
Newsletter

Vermont Monitoring Cooperative

Vermont's Cooperative Forest Ecosystem Monitoring & Research Program



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Director's Notes • May 2009

Two-thousand eight was a year of change for VMC. In May 2008, Jennifer Jenkins announced that she would be stepping down as VMC Program Director to allow more time to devote to her new position as Science Advisor to the Vermont Climate Collaborative. The staff and administration of VMC want to thank Jen for a very productive year that she spent with us and want her to know that we enjoyed the time spent working with her. Then The Rubenstein School of Environment and Natural Resources at UVM wooed an atmospheric scientist at the University of California, Santa Barbara, to join the faculty. Christopher Still hoped to move to Burlington this summer to also become the VMC Program Director. Unfortunately, and for personal reasons, Chris will not be able to make the move east as planned. However, he is working with us on the VMC synthesis report, an integrated analysis and presentation of VMC data and hopes to secure research funding so that he can be a major cooperator with VMC.

Additionally, VMC is very sorry that Sean Lawson decided to step down as Monitoring Coordinator. Sean had been with VMC for nearly five years as Monitoring Coordinator and also as Acting Director. Sean demonstrated exceptional dedication to VMC and its mission and has provided calm, steady, able leadership as both Monitoring Coordinator and Acting Director. His caring and courage this past year has been an inspiration to all of us. The VMC staff, cooperators, partners, and affiliated individuals and organizations want to thank Sean for his years of service to the organization. All of us at VMC wish Sean and his family the best of luck in future endeavors.

I have been filling the role of project director with a lot of help from Carl Waite and others of our very good staff and our partners and cooperators. I previously have served in a variety of management positions at the University of Vermont and also have served on the USDA Secretary of Agriculture's Forestry Research Advisory Committee. Ironically, about two decades ago I worked as dean of UVM's then School of Natural Resources with former Vermont Forest, Parks and Recreation Commissioner Connie Motyka; Bob Paquin, Senator Leahy's long term staff member; Michael Rains, then Northeastern Region Director for U.S. Forest Service State and Private Forestry; and Denver Burns, a former Director of the U.S.F.S. Northeastern Forestry Research Experiment Station to try to bring to life a forest ecosystem monitoring/research concept developed by two young scientists, Tim Scherbatskoy and Rich Poirot. The effort led to a multiple agency agreement to create and support the Vermont Monitoring Cooperative.

In October, VMC hosted the 2008 Annual Cooperators Meeting on the UVM campus. This year's program entitled "Carbon, People and Vermont's Ecosystems" included many prominent individuals. A panel discussion held during the meeting entitled "Using Vermont Forest Biomass for Renewable Energy: Opportunities and Cautions" also received very favorable reviews. I want to thank this year's speakers, panelists and participants for making this year's meeting an unqualified success (See page 7 for complete program.).

VMC is currently pressing forward with efforts to complete a "synthesis report" before the next VMC Annual Cooperators Meeting. The goal of this project is to examine all data sets from the last 18 years that reside in the VMC data library and to select variables which meaningfully best describe environmental factors and forest ecosystem health. The project has already brought together many stakeholders to determine what information is most useful to various user groups, to assess indicators of forest health, and to synthesize a single report using the VMC data. The synthesis effort is being coordinated and edited by the Hubbard Brook Foundation's David Sleeper. The synthesis publication should provide a clear message about importance of

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Who Is Using AIRMoN Data and How?

Miriam Pendleton, VMC Field and Program Technician

At the VMC's air quality monitoring site, located at the Proctor Maple Research Center in Underhill, Vermont, there are several programs that measure acid precursors and major ions in precipitation. This is a closer look at one of those programs, the Atmospheric Integrated Research Monitoring Network, or AIRMoN. AIRMoN is a sub-network of the National Atmospheric Deposition Program (NADP). The NADP/National Trends Network (NADP/NTN) currently has over 250 sites in the continental United States, Alaska, Puerto Rico and the Virgin Islands.

The NADP/NTN was established in 1978 to measure precipitation chemistry in order to understand long-term trends in the atmosphere. A weekly composite sample is collected at every site and shipped to a central laboratory for analysis. The advantage of the weekly sample is that it is relatively inexpensive, but the disadvantage is that it lacks temporal resolution, and the chemistry can change during the time the sample is sitting on the precipitation collector. AIRMoN was established in 1992 to address these shortcomings.

AIRMoN samples are collected within 24 hours of the end of a precipitation event, so by using the chemical properties of the sample, along with meteorological back-trajectories, the source of pollutants in that particular air mass can be determined. In this way, emission controls at a specific source, say a coal-fired power plant, can be monitored for compliance with the Clean Air Act. With this enhanced resolution, potential impacts of new sources on sensitive areas can be considered, and the data collected are also useful for identifying source/receptor relationships in atmospheric modeling.

Apart from providing data on which research or compliance are based, AIRMoN also functions as a quality assurance/quality control tool within the larger NADP/

NTN network. The samples are collected soon after the end of a precipitation event and are immediately refrigerated. Field chemistry (pH and conductivity) is measured at the site where the samples are collected using an aliquot of the sample, then the sample is shipped on ice overnight to the central analytical laboratory. By measuring pH and conductivity at the field sites and again at the central lab, changes in sample chemistry can be determined. Since the samples are kept cold, microbial activity is limited, so the atmospheric deposition can be more accurately calculated using AIRMoN samples to "calibrate" the samples from the larger NTN network.

Due to the frequency of sample collection (daily site coverage) and the higher shipping costs, the AIRMoN network is expensive. There are currently only seven AIRMoN sites operating at this time. In the past there have been as many as twelve sites and NOAA Air Resources Lab, the sponsoring agency, believes that twenty sites should be established to fully represent the precipitation-sampling network. The AIRMoN network also has a dry deposition monitoring component; before 1998 both parts of the AIRMoN network were represented in Underhill, but due to redirected funding the dry deposition component was terminated. At the same time, the AIRMoN-Dry station on Whiteface Mountain in New York was closed so there are no AIRMoN-Dry sites currently operating in some of the most "acidified" areas of the continental U.S.

The AIRMoN-Wet station at the VMC air quality site started operation on January 27, 1993 and has operated continuously since then. Data from the site are available online at the NADP website: <http://nadp.sws.uiuc.edu>. Recent requests for data specifically from our site in Underhill (VT99) totaled 192 in 2006 and 133 in 2007. For 2008, there were 89 requests as of July 27th. Again, these



VMC's air quality monitoring site at Proctor Maple Research Center in Underhill, Vermont.

AIRMoN Data continued from page 2

downloads do not include requests for data from multiple sites or the entire network, just VT99. The use descriptions vary from “assess effectiveness of the legislation to curb acid rain precursors” to “curiosity.” Many of the use descriptions are for educational purposes or for college-level assignments. Some of the data users are land management professionals, and some are university researchers, and several are environmental modelers. The following table and the other information on VT99 data use were compiled by Bob Larson at The NADP Program Office.

UseTypes of VT99 data downloads	
UseType	Download Count
College/Univ Education	118
K-12 Education	184
Individual	8
Atmospheric Dep.	70
Ecosystem Processes	5
Watershed Studies	10
Aquatic Effects	6
Terrestrial Effects	3
Materials Research	1
Other	5
NSTA Module User	3

Before VMC operated the Underhill site, data collected there identified sources of acid deposition that included several coal-fired power plants owned by American Electric Power (AEP). Research conducted by Dr. Hub Voglemann on Camel’s Hump identified acid precipitation as one of the stressors causing widespread die-off of red spruce at high elevations. Ironically, AEP funded one of the original monitoring sites in Underhill. They were hoping to demonstrate that coal-fired utilities in the Midwest were not responsible for acid deposition in Vermont. As soon as the data showed clear evidence that AEP and other utility boilers were in fact the source, funding for this program was cut. By that time, acid deposition was considered enough of a threat to ecosystem (and human) health that funding continued for the Underhill site through the EPA and other agencies.

Recently, a lawsuit brought by the EPA and several northeastern states (including Vermont) against American Electric Power was settled. AEP agreed to pay 4.6 billion dollars for scrubbers and other pollution control equipment to reduce emissions from 16 power plants in the Midwest and other downwind states. AEP had expanded old power plants without installing emission controls on the enlarged facilities as required by law. The company settled without admitting to criminal activity. Monitoring data from Underhill was used as evidence in the lawsuit, demonstrating the value of programs such as AIRMoN and NADP/NTN. Without a long-term record on which to

base research or see the effects of clean air legislation, it is nearly impossible to understand what is really going on at the ecosystem level.



Aerochem precipitation collector used to collect AIRMoN precipitation samples at the Proctor Maple Research Center’s Air Quality site.

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long-term environmental and forest health data that will be tailored for a variety of audiences. Barbara Burns and Carl Waite are stewarding the overall synthesis project to help integrate VMC programs with other research, monitoring, and policy initiatives in the northeastern region. An expected and important outcome of this project will be increased recognition of VMC as a leader in collecting, assembling, and providing environmental data needed by resource managers, policy makers, researchers, and the public.

During the planning of the synthesis report, I was reminded how the well-organized structure of the highly cooperative VMC provides a remarkably efficient way for a variety of stakeholders to keep up on information collection and shared and individual organization’s concerns and new directions. The structure of Stakeholders, research and monitoring Cooperators, Steering Committee partners, Project Staff, and effective outreach has been the right design for the Vermont Monitoring Cooperative.

As much as possible, all voices are not just listened to but heard. The data collection process and results are designed to be readily available, and there is a remarkable consensus that scientifically reliable information is essential for sustainable management of our remarkably productive and important forest ecosystems.

Climate change; the drive for more renewable, local energy sources; the economic downturn; and continued human population growth all make our collaborative monitoring even more important than it seemed two decades ago. I hope many others appreciate the efforts and sustained commitment and attention of the Vermont Monitoring Cooperative community as much as I do.

Regards,
Larry Forcier, Acting Program Director

The VMC Meteorological Stations

Carl Waite and Richard Furbush, VMC & UVM

For many of us, summer 2008 provided a bit of a challenge for getting fieldwork completed. Despite the rainy weather, we were able to eventually get to all VMC-operated meteorological sites to perform necessary repairs, calibrations, and maintenance. As many of you know, VMC operates and maintains six meteorological stations both on Lake Champlain and on the slopes of Mt. Mansfield. These stations are: Colchester Reef (CR), Diamond Island (DI), Proctor Maple Research Center Air Quality (PMRC AQ), Proctor Maple Research Center Forest Canopy Tower (Tower), Mt. Mansfield West (MMW), and Mt. Mansfield East (MME). Many of these stations are equipped with data radios or a telephone modem for automatic data downloads. Two of our stations, MME and Tower, still do rely on regular site visits to transfer data from the stations to the VMC archives. VMC also archives and provides meteorological data online from four additional stations: Mt. Mansfield Summit, SCAN Mt. Mansfield, SCAN Lye Brook, and the former CASNet, site at the Lye Brook Wilderness Area in Manchester, Vermont. Locations, elevations, data resolution, and variables collected at each site are provided in Figure 1.

As usual, CR, established in 1996, presented the biggest challenge for access as wind speed, direction, and lake water level all influence our ability to land and service the site. Unfortunately, CR also presented the most problems during winter 2008. Two of the anemometers (measure wind speed) at the site ceased functioning properly in early January, along with air temperature, relative humidity, and barometric pressure sensors. We assumed that something akin to rime ice may have encrusted several sensors causing temporary data glitches, but we also found a severed instrument lead and physical damage to some sensors when we visited the site. Despite the problems, it was pretty much a normal winter at CR. All damaged sensors were repaired or replaced and those requiring factory calibrations were replaced with recalibrated or new instruments. Field calibration of the remaining instruments was carried out.

Meteorological data from CR, particularly wind data, continues to be one of the most requested datasets from VMC and, as reported in our Spring 2008 newsletter, the National Weather Service (NWS) website had over 250,000 visits last year to their CR data site.

Work at DI, established in 2004, was much more routine and consisted of mostly normal maintenance and QA/QC activities. Sensors requiring factory calibrations were removed and replaced with either recalibrated or new instruments. Those sensors requiring only field calibrations were checked for proper performance and accuracy. Near real-time (one hour delay) meteorological data from both CR and DI are streamed to the VMC homepage at: www.uvm.edu/vmc.

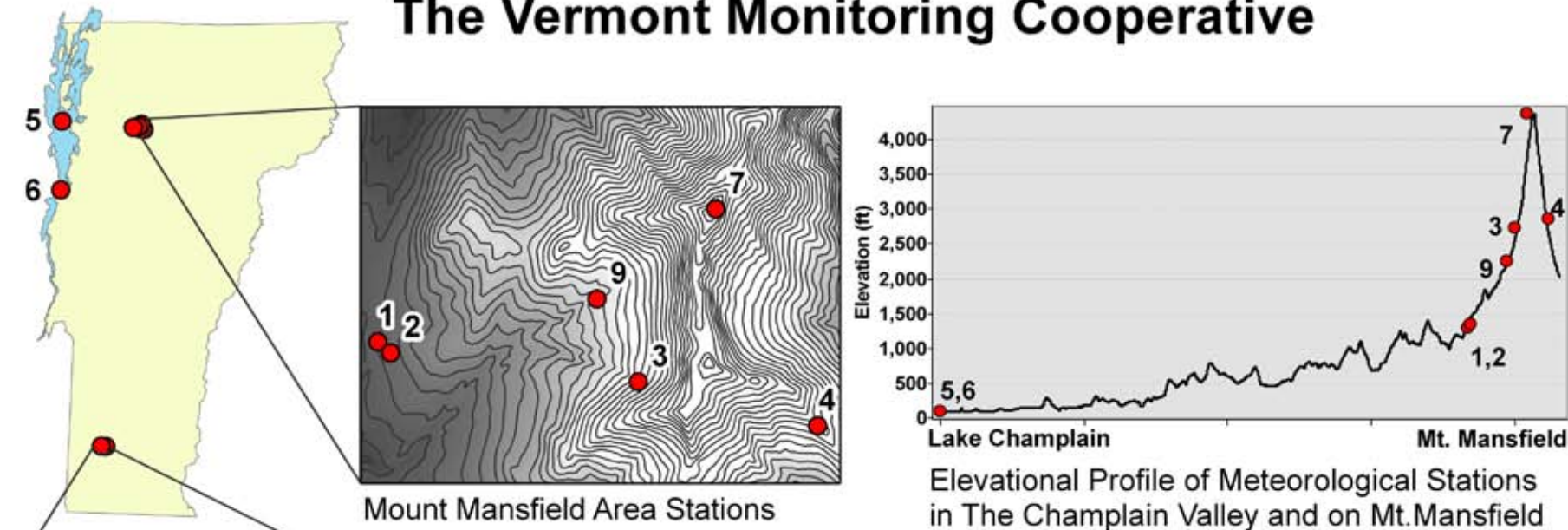
MMW, established in 1996, and MME, established in 1999 and also known as Ranch Valley, are VMC's two mid-elevation meteorological stations located on the western and eastern slopes of Mt. Mansfield, respectively (see Figure 1 for variables collected). Both stations are located in small clearings and provide our best representation of meteorological conditions at mid-elevations on the mountain. The MMW station is located off the CCC road in the Mt. Mansfield State Park and MME is located off the Mt. Mansfield Toll Road. Maintenance and instrument recalibrations were routine at both sites in 2008.

MMW is equipped with a data radio, and data are automatically downloaded from the site every four hours. These data are archived and published on the Burlington Eco Info website at: www.uvm.edu/~empact/weather.php3. MME does not have line-of-sight to our base station located at the Rubenstein Laboratory on the Lake Champlain waterfront, so direct data radio transmissions are not possible. Although, the possibility of establishing a repeater station and additional "summit" meteorological station at the top of Mt. Mansfield do appear feasible, based on a field test conducted in 2005, this additional station would require approval from the Mt. Mansfield Co-location Committee in what can be a lengthy process. For now this is a



Diamond Island meteorological station on top of Coast Guard navigational tower on Lake Champlain.

Figure 1. Meteorological Stations Operated by or Affiliated with The Vermont Monitoring Cooperative



Station	Site	Capture Interval	Variables	Period of Record
1	PMRC Air Quality	15 min	Wind Speed/Direction, AT, RH, Precip, BP	06/1988 to present
2	PMRC Forest Canopy Tower	15 min	Wind Speed/Direction, AT, RH, Leaf Wetness, PAR, Solar Radiation	11/1992 to 12/2004; 11/2006 to present
3	Mt. Mansfield West	15 min	Wind Speed/Direction, AT, RH, PAR, Precip, Solar Radiation	09/1996 to present
4	Mt. Mansfield East	15min	Wind Speed/Direction, AT, RH, PAR, Precip, Solar Radiation	07/1999 to present
5	Colchester Reef	15 min	Wind Speed/Direction, AT, RH, BP, Solar Radiation, Water Temperature	07/1996 to present
6	Diamond Island	15 min	Wind Speed/Direction, AT, RH, BP, Solar Radiation, Water Temperature	04/2004 to present
7	Mt. Mansfield Summit*	Daily	AT, Precip, Snow	11/1954 to present
8	SCAN Lye Brook*	Hourly	Wind Speed/Direction, AT, RH, Precip, BP, Solar Radiation, soil data	09/2000 to present
9	SCAN MT Mansfield*	Hourly	Wind Speed/Direction, AT, RH, Precip, BP, Solar Radiation, soil data	09/2000 to present
10	CASNet Lye Brook*	Hourly	Wind Speed, AT, RH, Precip, Solar Radiation, Ozone Concentration, Wetness, Flow Rate	01/1994 - 07/2007

AT - Air Temperature, BP - Barometric Pressure, PAR - Photosynthetically Active Radiation, Precip - Precipitation, RH - Relative Humidity
 Note: CASNet site at Lye Brook is now a site in the Interagency Monitoring of Protected Visual Environments (IMPROVE) program
 * Denotes VMC affiliated meteorological stations; all other stations operated by VMC

Please visit our website: www.uvm.edu/vmc for data and further information

Map prepared by: Amanda Holland, University of Vermont and Joanna Grossman, Vermont Monitoring Cooperative

“sneaker-net” station with data modules being periodically exchanged at the site.

The PMRC AQ station, located at the Proctor Maple Research Center, in Underhill Center, Vermont, began collecting data in 1988 as part of the VMC meteorological network and is the longest-operating VMC station. Variables collected are listed in Figure 1. Over the years, meteorological data from this station have been used to characterize climatic conditions for several publications looking at local levels of mercury in precipitation and the air. These data are also downloaded by the National Weather Service (NWS) in Burlington, via telephone modem, and used in conjunction with data from many other sources to make forecast predictions.

The PMRC AQ site is home to precipitation sampling equipment for several national networks that measure acid precursors, major ions, and mercury in precipitation and mercury in ambient air. Also located at the site is a Vermont State program quantifying acidic precipitation and a national UV-B monitoring/research program. For 15 years this was a keystone collection site for a regional wet and dry mercury deposition program operated by the University of Michigan’s Air Quality Laboratory, in cooperation with VMC. For the past four years, atmospheric mercury in ambient air has been sampled at the site as part of a comprehensive study funded by EPA and VMC. The AQ site is again in the forefront by being one of the initial locations for a proposed new National Atmospheric Deposition Program’s Mercury Trends Network.

VMC’s Tower meteorological station, established in 1992, is perhaps the most unique because of its, original five, now four micrometeorological stations located along an elevational gradient below and above a mixed hardwood forest canopy (See Figure 1 for list of variables collected.) As many of you know, meteorological data were collected continuously from the Tower site from July 1992 until early December 2004 when the forest canopy tower blew over as the result of severe winds and saturated soil conditions around the guy wire anchors. The tower was rebuilt in early October 2005, but the micrometeorological stations were not completed until November 2006 when all instru-



VMC’s 66-foot walk-up forest canopy tower at Proctor Maple Research Center in Underhill, Vermont.

ments were replaced and meteorological data collection resumed.

By supporting a core of basic meteorological stations on Lake Champlain and Mt. Mansfield, we believe that VMC is providing a vital service to other research and monitoring programs. As VMC, we are perhaps in a unique position to offer this support to a multitude of data users including our own cooperators, other researchers, state and federal agencies, universities, and the general public. Our intent is to make available high quality data, much of it in near real-time, that is relevant and useful to the people of Vermont and beyond.

VMC Web and Data Updates

Joanna Grossman, VMC Web & Data Manager

This year marks an exciting time in VMC’s web and data program. We’re in the process of mining our historical data holdings to clean and upload more data to our website, and we’re also repairing and expanding the site itself. Useful to you, you can now download the Proctor Maple Research Center and the Diamond Island meteorological datasets from our website, and you will soon be able to do the same for Mansfield East and Proctor’s Tower datasets. These are in addition to the Colchester Reef and many other datasets already available for download.

Having trouble telling our 10+ met data sets apart? Check out our new Met Data Primer on page 5. This cheat sheet will help you figure out which datasets have what and where, so you can determine which is ideal for your research.

The website is also undergoing several changes which are to be rolled out this Spring. These will include a new search engine to explore VMC’s vast publications and reports holdings, old newsletters, and a live news feed. As always, please feel free to contact me directly for any comments, questions or feedback regarding our data and website.

Program from October 2008 VMC Annual Meeting

Some Reflections of the Vermont Monitoring Cooperative in its 18th Year
Robert Paquin, Legislative Assistant, U.S. Senator Patrick Leahy

Understanding How the Natural World Works
Dr. F. Herbert Bormann, Oastler Professor of Forest Ecology Emeritus, Yale University
and member of the National Academy of Sciences

Sources and Sinks of Carbon at Multiple Scales
Dr. Jennifer Jenkins, University of Vermont, Rubenstein School

*Managing Carbon in the Northeastern Landscape:
Hubbard Brook's Science Links Carbon Project / Lessons from Eight Counties*
David Sleeper, Executive Director, Hubbard Brook Research Foundation

Cloud Patterns in the Burlington Area: Potential Influences on Ecosystem Function and Health
Dr. Christopher Still, University of California, Santa Barbara, Geography Department and VMC Cooperator

Update on Forest Health Conditions in Vermont
Ron Kelley, Vermont Department of Forests, Parks, and Recreation

*Developing an Integrated Land Use, Transportation, and Environmental
Quality Simulation Model for Chittenden County*
Dr. Austin Troy, University of Vermont, Rubenstein School

Carbon Dioxide Reductions Through Forestry
Sandy Wilmot, Vermont Department of Forests, Parks and Recreation

Carbon in Forest Surface Soils of the Northeast: Tight Linkages to Both Nitrogen and Tree Species
Dr. Donald Ross, University of Vermont, Plant and Soil Science

*Reflections: The Government's Role in Reducing Dependence on Fossil Fuel
and Simultaneously Sustaining Healthy Forest Ecosystems*
George Crombie, Vermont Agency of Natural Resources Secretary

Panel: *Using Vermont Forest Biomass for Renewable Energy: Opportunities and Cautions*

Paul Frederick, Utilization Forester, Vermont Department of Forests, Parks and Recreation
Adam Sherman, Program Manager, Biomass Energy Resource Center
William Kropelin, Chief Forester, McNeil Generating Station, BED
Richard Valentinetti, Director, Vermont Air Pollution Control Division
Lisa Rector, Senior Policy Analyst, NESCAUM



For presentations, contact information and project data, please visit our website at
www.uvm.edu/vmc

Newsletter

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Reminder to Cooperators:

Researchers conducting work in 2009 on state or federal land or at VMC study sites must update their study site permit and project description with VMC. Any changes should be sent to Carl Waite at cwaite@uvm.edu. In addition, if your research is located on the Green Mountain National Forest, please contact VMC and Brian Keel, Research and Monitoring Coordinator of the GMNF, at (802) 362-2307 ext 214 or bkeel@fs.fed.us.

If an existing project remains active and unchanged, please confirm your status with VMC to ensure your study site permit remains active. If you need a copy of your study site application on file, please let us know.

Thank you!

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THE UNIVERSITY
OF VERMONT

