

# Regeneration of Northern Hardwoods in the Northern Forest

**A Hubbard Brook Roundtable**

**Held March 25, 2021**

**Roundtable Summary Report**

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## Participants

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**Roger Boyer**, *White Mountain National Forest*

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**Wendy Weisiger**, *Society for the Protection of New Hampshire Forests*

**Aaron Weiskittel**, *University of Maine*

**Chris Woodall**, *USDA Forest Service, Northern Research Station*

*\* Participated in the pre-roundtable interview synthesis only.*

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*Artwork in this report is by Natalie Cleavitt.*



## Overview

On March 25, 2021, the Hubbard Brook Research Foundation convened a three-hour online dialogue event with a group of 27 foresters, natural resource managers, scientists, and students to discuss the regeneration of northern hardwoods in the Northern Forest region. Prior to the meeting, 21 participants engaged in one-on-one, semi-structured interviews with a group of student leaders, the results of which were compiled and shared in a synthesis report (**Appendix: Pre-Roundtable Synthesis Report**—pdf available online here: <https://hubbardbrook.org/hubbard-brook-roundtables>). Following the roundtable, 12 participants joined an optional one-hour follow-up meeting to discuss next steps.

The following themes emerged during this roundtable process:

- (a) persistent and widespread challenges of managing beech competition;
- (b) concerns about deer herbivory and the social and political challenges of managing deer populations;
- (c) uncertainty about future forests under climate change and which tree species to encourage;
- (d) the importance of matching treatments to site-specific conditions, particularly soils;
- (e) interest in developing a common protocol for measuring and sharing data about regeneration; and
- (f) the importance of external factors in determining what happens on the landscape, particularly market forces in the forest products industry, and public perceptions of forests and active management.

As these themes were discussed, the group converged on two main ideas:

- (1) a need to address the loss of what practitioners described as their “social license” to practice forestry as public perceptions and uses of forests in the region have shifted, and

- (2) the importance of opportunities for practitioners to interact with each other to share their knowledge, concerns, and approaches. Several participants expressed feelings of not wanting to “be alone” in figuring out how to manage for future forests in the face of increased public scrutiny, changing market pressures, and a multitude of ecological stressors including climate change, invasive species and diseases, and deer browse.

## About the Roundtable Process

The goals of this Hubbard Brook Roundtable were:

- (1) to synthesize and share knowledge and perspectives across disciplines and institutions to inform forest-related research and practice; and
- (2) to foster new connections and collaborations among forest researchers and practitioners in the region. The roundtable focused on concerns from both the researcher and practitioner communities about the regeneration of northern hardwood forests and the complex and interacting stressors that affect forest regeneration, including climate change, recovery from acid rain, invasive pests and diseases, past management, and herbivory.

The roundtable agenda opened with three short presentations: Scott Bailey, a scientist from the USDA Forest Service, shared emerging research about soil classifications; Nat Cleavitt, a scientist from Cornell University, shared research findings related to American beech and beech bark disease; and Kevin Evans, Director of Woodland Operations at Dartmouth



College, shared practical insights from decades of managing for northern hardwoods in northern New Hampshire. Following these presentations, the group engaged in two rounds of small-group dialogue: the first on the future of the region and forestry practices related to regeneration, and the second focused on four individual topics: measuring regeneration, managing for beech, soils, and deer.

A week following the main dialogue event, a group of participants gathered via Zoom to talk about next steps. This one hour-long meeting opened with individuals sharing the topics they had been thinking about since the roundtable, followed by an open discussion of next steps. The summary notes from the small-group dialogues and the follow-up discussion are shared here.

## Next Steps

The group discussed a variety of possible actions to be taken on these issues, including:

- Developing and piloting a common protocol for measuring regeneration.
- Convening a working group of scientists and practitioners to create a management-relevant scientific synthesis about beech.
- Scientists and practitioners co-designing and piloting a tool that would make aerial LiDAR-based soil data and updated soil classification systems more accessible and useful.
- Convening a group of collaborating organizations to develop a public engagement strategy about the ecology of forest ecosystems and the important role of silviculture and active management.
- Developing an engagement strategy for landowners, publics, and decision makers about the impact of deer browse.
- Reconvening and growing this group for additional/ ongoing knowledge exchange.
- Creating a collection of short essays or synthesis articles based on the topics raised in this roundtable.

Many of these next steps are underway. If you are interested in joining any of these efforts or if you have a related project to link to this group, please let us know by emailing Sarah Garlick: [sgarlick@hubbardbrookfoundation.org](mailto:sgarlick@hubbardbrookfoundation.org).

## Learning from Lichen

By Lynn Levine

### Part 1

Lichens

Two species that survive together  
One makes food; one provides stability  
Together they weather the storm

Humans

One species with many races  
That doesn't know yet  
How to weather the storm

### Part 2

Lichen takes nothing from the tree

Provides nothing to the tree  
The tree is only the canvas  
Of lichen circles that radiate truth

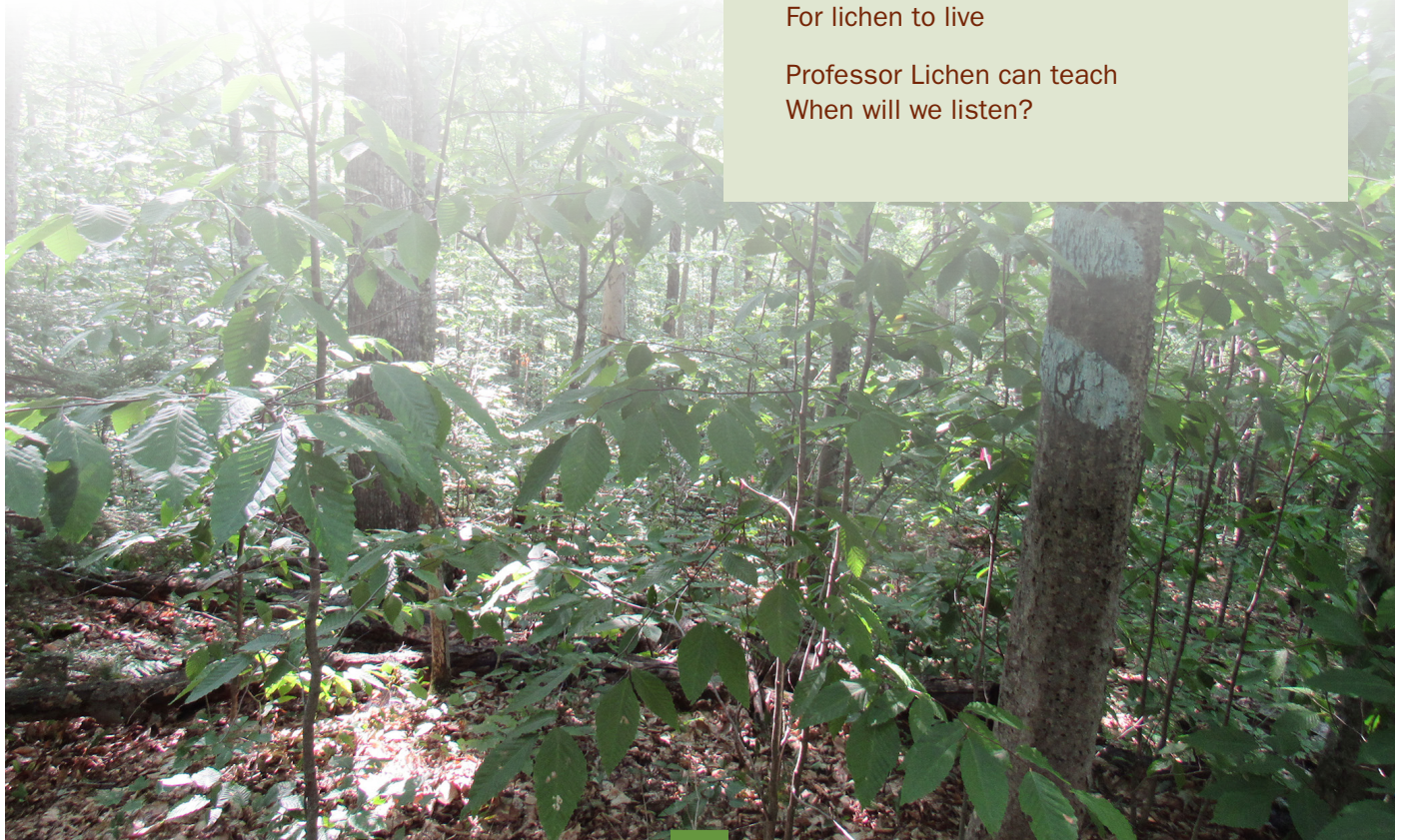
Lichen takes nothing from the rock

Provides nothing to the rock  
The rock is only the canvas  
Of lichen circles that radiate truth

### Part 3

Lichen is silent when the air is dirty  
Doesn't grow on trees or rocks  
People make it hard  
For lichen to live

Professor Lichen can teach  
When will we listen?



## Student Leader Reflections:

Through support from the Office of Engagement Initiatives at Cornell University, four undergraduate students helped lead this Hubbard Brook Roundtable. Each student shared some of their reflections on this work follows.



*“This interview process allowed me a holistic perspective of the issues centered on and surrounding regeneration in the Northern forest, and I was surprised at how many interconnections I witnessed across different disciplines and backgrounds. Knowledge gaps (and equally important, communication gaps) have been unearthed during this process, which I think is vital in the process of creating actionable plans for regeneration beyond this roundtable. I hope that the Northern Forest gets the attention it demands and deserves, not just from the people here today but from the public. More specifically, I hope that people who may not notice their connection to the forest in their daily lives begin to feel drawn to it and compelled to pay attention.”*

*“This Roundtable has sparked discussion and contemplation about very important issues related to forest regeneration, and it is amazing to see that it all starts with some people who really care about the future of our forests. I also see that environmental change does not automatically manifest. Programs to catalyze such change like this Roundtable are thoughtfully organized and facilitated, and it has been a great experience to see positive environmental change happening in action.”*

*“My main takeaway from the interview process was the importance of communication between people who have a common goal, even if their roles in achieving that goal are different. Working together to attack major problems as a unified force is going to be much more effective than each individual trying to solve these problems on their own. Though regenerating the northern forest in the face of economic and climate changes is a daunting task, I believe that the knowledge shared in the roundtable can help its participants to explore new perspectives on the issue. I hope the participants have gained more appreciation for each other’s work and felt a sense of unity through their common passion for the northern forest.”*

*“The Regeneration Roundtable experience has given me a greater understanding of the key factors that influence decisions made about forest management and regeneration as well as an unparalleled exposure to a diverse array of narratives from inspiring individuals who strive to make a significant ecological impact. Despite the inevitable influence of a relatively unstable economic and political climate, the ability for a multitude of perspectives from individuals of unique backgrounds to intersect harmoniously through constant communication and active engagement has instilled in me a great deal of optimism for the future of forest management. Through this opportunity, I have much greater confidence in the success and longevity of northern hardwood forests. I hope that individuals in forest management are guided by the same principles prioritized throughout this experience: a deep desire to protect and preserve the vibrancy and well-being of forests.”*

**“ The issue of regeneration is multi-faceted; different people are more or less attuned to different aspects—invasive species, overpopulation of herbivores, land history issues, soil fertility issues. Understanding how these facets interact is a real problem.” – Interview participant**

## Elephant Trees

By Nat Cleavitt

When I was younger, I marveled  
at the elephant trees.  
With bark like elephant skin, silver and smooth,  
and they were large and musical.  
Their flesh-colored leaves rustled  
melodies  
all winter.

The leaves are singing this winter, too,  
but the elephants are blistered and sore.  
The largest lie torn and broken, hopelessly  
sprouting,  
like their banished cousin,  
the chestnut.

Now it is true that the mosses and lichens  
seem to lick beech wounds, but on the  
whole,  
The demise brings me into sadness.

Yet there are still years when the woods  
are full of beechnuts, and mammals  
rejoice  
in the bounty to tide the winter.

I believe that the trees rejoice as well  
to see their young  
in the spring with their tender cotyledons.  
Maybe among this cohort of new beeches,  
enough resistance.



“

I'd like to see people getting engaged with the fact that the wood has to come from someplace. And I sound so industrial saying that, it bothers me, but it has to come from someplace So either it's going to come from someplace where it's carefully managed and well-thought out, or it's going to come from someplace where it gets torn apart.”

– Interview participant

“

What are some things that we should be doing, here in the Northern Forest, to leave a fully functioning forested ecosystem for the next 100 years? [...] The time to make some of those decisions...is probably now.”

– Interview participant

## Notes from Small-Group Dialogues

This section contains a selection of quotations and notes from the small-group dialogues that occurred during the Hubbard Brook Roundtable and a follow-up meeting a week later.

### I. Managing for Future Forests

#### Guiding Questions

- *What should the top forest management objectives be to support a thriving Northern Forest region over the next 80–100 years?*
- *If forests are being managed for timber production, what are the biggest hurdles to successful regeneration?*
- *In terms of regeneration in unmanaged versus managed forests, how different do you expect the outcomes to be 80 years from now against a backdrop of global change?*
- *If you were training a new group of foresters/managers who are just starting out now on a 40–50-year career, what are the most important things you'd want them to know?*

#### GROUP #1:

It stresses me out about what I'm doing wrong. I think that's something that everyone worries about. I feel like as foresters there's so much information we have to pull in. It's somewhat overwhelming.

I get overwhelmed about how people define a thriving northern forest region. I'm grappling with that a bit. What are we even trying to thrive with — depending on how you view the woods and your perspective on the woods?

We need to diversify. We need to establish new low-grade markets. It's hard to do good silviculture without having those low-grade markets. A place to sell the wood that you harvest. Going forward, we need to keep that steady drumbeat with the economic development leaders with those states.

Discussion about the shift toward recreation and tourism. We are losing our social license to practice forestry. That, combined with no low-grade markets — it's really difficult. The aesthetics change for the job. We think it is really important that users of the forest understand the complexities of working forests. We are really struggling with how to reach out to that recreation community. Because they use the lands so heavily.

We spend a lot of money to provide recreation and make a little bit of money selling timber. That's a really different concept.

Maintaining and expanding our social license to manage has to be a high priority and top objective going forward. That's one of the biggest potential obstacles to managing and to meeting our objectives on the landscape. Probably equally important is the economic side. Maintaining the logging capacity and the markets that we have.

Having the markets is important but also the changes in the logging industry — the changes in equipment, the year-round operations. There's a huge variation in the results — some of it is the equipment, some of it is how the equipment is being used.

Talking more about recreation, on the Whites we are overrun with new visitors and higher populations and one big obstacle to management on the Whites is managing for visual aesthetics, which ties your hands. It doesn't help the beech issue we are dealing with. I'm looking at how to describe to the public what we are really trying to do and highlighting our successes instead of hiding it.

We are developing a sign program for all our silvicultural prescriptions. It is the best way to reach people who are standing there and they walk through a patch cut. [The signs will] describe snags, brush piles, coarse woody debris. This may backfire on us, but we think it is important to explain to people what we are doing and why.

Fundamentally people are disconnecting consumerism from the northern forest. There's a huge issue of where we get our wood from and where we live. I think the bigger issue is that they don't want trees cut.

As much as I love regen and silviculture and it pays the bills, the social context is huge right now. These communities are not going to be bailed out by tourist dollars.

We aren't doing a good enough job talking about the ecological drivers of the jobs we are doing — climate change, habitat, carbon storage — letting the public know that these are part of what we are doing out here. We've done a better job of promoting working forests and forest economies — we need to talk more holistically.

## GROUP #2:

*What should the top forest management objectives be to support a thriving Northern Forest region over the next 80–100 years?*

- Keep sugar maple
- Maintain high species diversity for future options
- Keep forests as forests
- Support diverse working forest landscapes
- Maintain the capacity to keep target species
- Important to maintain dual goals, target species and overall diversity
- Preparing for the unexpected and novel conditions — hedge your bets with a diversity of species age classes and vertical structures

*If forests are being managed for timber production, what are the biggest hurdles to successful regeneration?*

- Available markets to support certain management actions
- Cannot regenerate if deer and moose populations remain high. First order barrier. Need to prove browse impact. Way underestimated impact of deer over the past decades.
- Foresters have become accustomed to high deer populations — society does not think it is a problem.
- Big communication problem about role of deer. It really is deer vs forests.
- Potential policy that limits management actions.

*In terms of regeneration in unmanaged versus managed forests, how different do you expect the outcomes to be 80 years from now against a backdrop of global change?*

- Increased presence of beech
- Lots of beech in the unmanaged forests
- It does not matter if there is a high deer population — deer preference for coexisting species is going to increase beech
- Stressors compound over time. It is the progressive impact of deer browse with acid rain and past management and earthworm invasion.
- Unmanaged stands that were previously managed are in the most dire state since they have a legacy and no active management.
- Smaller and smaller lots that are not managed.
- Did not anticipate the proliferation of beech in managed stands.
- Abandoned deer exclosures in ADKs (20 years) demonstrated robust regeneration. Huge difference between background woods and exclosures.
- System of growing best quality trees worked but not regeneration poses a problem to forestry

- Need to establish a threshold of too many deer.
- Important management information.
- There is some research on deer density (6/mi<sup>2</sup>) is acceptable according VT fish and wildlife but it is too high for regeneration. Also important to consider the landscape aspect of forests embedded into agriculture
- WMNF does not have a deer problem yet but it may be coming.
- With a changing climate and species migration, deer may move with browsed species.
- Link from Aaron: Quantifying impacts of white-tailed deer (*Odocoileus virginianus Zimmerman*) browse using forest inventory and socio-environmental datasets <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0201334>

*If you were training a new group of foresters/managers who are just starting out now on a 40–50-year career, what are the most important things you'd want them to know?*

- Land use history of New England
- Proforestation movement and potential impacts on long-term policy (Do not want trees to be cut)
- Decline of applied forestry students in comparison to environmental science students (issue of perception) — career options limited in some areas and not others
- More breadth than just managing trees (e.g. soils, pests & pathogens, ecosystem services)
- Learning from the previous generation of foresters

## GROUP #3:

Carefully match trees to conditions. Match tree to the site. Match regeneration objectives to the site.

How will operations be affected by changing climate (e.g., winter, site access)? Yes, it's happening now. We adapt daily. The alternative is to go bankrupt. Practitioners are ahead of academic level. Sites too wet to cut in summer.

Machinery is so big now — it is hard to get operators to hold back. But larger equipment has speed — that is helpful in some situations. The economic investment and machinery mean the bigger operations want to operate every day all year long. But we should reconsider place of smaller equipment and chainsaw use on the ground in certain conditions. We should recognize the full suite of operational tools.

From a harvesting standpoint, we are lacking the markets. The markets dictate what is cut — what is the future of the wood products markets?



More predictive regeneration survey data would be helpful for long-term planning. Next generation will be chasing changing moving targets. Need to know how to decide: will my intervention help or hurt the future composition of the stand? We will see an increased importance for timber stand improvement (TSI)? Future foresters will need to learn new nuances of differences between sites and what that bodes for regen.

Need to know the thresholds and tipping points for invasive plants. Forest inventory data could focus on these for tool development (e.g., tipping points for invasives, deer browse). FIA added an invasives inventory to their protocol in 2012. FIA data in general could be useful for building a regeneration assessment tool and metrics.

Carbon retention? We are all shooting for sustainable forestry. Using wood creatively in construction. “Carbon friendly forest products?” New, growing market opportunity? Potential for certification. More nuanced conversation related to beech — managing for reasonable beech presence.

Need to define: What is a successful, thriving northern forest? What is it that we should be aiming to create??

## II. Knowledge Gaps and Best Practices: Soils

*Take a few moments to imagine what success looks like. What would solving this issue look like?*

Soils determine which treatments to use. It is a huge factor in making decisions. But there is a lot of room for improvement - need better mapping and site identification tools. Habitat tools need to be adapted to reflect subregional differences.

Observational indicators are used (e.g. indicator species) but more objective/detailed tools are needed. LiDAR tools may help. Better tools for interpretation of soil information are needed. Much of the interpretation now is based more on intuition.

*Now walk backward in time: Can you identify specific behaviors or actions that lead to this vision of success?*

Everyone knows site is important but it is not considered as it falls down to 3rd or 4th priority behind other considerations. Soils considerations can get pretty technical and there may be a tendency to oversimplify things.

Changing weather conditions (less time for wetter sites in winter, more time for drier sites in the summer) is changing emphasis and effort given to managing different sites.

*What information or knowledge gaps exist?*

Easier keys are needed. Mapping improvements are needed. Information needs to be accessible to practitioners.

*Are there next steps that this group as a whole or individuals within this group could/should take?*

Research community should develop instruction manual for how to process lidar imagery to yield forest and soil information. States have made huge investments in acquiring lidar imagery. Maybe they should take the lead in converting lidar data into soils/forest structure maps using these instruction manuals? States and National Forests may have GIS expertise needed to accomplish this. But most others do not have permanent GIS staff at a skill level needed to make this happen.

## III. Knowledge Gaps and Solutions: Dealing with Beech

- Challenge: dealing with impact of beech in pine/oak lots
- Impact of browse is hard to deal with, have tried a bunch of things: timing, machines, lots of experimenting, effectiveness is spotty
  - ♦ In some places deer will even eat beech
  - ♦ Regenerated white pine in areas that would have been hardwood due to browse pressure
- Beech regeneration - patch size relationships
  - ♦ Have tried different sized patches 10-40 acre, and will revisit to look at regeneration
  - ♦ Single-tree or group selection doesn't work to outcompete beech, we think they need to be ¼-½ acre. Leaving high slash with conventional system. Oak will grow up through the larger cut
  - ♦ Leak: linear relationship between size of opening and regeneration of beech
- Don't have to eradicate beech all at once, leaving some might actually slow down regeneration
  - ♦ Need beech in northern areas to sustain ecosystems
  - ♦ Beech bark disease might help to diminish vigor naturally
  - ♦ Influencing species you want to grow up into the canopy layer
- Have been cutting beech under the canopy, cutting high, leaving a tab to deplete carbohydrates to regenerate
  - ♦ Also running skidder over it a bunch also works
- A lot of the regenerating species are also susceptible to diseases
  - ♦ Several noticed an uptick in beech bark disease over the past several years compared to the past decade or two

- Could be related to increase in temperature, or population dynamics of the scale insect
- Need to be mindful of how powerful and large the root system is for beech's ability to regenerate
  - ♦ Small-scale impacts with strong beech understory can increase beech vigor in a stand
- Bartlett: focused on beech issue 70 years ago — selective cutting in some cases “angered” the beech and it took off
- Forest service used to do early TSI in sapling-sized stand, and seemed to be effective to select overstory trees
- Is herbicide effective for beech?
  - ♦ Glyphosate effectiveness is good for beech, makes maple “groggy”, sometimes lime further north
  - ♦ Conclusions are that it's more important to manage the site
  - ♦ Have to be careful for dosage and application due to movement to other species with water movement

## IV. Developing a Common Regeneration Measurement Protocol

*Take a few moments to imagine what success looks like. What would solving this issue look like? Now walk backward in time: Can you identify specific behaviors or actions that lead to this vision of success?*

- Consistent protocols that spanned research and operational boundaries that allowed cross-regional comparisons
- Open and freely available data base of consistently defined regen measures
- Consistent browse metrics (Forest Ecosystem Monitoring Cooperative recent presentation)
  - ♦ Separating between ungulates, hares, and voles
- Better systems for evaluating pre- and post-management outcomes (e.g. impacts of equipment, past management, climate, etc. )
- Expand the regen discussion that includes the 1 and 2 inch DBH classes to minimize gap between seedlings to saplings transitions
- Need to quantify the “quality” of regeneration, particularly with respect to browse; don't disregard ALL browsed stems as some WILL likely make it
- The temporal nature of regen dynamics; some way to know what the possible trajectories for regen on a site are
  - ♦ 10 years is too long, while shorter can have negative impacts

- Need to track individual seedlings so we can separate the winners from the losers, but we need a reasonable amount of effort for regen assessment in the field
- Understocked vs. overstocked has ambiguity and needs better quantification/justification
- How to account for beech as desirable/commercially viable or an undesirable/non-commercial species? How and when do we define “adequate” regen? At 15 years out? How do we account for the potential impacts of climate change on regen outcomes?
- FEMC made regen data portal but found difficulties with widely different definitions for “seedling” and “sapling” — need to standardize both terminology and protocol before building the data
- We could start with managers in the National Forests to build the protocol and add in private forestry later since NF has a little more freedom (not total) from the markets
- Need to define some landscape targets for species composition that define a “healthy” Northern Forest
  - ♦ Should it be based on pre-Colonial conditions or something else? Should it have 20% beech? Need some boundaries for the target of what we are trying to regenerate
- Need to better understand the driving factors (e.g. soils, browse) to ensure most effective regeneration methods. Sugar maple regen success in the North may be because of lack of deer browse pressure there currently.
- Future of the forest is moving like an amoeba to better understand this movement and convey it to the markets so that the markets for what we will have are available — example of funky furniture and tongue depressor market for beech
- Industry can be dynamic and markets will likely adapt to the future conditions with a current transition away from wood products
- Strong interest in low-grade markets

*What information or knowledge gaps exist?*

- We do not know what is adequate/poor regeneration now and in the future.
- We do not know what the definition of a healthy sustainable northern forest looks like? Need boundaries to guide decisions. Maybe a hundred year outlook.
- Has acid rain made the soils a beech heaven? If so, how does that influence future management.
- What will be the future of the wood products market? Need to know the future to plan a market-based approach.

## V. Managing Deer Impacts

*Take a few moments to imagine what success looks like. What would solving this issue look like? Now walk backward in time: Can you identify specific behaviors or actions that lead to this vision of success?*

- Education landowners of benefits of leaving slash, benefits of all the tools we might use (fencing, high slash, herbicides, brushsawing, clearcuts, hunting)
- Actions — different products for measuring browse, haven't found them that easy to use, developing precise and simple browsing/regen inventory system to be used consistently across region
- Potential for citizen science?
- Tools - FWS - link hunters with landowners, didn't work, no people (landowners) signed up
  - Community outreach, education for landowners — some people don't want hunting on their land — use regeneration to educate/convince them
  - End goal — more (simplified answer) hunting, also increase because of COVID (interest in hunting to get outside)

*What information or knowledge gaps exist?*

- More data on deer density
- FWS say foresters should do it, foresters say FWS should do it - lack of funds
- Lack of realization or recognition that for regeneration impact, deer impact over last 50 years as deer impacts of today — still have impacts from deer browse in 60s and 70s
- Silvicultural techniques for regeneration (limited but severe) — not appropriate for many private/public landholders on small land areas
- Cost of fencing (documented that it does work) is high — labor, take onsite material and making fences — or put in fencing, clients might not want it on their land
- Slash walls
- Interaction of browse, poor silviculture, legacy understory, vegetation competition — lack information (its qualitative not quantitative — not based on real data)
- Hunting community — need significant hunting, hunting does (NH only 2 days season) — where we need evidence to convince
- As a practitioner, no data on contemporary deer numbers by region — no obvious way to get that level of information, could time regen harvesting with these numbers

- Deer browse and invasives coming in afterwards
- Are there next steps that this group as a whole or individuals within this group could/should take?

### NOTES FROM FOLLOW-UP MEETING ABOUT NEXT STEPS

*What have you been thinking about since the roundtable last week?*

I'm hung up on the concept of the future forest. I agree with the focus on deer and beech — we know this. What I continue to struggle with — it's an enigma — what do we think we want the future forest to look like, given climate change? It would be helpful to have a better sense of where this forest is going. Should we even bother for managing for x species because the reality is that all these other factors are so weighted against it, that we should really be focused on a different suite of species? I'm thinking of the map that was shown during the roundtable: the northern forest, what it was pre-settlement and today. It was not the same. I think that change is going to happen again. If we continue to manage for today, does that make sense?

Things that are bouncing around in my head: the role of the US Forest Service in this dialogue — how can we help out. I want to see this head somewhere. What resources that the USDA has to bring to the table to convene people and advance the science. I'm in a listening phase.

The deer, the deer, the deer. The deer and invasive plants are so critical and the public does not get it. the public does not understand that there won't be a forest unless they like beech and black birch. Are we throwing out the sugar maple industry and other industries for those who hunt who have such a strong voice? There needs to be more research on peoples attitudes, the general public.

It's something I've been told but I think it's finally sitting in: regenerating the forest takes a lot longer than we think and it is complicated. I think about a lot of competing views on what our forests should be and what the best use of that forest should be. Hunting, producing maple syrup, carbon storage: each view would take you in a different direction of management. The other thing I'm thinking about: we always wish we could fast forward 50 years and see what happened. In the Adirondacks, we are trying to accept our regeneration failures these beech blast forests. This acre of forest really wants to be that, regardless of why it got there. It really wants to be that right now maybe we should stop fighting it.

I mirror a lot of what has already been said. As a manager, it was comforting to hear that everyone has the same challenges and concerns. It is encouraging to see smart, well-informed people coming together regionally to talk about this and to talk about what research will help. It is nice to learn and be comforted by everyone else's woes. We don't want to do the wrong thing and send the forest in the wrong direction, whatever that might be. My hope is that what will come out of this is some research that will inform people about silvicultural methods and climate change and how what we do will be impacted by climate change. In NH there is a disconnect between the biologists and the game managers. Controlling the deer populations is extremely politically charged and difficult to do. It's not that easy to do to change the takes annually but well researched information may be able to do that, and a public outreach campaign.

Climate change has certainly been on my mind. Someone said in terms of the beech and moose browse issues, that those have been going on a long time. That was surprising to me — the length of time that those have been issues that we've been battling them. Then add to that climate change: that adds novel conditions that are going to be hard to predict. How our past bottlenecks might have been competition from beech, and deer browse, will there be new bottlenecks? Flowering earlier, frosts — how can we do research that really informs that? I think things like this roundtable are incredibly valuable. We are all in the same boat — we have a lot of the same pressures. They might come out differently, but we are all thinking about future forests.

I am listening with a capital L. I am thinking about next steps, thinking about measurement so we can have some vision of what's regenerating out on the ground.

Do we maintain what we have or project what we're going to get into the future? One challenge in deciding is to maintain biodiversity — we don't want to put our eggs in one basket. We need to think about multiple species and how they relate to a site. A couple of other things I've been thinking about: I was very interested in the roundtable to hear about public perceptions of forestry and I hadn't appreciated that that was such an issue. And with changing use of the forest during the pandemic this might be even more of an issue. This seems like it needs to be addressed.

That's the thing I'm thinking most about: what are we going to do now. I want to get something going and see what we can do. How do we get the really detailed

satellite imagery and lidar unpacked for land managers for full effect for a variety of ecosystem service including carbon. It seemed to me that could be an opportunity for promoting green jobs. What are some funding opportunities? Under the current administration there is an appetite for green jobs, infrastructure, carbon. To move forward in this way in a coordinated fashion... What are the tools, techniques, to clarify what goes on? How great would it be if our region could take the lead on this? I've got itchy feet to put together a proposal to do something big.

We need a refresh on our soil and site relations in a changing climate. I think that is something that science can solve. Getting new tools to get foresters thinking about their site, their forest and shift to forest that wants to be there. The social part of this is a massive complex challenging issue.

Demographics are changing in response to covid. Young people are moving in with strong environmental inclinations but no experience with the forests. The time to intervene is now, before bad habits take hold.

We are trying to figure out how to connect forestry to recreation: it is mostly private landowners who have working forests are providing the recreational opportunities

I'd be curious if any states would consider fertilization or soils programs — with Vermont I know there's been a fair amount of experimentation of putting lime in sugar bushes in Quebec. Is there some research on what that would look like?

There is a gap between the research and management. There have been calcium-addition studies at Hubbard Brook and Pennsylvania and Quebec, but the only application to a managed forest was Monagahegan. There's been a lot of research done showing the benefits: how do we bridge that gap to start having that be a tool?

What's our goal? I like the idea of diving into the lidar and soils — that will help us give direction to where we are going. The idea about educating the public better is very strong. When I think about educating the public and these new landowners — getting them to appreciate what's out there — to reach out to those — that will be helpful.

And then set the stage down the road for climate friendly forest products.

I love this "doing" energy!



I want everybody to understand that for forest managers in general, our ultimate goal is to improve the forest, despite the misconception that all we care about is cutting the forest down. We've dedicated our lives to a profession of growing forests and yet there's this vision that we don't care about the forest. That's a huge misconception."

– Interview participant



## About Hubbard Brook Roundtables

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For more information, please visit:

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