.22 or 3), Sonobat (v. 3.2.1) or EchoClass (v. 2), depending on the detector equipment being used to record calls. Each program attempts to assign a species identification to each file or to label the file as noise or something other than a bat. Automated analysis programs classified northern long-eared bats at 10 of the 11 project areas surveyed. After reviewing suspected calls by hand, northern long-eared bats were confirmed or considered probable at 15 separate locations in 7 project areas (Table 9), equating to nine percent of the total detector locations surveyed.

Interestingly, northern long-eared bat (NLEB) calls were not evenly distributed at either the Forest scale or within individual project areas. For example, over half of the detector locations with positive NLEB calls were located in the Maine portion of the Forest, while no NLEB were found on any of the project areas surveyed on the Saco Ranger District, except at the historic maternity colony site. At both project areas with more than one positive NLEB detector location, NLEB were found in "clumped" arrangements of detector locations, rather than scattered throughout the entire project area. The assumption is that these areas of higher NLEB activity could indicate possible maternity colonies and will warrant extra consideration during project analysis. Encouragingly, NLEB calls were detected at both historic maternity colony sites despite over 20 years having passed since NLEB were confirmed roosting at these locations.

Table 9. Northern long-eared bat (NLEB) survey results on the WMNF, summer 2014.

	Project	approx. project acres	approx. acres summer harvest or prescribed burning	# detector sites	# nights meeting survey protocol	total # possible bat calls recorded (Kaleidoscope/ Sonobat/Echoclass)	# NLEB calls classified by software	# NLEB calls after hand verifying	# sites with NLEB detected
Andro	Albany South IRP	7900	2954	33	111	1,284/ /1,560	33	10	5
	Bell Mountain Timber Sale	600	318	4	23	20 / /87	1	1	1
	Four Ponds Timber Sale	1500	228	12	56	451/ /905	20	7	1
Pemi	Bowen Brook IRP	9000	1631	60	138	1,404/2,836/	17	4	4
	Indigo Timber Sale	6500	1354	4	10	95/116/	1	0	1?
	Prescribed Burns	500	500	4	22	251/248/	4	0	
Saco	Douglas Brook Timber Sale	2700	440	4	13	7,764/ /14,141	7	0	0
	Northeast Swift Timber Sale	5400	655	14	42	24/ /55	0	NA	0
	Province Timber Sales	7300	912	15	68	213/ /260	34	0	0
	Historic Maternity Colonies								
	Pemi	NA	NA	1	5	33/87/	2	1	1
	Saco	NA	NA	2	8	972/1,658/	195	5	2
	TOTALS	**49000**	**9447**	**153**	**491**		**314**	**28**	**14**

Another interesting observation was that all of the NLEB locations were within approximately one half mile of a wetland. This supports earlier work done on the WMNF where Sasse (1995) found NLEB maternity roost trees in proximity to wetland complexes.

In 2015, WMNF staff plan to continue similar surveys in other project areas to help elucidate NLEB relative abundance and identify occupied habitat on the WMNF.

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. On-Forest research ranges from single to multi-year projects. Some projects occur entirely on the WMNF, while others may only have a small portion of their field work occurring here. Several long term research studies are ongoing, including work that examines tree survival and growth following ice storm injury and nutrient addition experiments that look at the relative roles of several nutrients in regulating forest growth and nutrient cycling processes. Additional research in FY14 focused on a wide diversity of topics including preparedness and decision making trends of visitors to avalanche prone areas, regional population trends of wood turtles, winter survival of moose in New Hampshire, biological mercury hotspots in montane ecosystems, mosquitos as disease vectors, among others. Research proposals are reviewed by Forest specialists before an approval letter is issued. Often limitations are placed on the location, type of activity, or intensity of work 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.

Beyond the projects that are taking place outside of designated research areas, the WMNF has two very active experimental forests within its boundaries, Hubbard Brook and Bartlett. In addition, there are three Research Natural Areas and five Candidate Research Natural Areas.

Moose on the WMNF. Photo by Forrest Seavey.

Literature Cited

McCune, B., J. Dey, J. Peck, D. Cassell, K. Heiman, S. Will-Wolf, P. Neitlich. 1997. Repeatability of community data: species richness versus gradient scores in large-scale lichen studies. Bryologist 100:40-46.

U.S. Fish and Wildlife Service. 2014. 2014 Range-wide Indiana bat summer survey guidelines. Available: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html.

Wetmore, C.M. 1995a. Lichens and Air Quality in Lye Brook Wilderness of the Green Mountain National Forest. Final Report for USDA Forest Service, Contract 42-649.

Wetmore, C.M. 1995b. 1993 Elemental Analysis of Lichens of the White Mountain National Forest Wilderness Areas. Final Report for USDA Forest Service and Northeast Area State and Private Forestry, Forest Health Protection. Contract 42-649.