YALE FORESTS NEWS

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2022 ANNUAL REPORT

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The Year Behind

The year 2021 saw a resurgence of activity at the Yale Forests. We were happy to welcome user groups back to the camps at Yale-Myers and get back to much of our regularly scheduled programming. Our ebb and flow of postgraduate fellows continued in 2021 as Rosa Goldman '19 MF finished up her fellowship with the Quiet Corner Initiative and was replaced by Adam Houston '21 MEM. Rosa has gone far, but not literally, as she now serves as the Forest Program Associate with Audubon in Connecticut and New York. Jess Lloyd '20 MF, our previous Forest Manager, also moved on to bigger and better things in 2021. She is currently the Urban and Community Forestry Specialist at the Washington State Department of Natural Resources. Matt Valido '21 MF stepped up as the next Forest Manager. Karam Sheban '20 MF stepped in and stepped out of a fellowship focused on agroforestry in 2021, taking a very appealing position as Director of Sustainable Forestry with Rural Action in Ohio, while continuing to collaborate with Yale Forests on our forest farming research and extension. However, we are glad to be welcoming Karam back to Yale in fall of 2022 as a PhD student studying forest farming in Professor Mark Bradford's lab.

Forest Crew and researchers returned to Yale-Myers for the summer, while our Quiet Corner Initiative programming stayed online. The forest crew made their way to our Bowen and Dummerston Forests in August to check boundaries and conduct inventories for our now-updated Vermont forest management plans. The northern forest proved a challenge for the crew that they were able to take head-on. Steep slopes, old boundaries, and unique site conditions were well navigated by the apprentices. They quickly made themselves at home in the northern forest, which might have been best evidenced by an elaborate tent encampment at Bowen that included a tarp covered area for dining, separate kitchen and campfire locations – it was downright glamping.

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From Ferns to Femelschlags: Forest Crew 2021

Emily Sigman '21 MF

Yale-Myers Forest Camp was full of great people and dogs this past summer. Photo by Joe Orefice

For decades, intrepid forestry students at Yale have taken part in a time-honored tradition: spending the summer working at the Yale-Myers Forest camp.

To be sure, summertime at Yale-Myers hasn't always been as structured as it is today. Prior to the early 2000s, a more relaxed tradition existed, in which Master of Forestry (MF) students lived and worked under doctoral student supervision in Yale's roughly 8,000-acre tract of forestland in Eastford, Connecticut. In the span of the last twenty years, the tradition has evolved into a more formal education curriculum, officially termed the Yale Forests Summer Apprenticeship. Yet to all those who have had the pleasure and the privilege of spending the summer honing their field skills in the Yale Forests—whether in 1947 or 2021—their time is perhaps best and most affectionately remembered by the simple shorthand "Forest Crew."

For all its varied appellations and manifestations, the quintessence of crew has long remained the same. Forest Crew immerses students in a hands-on learning environment, offering a first-rate field practicum on the science—indeed the art—of land stewardship. This year, under the impressive coordination of Forest Manager Jessica Lloyd '20 MF, nine students (and five dogs) got the opportunity to spend the summer in the woods of New England and discover what it is like to be a real-life forester.

Following a safety course in chainsaw use and tree felling at the historic Yale Camp at Great Mountain Forest, the crew reported to the celebrated Yale-Myers Forest camp where they would remain for the next two months. After more than a year of remote learning, the group was more than happy to trade in their laptops for hardhats and head out for a week of laborious roadwork and trail maintenance. Digging ditches, whacking water bars, and clearing culverts were not easy tasks, but silly songs and copious amounts of post-work popsicles kept the group in good spirits, even as

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While the Forest Crew was living their best life in tents at the Bowen Forest, a swarm of incoming Master's students found their way to Yale-Myers for a week in the woods as part of MODs. The outbreak of MODs students descended on the forest with a force of energy not seen in the region since the last lawn defoliation event of MODs 2019. This energy brought with it friendships that will last a lifetime and a sense of connection to the land that we all at the Yale Forests hold so dearly.

Fall at Yale-Myers was a flurry of activity as classes returned with field trips and outreach programing began again. It seemed every weekend in September and October was booked at Yale-Myers with a group of students hiking through the woods behind a faculty member. Management Plans and land stewardship returned in full force with six landowners of the Quiet Corner working with students to learn about their land. One notable class, led by Professor Craig Brodersen, felled a white pine to quantify the carbon from stem to needles. Our research lab proved the right location to spread out branches for the needle-counting students. The student chapter of the Society of American Foresters also made camp their home for a couple of weekends to care for the Christmas trees, make wreaths, and harvest trees for sale. It was a rewarding year to see students once again engage with the land and traditions of our forests, as so many Yale students have done in the past.

Outside of classes the activity continued. Karam Sheban and Walker Cammack MF '22, under the leadership of Director of Research Marlyse Duguid MF '10, PhD '16, planted hundreds of forest farming herbs as part of a current USDA Sustainable Agriculture Research and Education (SARE) grant. These research plots will serve in both a demonstration and research role in helping forest farmers improve practices when it comes to growing understory medicinal and edible plants. Speaking of edible non-timber forest products, Yale-Myers Forest now has an operating maple sugarbush. Mary Katherine DeWane MF '23 and Emma Broderick MF '23 worked as assistants on the Yale Forests ACER Access grant from the USDA. In addition to hosting hands-on workshops for maple producers on climate smart practices, Mary Katherine and Emma installed sap collection tubing on 109 red maple (*Acer rubrum*) and sugar maple (*Acer saccharum*) trees, helped build a 16'x20' sap house, and customized a food truck trailer into a maple syrup processing facility. Our caretaker at Yale-Myers, Steve Prinn, was a constant source of support for this work, providing Yankee ingenuity and practical knowledge as a sugarmaker himself.

At Great Mountain Forest use was limited to Yale affiliated groups in 2021. The first user group back was MODs 2.0 in May. Hiking, campfires, and connecting as a community were the primary activities the class of 2021 focused on during their stay at the Yale Camp, despite a surprising number of dog ticks (*Dermacentor variabilis*) who also made themselves cozy on the porches, picnic tables, and legs of Yalies. Summer was quiet at Great Mountain Forest as MODs now spends two weeks in New Haven (and one at Yale-Myers) instead of one at the Yale Camp at Great Mountain. However, Yale School of the Environment held a few Wellness Weekends at the Yale Camp in the fall, providing students an opportunity to engage off-line and outdoors.

The Year Ahead

The year ahead is full of excitement at the Yale Forests. Perhaps most encouraging is the student interest in living and learning experiences in the woods. Requests for both Yale camps have been coming in from faculty for field trips, outreach events, and student interest groups who recognize the value of spending time with people surrounded by a forested environment. Spring 2022 is now beginning to look toward summer. Silviculture field trips have now become ten day-excursions and get aways for students over the month of April to stay at camp and both learn about silviculture practice and avoid the hubbub of New Haven during the month of April. Prescribed fire has burned (see photo below), wild leeks have popped up, and 20 gallons of maple syrup has been produced. Walker Cammack is going to start as the agroforestry fellow after graduation and will be working on our forest farming and maple outreach programming, part of which will include an expansion of our maple tapping.

Students will embark on a number of international field trips in May, including our much-anticipated two-week trip to Bavaria with the Technical University of Munich, led by Joe Orefice and Adam Houston. We will be centered around the Spessart region and are sure to come back with all kinds of ideas about growing hardwoods on 300-year rotations.

Our forests are healthy despite the ongoing attack of emerald ash borer (*Agrilus planipennis*). Another large acorn crop occurred in 2021 and we are hopeful for the future trees these will bring. We have been a bit behind on silvicultural treatments as we are shifting back to selling timber ourselves. In the recent past some of our timber sales were offered as lump sum stumpage. This began to prove a challenge as buyers of standing timber in our region have declined or specialized in certain species. To improve our profits over the long term, have more control over who operates on our forestland, and better achieve our silvicultural objectives, we are transitioning to selling timber on a contract basis instead of lump sum offerings. The transition will take some time to perfect with new contractors, but our initial trials of this have tripled our stumpage income per sale and allowed us to engage students and fellows more directly in the process of forest operations and log markets. We hope that this system of selling timber will bring good things in 2022, and we now have the proper Yale contracts in place and logger relationships budding to do this work.

We look forward to seeing many of you in 2022 and thank you for your continued support of the Yale Forests.

Joe Orefice and Mark Ashton instructed the forest crew on different types of silvicultural treatments in order to fit our management techniques to the needs of different stands at Yale-Myers. Photo by Genevieve Tarino.

torrential rains repeatedly washed out their progress and necessitated repeated work days.

During the next week of Crew, the foresters-in-training got a daily deep dive into a diverse array of disciplines. Dr. Marlyse Duguid led a daylong foray into the forest, equipping the Crew with the ability to identify key plants and trees, and teaching them how to decipher different species of ferns—a useful skill for intuiting soil moisture and predicting how an understory might respond to changes in the canopy. Dr. Kealoha Freidenburg gave a crash course in wetland ecology, treating students to an expert view into the many vernal pools they would encounter throughout the wet summer. Dr. Mark Ashton went all-in on site classification, sharing with students the secrets of soils and land use history, and familiarizing them with no fewer than 63 distinct bird calls.

The following week, Dr. Joseph Orefice and PhD student Reid Lewis '21 MF unpacked the mechanics of sampling design, walking the crew through the ins-and-outs of forest inventory. Group members with GIS skills adeptly created geo-referenced maps that the Crew used to generate and find randomized plot points. In no time, the Crew was out in the field putting all of their accumulated knowledge to the task of collecting vital information about the forest.

Recognizing that forests are more than data, the group also integrated one minute 'centering exercises' into each of their plot points. Prior to spinning an angle gauge or estimating log heights, each team would pick from a list of ten prompts meant to provide space for reflection, stimulate non-linear thought, and foster a more emotional and intuitive connection to the landscape.

The group also spent time reflecting on the profession of forestry broadly, especially as it sits within a wider conversation about restoration and environmental justice. Several crew members endeavored to read Dr. Lisa Brooks' book Our Beloved Kin: A New History of King Phillip's War. The book's contents stimulated repeated discussions and explorations of the relationships between forests, Indigenous nations of the Northeast, and European colonists, and gave the group a more complex and nuanced understanding of the landscapes in which they were studying, working, and living.

Additionally, the Crew grappled with questions of inclusivity, both within the apprenticeship and throughout the field of forestry writ large. Conversations in particular centered on the need for forest crew—and other aspects of forestry education—to evolve in order to be accessible and attractive to aspiring foresters with a range of different physical abilities. The rigorous fieldwork component is, for many, one of the most rewarding aspects of the apprenticeship. By the same token, Forest Crew can be intensely physically demanding, severely restricting who can—and who wants to—participate in this formative program. The vast majority of activities during Forest Crew are prohibitive to wheelchair users and other mobility-restricted people; even the library at camp is not wheelchair accessible.

Many central and requisite components of the forestry degree are similarly restrictive, including the mandatory school-wide Summer Orientation Modules known as MODs, which follows on the tail end of Forest Crew. As a keystone experience, the Yale Forests Summer Apprenticeship has the potential to act as a locus of meaningful intervention and a vehicle through which the Yale Forests and the forestry curriculum can be made more welcoming to a diversity of talents, backgrounds, and experiences. Creativity and continued reflection can hopefully guide future crews towards interventions that allow space for—and even enhance—the existing field components of the summer program.

The depth of these conversations and the intensity of the learning experience were held within a collective and continued commitment to group care. As part of this ethic, the Crew invested energy in co-creating an atmosphere that felt expansive and joyous. Uproarious laughter, spontaneous singing, and mischievous merriment were staples of the Crew's daily activities, contributing to a palpable air of elation, exuberance, and gratitude. A childlike sense of wonder pervaded time in the field, where the Crew gaped at profuse fungal flushes, admired arboreal abnormalities, and paused to take in the beauty of bird calls. After-work outings to refreshing swimming holes and quaint local creameries quickly became common and

Forest Manager Matt Valido marks boundaries in the Boston Hollow Division. Photo by Emily Sigman.

cherished rituals.

In no time, the camp transformed into a near-magical refuge, and the group spent their down-time sharing stories in a not-so-secret treehouse, reading books from the well-curated shelves of the library, and standing in wide-eyed rapture on the porch of the dining hall as the drama of near-daily thunderstorms played out against the silhouette of a sea of trees. The night sky offered itself to constellation-spotting, and the crewmates fell asleep counting their lucky stars.

A balance of seriousness and levity sustained the Crew as they carried out their culminating assignments at Yale-Myers: select stands in the forest deemed appropriate for immediate active management, write comprehensive silvicultural prescriptions, consider operational mechanics, and mark trees for inclusion in timber sales. These were not trivial tasks; the decisions the Crew made would not only dictate which trees would live and which would die, but moreover would set those forest stands on a course that would affect their growth for decades or even centuries.

One of the more remarkable aspects of forestry as it is practiced in the Yale Forests is that foresters typically avoid planting any trees. Instead, foresters become highly attuned to the existing flows of a given site, taking heed of the abiotic and biotic factors present and classifying where a given forest sits within a cycle of stand dynamics. Foresters look for the natural disturbances to which the forest is inherently adapted—such as hurricanes and blow down events in the Yale-Myers Forest—and they work within these adaptations to prescribe treatments that will provoke a regenerative response.

In so doing, trained foresters can promote both ecological and financial sustainability, harvesting marketable timber while also increasing the age-class diversity—and thus resilience—of otherwise fairly homogenous secondary growth forests. Funds from timber sales enable educational programs, such as Forest Crew, while managed forest holdings provision research opportunities in diverse disciplines.

Following in this tradition, the group relied on their extensive data collection and qualitative assessments, as well as repeated visits to the stands—often in the company of Dr. Ashton, Dr. Orefice, and Jessica Lloyd—to draw up plans and mark timber in ways uniquely suited to each site. In some stands, for example, the group prescribed a silvicultural treatment known as a crown thinning, in which some trees of marketable value are harvested in order to let other, often more desirable trees grow larger. This treatment accelerates the self-thinning that occurs naturally as a result of light competition.

In other stands, the group chose to use a Femelschlag approach. This technique,

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sometimes translated from German as an 'expanding gap shelterwood,' mimics and exaggerates the effect of a large tree or group of trees crashing down during a storm event. The Crew looked for existing forest canopy gaps where advance regeneration was present in the understory and expanded these gaps outward such that some marketable timber and firewood logs could be harvested, while simultaneously releasing the understory and letting it grow up into the now-open sky.

After completing their work at Yale-Myers, the Crew was put to one final test: condense everything they'd learned that summer into a ten-day intensive trip to Yale's northern forests. In early August, the Crew bid a fond farewell to their beloved summer home, packed up their tools, and headed north to Vermont and New Hampshire. There, they delineated boundaries, designed a sampling method, and completed a thorough inventory of the Bowen and Crowell Forests in Vermont.

Their sharpened skills in observation and analysis served them well and enabled them to write an updated management plan for these forests. Splitting time between camping in Bowen Forest and staying in rustic accommodations at the historic Yale-Toumey property in New Hampshire, the crew was able to weather unexpected challenges in the field, survive swarms of unrelenting mosquitos, and navigate an unprecedented heat wave to finish the summer with integrity and confidence.

For the crew members involved, the summer of 2021 was more than memorable. The Yale Forests Summer Apprenticeship served each participant as a formative experience, endowing them with new ways of understanding and interacting with both forests and people, and preparing them to thrive in forested landscapes throughout their lives and careers. Once again, the decades-old and yet ever-evolving tradition of Forest Crew saw a new cohort of students graduate, leaving in their wake a new architecture in the forest as a signature and living memory of all they learned and accomplished.

So long as new and diverse students are welcomed into the Yale Forests as apprentices, collaborators and stewards, Forest Crew can continue to make a lasting impact for decades more to come.

Prescribed fire at Yale-Myers

Adam Houston, Research Coordinator, '21 MEM

On a gray, chilly morning in April a group of Yale School of the Environment students gathered at Yale-Myers to conduct a prescribed burn in the French Meadow. This former farm field was overgrown with young pines, brambles, and invasive roses, barberry, and autumn olive. Assistant Forest Manager Gracie Bachmann MF '23 and Forest Manager Matt Valido MF '21 prescribed this burn in order to reduce the invasive plants and restore the meadow. Bachmann, who has years of experiencing managing fire in Colorado and Oregon, showed the team how to dig a fire line, use a drip torch to ignite dry leaf litter, and read the wind so that the fire stays in control. While mopping-up a few smoldering patches at the end of the day, students observed that some of the invasive shrubs were either entirely burnt or had wilting leaves. In a few weeks the effect of the burn will be even more clear, and we will make plans for the French Meadow's next treatment.

Top: Matt Valido, Forest Manager, checks the fire line to ensure flames do not cross into the woods.

Bottom: Amalta Gupta '23 MEsc gets the burn started, while Elwin Lim '23 MEM stands ready to put out any errant flames.

Forest Management News

Matt Valido, Forest Manager, MF '21

Dear Yale Forests alumni and community members: my name is Matt Valido and I am the current Forest Manager for the Yale Forests. I am coming into the role from the previous forest manager Jess Lloyd, who is now working in urban and community forestry in Washington State, though maintains her support of the Yale Forests by graciously passing down her past experience and knowledge to me. Luckily, this role has benefited me by giving many opportunities to meet some of the Yale Forests' past community members. However, I'd like to offer a more formal introduction of myself to those who I have not yet met, and share news of the Yale Forests through brief updates, stories, and anecdotes from the past year. In parallel to the rest the world, much has happened and much has changed in 2021 for the Yale Forests. I am proud of all the accomplishments and growth of the past year at the Yale Forests and can speak at length with genuine admiration to the students and faculty who've worked hard to make those achievements happen. I am equally proud of, and want to share, all of the anecdotes and antics from the moments in between these impressive accomplishments; I cherish these small moments that brought levity in times of uncertainty and reminded us to see the forest for the trees. Looking back at the year, much of my own memories from the Yale Forests are centered around both the big accomplishments and small anecdotal moments. I suspect that for many of you as well, your memories from the Yale Forests may too follow a similar pattern.

I entered into the program in the Fall of 2019 after completing my undergraduate degree from Colorado College, where I developed a range of interests in natural and physical sciences, natural resource management, and wildfire. I am grateful for the early educational experiences I carried with me to Yale, in particular the curiosity instilled in me through the natural sciences in shaping the world by breaking it down into its fundamental parts. During my time as a student at Yale, my interests expanded further to include sustainable timber production, rural economic development, climate adaptation, and community-based natural resource management where my interests still remain. Graduating in May 2021, I was able to finalize my educational foundation in forestry as a member of the 2021 Forest Crew.

Following University public health policy changes, the 2021 Forest Crew was fortunate enough to have a full summer schedule working in the Boston Hollow and Still River Divisions of Yale-Myers Forest, and the Dummerston and Bowen forests in Vermont. The crew dubbed itself the "No Boundaries Crew" which was inspired by many pivotal events throughout the summer including but not limited to the thoroughness of tick checks we needed to perform on one another, and the difficulty of refreshing property boundary blazes while navigating through a sea of mountain laurel. Alongside performing needed stewardship work throughout the forest, the Crew designed and implemented three silvicultural prescriptions for selected stands in the Boston Hollow Division. These prescriptions feature two crown thinnings covering 23 acres of high-quality hardwoods and white pine, and a femelschlag covering 59 acres of mixed hardwoods. To cap off the summer, the crew traveled north to Vermont conducting inventory and boundary work to renew the Use Value Appraisal (UVA) management plans for the Dummerston and Bowen forests which also laid the foundation for a planned crown thinning and precommercial stand improvement work at Dummerston.

Two sales marked by the 2021 Forest Crew are in the process of being sold to a logger, Paul Burke, who will be starting work the summer of 2022. Additionally, a crown thinning treatment marked, sold, and administered by Jess Lloyd through her forest crew ("The Corona Crew" of 2020) has successfully been completed by the logger Greg Harvey in the Morse Division of Yale-Myers. This sale covered about 36 acres and totaled 63 thousand board feet of harvested timber volume of mixed hardwoods. Further, to improve the administration of active management operations across the Yale Forests, the forest management staff invested a great deal of time over the fall working with Yale's General Council Office to improve contract and hiring requirements for loggers. We believe the time spent improving the general structure of our logging contracts will payoff greatly by making insurance requirements for loggers more accessible and bring greater financial outcomes by hiring loggers on a contractor

Sale Name	Acreage	Volume (mbf)	Silviculture Prescription	Sale Name Origin
Ticks Or It Didn't Happen	18.7	36.1	Crown Thinning	Throughout the summer, no task was complete without a mandatory tick imbedded in at least one person
Hot Poultice On An Irish Toothache	4.5	18.0	White Pine Crown Thinning	Unknown; speculations for this name come from an experimental art show, and multiple consecutive days stuck indoors from thunderstorms
Schlag Days of Summer	58.7	108.8	Femelschlag with Intermittent Crown Thinning	This sale was marked during the peak of summer when the ice-pops were cold and the mosquitos plentiful

Table 1. Three of the prescriptions marked the summer of 2021 and their descriptions.

Perry Sawyer, a veteran log buyer from Hull Forest Products, taught the Forest Crew about grading, transporting, and tracing timber from the harvest site to the construction site. This timber sale was marked by the 2020 Forest Crew and harvested by Greg Harvey. Photo by Brad Ward.

basis. We are looking forward to getting new sales off the ground with this new structure.

This past fall, I was fortunate enough to spend time in the field mapping, inventorying and writing management plans for three of our Northern forests: Dummerston, Bowen, and Crowell Ravine. This process has been a very rewarding experience for me by getting to spend time learning and exploring new forest types and pushing my silvicultural skills within true Northern hardwood forests. These management plans also served the role in renewing the UVA (current use) status for Vermont's working forest program. Joe Orefice set a department record for longest email chain back and forth with Vermont's UVA approval body before our management passed muster with their digital silviculturalists. I am looking forward to bringing the upcoming forest crew this summer to continue our needed work there.

When not in the splendor of New England's fall forests, I sat in the splendor of Marsh Hall room 21A. This office has a unique charm; its size is perfect for exactly 1.5 people and features all the original furniture and decorations from the early aughts, including the same used coffee cups and unfiled stacks of documents. The real estate value of this office is further enhanced by its neighbors, Joe Orefice, Mark Ashton, and Adam Houston whose offices surround it on either side and feature matching décor of dying plants, half-read books, and exotic trinkets. The walls are thin and there is no privacy, which makes our staff meetings uniquely efficient as we all are attuned to each other's work updates beforehand. The best perk of this office is the snack selection which Mark Ashton keeps reliably stocked with a fixed menu of Oreos and Cheez-Its. To counter a tragedy of the common's scenario, the snacks are kept in a filing cabinet directly behind Mark Ashton's desk under his watchful gaze and judgmental scoffs. I also believe that Mark will store just about anything in a filing cabinet as a pure act of rebellion against digital, cloud-based storage systems, which he categorically distrusts. Despite the quirks of the shared office, I am grateful to be back in an in-person setting with the rest of the School Forests staff.

Yale-Myers Forest hosted a variety of activities over the course of this academic year: Management Plans field work, forest farming workshops, maple syrup production, Silviculture pods, the annual Christmas tree harvest, a prescribed burn, and much more. I encourage everyone to explore further into these activities, both familiar and new to Yale-Myers Forest, via the Yale Forests digital media outlets and email lists where these programs are described in richer detail. However, a final detail I wish to highlight here is the role of the MF class of 2022 in helping make many of these events happen, both directly under their leadership and indirectly through their support and volunteered labor. It takes a lot of unseen work to host all of the enriching programs that Yale-Myers has to offer, and the School Forest staff is grateful for the leadership and support the second year class of MFs have brought to the forest. It has been an honor for me personally to get to know and work with them throughout the year, first as a student, then to Forest Crew, and finally as Forest Manager. They showed courage and tenacity starting graduate school during the chaos of a global pandemic, and now exhibit talent, grace, and leadership in their various roles as second year students within The Forest School. We will surely miss their presence around Yale-Myers and Marsh Hall, and know with certainty the positive impact they will bring to the next forest and community wherever they may go.

RESEARCH NEWS AND NOTES

Adam Houston, Research Coordinator, '21 MEM

Marlyse Duguid,
School Forests Research Director and Thomas G. Siccama Lecturer in Environmental Field Studies, MF '10, Ph.D.'16

In 2021 researchers at the Yale School Forests investigated organisms and ecosystems across the forest, uncovering new relationships and demonstrating the value of this forest as a living laboratory. There were eleven new research projects in 2021, in addition to a dozen long-term projects.

New Grants and Programs

Dr. Joe Orefice '09 MF was awarded $394,000 through the USDA Acer Access and Development Program to install a maple syrup production system and host a series of workshops at Yale-Myers. The sugarbush, sugarhouse, and evaporator will be used as a living classroom for maple syrup producers in southern New England. This region has great potential for maple syrup production, and workshops will help connect producers and educate them about different production systems, climate change, maple silviculture, and more. The first few workshops in the series have already been held, and you can find the workshop schedule at https://forests.yale.edu/resources/maple.

Incoming doctoral student Karam Sheban '20 MF, Marlyse Duguid '10 MF, '16 PhD, and Joe Orefice were awarded a $250,000 Research and Education Grant through USDA Sustainable Agriculture Research and Education (SARE) establishing the The Northeast Forest Farmers Coalition. Along with extension and outreach activities, this research will provide important ecological, financial, and production data on five species with significant profit potential—American ginseng (*Panax quinquefolius*), goldenseal (*Hydrastis canadensis*), ramps (*Allium triccocum*), black cohosh (*Actaea racemosa*), and bloodroot (*Sanguinaria canadensis*). Currently little is known regarding rates of survival, establishment, and growth and yield for these species under different management systems, especially in the Northeast region. These new projects will enhance applied knowledge of agroforestry and help forestland owners in the region who want to grow valuable non-timber forest products of their own. Curious to learn more about the research program? Visit us online at http://forest.yale.edu/research

Kohlberg-Donohoe Research Fellowship

The Kohlberg-Donohoe Research Fellowship, which was in its fifth year in 2021, makes competitive research grants to Yale University students who are conducting research at any of the School Forests. The fellowship was awarded to five research projects in 2021.

Emma Broderick '23 MF and Mary Katherine DeWane '23 MF set an anchor point in the tubing system for maple sap collection. Photo by Joe Orefice.

Yara Alshwairikh, a PhD student in Dave Skelly's laboratory, investigated how wood frogs can survive the freezing conditions at Yale-Myers Forest over the winter. Wood frogs hibernate under the soil and can allow up to 70% of the water in their bodies to freeze. This remarkable process is not well understood, so in addition to monitoring soil and air temperatures over the winter, Yara collected adult wood frogs and froze them in the lab. The frogs were exposed to similar temperatures that they would experience in the wild, and Yara collected RNA samples to better understand the genetics behind wood frog freezing.

Logan Billet, also a PhD student in the Skelly Lab, spent the spring and summer visiting 40 ponds at Yale-Myers and surveying the wood frog tadpole populations for ranavirus, a deadly amphibian pathogen that has been implicated in global declines in amphibian populations. Seven of the forty ponds had ranavirus epidemics, and Logan found that infections may be occurring earlier in the year and changing the growth of wood frog tadpoles. This is one of the first multi-year studies of ranavirus happening in the same locations, and as more data accumulates Logan will be able to figure out how the virus spreads and impacts frog populations.

PhD students Kristy Ferraro and Eli Ward, and undergraduate Les Welker, advised by Mark Bradford and Os Schmitz collaborated on a project to expand our knowledge of an unappreciated source of nutrients in the forest: deer placentas. Large herbivores like deer have big impacts on forests through browsing on plants and recycling nutrients in their poop. Deer also give birth every year, and in places like

Karam Sheban '20 MF answers questions about forest farming at a recent workshop. People interested in forest farming have had several opportunities to learn about and plant five different species of understory medicinal herbs with Sheban, Cammack, and Dr. Duguid. Photo by Walker Cammack.

Connecticut with high deer populations, their birthing material may contribute a significant amount of the nutrients that plants need to grow. Kristy, Eli, and Les spent the summer measuring soil and plant nutrients before and after depositing cow placentas on the forest floor, as a stand-in for deer placentas.

Alex Polussa, a PhD student in Mark Bradford's lab, worked with Dr. Fiona Jevon to complete an experiment on how the timing of leaf fall might impact soil. As the planet heats up due to climate change, trees are losing their leaves at different times of the year and creating atypical leaf layering patterns on the forest floor. For example, oaks are holding onto their leaves longer, and their leaves are more resistant to decay than birch leaves. Alex and Dr. Jevon collected leaves from several different species and artificially layered them in different patterns. Preliminary results show that microbial biomass determines the rate of leaf decomposition, and as more data is analyzed we will begin to understand how the timing of leaf fall can change the microbial community.

Jon Gewirtzman, a PhD student in Pete Raymond's lab, continued measuring methane emissions from trees and soils in the Forest Global Earth Observation plot. Trees can emit a significant amount of methane from their stems – you can find videos of scientists igniting the gas as it bubbles out of holes drilled in the bark of some trees. Quantifying the methane emissions is a relatively recent endeavor, and Jon's work will help reduce the uncertainty around methane in global greenhouse gas emissions budgets. This work is particularly important because methane traps 84 times more heat than carbon dioxide, the other major greenhouse gas contributing to climate change.

The Louise H. and David S. Ingalls Field Ecology Program

In 2021 the Ingalls Field Ecology Program was able to restart after last summer's pandemic-induced hiatus. Five undergraduates, including Camilla Ledezma, Marsh Hlavka, Ellie Jose, Vincent Gleizer, and Makenzie Birkey, spent the summer learning a variety of field ecology skills and providing valuable assistance to researchers. The Ingalls team started the summer learning about botany, soils, birds, and other natural history skills along with Forest Crew, and then split off into different groups around the forest. Vincent worked with Sarah Bonello '22 MEsc, in Marlyse Duguid's lab, to survey how forestry treatments affect insect communities over time, which involved both days of trekking through the thick brush and long hours identifying insects in the lab. Makenzie spent much of the summer working with Eli, Kristy, and Les studying deer placentas. Camilla, Marsh, and Ellie worked with Nora Hardy, '22 MEsc, in Mark Ashton's lab, to complete several different projects across the forest, including measuring decades-old oak seedlings and counting sapling regeneration in shelterwood treatments. Franklin Bertellotti, who was an Ingalls intern in 2019, completed his senior thesis research with the Schmitz Lab on how insect communities are affected by size and connectedness of their habitat.

Summer 2022

Marsh and Ellie from last year's Ingalls cohort will be returning this summer to complete their senior theses at Yale-Myers in Marlyse Duguid's lab, studying forestry treatment effects on birds and understory plant communities, respectively. David Rubin, another Yale undergraduate in the Duguid Lab, is contributing valuable research to the chronically understudied wild

Eli Ward applies a urea solution to simulate white-tailed deer calving and study the impacts that nitrogen pulses can have on forest soil and plant dynamics. Photo by Kristy Ferraro.

bee populations in the forest. Logan Billett is resampling vernal pools for wood frogs and ranaviruses. Brandon Sanchez, a first-year PhD student in the Skelly Lab, is comparing wood frog tadpoles at Yale-Myers with populations up and down the East Coast to understand how rates of development and thermal performance might interact. Janey Lienau, '23 MEsc in the Schmitz Lab and the Duguid Lab, will be studying how ground beetles impact nitrogen cycling in the forest floor. Annli Nakayama, '23 MEsc in the Duguid Lab is going to look at whether invasive plant removal treatments are effective over the long term. Jon Gewirtzman is continuing to measure methane emissions from trees and soils and is developing new technologies for measurement along with colleagues from the School of Engineering and Applied Sciences. Alex Polussa and Eli Ward are embarking on a project to understand how fungal root connections with ericoid plants affect soil.

Come join us this summer at our Summer Research Seminar series, where you can hear from these scientists in-person and on Zoom!

A Selection of Papers published from Data Collected at Yale Forests over past year

Arietta, AZ Andis, and David K. Skelly. "Rapid microgeographic evolution in response to climate change." Evolution 75.11 (2021): 2930-2943.

Borden, Caroline G., Marlyse C. Duguid, and Mark S. Ashton. "The legacy of fire: long-term changes to the forest understory from periodic burns in a New England oak-hickory forest." Fire Ecology 17.1 (2021): 1-17.

Buchkowski, Robert W., and Oswald J. Schmitz. "Weak interactions between strong interactors in an oldfield ecosystem: Control of nitrogen cycling by coupled herbivores and detritivores." Functional Ecology 36.1 (2022): 133-147.

Carpenter, Romy, et al. "Soil nutrient recovery after shelterwood timber harvesting in a temperate oak hardwood forest: Insights using a twenty-five-year chronosequence." Forest Ecology and Management 499 (2021): 119604.

Craig, Robert J., Marlyse C. Duguid, and Mark S. Ashton. "Breeding forest birds of northeastern Connecticut show a long-term population increase and high species turnover." The Wilson Journal of Ornithology (2022).

Gahm, Kaija, AZ Andis Arietta, and David K. Skelly. "Temperature mediated tradeoff between development and performance in larval wood frogs (Rana sylvatica)." Journal of Experimental Zoology Part A: Ecological and Integrative Physiology 335.1 (2021): 146-157.

Giery, Sean T., Dana L. Drake, and Mark C. Urban. "Microgeographic evolution of metabolic physiology in a salamander metapopulation." Ecology 102.11 (2021): e03488.

Gotelli, Nicholas J., et al. "Estimating species relative abundances from museum records." Methods in Ecology and Evolution (2021).

Kinlock, Nicole L. "Uncovering structural features that underlie coexistence in an invaded woody plant community with interaction networks at multiple life stages." Journal of Ecology 109.1 (2021): 384-398.

Martin, M., Woodbury, D., Glogower, Y., Duguid, M., Frey, B., & Ashton, M. (2021). Within-gap position shapes fifty years of forest dynamics in a temperate hardwood forest in Connecticut, USA. Forest Ecology and Management, 494, 119311.

Rosenblatt, Adam E. "Drought rewires an old field food web through shifts in plant nutrient content and herbivore feeding behaviors." Climate Change Ecology 2 (2021): 100019.

Rowland, Freya E., et al. "Asynchrony, density dependence, and persistence in an amphibian." Ecology (2022): e3696.

Spake, R., Mori, A. S., Beckmann, M., Martin, P. A., Christie, A. P., Duguid, M. C., & Doncaster, C. P. (2021). Implications of scale dependence for cross-study syntheses of biodiversity differences. Ecology Letters, 24(2), 374-390.

Ward, E. B., Duguid, M. C., Kuebbing, S. E., Lendemer, J. C., Warren, R. J., & Bradford, M. A. (2021). Ericoid mycorrhizal shrubs alter the relationship between tree mycorrhizal dominance and soil carbon and nitrogen. Journal of Ecology, 109(10), 3524-3540.

News from the Quiet Corner

Adam Houston, QCI Coordinator, '21 MEM

It has been so exciting to watch people return in-person to the Yale Forests this past year! Yale-Myers Forest has come alive with students working on management plans, maple and forest farming workshops, field trips, seminars, and so much more.

Management Plans

This fall, twelve Yale School of the Environment students spent their weekends measuring trees, digging soil pits, and wading in wetlands around northeastern Connecticut. Each student team worked with a forestland owner whose property neighbors Yale-Myers Forest to develop a detailed biophysical survey, social assessment, and management plan for the longstanding "Management Plans for Protected Areas" course, taught by Dr. Mark Ashton. These plans, which often range from 100 to 200 pages, are developed over three months and require all the skills that students learn during their time at The Forest School at the Yale School of the Environment. Since 2011, Management Plans has been focused on working with forest landowners in the three watersheds surrounding Yale-Myers Forest.

"It has been a heavy lift, but an enjoyable one," said Genevieve Tarino '22 MF. "This has been the culmination of everything I have learned here at Yale so far." Tarino worked with Hannah Andrew '22 MF to create a plan for a 40-acre property in Eastford, CT. The owners were interested in creating a meadow for pollinators, promoting wildlife habitat, and establishing long-term conservation of the property. After completing an in-depth survey of the property's geology, soils, and vegetation, Andrew and Tarino recommended changing mowing strategies in the property's meadows, protecting riparian areas, and exploring several different long-term conservation strategies.

The Management Plans course culminated with a marathon session where each team gave an hourlong presentation to their landowners. The session also gave the clients a chance to convene with the other landowners, many of whom are their neighbors. This kind of cross-pollination has led to collaborations between Quiet Corner landowners in the past, such as stream protection plans that span multiple properties.

"After today, I feel like real forester," concluded Eudora Miao '22 MF, after the presentations were over – a sentiment that was shared by everyone in this year's class, and for every Management Plans student in the past.

PhD student Logan Billett presents his research on ranavirus pandemics affecting wood frogs in vernal pools. Photo by Adam Houston.

Maple, Forest Farming, and More

The introduction of two new research and education programs at Yale-Myers Forest created some exciting workshop experiences for our neighbors. As described in the Research News and Notes section above, faculty and students at The Forest School have begun working on maple syrup production and understory medicinal herb cultivation.

Joe Orefice led a number of workshops this fall and spring utilizing our newly installed maple sugarbush, sugar shack, and portable evaporator. This program, funded by a USDA Acer Access and Development grant, will encourage a new crop of maple syrup producers here in the Quiet Corner and across southern New England in general.

Karam Sheban, Marlyse Duguid, and Walker Cammack led the installation of five research sites and the creation of the Northeast Forest Farmers Coalition. They were also funded by the USDA to research the management and production of five medicinal herbs (described above), and to cultivate a network of forest farmers acros the Northeast. Steve Prinn, the Yale-Myers Forest caretaker, assisted with both the maple and forest farming programs. Prinn has turned his property is an amazing demonstration site, with almost 200 maple taps and a great diversity of understory herbs, both wild and cultivated.

Summer Research Seminars

June 15th: **Wood Frogs** - Ranavirus pandemics in vernal pools, *Logan Billett, PhD student*

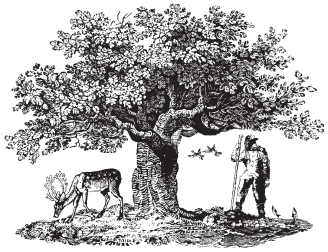
June 29th: **Insects** - Investigating the impact of forestry on ground beetles, *Sarah Bonello, MEsc*

July 13th: **Trees and Forests** - Methane and other greenhouse gas emissions, *Jon Gewirtzman, PhD student*

July 27th: **Mountain Laurel** - Below the surface: mountain laurel and forest development, *Eli Ward, PhD candidate*

* Join us at 6 pm for socializing. Seminars will begin at 6.30.

From all of us at the Yale School Forests: Thank you for your support!



Top: Forest Crew relaxes like ants on a log. Photo by Mark Ashton.

Right: Walker Cammack MF '22 demonstrates how to escape from a wild dog. Photo by Emily Sigman.

Left: A luna moth, an unexpected and beautiful find. Photo by Adam Houston.

Bottom: Forest Crew and researchers follow Mark Ashton on a natural history field trip. Photo by Walker Cammack.