HOPKINS MEMORIAL FOREST

The Year in Review

2020-2021

Center for Environmental Studies

Williams College

December 2021

September 2020 through August 2021

The year 2020-21 saw a gradual but steady return to regular programming at Hopkins Memorial Forest (HMF), Williams College's environmental field station. After an almost complete shutdown of operations at the onset of the Covid-19 pandemic we were able to gradually reopen the forest for research and educational activities starting in the fall semester. A slower return to elementary and public educational activities has been in the works as well. The fall began with strict pandemic related protocols resulting in limited use of the forest for teaching and outreach, though these restrictions were relaxed enough in the spring semester to permit a wider variety of programming. By summer 2021 we had largely returned to our full slate of pre-Covid activities; the forest was abuzz with researchers, caretakers and recreational users.


Jordan Fields locating tracer stones

The Forest saw the establishment of two new field studies this year. Allison Gill (Biology) implemented her ecosystem-level study of nitrogen fertilization, which looks to ascertain the effects of nutrient manipulations on the rates of carbon sequestration and respiration. In Geosciences, Dartmouth College PhD candidate Jordan Fields established his investigation of sediment fluxes in a first order watershed by applying 85 tracer rocks in the upper reaches of the South Branch of Birch Brook.

Established studies resumed full-bore as well. Among them were Mea Cook's (Geosciences) investigation of ecosystem dynamics though the monitoring of stable carbon, nitrogen and water isotopes at various locations within the Forest. Joan Edwards (Biology) continued her study of the effects of differential mowing regimes on late season wildflowers and pollinators, and her investigation of the population dynamics of garlic mustard (*Allaria petiolata*) at three sites in the Forest. Concurrently, Manuel Morales' (Biology) study of mutualisms in goldenrod fields turned its focus to host plant selection by ovipositing treehoppers. All the while, Jay Racela (Environmental Studies) continued to run biogeochemistry and meteorological monitoring in the Forest and to maintain the weather and stream gauging stations. The Northern saw-whet owl banding station's twentieth season turned out to be a busy one at the nets.

Class use of the forest during the fall was problematic due to Covid-19 related restrictions on social distancing and transportation. Nonetheless, one course was able to make use of the forest on a voluntary basis for its students. In the spring vans were able to deliver students to the forest resulting in an increase in class visits as well as limited organized events. Indeed, Hopkins Forest caretakers mobilized to plan and carry out a more choreographed, student only, Maple Festival this year. Our elementary education program had to redirect its focus toward developing virtual content as no in-person field trips were permitted to return to the forest during 2020-21.

The cancellation of spring break meant that we had more labor available during the 2021 maple sugaring season and, with the added help, we were able to produce about 27 gallons of finished syrup. The trails remained very popular with hikers, joggers, and dog-walkers even as lock-downs and other Covid-19 related restrictions began to relax, and a more determined group of hunters took more deer from the forest than they had in 14 years.


Alice-Henry Carnell with saw-whet owl

This coming year we will continue to support recently established and long-term research initiatives as well as Williams class use of the Forest. Additionally, we look forward to working with local schools to bring back the full array of elementary education and public programming that we were in effect before the pandemic. Of course this will be contingent on what happens with the public health situation moving forward.

RESEARCH & MONITORING

The following scientific studies were underway during the past year.

Ecosystem-Level Nitrogen Fertilization Experiment (*description by Dr. Gill)*
This year, the Allison Gill lab established a new long-term nitrogen fertilization and substrate addition experiment at two sites within Hopkins Forest. The experiment is replicated in two locations: in a low-elevation site near the Rosenberg Center, and a high-elevation site off the Taconic Crest Trail near Petersburg Pass. The sites differ in soil minerology, which may influence the processes by which added C substrates are stabilized in soils, as well as soil responses to N fertilization. Plots were established in spring 2021, and the group spent the summer collecting intensive pre-treatment data to develop a stronger mechanistic understanding of the biogeochemical differences between the two experimental sites. We characterized soil carbon and nitrogen content, cation availability, cation exchange capacity, and nutrient availability, which are important baseline data that will inform hypothesis structures for grant proposals and experimental design in years to come. Angela Hsuan Chen ’23 is conducting independent research evaluating rates of nitrate and ammonium production across the plots. We also mapped the size and identity of all trees within the experiment in order to track tree growth and biomass production throughout the experiment, and measure continuous leaf litter production throughout the growing season. Aaron Stanton ’22 is completing an honors thesis evaluating relationships between soil chemistry and tree community composition across the experiment.

We made biweekly measurements of field-based soil carbon dioxide fluxes (soil respiration), which thesis student Patrick Hodgson ’22 is using to model differences in the temperature sensitivity of soil respiration across sites. This is important baseline information about the differing susceptibility of soil C pools to warming temperatures. Patrick is supporting these field-based measurements with laboratory quantification of the microbially-available carbon pool size, as well as experimental determination of the capacity of the microbial communities to metabolize substrates of differing chemical complexity. Complementing our work evaluating microbial activity and soil carbon respiration, Molly Fraser ’23 is characterizing the invertebrate decomposer community. Her work this summer has highlighted the dominance of invasive earthworms (*Amynthas agrestis*) at the lower elevation site, and she is now working in the lab to quantify the effect of earthworms on the size of the microbially-available soil carbon pool.


Angela and Molly measuring soil respiration

While my interests and focus within the new experiment lie within soil microbial and carbon cycle responses to N fertilization, my ultimate hope for this experiment is to create an opportunity for cross-disciplinary collaboration that expands the scope of data collection and understanding. To this end, Professor Martha Hoopes (Mount Holyoke College) began a study of invasive plant responses to nitrogen fertilization in the experimental plots. Professor Hoopes and her students surveyed the current distribution

of *Alliaria petiolata* (garlic mustard), *Berberis thunbergii* (Japanese barberry), *Celastrus orbiculatus* (Asiatic bittersweet), *Frangula alnus* (glossy buckthorn), and *Lonicera japonica* (honeysuckle) across the plots in fall 2021, and plan to track seed production, recruitment, and spread of the focal species in response to experimental treatments. Her group will leverage our ongoing measurements of soil temperature and moisture, soil respiration, tree growth, soil microbial activity, and soil carbon and nutrient cycling to mechanistically evaluate conditions that facilitate or constrain the spread of focal invasive species in eastern deciduous forests.

Birch Brook Stable Isotope Study

Mea Cook, Jay Racela, and Allison Gill continued work on the Birch Brook Stable Isotope study, which was initiated at Hopkins Forest in the summer of 2019. The analytical work allows us to identify the sources of dissolved inorganic and organic carbon within the watershed, and we can use the data to track seasonal shifts in stream water carbon sources over the course of the year. We have continued data collection through summer 2021, and were excited to include five students in our intensive summer sampling day. Data from the work are being used to support a study of invertebrate community structure in the watershed in the BIOL/ENVI 203 - Ecology course.

Tracing Sediment Flux in Birch Brook (*description by Jordan Fields*)

Sediment tracer in South Branch of Birch Brook

In October 2020, we deployed 85 'tracer' rocks painted pink and tagged with a unique radio frequency identification (RFID) chip so that we could relocate them. Our study benefitted from the very wet year that Hopkins Forest experienced, as we could record five separate storm events that mobilized our rocks. These data allow us to better describe the type of climatic events that result in sediment mobility, how sediment mobility changes seasonally, and also allow us to attempt to predict annual bed load flux by comparing our rock movement to the amount of sediment dug out from the South Branch weir. In the first year of the study, we found that the mobility of RFID-tagged rocks predicts bed load flux within 20%. We expect that this uncertainty will be improved with another year of data and with more careful measurements of the characteristics of the channel's bed, which we plan to undertake this fall. David Dethier, Jay Racela, and Drew Jones have proved invaluable resources on this project and we are excited to continue our work in Williamstown this coming year and beyond.

Impacts of Mowing Patterns on Flower Production and Pollinator Activity


Newly mown the plots in August

Joan Edwards' study of the effects of differential mowing regimes on fall wildflowers and their pollinators entered its ninth year. The goal of this study is to assess the impact of both timing and frequency of mowing on flower production and pollinator activity. The sixteen plots are divided into four blocks with treatments in a full-factorial randomized block design. This year, according to the schedule, we implemented only the annual treatments (four plots were mown in early August with four more done in early November). During autumn 2020 Professor Edwards and students spent time gathering data on the flowering stems within the plots.

Garlic Mustard (*Alliaria petiolata*) Dynamics
Three distinct sites – early successional (near the Rosenburg Center), mid-successional (Red Oak Stand) and late-successional (Beineke Stand) – have been the focus of Joan Edwards' garlic mustard study. This 22-year investigation involves a complete annual survey of the three sites in mid-July when researchers count all rosettes, reproductive stems and seeds in 0.5m x 0.5m permanent quadrats. Declan Houlihan '23, Darren Wang '23 and Mikayla Kappes '22 provided field assistance this year. In addition, Henry Newell '21 wrote an Honors Thesis, "*Invasive Garlic Mustard in a Deciduous New England Forest: Insights from a 22-year Field Study*."

Ant/Tree Hopper Mutualism (*description by Manuel Morales*)
This summer we tested the hypothesis that the oviposition behavior of female treehoppers follows an ideal-free distribution. This hypothesis predicts that each female oviposits on the plant with highest quality. However, a host-plant's potential quality decreases as more females oviposit on it. At equilibrium, host-plant quality per treehopper becomes equalized across plants of varying initial quality. Ultimately, this means that under natural conditions there is no correlation between plant-quality and offspring performance. Preliminary data collected in summer 2021 by Dara Etienne '22 and Chase Cohen '23 are consistent with this hypothesis.

Table I. Student researchers in Hopkins Forest -- summer '21.

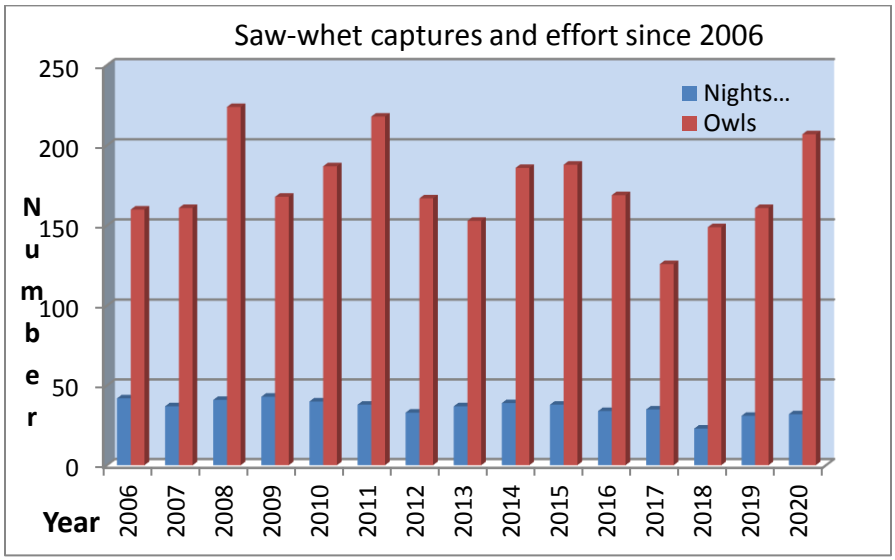
Name	**Lab**
Patrick Hodgson '22	Gill
Molly Frasier '23	Gill
Dan Lee '23	Gill
Dara Etienne '22	Morales
Chase Cohen '23	Morales
Declan Houlihan '23	Edwards
Mikayla Kappes '22	Edwards
Darren Wang '23	Edwards
Aaron Stanton '22	Racela
Angela Hsuan Chen '23	Racela

Northern Saw-whet Owl (NSWO) Migration Banding
The 2020 Northern saw-whet owl (*Aegolius acadicus*) fall banding season turned out to be a very busy one, even as Covid-19 severely limited the number of volunteers and visitors to the station. Nevertheless, we were able to open the nets on 32 evenings from October 1st through November 14th and capture 207 individual saw-whets. Of these captures seven had been previously banded at other stations throughout eastern North America. The total of 207 owls was the third highest in the 20-year history of our station (Figure I) and was consistent with the increased numbers registered at many of our peer stations as well -- indicating an irruption year for this species.

Barred owl predation continued to be an issue in 2020. However, we were able to fully deploy the electronic "net occupancy sensor" designed by Jason Mativi, Instrumentation Engineer in the Williams Science Center. This innovative detection system did appear to help curtail predation, although, at times we still had to take additional measures such as surveilling the nets with night vision equipment.

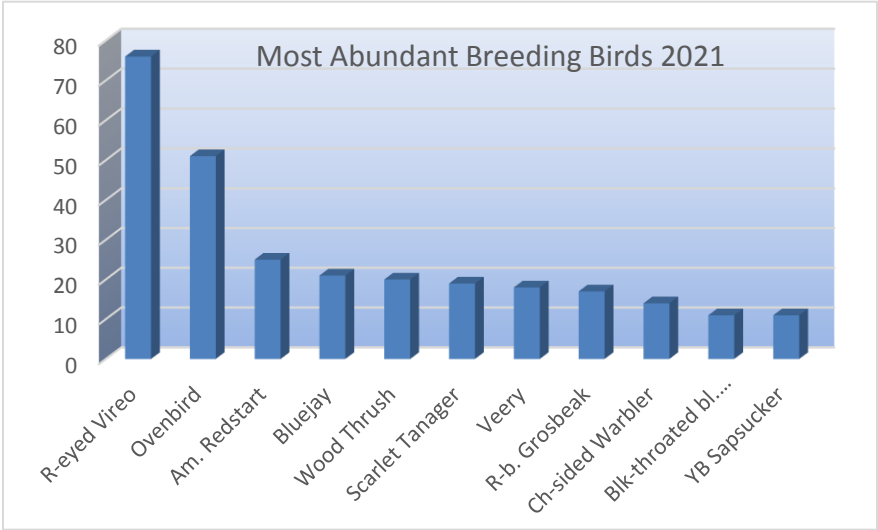
In 2020 there was no class or public visitation to the station due to Covid-19; although two Williams student educators, Alice-Henry Carnell '22 and Darren Wang '23 were able to produce and post a video to allow people to experience this annual activity virtually.

Figure I. Saw-whet owl banding results.



Breeding Bird Point Surveys
In June 2021, I sampled singing males at the 44 breeding bird monitoring points around the Forest for the 21st consecutive year. The year's totals of 423 individuals and 51 species were fairly typical of recent years. Again the red-eyed vireo ranked as the most abundant species, with the ovenbird, American redstart, blue jay and wood thrush rounding out the top five (Figure II).

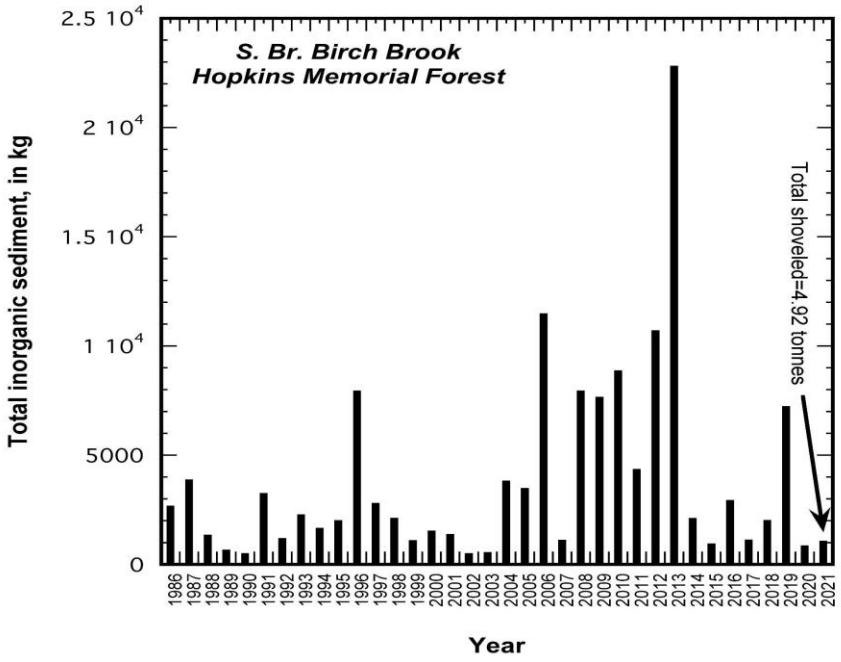
Figure II. Most abundant bird species from 2021 point surveys.



Watershed/Meteorological Monitoring -- Environmental Analysis Lab (*description by Jay Racela*)
As part of our long-term climate monitoring in and around Hopkins Forest, the Center for Environmental Studies' Environmental Analysis Lab (http://sites.williams.edu/envilab/)--under the guidance of David Dethier (Geosciences, emeritus) and Lab Supervisor and Lecturer Jay Racela--continued to gather, analyze and archive meteorological, hydrological and biogeochemical data from the Forest, and surrounding areas. We ran four standard weather stations, one 50-m tower and two stream gaging stations, all using digital data loggers, continuously throughout the year. We also continued bi-weekly

and monthly collection and laboratory analysis of rain and stream water, respectively, as part of ongoing forest geochemical research studying nutrient cycling and deposition by the forest ecosystem.

Figure III. South Branch Birch Brook inorganic sediment shoveled 1986-2021.



Much like every summer since 1986 HMF caretakers plus ENVI lab personnel and a bevy of volunteers from various disciplines dredged and weighed sediment in the weirs along the South Branch and Main Stem of Birch Brook at the beginning of August. Similar to many of the previous 5 to 7 years, total sediment removed from the South Branch weir was about average at 4.9 tons (Figure III). This is somewhat surprising given that July 2021 turned out to be the wettest month in Williamstown on record (~14.3" precipitation) dating back 130 years. Taken together this indicates a lack of significant inorganic sediment transport in the brook.


Aaron measuring tree diameters

Angela Chen '23 and Aaron Stanton '22 worked as research assistants in the ENVI lab during the summer. During their tenure, in addition to regular field and lab research duties, Angela and Aaron also worked with Allison Gill in measuring soil exchangeable cations, soil cation exchange capacity, and tree identification plus diameter, within Allison's HMF research plots. Angela and Aaron presented their findings to many of the summer researchers near the end of their time in the lab. This work also led to the inspiration for Aaron's thesis proposal, which was accepted.

Coinciding with our continuous HMF hydro-geochemistry and weather monitoring, other research projects either arose or continued in the lab and/or Hopkins Memorial Forest, including: PFOA/S in ski wax and the environment (Marika Massey-Bierman '22.5), Housatonic River floodplain PCBs (Jacob Jampel '23, Xiaoyi Zhang '23, Ziyang Shen '23, Jay Thoman (Chemistry)), Green River coliforms and geo-chemistry (Syl Foisy '24, Caroline Douglas '23, José Constantine (Geosciences)), Tallevast, FL air quality (Siri Bohacek '22, Anthony Carasquillo, José Constantine), and HMF stream and rain water isotopes (students pictured below, Mea Cook). We also continue to work closely with a variety of folks from Earth Justice, NRDC, Equity Legal Services (Belleville, IL), Southern Illinois University Edwardsville (SIUE), and the University of Southern Maine to deal with long term drinking and surface water infrastructure neglect for the residents in and around Centreville, IL.

Brave stalwarts finishing the all-day stream sample collection for the ongoing water isotope study (M. Cook/A. Gill). Angela Chen '23, Marika Massey-Bierman '22.5, Jay Racela, Dan Lee '24, Dover Sikes '24, Aaron Stanton '22, Allison Gill (pictured L to R).

EDUCATION & OUTREACH

Undergraduate Classes

A few classes did manage to make it out to the forest during the academic year. The Ecology course made a few trips, having to do so on foot, during the fall. In the spring the Environmental Science course was divided into six lab sections in order to accommodate social distancing guidelines. Nonetheless, they were able to visit the Forest for one of their labs (six visits). The classes that managed to visit the Forest in 2020-21 follow:

- BIOL/ENVI 203 – *Ecology* (Gill)
- BIOL 220 – *Field Botany and Plant Natural History* (Edwards)
- ENVI 102 – *Introduction to Environmental Science* (Apotsos (Geosciences), Auer (Biology))

Elementary Education

Our educational programming was much curtailed. With no in-person field trips, our team of student educators diverted its focus to developing virtual programming that could be accessed remotely via a new *Educators Corner* page on our website. The new content featured videos, on-line modules and worksheets and one on-site self-guided activity -- all of which were produced by eight students throughout the year (Table II). The educators were again employed by the Center for Learning in Action (CLIA) at Williams; we are most appreciative of its continued collaboration in this endeavor.

We did manage to host one in-person school visit this year: on May 4th a high school class from Buxton School came out for a guided walk focusing on the biology and history along the Lower Loop trail.

Table II. Student Educators 2020-21.

Fall	**Spring**
Regina Fink ‘22	Regina Fink ‘22
Eva Castanga ‘22	Eva Castanga ‘22
Darren Wang ’23	Darren Wang ‘23
Isabelle Zollinger ‘23	Isabelle Zollinger ‘23
Alice-Henry Carnell ‘22	Rachel Morrow ‘22
William Donoso ‘23	
Tali Natter ‘23	
Gavin McGough ‘22	

Teacher Workshop

This summer we teamed up with Jennifer Rosenthal -- who was teaching a Science Education course (*Connecting PK-6 to the Hoosic Watershed*) at Massachusetts College of Liberal Arts -- to host two instructional sessions at the Forest. On the mornings of August 3rd and 4th Jay Recela and I taught segments on weather and climate monitoring and habitat-based biodiversity surveys to a small but enthusiastic group of three elementary teachers.

Community Events

Hopkins Forest hosted fewer public events this year because of the public health crisis. We did not have the usual Fall Festival, Animal Tracking, and Alumni Day events. However, we did manage to host three events, all restricted to Williams students who had to register in advance (listed below).

- ***Maple Festival*** – Saturday March 27th for Williams students only.
- ***Amphibian & Reptile Foray*** – April. Led by Darren Wang ‘23 for Williams students.
- ***Wildflower Walk*** – Sunday May 9th. Led by Drew for Williams students only.

Visiting the sugarhouse during *MapleFest*

Volunteer Service Days

This year we collaborated with the Lehman Community Engagement Office to facilitate volunteer service opportunities for Williams students. The fall featured four Saturday sessions during which students helped with trail drainage work and invasive species removal under the guidance of HMF student caretakers. In April and May we held two similar volunteer sessions. These opportunities provided a nice way for non-regular forest users to get involved in the outdoors, and appeared to be especially welcome during the fall semester, with its dearth of typical extra-curricular offerings.

RECREATION

Although recreational activity did diminish somewhat from the previous spring, the trails continued to experience elevated public use, and we did reopen the Rosenburg Center for general access (masks required) in summer 2021. Apparently there had been a carryover from the wave of recreational use that arrived with Covid-19 in the spring of 2020. In spite of the continued heavy use and ample rain, the trails seemed to hold up well and we noted few problems relating to recreational use.

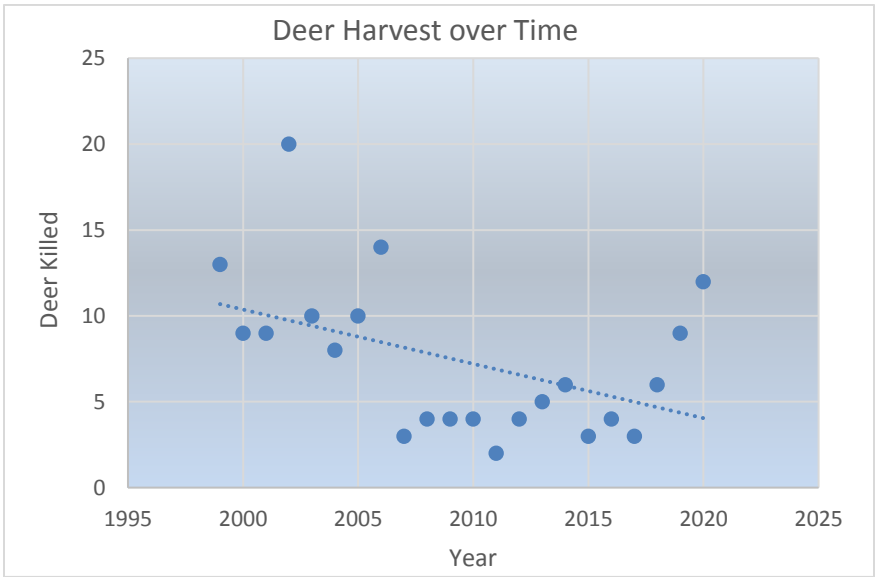
Williams Outing Club (WOC)

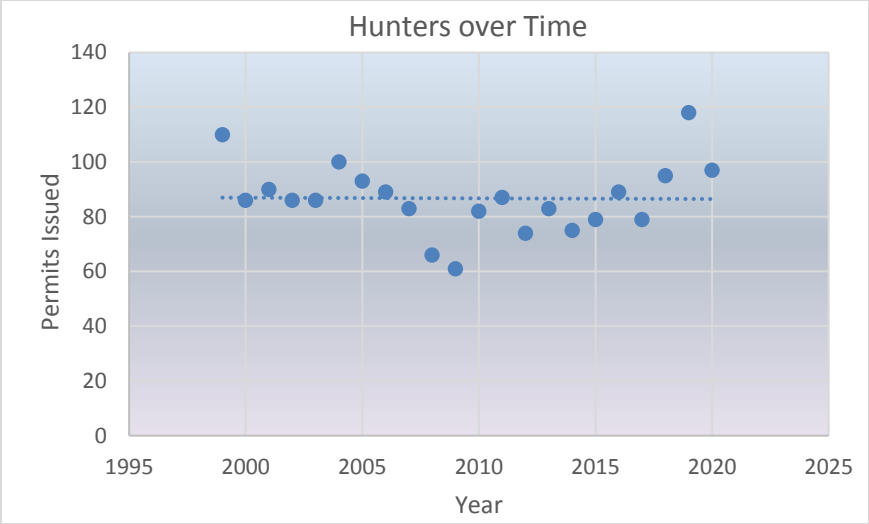
The Outing Club cabin continued to be closed in 2020-21. We expect that it will reopen soon for overnight use by Outing Club members.

Hunting

The 2020 special permit shotgun hunt for deer proceeded smoothly. After some uncertainty as to whether hunting would be permitted at all, and a subsequent delay in the permitting process, we issued permits to 97 hunters, who responded by taking 12 deer (unofficial tally board) from the property (Figures IV and V). This represents a fourteen year high and the fourth highest deer harvest in my 22 years as manager, and continues a recent trend of increased harvests in HMF after years of steady declines. It's plausible that the stalled economy and lingering shutdowns late into 2020 contributed to an increase in hunting pressure by allowing hunters more time to spend in the woods. Once again Williams College safety officers were on site during the busiest days of the hunt.

Figure IV & V. HMF Deer hunting harvest and participation trends since 1999.



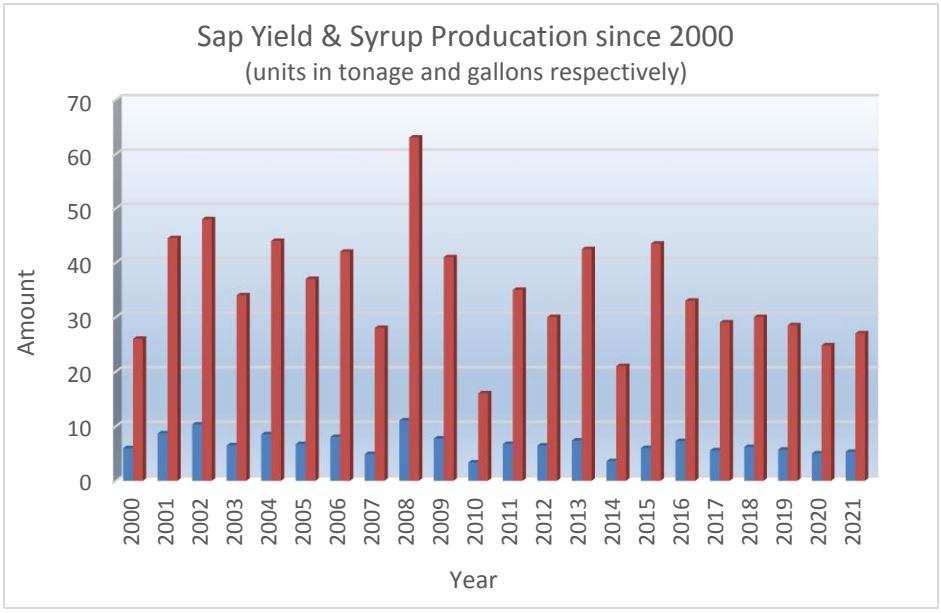


MAPLE SYRUP PRODUCTION

The 2021 maple season returned to a more normal operating mode with student caretakers again involved in the collection and processing of sap. With their help we were able gather 1330 gallons of sap (from 130 trees) and boil it into 26.7 gallons of finished syrup. This yield was up slightly from the previous year but does follow the recent trend of declining yields of both sap and syrup (Figure VI). Our 25-year old flue pan failed and had to be replaced with a new model at the beginning of the season. This new evaporator helped us process sap at a rate of 23.6 gallons per hour – a solid rate and a slight increase over recent years.

After a year off, we were able to celebrate the maple season again with a small, student-only Maplefest event. We had to restrict attendance to small groups totaling 130 visitors; nonetheless it was nice to see people out and enjoying the season – one of their first opportunities in months to do so in an organized manner.

Figure VI. Hopkins Forest maple syrup production since 2000.



LAND MANAGEMENT, CARETAKING & FACILITIES

Forest Management—Vermont Parcel
We did not do any commercial or pre-commercial work on this remote tract this year. The 370-acre parcel remains in the Vermont Use Value Appraisal program. Its management plan, approved by the Vermont Department of Forestry, calls for timber harvesting in the next few years.


Tallon and Gavin at work on the muddy Taconic Crest

Wire Bridge Farm
Jay Galusha of Williamstown continued to grow hay on the Farm. His aim is to restore the meadow to its former quality, which would enable it to sustain two to three annual cuts. The Farm continued to be used sparingly for recreation and wildlife viewing.

Infrastructure
We made no major upgrades to the buildings and outdoor infrastructure during the past year. Incessantly wet weather precluded doing planned upgrades to the two stream gauging weirs, and a funding reduction meant that the road was not thoroughly graded for the second year in a row, though the Facilities Department did make some minor spring repairs to the driveway.

Caretaking
During this unusual year, caretaking was more popular than ever before and each semester had a waiting list to join the crew, which was limited to about 17 per semester. (Table III). We took strict measures -- such as mask wearing, the issuance of personalized gloves and sanitation of tools -- in order to prevent the spread of the virus. Nonetheless, students worked diligently on trails, gardening, maple sugaring, vegetation management and leading volunteer crews though the year. This year caretaking seemed to be an especially welcome outlet for the students, faced as they were with a reduced array of extracurricular and employment alternatives on campus.

In the summer 2021, after a year off, we were able to resume our caretaker internships, hiring Gavin McGough ’22 and Tallon Garelli ’23 for ten weeks. They were joined by long serving, part-time gardener Debra Rogers-Gillig, whose main focus is Buxton Garden. Among their many jobs, Gavin and Tallon completed the formidable task of rebuilding the post-and-rail fence bordering the weather station and installed some much needed bog bridges and waterbars on the Taconic Crest Trail. Their impressive accomplishments came in spite of record rainfall in July.


Gavin and Tallon rebuilding the weather station fence

In addition to their on-site responsibilities, this summer’s crew got to spent a day, July 7th, in Stockbridge, Massachusetts, taking part in an archeological dig organized by the local office of the Stockbridge-Munsee Band of Mohican Indians.

Rosenburg Center/Moon Barn
This year the Rosenburg Center functioned on a more limited basis as a focal point for classes and lab set-ups and was closed to the public or open only for restroom access. Instead, the Center served more as an office primarily due to restricted access to the main campus. The Moon Barn by contrast was used mainly for storage. The Facilities Department did take initial steps to re-connect the power line from the Rosenburg Center to the barn; we anticipate having the electricity and lighting restored to this historic building in the coming year.

Canopy Walkway
This year the canopy walkway was used only once, for a physical education class in the spring. Other typical use days, such as Fall Festival and Alumni Weekend, were cancelled. The bridge that connects the two platforms was slated for replacement in the coming year.

FUTURE – *What's in store for 2021-22?*

This coming year we will continue to support recently established and long-term research initiatives as well as bring more Williams classes back to the Forest. We also aim to work with CLIA and local and regional public schools to gradually restore the full slate of elementary field trips that we had been hosting before the pandemic, and we intend to continue to expand the offerings of public events and programs for the Williams and broader communities. Of course, all of this might well depend on what is happening on the public health front – we can only hope and plan for the best.

Table III – Student Semester Caretakers 2020-21

Name	Fall	Spring
Lyza Berg '21	x	
Henry Newell '21	x	x
Patrick Postec '21	x	x
Felix Biwott '21	x	x
James Fitzpatrick '21	x	x
Siri Bohacek '22	x	x
Gavin Mc Gough '22	x	
Niko John '22	x	
Alice Henry Carnell '22	x	
James Fortin '23	x	
Max Enis '24	x	x
Tasan Smith Gandy '24	x	x
Robin Henrikson '24	x	x
Kimberly Rogers '24	x	x
Auden Naimen '24	x	x
Elizabeth High '24	x	x
Isabel Cushing '21		x
Mila Nazarali '23		x
Jack Sullivan '24		x
Imogen Mandl-Ciolek '24		x
Tina Zheng '24		x
Rosemary Kehoe '24		x

In addition to those featured in the preceding pages, special thanks go to Dee Dee Lewis, Roger Bolton and David Dethier for their contribution to this report.