City of Keene, New Hampshire

CONSERVATION COMMISSION

Monday, April 19, 2021 **4:30 PM** **ZOOM**

Commission Members

Alexander Von Plinsky, IV, Chair	Councilor Robert Williams
Eloise Clark, Vice Chair	Brian Reilly, Alternate
Kenneth Bergman	Thomas P. Haynes, Alternate
Art Walker	Steven Bill, Alternate
Andrew Madison	John Therriault, Alternate

- This meeting will be conducted using the online meeting platform, Zoom. The public may view the meeting online by visiting www.zoom.us/join and enter the Meeting ID: **868 3840 7352**.*
- More info on how to access this meeting is available on the Conservation Commission webpage at https://ci.keene.nh.us/conservation-commission
- If you encounter any issues accessing this meeting, please call (**603) 209-4697** during the meeting.

1. Call to Order

2. Approval of Meeting Minutes – March 15, 2020

3. Communication and Notifications
   a. National Grid – Herbicide Use Notification
   b. Antioch Bee Proposal – Michael Akresh, PhD.
   c. Ashuelot River Local Advisory Committee -- request for funding for river montoring program

4. Informational
   a. Subcommittee reports
      - Outreach Subcommittee
      - Arm Fund Subcommittee

5. Discussion Items
   a. Greater Goose Pond Forest Management Stewardship Committee – Mayor Hansel
   b. Garlic Mustard Challenge
   c. Old Gilsum Rd – Goose Pond Forest

6. New or Other Business

7. Adjournment – Next meeting date **Monday, May 17, 2021**

**In Emergency Order #12, issued by the Governor pursuant to Executive Order #2020-04, which declared a COVID-19 State of Emergency, the requirement that a quorum of a public body be physically present at the meeting location under RSA 91-A:2, III(b), and the requirement that each part of a meeting of a public body be audible or otherwise discernible to the public at the meeting location under RSA 91-A:2, III(c), have been waived. Public participation may be provided through telephonic and other electronic means.*

City of Keene
New Hampshire

CONSERVATION COMMISSION MEETING MINUTES

Monday, March 15, 2021 **4:30 PM** **Remote Meeting via Zoom**

Members Present:
Alexander Von Plinsky, IV, Chair
Eloise Clark, Vice Chair
Councilor Bobby Williams
Art Walker
Ken Bergman
Andrew Madison
Tom Haynes, Alternate (Voting)
Steven Bill, Alternate
John Therriault, Alternate

Staff Present:
Rhett Lamb, Community Development Director/Assistant City Manager
Andy Bohannon, Director of Parks, Recreation & Facilities
Corinne Marcou, Administrative Assistant

Members Not Present:
Brian Reilly, Alternate

1) Call to Order

Chair Von Plinsky read the executive order authorizing a remote meeting: Emergency Order #12, issued by the Governor of the State of New Hampshire pursuant to Executive Order #2020-04. Pursuant to this order, Chair Von Plinsky called the meeting to order at 4:33 PM and members present stated their locations and whether calling alone.

2) Approval of Meeting Minutes – February 16, 2021

Corrections: line 36, change *wee* to *week*; line 40, change *Mr. Therriault* to *Mr. Bergman*.

Mr. Bergman moved to adopt the minutes of February 16, 2021 as amended, which Mr. Walker seconded, and the motion passed with a unanimous roll call vote in favor.

3) Applications

a. NHDES 34 Darling Ct. – Expedited Minimum Impact Wetlands Permit

Mr. Lamb said this was an expedited application from the property owner of 34 Darling Court for a new driveway crossing that was approved previously in 2006. A representative of the owner spoke: Chris Danforth – Senior Environmental Scientist for TFMoran, Inc. of 48 Constitution

Drive in Bedford, NH. Mr. Danforth began stating that due to how this subdivision was set-up, access to each lot was limited with a 40-foot right-of-way (ROW) and so there were no other options to place this culvert. Mr. Danforth showed a photo of driveway access from Darling Court and a photo of the actual wetland, which he called a small finger extending upslope and terminating where the crossing was proposed. To construct this crossing, 310 square feet of wetland impact were proposed. As a part of this application, two abutters were notified of this action due to work within 10 feet of the common property lines; the original sub-divider did not respond and Mr. Danforth assumed their compliance, and the second property owner responded with no expressed concerns in a signed letter. He explained that this proposal was to install a 15-inch culvert for cross drainage due to filling to raise the driveway and accommodate the culvert. A septic system was approved already and the owners hoped to begin construction in the spring. He reiterated that the intent to cut was already approved in 2006 so the lot could be cleared, which occurred. State rules require obtaining a Wetlands Permit for residential use because logging was a different use with a different permit than this one. Mr. Danforth said he found no information on endangered species in the area and maps show no rare wildlife or wetland habitat. To submit this application as expedited, a signature of concurrence was required from the Conservation Commission Chairman.

Mr. Lamb explained that this was a conservation residential subdivision and under City rules, significant portions of the original lots were set aside for conservation of identified natural resources, wetlands, steep slopes, and habitat values. As such, the maximum preservation of resources had occurred already on these lots through that zoning district.

Vice Chair Clark asked how wide the driveway would be. Mr. Danforth said the road surface would be 15 feet and that the shoulders of the fill would be 30 feet at grade. Vice Chair Clark asked the condition of the wetlands on both sides of the driveways and whether connectivity existed or would remain with the abutting lots. Mr. Danforth said he found no jurisdictional wetlands above the culvert, only surface water that accumulates at this low point. This is the head of a small wetland finger that extends to a larger wetland downstream and so connectivity would be maintained for surface runoff from upslope of the driveway.

Mr. Bill asked if the culvert size would be the standard 15-inch and Mr. Danforth replied in the affirmative, stating that the size is standard for a driveway culvert ditch with a small watershed above and the driveway cutting-off flow. Mr. Danforth did not encounter any ground scouring that would indicate high flows in the area, which is mostly lawn and intact vegetation. Mr. Bill asked about the degree of driveway fill. Mr. Danforth said that the driveway is on a slope and on the downstream side, the invert of the culver is at 1,012.5 feet with the top of the driveway at the road surface is 1,017 feet. He continued that therefore the project would require five feet of fill from the high to low point of the driveway, which is just enough to accomplish the driveway width without going over the property lines. Mr. Bill asked the type of fill. Mr. Danforth said it would be essentially road material; structural fill that would be probably crushed gravel.

Mr. Therriault assumed the disturbance of land on either side of the fill area for equipment, etc., and asked what the ground cover would be reseeded with. Mr. Danforth referenced the plans in the meeting packet and said they would use a Department of Transportation (DOT) slope mix (#44 – tall fescue, KY blue grass, perennial ryegrass, laser poa trivialis, streaker red top, and switchgrass) intended be suited well to transitional areas between wetlands and uplands. He was unsure what the owner planned for the remaining private areas, but Mr. Danforth recommended revegetating any disturbed ground. Mr. Danforth agreed with Mr. Therriault about the benefits of reseeding with native wildflowers so that not all grasses would be used. Mr. Therriault suggested wildflower species that do well in wetter ground and self-seed well including New England asters, ironweed, and rose milkweed.

Mr. Bergman asked whether the ultimate criterion for evaluating the project would be that flow through the culvert remains or to maintain this small wetland in close to its near original state and what is compatible with the conservation residential zoning district. Mr. Danforth said there is no jurisdictional area above the head of this wetland where impacts would occur, with the exception of surface flows. Mr. Danforth was using the culvert to maintain the connectivity and hydrology for the wetland downstream. Mr. Lamb referred back to the subdivision plan approved in the early 2000s and pointed out where there was a wetland adjacent to the lot in question to demonstrate that the primary resource value of the area was duly protected already. In order to provide that owner some developable land, some small areas of lots 13 and 14 at the head of the larger wetland remained. He confirmed that the criterion for issuing the Wetlands Permit falls to whether the proposal meets NH Department of Environmental Services (DES) rules. Mr. Lamb said that short of narrowing the proposed driveway, there were no other feasible options to place a driveway to reach the buildable portion of this lot. Mr. Danforth said the 40-foot ROW is just sufficient enough for the grading to install the culvert to function correctly.

Mr. Lamb said that this would require a vote to *not* intervene should the Commission have no concerns, at which time the Chairman would sign the application that goes to NH DES. The Chairman said it seemed sufficient planning occurred and he felt good about the work done for the whole subdivision. He heard no objections.

Mr. Madison moved to not intervene with the NH DES application for 34 Darling Court, which Councilor Williams seconded, and the motion passed with a unanimous roll call vote in favor.

4) <u>Communication and Notifications</u>

a. NH Fish & Game Department Letter – "Trails for People and Wildlife" Update

Mr. Lamb referenced this informational letter in the meeting packet on the topic of access to trails for both people and wildlife.

5) <u>Informational</u>

a. Subcommittee Reports

i. *Outreach Subcommittee*

Vice Chair Clark continues submitting Nature Nuggets to Ms. Marcou, who posts them to the website and social media. The Vice Chair had submitted nine since the last meeting, including one on garlic mustard but without details yet on the upcoming event.

ii. *ARM Fund Subcommittee*

The Chairman said the Subcommittee had not met since learning there would be no funding for this watershed in 2021 but said they should start meeting to consider other funding for goal projects. Mr. Bergman and Chair Von Plinsky agreed they could continue with an intention to review City property maps in search of targets to rank for easement or purchase, possibly starting in April. Mr. Bill stated that he had a site to recommend when the time was appropriate. When the time comes, Mr. Madison offered to help develop conservation criteria for evaluating properties, which he used to do through non-profit work. The Chairman recalled that Mr. Haynes began to highlight rough criteria a few years ago also and all help was welcome moving forward.

Mr. Lamb said that a primary idea on the record from previous meetings was to seek funding to improve habitat and watershed value of the portion of Beaver Brook near to the new Russell Park. He thought there were still opportunities for this because it is a phased project. Mr. Bill requested a Commission site visit at Russell Park to understand the design plans. The Chairman, Mr. Lamb, and Mr. Bohannon would try to schedule that. Mr. Lamb noted that it was likely too late for the Commission to influence the final design choice, which was underway. The Commission could, however, have an influence from the point of view of Beaver Brook. The Chairman thought a site visit would be beneficial for the Commission to be better acquainted with the context moving forward. Regarding the 2009 Moosewood Ecological report requested at previous meetings, Mr. Lamb said it was very large and he was seeking a way to divide it and post on the Commission webpage.

b. Greater Goose Pond Forest Management Stewardship Committee (Proposed)

The Commission's February 2021 vote to recommend this Stewardship Committee would be introduced to the City Council on March 18, presented in detail to the Planning, Licenses & Development Committee on March 24, and would go before Council again for final vote to form this public body on April 1.

6) <u>Discussion Items</u>

a. Discussion – Garlic Mustard Challenge

Councilor Williams shared a presentation to help the Commission leave this meeting with a plan for the Garlic Mustard Challenge (GMC). He began by sharing three goals:

1. Replace stands of invasive garlic mustard with native and pollinator-friendly plants.

2. Create awareness of invasive species issues among Keene citizens, landowners, and government officials.
3. Identify people willing to volunteer for invasive species management projects and develop a model for engaging with them on City-sponsored invasives projects.

Councilor Williams shared a list of potential partners:

- Conservation Commission – project oversight
- Keene City Staff – operational support
- Mayor and City Council – publicity
- University of New Hampshire Cooperative Extension – training materials
- Nature Groupie – volunteer recruitment support
- Local schools and service organizations
- Local restaurants and merchants
    - Machina Arts Restaurant has expressed interest in creating special garlic mustard dishes
- Town of Hanover, NH
- Cheshire County Conservation District – appropriate native seed mixes for replanting

Councilor Williams discussed a high-level timeline, which may need to shift based on when garlic mustard blooms this spring, but the goal is a two-week event:

- March 15 – Conservation Commission meeting
- April – early publicity & acquire supplies
- April 19 – Conservation Commission meeting
- April 22 – Earth Day
- April 24 (Saturday) – volunteer training
- May 1 (Saturday) – location scouting and flagging/GMC begins
- May 3 (Monday) – public map
- May 6 (Thursday) – City Council meeting (Mayoral proclamation?)
- May 16 (Sunday) – GMC ends
- May 17-23 – post-pull site evaluations and reseeding/replanting
    - This was a new suggestion from the Councilor since the last meeting

The Chairman asked Councilor Williams how many pull sites he imagined and the Councilor asked to discuss that later in his presentation.

Next, Councilor Williams discussed publicity options:

- The City Website – early advertising and possible support for GPS/GIS mapping
- Social Media – all Commission members were urged to share Vice Chair Clark's Nature Nugget's on their personal social medias, including the recent one on garlic mustard, and to spread the word about the GMC through their personal networks
- Instructional Video – some already exist and some volunteers have offered to help create the training video
- Radio – public interest advertisements for a broader awareness

- College radio stations included
- Nature Groupie – to reach and organize volunteers; success with the GMC in the past
- Green Up Keene – one or two weeks before the GMC and could include GMC information in the Green Up Keene materials to raise awareness about the species and reach a target audience that might want to participate in the GMC
- Mayoral proclamation or Council resolution – a resolution would be great for attention but might require too much administrative time; Councilor Williams thought a Mayoral proclamation would be possible
  - Councilor Williams and Mr. Madison agreed that a resolution should not be needed legally and the Conservation Commission should be able to act on its own authority to hold the event

On publicity, Vice Chair Clark suggested announcements in local newspapers. Mr. Therriault added that the Keene Sentinel's ELF section is always looking for community activities to share.

Mr. Therriault suggested that GMC participants could be provided packets of purple coneflower seeds to distribute on the disturbed ground, stating that it is one wildflower that does not require a cold conditioning period prior to seed germination. He could acquire one pound for $45. Councilor Williams thought of clover as a similar option. Vice Chair noted that purple coneflower actually likes sunny areas and garlic mustard does not. Councilor Williams was hopeful that working together, a proper seed mix could be established.

Councilor Williams continued his presentation discussing supplies necessary for the event:

- Black plastic bags
  - All agreed that adding more black plastic bags to a landfill is not ideal, despite it begin understood as the best management practice for garlic mustard eradication, and not wanting to disturb the disposal procedure so that it defeats the purpose.
  - Councilor Williams suggested a large, plastic reusable bin at one location to see if it could work. Mr. Haynes has 40-gallon bins to donate for this experiment.
  - Vice Chair Clark said that when she plucks baby buckthorn and other invasives she hangs them in tree crotches and allows their roots to dry. She wondered if there was rationale for doing the same with garlic mustard. Because garlic mustard is picked while in bloom, there would be no seeds on them to disperse.
  - Mr. Bill wondered if leaf bags could be a viable alternative. Councilor Williams thought that would be a good question for the Chairman and Mr. Walker to ask during the NH Invasives Academy they were attending.
- Informational signs
- Flags – to mark areas designated for volunteers
- Seeds and/or seedlings – for replanting garlic mustard pull sites

Next, Councilor Williams discussed a possible budget, stating that it did not seem the costs would be high and that he was willing to contribute some out-of-pocket. He asked what remained in the Commission's budget. Mr. Lamb said that at the beginning of each fiscal year, the

Commission budget gains approximately $1,500 and there were $1,430 remaining as of this meeting's date. The Commission could also solicit donations. Mr. Madison agreed that the costs should not be high, no more than a few hundred dollars. Councilor Williams thought the greatest possible expense could be seeds but he hoped to have a good bargain through the Cheshire County Conservation District, with the help of Amanda Littleton. Mr. Bill questioned whether there would be landfill fees. Mr. Lamb said the cost is approximately $2 per bag, which could become costly, and he was unsure whether those fees could be waived. Councilor Williams wondered if there was someone local with the willingness and capacity to compost the garlic mustard safely. Mr. Lamb said that the Elm City Cooperative was collecting compost across the City around the time of this meeting.

Councilor Williams continued his presentation discussing volunteer training. He read a quote from Malin Clyde of the UNH Cooperative Extension about how to host a training: *"You could plan to host a training in the spring to show a few key volunteers how to ID the plan (it's easy during the right season, and I'm sure there are folks in garden clubs, the Commission, or at Keene State that know the plant). The trained folks could then go out and look for populations in parks or conserved lands. When you have a few key areas identified, you could either encourage people to go pull on their own (and report their bags to you), or you could have the trained volunteers host some small workdays, and submit their number of bags pulled on the GMC website (reporting form)."* Councilor Williams said that training should include:

- How to identify garlic mustard and other plants to not touch
- The City's new See-Click-Fix municipal reporting system – now available as a phone app and the Councilor wondered if it could be adapted to report and mark invasive locations as a map building tool.
    - Citizen concerns (e.g., potholes, a downed tree on a trail, etc.) are reported through the app and feed directly into the Public Works Department work order system. In the app, citizens can see a map of the location of their reported concerns and all other active work orders.
    - Mr. Lamb would inquire whether this could be adapted for garlic mustard location reporting during the challenge because it goes to the Public Works Department for action. Councilor Williams said it is a great tool with quick results and he wondered if the system could be adapted to divert garlic mustard reports to the Commission instead of Public Works Department for the period of the Challenge. If this is not permissible, locations could be reported via email for map creation.
- What City properties are "in bounds" for the activity
    - Locations to publicize that are safe (e.g., not too close to roadways, etc.)
    - Properties where this activity would be permissible – must be City properties

Mr. Madison thought that Zoom or YouTube would be the best platforms for training due to Covid-19. Then, when materials are distributed to volunteers for the challenge, they could include a handout on garlic mustard identification and plants to not touch, and a map of areas that are in bounds for the activity. He thought that a short five to 10-minute YouTube video would engage more volunteers because they could do the training in their free time versus

constricted Zoom call times. Councilor Williams said that a digital information packet could accompany the video.

Mr. Bill asked whether any garlic mustard sites were already identified or if best to wait until growing season to determine. Councilor Williams knew of three in his neighborhood: one likely too close to the road, one near Robin Hood Park, and one other on a City lot. Mr. Bohannon wondered whether there were any spots in the Ashuelot River Park, where there was an upcoming large volunteer work day during the last week of April that could address the concern. Mr. Madison said he would be unsurprised to find garlic mustard patches in Ashuelot River Park. If the bloom time did not align with that volunteer event then Councilor Williams suggested those individuals could scout and flag garlic mustard in advance of the Challenge. Mr. Madison recalled that Green Up Keene was scheduled for April 24, when people would be roaming the City and could be flagging garlic mustard as well. Mr. Bill wondered whether that would leave enough time to create maps during the following week in time for the Challenge. Councilor Williams thought it was possible, stating that he thought aggregating the locations would be the harder part, and at very least it should be possible to find enough general sites to advertise. Mr. Bill suggested likely locations in Robin Hood Park too. If enough sites and volunteers were scouted during Green Up Keene, then Mr. Haynes said that Commission members could be posted at those locations to guide and supervise volunteers.

Councilor Williams continued his presentation with a quote from Nature Groupie on the GMC: *"After a wide-ranging educational effort, [Hanover, NH's] Biodiversity Committee has begun to focus on an innovative management approach: neighborhood efforts coordinated by neighborhood leaders. Along trails and roads with garlic mustard infestations, "pulling stations" were established to promote pulling by individual volunteers. These stations were stocked with educational materials, a movable "PULL HERE" sign-post and bags to promote anonymous walkers to pull. Trained volunteers then check all the sites and remove full bags to the landfill."*

The Councilor shared what he envisioned for Keene's GMC:

- Conservation Commission provides a live map of pick-able garlic mustard on public property, including the location of a few mobile "stations" near significant stands of garlic mustard.
- Each station has large garbage bins or bags with explanatory signage.
    - Stations to be checked regularly by volunteers, with garlic mustard to be disposed of appropriately.
    - Stations to be moved if an area is "picked out" – perhaps five floating stations, one in each Ward.
- People also encouraged to pick garlic mustard on their own and send photos of locations.

Chair Von Plinsky cited challenges because the Commission does not know yet the scale of the problem in Keene. Mr. Madison said that this year could be a test and there should be no surprise if turnout is not what the Commission hopes/expects because it is the first and it would provide the basis to improve next year. Mr. Madison hoped that Green Up Keene would be taken as an

opportunity to raise awareness of the species, the GMC, and properties in volunteers' neighborhoods. Mr. Madison said that Jordan Scott at Machina Arts Restaurant agreed to create a few menu specials to raise interest and awareness.

The Chairman wondered whether it made sense for the first year to choose a certain number of places or "volunteer basecamps" like Ashuelot River Park, Robin Hood Park, and Wheelock Park for easier planning. Councilor Williams thought an advantage was that locations could move throughout the two weeks as areas are picked fully. There could be a list of priority areas that are convenient and dispersed geographically; he thought two or three locations were reasonable. The Chairman and Mr. Walker would inquire at the NH Invasives Academy about early detection and whether seed dispersal maps exist already. Nature Groupie could have something similar.

Councilor Williams concluded his presentation suggesting follow-up actions after the GMC: revisit, evaluate, replant, water, and care for new plantations of appropriate native/pollinator-friendly species.

The Commission discussed and claimed tasks to accomplish before the April meeting:

- Chairman:
  - Seek pamphlet from Nature Groupie to include with Green Up Keene materials.
  - Communicate with Elm City Compost about transporting garlic mustard to Wyndham for composing.
  - Inquire at the NH Invasives Academy about mapping and alternatives to landfill disposal, like composting. (Mr. Walker would inquire as well)
- Vice Chair Clark, Mr. Therriault, and Mr. Bergman:
  - Work together and in collaboration with Amanda Littleton at the Cheshire County Conservation District to determine the most appropriate and affordable native seed mix for replanting.
  - Follow-up quickly after this meeting because seeds would require 30-60 days to be stratified.
  - Commissioners could buy the seeds and submit receipts to Ms. Marcou for reimbursement or provide the supplier information to Mr. Marcou, who could purchase directly from the Commission's budget.
  - Vice Chair Clark emphasized the importance of not replacing one problem with another (e.g., hostas are non-native and would defeat the purpose, and any type of ironwood could be a problem here).
  - Forest asters could be good options.
  - A two or three species seed mix that is best suited to the environmental conditions of replacement patches. Creating a monoculture of one species replacement would be vulnerable to disturbances, like bad weather.
  - Could inquire about the NH DOT wildflower mix used along highways.
  - Confirming a seed mix should be based on good science and not Commission preference/consensus to ensure the replanting have the best chance at success.

- Councilor Williams:
  - Provide free envelopes for seed packaging.
- Councilor Williams and Mr. Madison:
  - Work together to create training materials and establish opportunities for broader social media exposure.

The Chairman and Mr. Madison agreed with Mr. Lamb that choosing some pre-selected locations for this first Challenge could be optimal to simplify site access, site permission, and safety. Then, the GMC can grow in future years. Chair Von Plinsky said to keep in touch with Mr. Lamb and Ms. Marcou via email throughout the next month so this work proceeds. The schedule would be tight between the April meeting and the commence of Green Up Keene.

b. Update – Bee City Designation

Mr. Therriault reported that he received confirmation the day of this meeting that Keene has been certified officially as a Bee City USA affiliate. In the meeting packet, Mr. Therriault shared five goals to accomplish during the first year as a Bee City:

1. Whenever City land is disturbed, native wildflower seeds should be scattered as a part of the restoration.
2. Encourage homeowners to create small areas (50-100 square feet) for pollinators through newspaper articles or other publicity.
3. Conduct a pollinator survey to document a baseline of municipal species diversity.
4. Plant a pollinator strip on a visible section of public land and provide one or two educational signs to accompany.
5. Parks Department consideration of over-seeding park lawn areas with Dutch white clover.

The Chairman thanked Mr. Therriault for his continued work and said he thought that if those goals were accomplished, then it would be a successful first year.

c. Old Gilsum Road – Goose Pond Forest

Mr. Lamb shared a map of the Class VI portion of Old Gilsum Road, where three decades ago the road was closed with gates and bars to restrict access by motorized vehicles, while still being a public way and open to recreation. The use of Old Gilsum Road is an ongoing discussion at the Municipal Services, Facilities and Infrastructure (MSFI) Committee, which Mr. Lamb encouraged Commissioners to follow continuing on March 24. Through that MSFI process, a local resident sought to access a 30-acre parcel by ATV, first by using Old Gilsum Road and now by using a water tank utility road that is on conservation easement land. Additionally, Mr. Lamb said that other local residents have stated interest in returning Old Gilsum Road to a City-maintained Class V road because permits for development cannot be issued for properties on Class VI roads. These lots no longer comply with Zoning, would be not in compliance with

today's codes for road design or dead-end streets, and the cost of maintaining a new road could be cost prohibitive.

At today's meeting, Mr. Lamb was initiating discussion of possibility of the City acquiring eight small privately owned outparcels along Old Gilsum Rd owned by six property owners. These parcels of land are south of the power line. If acquired the land would be added to the Greater Goose Pond Forest. Adding contiguous land to the forest has been a City priority for some time, and, several times in the past, owners have approached the City and he City Council has voted to acquired land for this purpose. Mr. Lamb oriented Commissioners with these parcels on a map. The eight lots were present when Old Gilsum Road was still maintained as a Class V City street. Today it acts like a trail and is not maintained by the City. Staff suggested that the Commission could start a discussion about reaching out to these property owners to determine their willingness to sell, which would align with the Commission's general priorities and focus on the Greater Goose Pond Forest. Mr. Lamb hoped to reserve time at an upcoming meeting to discuss the value of the City's approach to acquiring land to complete the larger Greater Goose Pond Forest.

The Chairman suggested that a few Commissioners could work under the lens of the ARM Fund Subcommittee – despite knowing that fund is unavailable currently – because of that groups focus on identifying parcels for City acquisition and conservation. Councilor Williams wondered if this would be a more appropriate role for the proposed Greater Goose Pond Forest Management Stewardship Committee. Mr. Lamb thought that was a great point and continued that the Committee could be preoccupied implementing the Forest Management Plan, though he saw no reason they could not do that work.

The discussion would be agendized for the April meeting.

7) New or Other Business

Mr. Bergman shared that over the winter, the Keene Dillant Hopkins Airport in Swanzey had become a birding hotspot for visitors observing activities of wildlife such as short-eared owls, barred owls, norther harriers, and more. He anticipated further interest in the location as spring progresses and new species could appear. He recalled that the Airport Director was seeking an environment impact report for the area and Mr. Bergman wanted that group to consider this activity. Mr. Lamb encouraged Mr. Bergman to compile photos and brief summaries on wildlife activity there that could be shared like the Nature Nuggets via Ms. Marcou.

8) Adjournment

There being no further business, Chair Von Plinsky adjourned the meeting at 6:03 PM.

Respectfully submitted by,
Katryna Kibler, Minute Taker

March 18, 2021
Edits submitted by
Corinne Marcou, Admin. Assist.
March 19, 2021,
Rhett Lamb ACM/Community Development Dir.
April 13, 2021

RECEIVED APR 08 2021

nationalgrid

April 6, 2021

Keene Mayor George S. Hansel
3 Washington Street
Keene. NH 03431

HERBICIDE USE NOTIFICATION (MUNICIPAL NOTIFICATION)

Dear Mayor George S. Hansel:

I am writing to inform you that National Grid has scheduled vegetation management treatments on its ROW(s) in your municipality, please see attached map(s)). Rights-of-way may be identified by locating a metal tag on a pole or structure with the following initials: "NEPCO" or "GSECO" and usually appear with a pole or structure number and the right-of-way number.

Two methods of application will be used to maintain rights-of-way in New Hampshire. A preparatory Cut and Stump Treatment (CST) will be made where trees must be hand cut near inhabited areas, roads, and for all trees over 12 feet tall. A foliage application consisting of the same materials will be made selectively to target species less than 12 feet tall over the remaining portion of the right-of-way. Foliar applications will take place between June and October 15th. (The tentative starting date of the work is June 1, 2021. Because of possible inclement weather, access difficulties and other factors, it is impossible at this time to pinpoint the exact date we will be working in your community). In both treatment methods, applicators walk to each target plant and apply minimal amounts of herbicide. All herbicides have been approved for use by the U.S. Environmental Protection Agency and the New Hampshire Division of Pesticide Control. The herbicide mixes used may include: Vastlan (Triclopyr), Milestone (Aminopyralid), Escort XP (Metsulfuron Methyl), Rodeo (Glyphosate), and/or Garlon 4 (Triclopyr).

This work has been planned and will be coordinated and inspected by professionally trained National Grid Foresters. Landowners or residents should make the application contractor aware of the location of a potentially affected water supply, and of any other sensitive area where herbicide application should be further restricted. The planned work will be performed by Lucas Tree Experts. The contact person at Lucas Tree Experts is Jared Valiquet and can be reached from 8:00 AM to 4:00 PM at 207-747-8399.

In accordance with the laws of the State of New Hampshire and the Pesticide Control Board, utilities must make "an offering in the form of a Notification Request Coupon to individual

landowners whose property is within 200 feet of the right-of-way, or over whose property the right-of-way passes, an opportunity to request and receive individual written notification thirty days prior to any foliar treatment. The newspaper notification will contain the clip out, mail-in coupon for purposes of registration of the request." If you are a recipient of the coupon "you have the right to request and receive the approximate date, plus or minus five days that pesticides will be applied to the right-of-way in your area." Requests should be made to me by May 15, 2021 at:

Mariclaire Rigby
National Grid Transmission Forestry
939 Southbridge Street
Worcester, MA 01610
508-860-6282 or mariclaire.rigby@nationalgrid.com

Also, in accordance with the laws of the State of New Hampshire and the Pesticide Control Board enclosed are a USGS Map(s) Scale 1:24,000 delineating the right-of-way to be treated, a copy of the Newspaper Notification format with a Notification Request Coupon, and a supply of mail-in Notification Request Coupons for use by property owners who are entitled to request specific written notification as stated above.

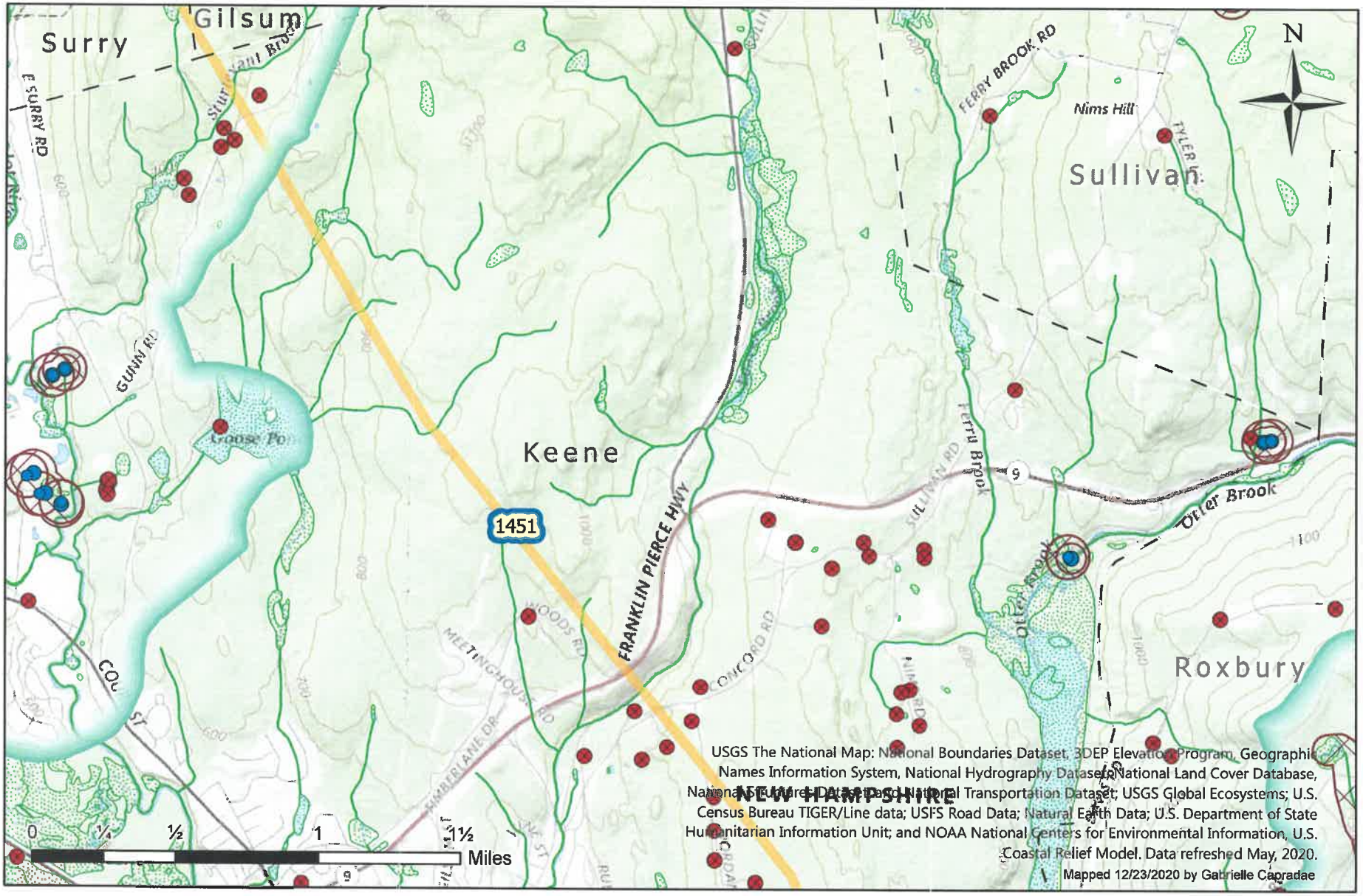
Please contact me between 8:00 AM and 4:00 PM if you have any further questions about the application and monitoring of the vegetation management program. Email is the best way to contact me.

Sincerely,

Mariclaire Rigby

Mariclaire Rigby
Lead Vegetation Strategy Specialist

Enclosures:
Municipal Map(s)
Copy of Newspaper Notification/Notification Request Coupon
Notification Request Coupons



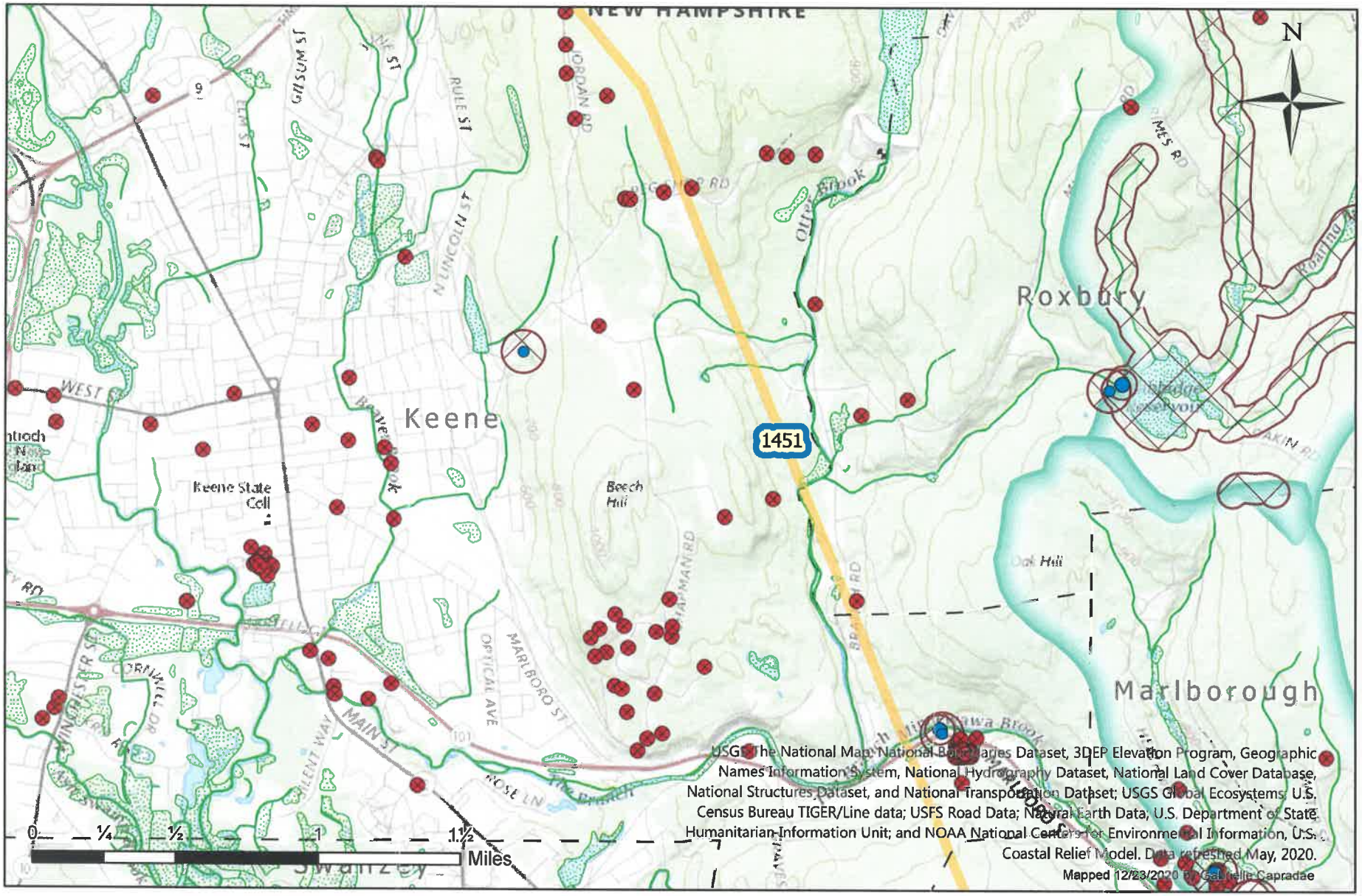
- Public Source
- Private Well
- Pasture
- Wetlands
- WHPA & SWPA
- No Herbicide Use
- Right-of-Way
- Town Border

IVM 2021

Keene, NH

Right-of-Way 1451

nationalgrid



- Public Source
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- Town Border

IVM 2021

Keene, NH

Right-of-Way 1451

nationalgrid

HERBICIDE USE NOTIFICATION

National Grid plans to apply herbicides along certain rights-of-way in New Hampshire in 2021. In accordance with administrative rules of the State of New Hampshire Pesticide Control Board, no application of herbicides shall be made to rights-of-way, during the months of June through October 15, without first providing notification to Town officials, the public, and residences near the rights-of-way. This announcement serves to provide notification to the public. The following herbicides will be selectively used to control certain tall-growing vegetation on the rights-of-way: Vastlan (Triclopyr), Milestone (Aminopyralid), Escort XP (Metsulfuron Methyl), Rodeo (Glyphosate), and/or Garlon 4 (Triclopyr). National Grid will conduct maintenance on the following rights-of-way in the associated Towns, beginning June 1, 2021:

Right-of-Way	Towns
1301	Bath, Benton, Haverhill, Lyman, Monroe, Warren, Wentworth
1451	Alstead, Gilsum, Keene, Marlborough, Roxbury, Surry, Swanzey, Troy, Walpole
1453	Fitzwilliam, Rindge, Troy

Individual landowners whose property abuts the right-of-way, or over whose property the right-of-way passes, may request and receive individual notification thirty days prior to any treatment. A Notification Request Coupon is provided below. To receive individual notification, fill out the Notification Request Coupon and return to the specified address. Coupons must be received by National Grid no later than May 15, 2021. Requests received after this date will not be granted until the next treatment cycle.

In addition to the Personal Notification by mail, as an individual landowner whose property abuts the right-of-way, or over whose property the right-of-way passes, you have the right to request and receive the approximate date, plus or minus 5 days that herbicides will be applied to the right-of-way in your area. Requests should be made to the contact listed below.

Rights-of-way may be identified by locating a metal tag on a pole or structure with the following initials: "NEPCO" or "GSECO" and usually appear with a pole or structure number and the right-of-way number, see list above.

In accordance with State Regulations, it is the duty of each landowner or resident to make National Grid aware of the location of potentially affected private water supplies, and of any other environmentally sensitive areas where herbicide application should be further restricted.

Further information may be requested by contacting, during business hours (Mon.-Fri. 8:00AM-4:00PM):
Mariclaire Rigby • National Grid • Telephone (508) 860-6282 • mariclaire.rigby@nationalgrid.com

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NOTIFICATION REQUEST COUPON

Name _____ **Property Location: Town** _____ **Street** _____

Street Address _____ **Tel. # (home)** _____ **Tel. # (work)** _____

Town _____ **State** _____ **Zip Code** _____

Line and Pole Numbers: _____

Other Landowner Location Information: _____

Sensitive Areas: _____

Landowner or Abutter requests notification of approximate date of application (Yes or No): - _____

Return to: Mariclaire Rigby
National Grid Vegetation Strategy
939 Southbridge Street, Worcester, MA 01610

Rhett Lamb

From: Michael Akresh <makresh@antioch.edu>
Sent: Tuesday, April 13, 2021 3:35 PM
To: David Hickling; Rhett Lamb; Alaina Bandanza; Rebecca Landry
Subject: Re: FW: Bee Project - Antioch University
Attachments: Antioch Bee Proposal_Bandanza Akresh 4 13 21.docx

Hi David and Rhett,

Thank you for welcoming the idea and bringing this to the Conservation Commission. We appreciate it!

I have attached our scientific proposal for the broader project (surveys in wetlands throughout the state). Please feel free to share this with the Conservation Commission. If funding were available, we'd be happy to write up a budget detailing costs and plans specific to the airport wetlands (or any other fens/peatlands within Keene that you know of, and would like surveyed). We are planning to have our study over two years (although we haven't decided yet if we will survey the same sites in each year - bee abundance/diversity can vary among years - or instead survey different sites next year).

Mike

--
Mike Akresh, Ph.D.
Faculty, Environmental Studies Department, Antioch University New England
Research Affiliate, University of Massachusetts Amherst
http://mikeakresh.weebly.com
https://www.antioch.edu/new-england/faculty/michael-akresh-phd/

On Tue, Apr 13, 2021 at 1:11 PM David Hickling <DHickling@ci.keene.nh.us> wrote:

> Mike, I would certainly welcome this project at the airport. Although the airport would not have any funding available to support such a project, I have reached out to a colleague who works with the Keene Conservation Commission to see if they would have any interest in assisting with the funding. His response is below.
>
> I will follow up with you when I hear their response. In the meantime let me know if you have any other questions or wish to discuss further.
>
> Thank you.
>
> David Hickling

Wild bee assemblages of New Hampshire peatland ecosystems

Alaina Bandanza, Conservation Biology Masters Candidate, Department of Environmental Studies, Antioch University New England
Advisor: Dr. Michael Akresh

Introduction

Status and importance peatlands

One quarter of the world's peatlands have been degraded (*Peatlands Mapping and Monitoring*, 2020). The Convention on Biological Diversity's Aichi Targets and the United Nations Framework Convention on Climate Change support further conservation and research on peatlands due to their importance in global climate systems and as habitat for vulnerable and rare species (*Peatlands Mapping and Monitoring*, 2020). Additionally, peatlands are a key player in global hydrology as they contain 10% of the freshwater on Earth (Lamers et al., 2015). Fens, a class of peatland which form from water seepage or in association with freshwater lakes and streams (Fahey & Crow, 1995), also play an important role in global terrestrial carbon sequestration and flood mitigation (Hedwall et al., 2017; Morris et al., 2011; US EPA, 2015).

Fens are particularly vulnerable to the proposed environmental changes in temperature and nitrogen cycling associated with climate change, disturbance, and habitat fragmentation--necessitating continued study of this fragile ecosystem (Hedwall et al., 2017; Johansson et al., 2006; Lamers et al., 2015). Fen ecosystems in the United States experienced declines of 8% between 1950 and 1970 (US EPA, 2015). Proper monitoring and assessment of peatland health are essential to conservation efforts (*Peatlands Mapping and Monitoring*, 2020).

New Hampshire is home to a unique array of open peatland communities (Sperduto et al., 2004). Fens, a class of peatland primarily found in the northern hemisphere, receive the majority of their water from mineral and soil sources--as opposed to bogs which are ombrogenous, or dependent upon rain as a water source (US EPA, 2015; McBride & Scottish Natural Heritage, 2011; Sperduto et al., 2004). Acidity is also a key defining characteristic of peatlands, and bogs and poor fens typically have lower pH (Sperduto et al., 2004). Alternatively, rich and medium fens are classified (generally) as less acidic (Sperduto et al., 2004). Fens are particularly unique in that they exhibit the highest biodiversity of wetland ecosystem types (Lamers et al., 2015), and are capable of hosting an abundance of vulnerable, rare plants (Heidel et al., 2017).

Use of the terms "bog" and "fen" is subject to some debate, but as the peatland sites of New Hampshire were not formed exclusively from rainfall there are no true bogs in the region (Sperduto et al., 2004). For the purposes of this paper, the term "fen" is used in reference to the majority of open peatland communities of New Hampshire, of varying pH, formed via limnogenous, topogenous, and soligenous processes (Sperduto et al., 2004).

Fens are generally dominated by sedges and grasses, as well as rushes and wild flowering forbs, with *Sphagnum* mosses playing a lesser role (US EPA, 2015; Fahey & Crow, 1995). However, the use of the term "fen" is complicated by the fact that the natural variation in mineral richness of fens lends itself to vegetation patterns mimicking that seen in ombrotrophic bogs (Fahey & Crow, 1995). Furthermore, peatlands can be classified and grouped based on a broad range of characteristics such as their hydrology, their chemistry (mineral, nutrient, or pH levels), climate influences, or their development (Fahey & Crow, 1995; Sperduto et al., 2004).

In New Hampshire, fen ecosystems are known to host over 550 different species of plants, rare orchids, and vulnerable invertebrates such as the state endangered boghaunter dragonfly *Williamsonia lintneri* (Bowman & Brunkhurst, 2009). Among peatlands, fens have

greater invertebrate diversity and taxonomic richness than their more acidic bog counterparts (Batzer et al., 2016). The heightened plant diversity of fen ecosystems could have implications for pollinators as multiple studies have demonstrated the importance of floral abundance to bees (Goulson et al., 2008; McNeil et al., 2020)

Despite the fact that peatlands are host to many threatened invertebrate species, there remains a paucity of knowledge on the ecology of peatland invertebrates (Batzer et al., 2016). The majority of studies on peatland invertebrates have focused on Araneae (Blades & Marshall, 1994; Koponen & British Arachnological Society, 2000; Koponen, 2002), Diptera (Blades & Marshall, 1994; Marshall, 1994), and general surveys of insects and terrestrial arthropods (Blades & Marshall, 1994; Spitzer & Danks, 2006). One of the only known surveys to focus on Hymenoptera in fens was conducted in western Canada in 1994, but this study was unable to achieve species level identification (Finnamore, 1994).

In European studies, invertebrates have been utilized as eco-indicators of peatland health and successful restoration, with particular weight given to populations of invertebrates that form strong associations with specific plants--implicating the importance of pollinators (Batzer et al., 2016). Additionally, Fowler (2016) found strong associations between plants present in wetland habitats and specialist bees. Furthermore, Fowler (2016) suggests that wetland restoration is an essential component of oligolege (pollen-specialist bees) conservation and highlights the importance of plant species such as "...Hibiscus (mallows), Lysimachia (loosestrifes), Pontedaria (pickerelweeds), Salix, and Ericaceous plants" (p.315). Fowler even lists wetlands and wetland ecotones among the most important habitat types to specialist bees (Fowler, 2016).

Conservation status and importance of bees

Plant-pollinator relationships are some of the most ecologically and economically important interactions on Earth-- without which a majority of plants would not be able to reproduce effectively or diversify (Ollerton et al., 2011). Additionally, one third of all food and beverage requires pollination (Mader et al., 2011). With over 85% of plants reliant on animal or insect pollinators, the entire trophic pyramid of most ecosystems are dependent upon the relationship between producers and their pollinators (Ollerton et al., 2011). In the United States, native bees are estimated to provide over the equivalent of $3 billion worth of pollination annually (Losey & Vaughan, 2006). Bees are essential for healthy, functioning ecosystems as they act as an important food source for insect-eating species and support successful plant reproduction which, by extension, protects against soil erosion and generates fruits and seeds for other animals to consume (Mader et al., 2011).

Bees are not only the foremost pollinators and keystone species in most environments in North America, but they also act as valuable indicators of overall ecosystem health due to their strong floral associations (Goulson & Nicholls, 2016; Mader et al., 2011). For example, in a study of red spruce (*Picea rubens*) forests, insect pollinated plants in the understory have even been implicated as a key determinant of successful regeneration (Dibble et al., 2018).

The strong floral associations expressed between pollinators and their host plants are an expression of the pollination syndromes that have, in many cases, influenced their convergent evolution (Mader et al., 2011). While the usefulness of pollination syndromes has been subject to some debate in light of new views in floral biology and genetic methods, they remain an important example of the strong, mutually selective pressures exhibited by plant-pollinator relationships (Ayasse & Arroyo, 2011). McNeil et al. (2020) highlight the importance of the coevolution of plants and native pollinators as they found floral abundance has the potential to influence decreased pathogen loads in Bumble bees (McNeil et al., 2020). Thus, an

understanding of plant community composition and the presence of insect pollinators are essential to pollinator conservation (Bergh, 2011).

The global collapse of bee populations has been well documented in the literature and received much media attention (Bacandritsos et al., 2010; Cameron et al., 2011; Goulson & Nicholls, 2016; Jacobson et al., 2018; Koh et al., 2016). Domesticated honey bees (*Apis mellifera*) have experienced colony losses of 56% between 1947 and 2005 in the United States (Goulson et al., 2015). Declines in North American native bee populations are also well evidenced by dwindling numbers of the rusty patched bumble bee (*Bombus affinis*), the yellow-banded bumble bee (*Bombus terricola*), the western bumble bee (*Bombus occidentalis*), and the potential extinction of Franklin's bumble bee (*Bombus franklini)* (Mader et al., 2011). Additionally, the International Union for the Conservation of Nature currently recognizes 6 species of North American bumble bees as either endangered or critically endangered (*The IUCN Red List of Threatened Species*, n.d.). Of the six bumble bee species of concern identified by the IUCN, the United States Fish and Wildlife service lists the rusty patched bumble bee (*Bombus affinis*) as federally endangered (*FWS-Listed U.S. Species by Taxonomic Group - All Animals*, 2020). In New Hampshire alone, 14 species of bees have declined significantly in the past 125 years (Mathiasson & Rehan, 2019).

There is overwhelming evidence that the primary causes of bee declines are human-driven and include threats such as habitat loss and fragmentation, pesticide use, and spread of parasites and disease (Cameron et al., 2011; Goulson et al., 2015; Mader et al., 2011; Murray et al., 2012). Remaining knowledge gaps regarding bee nesting, and the scope and causes of bee declines necessitate continued research to elucidate baselines of bee abundance, and important life history components such as nesting (Goulson et al., 2010, 2015; Osborne et al., 2007). As improved nesting habitat is hypothesized to bolster declining bee populations, it is essential to conservation efforts to expand on the current dearth of knowledge on nesting (e.g. distance to floral resources, preferred substrate, required resources/building materials)(Goulson et al., 2008, 2010; Osborne et al., 2007; Russell et al., 2018).

In New England, the limited information available on native bee ecology and subsequent floral associations, is a key hindrance to effective conservation and management in the region (Jacobson et al., 2018; Tucker & Rehan, 2016). In recent years, studies have encouraged further research into vulnerable specialized bee species and their habitats in order to better understand declines and potential management strategies (Bartomeus et al., 2013; Fowler, 2016; Milam et al., 2018; Weiner et al., 2014). Fundamental knowledge of the bee species present in New Hampshire and their habitats is essential to support successful conservation (Jacobson et al., 2018; Tucker & Rehan, 2016).

There exists a large amount of literature on the presence and abundance of bees in the Northeast at more mesic/well-drained, managed, and early successional habitats (Bried & Dillon, 2012; Milam et al., 2018; Tucker & Rehan, 2019; Wagner et al., 2014). While New Hampshire hosts a diverse range of unique natural communities such as open or wooded uplands, wooded and open wetlands (peatlands), and estuarine and riparian communities (Sperduto et al., 2004), studies of bees in open peatland communities of the region are lacking (Fowler, 2016; Milam et al., 2018; Tucker & Rehan, 2016; 2019; Wagner et al., 2014). The majority of studies conducted on northeastern bees have been in habitat types other than wetlands and peatlands with the few exceptions to this rule focusing on cranberry bogs (**Table 1**; Averill et al., 2018).

Table 1: Habitat types studied for bees of northeastern U.S.

Source	Habitat Type
Averill et al., 2018	Cranberry bog
Bried & Dillon, 2012	Pitch pine scrub oak barren
Dibble et al., 2018	Review: Closed canopy hardwood forest Closed canopy deciduous forest Timber harvest-early successional Pastureland/fields Sandy outwash plains Cranberry bogs Coastal islands and shore Alpine (Mount Washington) Wetlands, lakeshores, bogs, marshes Farms and orchards Suburban and urban parks and gardens Highways,roadsides, and utility corridors Closed landfills and open pit mines
Lerman & Milam, 2016	Suburban lawns/yards
Milam et al., 2018	Managed early successional-New England Cottontail habitat
Roberts et al., 2017	Mature forest and forest openings
Russo & Danforth, 2017	Apple orchards
Tucker & Rehan, 2019	Pitch pine scrub oak barren
Wagner et al., 2014	Managed early successional-powerline corridors

Study Goals and Objectives

The purpose of this study is to assess wild bee assemblages in New Hampshire fen ecosystems. The objectives of this study are to: 1) Elucidate baselines for bee population diversity and abundance in poor and medium level fen systems and other peatlands of New Hampshire; 2) Explore the potential floral community characteristics associated with bee diversity in different fen class ecosystems of New Hampshire; 3) Investigate the potential role/influence of fen distance to forest edge on bee community composition.

Methods

Site Description

Study sites will be primarily located within the Central/Lakes Region and Southeastern Regions of New Hampshire. Distant Hill Gardens and Nature Trail in Walpole, New Hampshire has been

identified as an initial site. The Distant Hill Gardens property is 125 acres, on which a half-acre portion of land has been identified as a "semi-rich" fen which is known to support rose pogonia orchids *Pogonia ophioglossoides*, water lilies *Nymphaea odorata*, and *Sphagnum* mosses (personal correspondence). If awarded the bid, there is also potential for sampling of a red maple swamp site on NH Army National Guard training lands in Strafford, NH as part of a large insect survey effort organized by Mike Akresh. Other poor level and medium level fen system sites, and other wetland sites, within the region will be identified with the help of the NH Natural Heritage Bureau following proposal review.

Study Superfamily: Bees (Hymenoptera:Apoidea)

401 species of wild bee have been recorded in northern New England (Dibble et al., 2018). New England bees belong to the superfamily Apoidea and include the families Andrenidae, Apidae, Colletidae, Halictidae, and Megachilidae (Dibble et al., 2018). Bees may be either eusocial, and form colonies like bumble bees (*Bombus*) and honey bees (*Apis mellifera*); or solitary e.g. mining bees (*Andrena*), carpenter bees (*Xylocopa sp.*), leaf cutter bees (*Megachile*),and mason bees (*Osmia*), etc (Dibble et al., 2018). Bees are also often classified based on whether they are pollen generalists or specialists (polylectic and oligolectic, respectively) (Fowler, 2016). Currently, baseline data on all bee populations of New Hampshire is inadequate to assess population trends (Dibble et al., 2018). Further study of New Hampshire bee populations, ecology, and life history is essential to facilitate conservation (Jacobson et al., 2018).

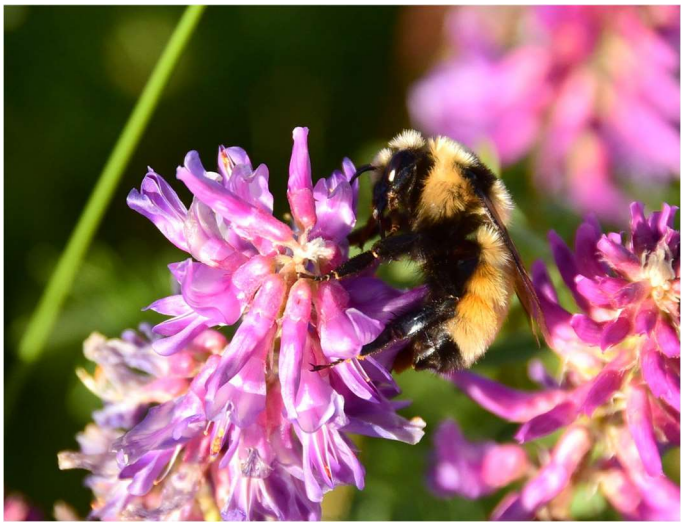

Figure 1: "Golden northern bumble bee nectaring on two grooved milkvetch at Arapaho NWR" by USFWS Mountain Prairie is marked with CC PDM 1.0

Study Design

Between May and September 2021 and 2022, I will conduct surveys at 10-16 New Hampshire fens and other wetland sites. Each site will be sampled 3 times throughout the season (Spring, mid-Summer, and late Summer). Both pan trapping and netting will be conducted to collect information on the bee assemblages. Pan trap sets will consist of one white, one fluorescent yellow, and one fluorescent blue standard 3.25oz souffle cup (New Horizons Support Services, Upper Marlboro, Maryland, USA) filled with soapy water (blue Dawn© dishwashing liquid) (Droege, 2015). At each site, 2-3 sets of pan traps will be placed randomly within the fen at least 10m apart (ideally farther apart in larger fens), while opportunistically circumventing open water in the style of Stephenson and Dowling (2017). Pan traps within the fen will be >10m from the forest edge. Additionally, 4-5 sets of pan traps will be placed along a transect perpendicular to the fen into the adjacent forest, with 1 set placed every 10 m (Roberts et al. 2017). To standardize pan trap height, and minimize damage to delicate peatlands, the cups will be placed in modified 31" tall outdoor drink holder stakes (Juvale Outdoor Drink Holder Stakes, ASIN:B0899JSHSZ). Pan traps will be left out for 24 hours, and collection surveys will be conducted only on sunny, warm days. After 24 hours, bees will be removed from the traps and

stored in 70% ethanol. Site conditions such as cloud cover, temperature, and wind will be recorded each visit. Collection will be on a per-bowl basis, in order to determine if bowl color influences bee capture.

To accurately account for the greatest diversity and abundance of bees at each site, net sampling will also be used during each visit (Popic et al., 2013). Net sampling effort, modified from Lerman & Milam (2016), will consist of opportunistic sampling on flowers with 15-minute surveys. Netting surveys will focus on rare and unique fen and wetland plant species, if present. Upon capture, netted bees will be placed in vials containing soapy water, and will then be transferred into plastic bags containing 70% ethanol. GPS location, time, and host plant species will be recorded for all netted bees.

All bees will be washed in soapy water, dried with a hairdryer, and pinned and labeled following LeBuhn et al. (2003). Bees will be identified to the species level when possible, using taxonomic keys (Mitchell 1960, 1962; Gibbs 2010, 2011; Gibbs et al. 2012). Joan Milam (Univ. of Massachusetts) will assist with bee identification. We will further send out any bees of uncertain identification to other specialists. Specimens will be deposited to Antioch University (reference collection), Harvard's Museum of Comparative Zoology or American Museum of Natural History. Specimens collected at Army Corp sites may be deposited with the US Army Corp.

Flowering vegetation within a 1 meter radius of each set of pan traps will be counted and identified at least to genus, preferably species level and recorded. Thus, flower abundance, diversity, and richness will be tallied at each set of pan traps. We may also conduct some bee nesting observations (Osborne et al. 2007), to determine if bees are nesting within the fens, or in the adjacent forest. Nesting observations would entail following bees to their nest sites, and recording substrate use and location.

Data Analysis

All statistical analyses will be performed in R (R Core Team 2020). The significance of all statistical tests will be considered for alpha ≤ 0.05. We will examine bee assemblage diversity and abundance among sites and fen types, in relation to floral abundance/diversity data, and between the fen and adjacent forest, using Generalized Linear Mixed Models. We will account for potentially confounding variables such as year, survey period (early, mid, late), and site. Bee abundance, diversity, and richness will be examined, with potential to also examine specific bee groups (e.g., Polylectic vs. Oligolectic, Eusocial vs. Solitary, nesting type, size, etc., Roberts et al. 2017), and individual species with high capture rates.

Timeline

	3/21	4/21	5/21	6/21	7/21	8/21	9/21	10/21	11/21	12/21	1/22	2/22	3/22	4/22	5/22	6/22	7/22	8/22	9/22	10/22	11/22	12/22	1/23	2/23	3/23	4/23
Write proposal																										
Apply for permit																										
Identify sites																										
Finalize methods																										
Apply for grants																										
Finalize proposal																										
Collect field data																										
Pin and ID bees																										
Data Analysis																										
Write Results																										
Write Discussion																										
Revision w/advisor and comm.																										
Submit thesis final draft																										

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