External Advisory Committee for the Northeastern States Research Cooperative
2020 Summary Report

September 3, 2020
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Hubbard Brook Research Foundation

Overview of the Committee Charge and Process

The charge of the 2020 External Advisory Committee (EAC) for the Northeastern States Research Cooperative (NSRC) is to inform the NSRC Executive Committee about the priority issues facing forest stakeholders in the Northern Forest region and to provide guidance to the NSRC Executive Committee for crafting the 2020 request for proposals (RFP) in response to broader stakeholder interests and needs. This report is a summary of responses from the EAC following one-on-one interviews with individual members conducted in June and July 2020, a three-hour facilitated EAC group meeting via Zoom held on August 6, 2020, and EAC member feedback on a draft of this report during a two-week comment period, August 13–27, 2020.

2020 External Advisory Committee Members

Susan Arnold, Vice President for Conservation, Appalachian Mountain Club
John Bartow, Executive Director, Empire State Forest Products Association
Amanda Cross, State Wildlife Planner, Maine Department of Inland Fisheries and Wildlife
Frank Cuff, Senior Research Forester, Northern Hardwood Region, Weyerhaeuser
Robert K. Davies, State Forester, State of New York; Director, NY Department of Environmental Conservation, Division of Lands and Forests
Chad P. Dawson, Board Member, Adirondack Park Agency; Professor Emeritus, Recreation and Resources Management, SUNY-ESF
Rich Grogan, Executive Director, Northern Border Regional Commission
Kathy Fallon Lambert, Senior Advisor, Harvard T.H. Chan School of Public Health, Center for Climate, Health, and the Global Environment; Co-Founder, Science Policy Exchange
Donald Mansius, Director, Forest Policy and Management Division, Maine Forest Service
Ian Prior, Chair, Executive Committee, Cooperative Forestry Research Unit, University of Maine; Inventory Analyst, Seven Islands Land Company
Tyler Ray, Founder and Principal, Backyard Concept
*Sean R*oss, Managing Director, Lyme Timber Company
April M. Salas, Executive Director, Revers Center for Energy at Tuck School of Business, Dartmouth College; Chief Sustainability Officer, Town of Hanover, NH
Joe Short, Vice President, Northern Forest Center

John Sinclair, Forest Supervisor, Green Mountain and Finger Lakes National Forests
Michael Snyder, Commissioner of Vermont Forests, Parks, and Recreation, State of Vermont

Summary of Recommendations

Through one-on-one interviews and group discussion, the EAC members identified issues of pressing importance to the forests and people of the Northern Forest region (Table 1). During the group discussion, rather than choosing to narrow or prioritize the initial list of topics from the interview summary (Appendix A), the EAC unanimously chose to retain the full list. Several suggested changes were made to the original wording and organization of the list, which are reflected in Table 1 below (e.g., consolidating the climate change and energy categories, distinguishing maple sugaring within the forest products industry category, and adding a separate category for biodiversity and habitat connectivity).

The EAC recommends that the NSRC prioritize research by: (1) how relevant it is across the four-state region, as opposed to a narrower focus on localized areas or individual states; and (2) how serviceable it is to practitioners, decision makers, and other stakeholders. The EAC recommends that the RFP and proposal review process: (a) be intentionally designed to support interdisciplinary teams that demonstrate genuine grounding of the research in stakeholder priorities, with buy-in and engagement at the project design phase and throughout its execution; and (b) include clear communication plans for how research results and products will serve broader stakeholder groups and communities in the region.

Given that the NSRC Executive Committee is composed primarily of academic forest researchers, members of the EAC suggested that extra effort should be made to assess the practical, economic, and social elements of each proposal. Recruiting technical proposal reviewers with this expertise will help to assess each project's potential for on-the-ground application.

During the EAC Zoom meeting, in addition to the recommendations above, small groups proposed and discussed possible frameworks for the RFP. One idea was to organize the RFP around three categories of research:

1. *State of the forest:* Research that elucidates the state of the Northern Forest region, with preference given to projects related to forest health and those with predictive power (e.g., regional trends, future projections).
2. *Measuring and quantifying impacts:* Research that measures/quantifies the ecological, social, and economic impacts of management and policy decisions, with consideration for how to create shared or standardized measurement approaches across the region (e.g., carbon accounting).
3. *Developing tools for response:* Research that leads to practical, on-the-ground tools for practitioners and other decision makers for predicting and responding to change (e.g., climate, land use, invasive forest pests and diseases). These tools could include management approaches/techniques, new technologies or applications, decision support tools, and messaging/communication strategies. Several EAC members emphasized the need for evidence-based communication strategies for engaging with private forest landowners about sustainable forest management, and for engaging with stakeholders from external industries about the use of sustainably harvested wood (e.g., engineering, architectural, and construction firms; corporate sustainability officers; business associations).

The group came up with the following ideas for recommended filters or lenses through which the above topics should be approached:

- Social/human dimensions
- Synthesis of existing knowledge, perspectives, and tools/resources
- Building interdisciplinary teams
- Environmental and social justice, equity, diversity, and inclusion — need to think creatively about how these issues are addressed in the Northern Forest
- Scalability and applicability (i.e., considering not only how research findings can be scaled up to the regional level, but also how they are scaled down and applied on the ground.

Following the Zoom meeting, one EAC member noted that the three categories outlined above are not exclusive and that competitive projects would likely integrate ideas from more than one category. Another EAC member commented that the emphasis on forest health in the "state of the forest" category could be broadened to include other dimensions beyond ecology, for example the health of the region's economy.

An additional framework that was proposed during the EAC Zoom meeting grouped topics into four categories:

1. Climate change (mitigation, adaptation, carbon accounting, renewable energy)
2. Forest health (invasive pests and diseases, biodiversity, sustainable forest management, connectivity, water quality)
3. Land use (role of the future of private lands, recreation impacts, fragmentation, environmental justice)
4. Rural communities and the bioeconomy (workforce, forest products industry, recreation and tourism).

Table 1: Priority issues in the Northern Forest

1. Invasive pests and diseases - Forest health is a big concern: insect- and disease-related pressures on the forest and concerns about vulnerabilities due to lack of stand diversity - "We need research that can help us detect things earlier and help us respond earlier."
2. Climate change and energy: mitigation, adaptation, and accounting - Forests and forest-related industries as part of the solution to climate change - Managing for carbon, measuring/accounting for carbon, and setting up/accessing carbon markets - Forest management strategies for increasing resilience to the impacts of climate change - Tradeoffs between biomass and other energy sources - Quantifying ecological impacts of solar and wind farms (tradeoffs between renewable energy and loss of forest cover)
3. Land use, sustainable forestry, and forest fragmentation - How to help landowners keep forests as forests (e.g., tax incentives, conservation finance, alternative markets) - Effective messaging and communication tools for working with private forest landowners (e.g., Vermont's Foresters for the Birds program) - Challenges of navigating management for a variety of competing needs (wildlife habitat,

carbon, resilience)
- Concerns about regeneration and stand diversity
- Potential for increased fragmentation with COVID-related migration to rural areas

4. *Forest products industry (wood and maple products) and innovative technologies*
   - Concerns about workforce and market declines, need for innovations in products and technologies
   - Need for engagement with external stakeholder groups about sustainable wood products (e.g., corporate sustainability officers, engineering and architectural groups, business associations)
   - Opportunities at the intersections of job creation, sustainable forestry, and climate change mitigation
   - Impacts of industrial sugaring on wildlife, site productivity, and ecological function

5. *Rural community and economic development*
   - Need for shared vision for the future
   - Challenges of implementation in rural communities
   - Concerns about workforce, housing, and broadband

6. *Recreation*
   - Managing for recreation
   - Understanding visitor motivations and behaviors; increased visitation due to COVID-19
   - "Carrying capacity" of lands and waters
   - Economic impacts of outdoor recreation and tourism
   - Recreation impacts on wildlife

7. *Environmental justice, equity, and inclusion*
   - Creating more inclusive communities, conservation lands, and recreational opportunities within the Northern Forest
   - More equitable consideration about who pays and who benefits from ecosystem services, especially air and water quality
   - Importance of including Indigenous knowledge and engaging with stakeholders from the Tribal Nations in the region

8. *Biodiversity and connectivity*
   - Addressing terrestrial, riparian, and aquatic biodiversity and connectivity
   - Being able to integrate management for carbon with long-term biodiversity and sustainability goals
   - Amount and configuration of conserved and working lands needed to support biodiversity
   - Wildlife, species recovery, species adaptation

Attached:
Appendix A: 2020 EAC Interview Synthesis Report (July 31, 2020)

2020 External Advisory Committee for the Northeastern States Research Cooperative
Interview Synthesis Report
July 31, 2020

Overview of the Committee Charge and Process

The charge of the 2020 External Advisory Committee for the Northeastern States Research Cooperative (NSRC) is to inform the NSRC Executive Committee about the priority issues facing stakeholders in the Northern Forest region and to provide guidance to the NSRC Executive Committee for crafting the 2020 request for proposals in response to broader stakeholder interests and needs. The Hubbard Brook Research Foundation will facilitate the External Advisory Committee (EAC) through three phases: Phase 1: individual interviews with EAC members followed by an interview synthesis report (June and July 2020); Phase 2: a three-hour facilitated group meeting via Zoom (August 6, 2020); and Phase 3: a draft report to the EAC for review (August 13–27, 2020), followed by a final report delivered to the Executive Committee (September 3, 2020). The Executive Committee plans to release the 2020 request for proposals by the end of September or early October.

Phase 1 Executive Summary

During June and July 2020, staff from the Hubbard Brook Research Foundation conducted one-on-one interviews via telephone or Zoom with 15 of the 17 the members of the 2020 External Advisory Committee (one member was unable to participate due to scheduling conflicts and the committee seat for the state forester for New Hampshire was unfilled during the interview period). Notes from these interviews were compiled anonymously and synthesized here.

The issues that people raised in their interviews clustered into the following list of themes. Interviewees also noted important overlaps and intersections among these themes.

1. *Invasive pests and diseases:* "We need research that can help us detect things earlier and help us respond earlier."
2. *Mitigating climate change:* forests and forest-related industries as part of the solution to climate change; managing for carbon and setting up carbon markets
3. *Adapting to climate change:* management strategies and techniques for increasing resilience to the impacts of climate change
4. *Sustainable forestry, forest fragmentation, and working with private landowners:* help landowners keep forests as forests; navigating management for a variety of competing needs, including wildlife habitat and connectivity; valuing forests for a variety of ecosystem services; tax incentives; regeneration and stand diversity
5. *Forest products industry:* "a lot of low-grade product without a low-grade market;" potential for innovative products and technologies; concerns about workforce

6. *Rural community and economic development:* workforce issues, housing, broadband, shared vision for the future
7. *Recreation:* managing for recreation, understanding visitor motivations and behavior, "carrying capacity" of lands and waters, economic impacts
8. *Environmental justice, equity, and inclusion:* creating more inclusive communities, conservation lands, and recreational spaces within the northern forest; more equitable consideration about who pays and who benefits from ecosystem services, especially air and water quality
9. *Energy*: biomass, renewable energy, carbon markets, and ecosystem services

Scanning the horizon, interviewees noted the continuation of the issues above, plus a few additional considerations:

- Changes due to COVID-19: potential influx of visitors and short-term or part-time residents
- Possible acceleration and amplification: climate change and COVID-19 as drivers of migration into the region, amplifying the land use and forest health concerns of the past.
- Interest in intersections between the topics above:
    - "I'm really interested in the market structure. The interconnection between the creation of the markets that sustain jobs and create a price signal for carbon. This is one of the top issues I'm looking for. That to me has the highest impact."
    - "Research that is at that intersection of job creation, sustainable forestry, and climate change mitigation is very interesting to me for this region."

Interviewees also had suggestions for successful approaches to scientific research to benefit stakeholder interests and needs, emphasizing:

- The importance of researcher–practitioner engagement early on in the research process
- Developing deliverables and applied knowledge that matter to managers and practitioners
- Consideration of the challenges of implementation in rural communities
- Need for synthesis of existing research and resources
- Importance of collaborations, partnerships, and boundary spanners

—Prepared by: Sarah Garlick, Clara Chaisson, and Anthea Lavallee

INTERVIEW SUMMARIES

The following text is a combination of direct quotes and paraphrasing from our one-on-one interviews. We have attempted to record faithfully the comments that were shared with us, and we acknowledge the possibility that our own biases may have slipped in as we made choices on what and how to report and synthesize what we have heard. We hope this report serves as a catalyst for discussion during the August 6 online meeting. —SG, CC, AL

Interview participants: Susan Arnold, John Bartow, Amanda Cross, Frank Cuff, Rob Davies, Chad Dawson, Rich Grogan, Kathy Fallon Lambert, Don Mansius, Ian Prior, Sean Ross, April Salas, Joe Short, John Sinclair, Michael Snyder

Thinking back to the past 3–5 years, what are some of the top issues/concerns/pressures that come to mind for you when you think about the forests and human communities of this region?

We are very focused on the role of forest products in rural economies across the region. The role that sustainably managed forests have in adapting forests to changes (such as invasive species and climate change), and the role of forests in terms of markets, especially given the extent of privately-owned forests in our region. We are very hyper focused on how our forest markets can play a role and how we can help private forest landowners keep their forests as forests when faced with alternatives.

The role of forests and water quality and water supply is big in New York. We have a drinking water supply in the Catskills for 9 million people in New York City. We continue to see the role of privately-owned forest lands in protecting the water supply throughout New York State.

The two issues that jump to the forefront are forest health issues and forest workforce issues. Forest health: We're dealing with black cherry dieback in West Virginia. There is an ongoing outbreak of spruce budworm in Canada, and it seems like just a matter of time before it reaches us here in Maine or New England.

Forest workforce: That ranges anywhere from tree planting, to road building, to harvesting, to trucking. The workforce is getting older, and there aren't a lot of young people coming into the business. A lot of these jobs rely on H-2B visas. In Maine, a number of mills have closed over the last 4-5 years due to changing demand for forest products. There's lower demand for paper products, newspapers etc.

There are significant challenges to being able to manage one's land when faced with a variety of competing needs. For example: the management objectives for the land vs. the economic needs of one's own family vs. fitting into the larger context of carbon storage and sequestration.

In Maine, we certainly have different types of forest owners and managers. A small percentage of lands are public, a large percentage of lands are privately owned, then there are also NGO communities that manage lands as well as industrial forest owners—all have different management objectives.

One of the biggest suites of challenges for *all* forest landowners is being asked to do a lot. Ninety-four percent of our forests are privately owned, so we're reliant on private landowners to manage for at-risk species. Now, we're being asked to create a climate plan for December 2020 , and we're really looking at forests to offset a lot of carbon emissions.That's another ask that forest landowners and managers have to consider when thinking about management objectives.

Being able to help people figure out how to incorporate all those needs is a huge challenge, but it's a very important thing to tackle.

Invasive species and pathogens and pests that impact the forests have been a big issue. Because of where we sit in international and interstate commerce, New York State, is the bullseye for invasive species

infestation. We are trying to get up to speed on invasive species. Our motto is "early detection, rapid response." We need research that can help us detect things earlier and help us respond earlier. We need strategies and partners..

Another big issue that shouldn't be a surprise is climate change. New York State just passed a major climate protection act. It has very, very aggressive goals. In order to be a player, we need to be able to bring the tools to the table to demonstrate that forests should be a part of the solution. We are finding that we don't have all the information we need, frankly. There are a lot of research needs.

We have to be considering any state action in the context of climate change—how is this impacting carbon emissions, energy, all of it. We are lacking a lot in the information we need to make those decisions.

The biggest challenge has been the uncertainties around invasive species. Where are we now, and where is it going? Then layer climate change on top of that.

Not enough people in the forest products industry are thinking about how the system has changed. We have beech challenges, sugar maple decline… The ecology is changing. What are we doing about it?

The resource is changing profoundly, and policy isn't moving. Whether we are talking about race relations, or other things in the world—people don't want to face change. This is also true in science, particularly in the breakdown between science and policy. We need someone who is sort of the Dr. Fauci of forest ecosystems, who says what needs to be said and does it with an honest heart "I'm sorry. I know this is difficult to hear, but this is what's going on."

How do you pay landowners for ecosystem services like storing carbon? Is there a real market in this region for that kind of work? Another pressure is on forest health.There has been a shift from the impacts of pollution to the impacts of climate change and pests. We've gone from regional scale drivers of forest health to more global pressures.

There have also been global pressures on things like energy, coming from Enviva (the world's largest producer of industrial wood pellets) and other corporate interests driving biomass energy.

And fragmentation. Fragmentation might be the thread that winds through the past and present. The fragmentation issues have ecological implications and management implications. This tradeoff between the economic benefits of more people coming to an area that is depopulating against the economic impacts of managing coherently the forest in a fragmented landscape. The shift from a working landscape to a recreational landscape. What does that mean for the people and ecosystem?

One of the pressures is the lack of a cohesive singular vision. Oftentimes, economic development work can fall back on the diversification of economies that suffered. Economic diversification is fine, but I don't think there's been fine attunement to what that diversification should look like. A formula for what that should look like. Everyone in these communities knows there's not going to be a one trick pony, one industry that's going to dominate everything. But, we're all over the map when it comes to solutions.

Another huge challenge is the human resources component. You've got a limited pool of people in any small community. They all serve on the same boards. They all get burned out. There's just limited capacity to run the infrastructure of things that need to get done. The glass half empty of rural communities is burnout.

I get really sad thinking about the climate here being similar to Tennessee or something in the next 25-30 years. What does that do for the local agricultural and maple farming industry? How does that affect the industries here today?

Many pulp and paper mills have closed their doors: I'm nervous about the sustainable forestry industry dying off. I understand conservation agencies are buying off land, leveraging government funding. How can we create market forces and constructs that unlock the industry so we don't have to rely

on the irregularity of government funding? In particular, we are thinking about carbon offset programs and local projects. How do we think about our own backyard and sustaining the beauty that brings us here in the first place? It is incredible to me that we don't have a more comprehensive carbon offset program for New England.

We are also thinking about water and climate change and how it is affecting recreation, especially the ski industry. Variability in winter is creating uncertainty for local markets. How do you sustain recreation with the costs of those types of operations when there is so much variability? Water availability becomes an issue with snowmaking.

Forest health is a big concern at this point in time. There are insect and disease related pressures on the forest, and we have a lack of stand age class diversity. We are seeing changes in the land usage and aspect and we are getting very heavy in the mid-age stands. We aren't seeing a lot of old age forest stands, and we are definitely not seeing a lot of early successional stands. We are getting homogenous stand diversity, and I think that's going to affect us with vulnerability to insects and diseases.

The other issue is the timber industry. Being able to manage the lands appropriately under the current conditions and having the industry there to support us and to have an economic basis to manage. As mills shut down, there is economic decline and difficulty in getting trained forest crews to do the work. It impacts our ability to move and manage the forest into the classes and structures we desire.

The top issues in the northern forest for us have been invasive insects and plants, and climate change. Related to the northern forest region, it has really been wet weather events and the variability of temperature—it's not necessarily that it is warmer, but the warms are warmer and the colds are colder. These are big issues we are dealing with daily.

The top issues are climate change—it is the big amplifier—loss of low-grade wood markets, invasive species such as beech bark disease, loss of connection between people and the working landscape, a narrow tax base, and a loss of forest in central and southern Maine.

Issues related to social justice, conservation, and outdoor recreation.

The workforce is aging, and young people aren't interested in rural living or physical work in the woods. Kids are less interested in nature and more interested in technology. In the U.S., we tend to look down on forestry. As a society, in the U.S., we no longer value manual labor. Also, equipment for this work requires a sizable cash outlay. Could we provide business training to young foresters to boost the confidence needed to make these kinds of multi-million-dollar investments? Can we look to Scandinavia as a model for appreciating the forest workforce as a group of trained, expert professionals?

Our communities are tied to the culture and economy of the forest, and both are threatened. Specific threats include: contraction of the wood products market; invasives; declining forest health (e.g., dieback, regeneration failure); ownership challenges; the cost of owning land; and human communities becoming increasingly disconnected from forests. People are increasingly aware that forests are important, but there is little understanding of good forestry as a necessity. Historically, there has been no economic or policy-related framework to support forests.

My head is pretty much entirely in the community and economic development space. A big focus for us is what it will take to make rural northern forest communities attractive to the 25- to 45-year old demographic. That age demographic has been hollowed out over the past couple of decades, and that's true in rural places across the country. Without it, it's harder to envision vibrant communities. That's who's taking jobs, creating businesses, putting kids in schools, and populating volunteer boards. That is a

huge issue. There are many facets to why that's true and what it's going to take to reverse it. For us, it's meant a focus on outdoor recreation. A lot of people come to the northern forest to recreate. We already know that. We need to get better at capturing the economic value of recreation, for communities and for landowners. Most recreation happens on private land, but it's hard for private landowners to benefit directly.

There are issues with the jobs and careers that are available in northern forest communities. And there is an issue not of affordable housing, but of quality housing. If a town recruits a new librarian, or nurse, or doctor to their community, a lot of times the barriers to them closing that deal have to do with housing and education, especially housing.

Other regional issues, focused more on the forest side, include ongoing changes in how forest products are used. There are continuously changing markets for wood and wood products. The condition of forests in the region is high volumes of low grade material. Are there pathways forward to higher grade material? We have this almost perennial crisis around low grade wood. We need new uses for that wood, but we also need to depend on those markets less.

Less in our wheelhouse but certainly relevant is how are forests changing over time from climate change, fragmentation, acid rain, and invasive pests.

Of these issues, can you think of a specific case where new, forest-related scientific research or a synthesis of existing research was or would have been helpful?

Invasive pests and diseases

- How to respond; how to be more proactive.

Mitigating climate change

- Silvicultural strategies and tools for maximizing carbon storage and sequestration and tools and techniques for measuring it — clear research and guidelines regarding practices.
- Comparing different harvesting methods that impact the uptake of carbon in the forest.
- How different forest management practices for carbon storage support, or don't support, wildlife habitats, particularly for at-risk species. Being able to integrate carbon considerations with the long-term biodiversity and sustainability piece is very important.
- Having a solid baseline for how much carbon is being stored in the forest right now.
- Research dealing with carbon offsets or the efficacy of offsets — paper trading types of programs. They have this unknown cost/benefit. All too often we are driving down the road of issuing program funding without pausing to look at whether or not it is successful. Let's actually measure the impact that these carbon offset programs are having and how big they need to be to accomplish our mission. We need to price the market. There is so much variability in the market. We need to know how much carbon is sequestered — know what the impact is — to signal the market and measure the change.

Adapting to climate change

- Water quality/storm resiliency questions. Policymakers need a better understanding of the extent of how forests contribute to resiliency, and what role they have in increasingly intense weather events.
- What are the silvicultural methods to help our forests become more resilient to the effects of climate change?
- Research and synthesis to aid decision-making about upgrading culverts and improving the regulations that go into culvert and road decisions.

- Understanding oak management techniques for possible application farther north: management of fringe-range species that may increase in importance.

Sustainable forestry, forest fragmentation, and working with private landowners

- So much isn't known or well publicized about the need for sustainably managing forests so they can remain healthy. I don't understand why there isn't more visibility or understanding. Where is the clog in the system? Is there not enough research?
- Tax incentives for landowners. I don't think the policy has changed enough to accommodate trends in landownership and the forest products industry. People need incentives to "be in it for the long haul."
- Micro forest management: managing lots of little things in a fragmented landscape. Tax incentives, certification of properties — seeing opportunities in backyards and the right of ways for power lines and roads.
- We found value in carbon management research, in particular, [for working with private landowners.] Research focusing on Canada lynx habitat was very helpful in terms of reassuring people and forest professionals that their management were not threats.

Forest products industry

- How do we come up with better wood products? What is mass timber's role from an engineering perspective? Can we make better paper products, better biofuel products…what is the engineering and science behind making all that happen?
- Example of a recent context where research would have been helpful: making wooden buildings faster. The research community didn't listen enough to landowners and the forest products industry. Research that is at that intersection of job creation, sustainable forestry, and climate change mitigation is very interesting to me for this region.

Rural community and economic development

- We need research that leads to scalable, fundable solutions for rural communities. I think a lot of times rural communities are highlighted in anecdotal ways. But rural communities are very bespoke. A research approach could dig deeper into the factors that play a role in rural community successes. I haven't seen this produced in a way that community leaders are able to act upon.

Energy:

- We watch states and the federal government formulate policy. We have questions about the carbon neutrality of biomass, the role of fuels in long-term transportation...we're constantly looking for good science that helps support that from a climate perspective. As a trade association, we're selfishly looking at the role of wood products, but our members want to do the right thing. How do we do that? We want to be respected and have credibility when we sit at the table and say that our products can have a benefit going forward.
- A major push from all aspects is that we want to reduce emissions, which means we need to find a new energy source for the public. They are developing these new renewable energy projects like solar farms and wind farms. We need a way to quantify the impacts of renewable energy projects on the quantity and quality of forests that may be impacted. We are seeing solar and wind farms on forest lands that will be converted. The trees will be removed. We are struggling with it. The priority is to reduce emissions—and that solar farm might help reduce emissions more than that standing forest does, but there are so many other benefits that that forest provides to the environment and the community. We need a way to quantify all those ecosystem services that

forests provide at no cost to the public. But maybe there are low value forests out there and if we have to sacrifice some forest lands, we can identify those.
- I would love to see more in the area of biomass and energy sources: the tradeoffs between biomass and continuing to distribute oil and propane. How do we think about that analysis?

Looking forward, over the next 5 years, what issues do you see on the immediate horizon in this region that would benefit from new, forest-related research and/or research synthesis? How can science be a tool for addressing these challenges/opportunities?

Invasive pests and diseases
- How do we better anticipate them? How do we get better biological controls? Our state legislature is currently trying to ban certain pesticides, when we don't necessarily have alternatives. Outright bans are challenging,especially when you're up against public pressure. If we can't deal with some pests and diseases, we're going to have significant impacts.
- Biocontrols for invasive species. We have a big biocontrol project for hemlock wooly adelgid. What are the biocontrols out there? How do you manage those biocontrols? It is a very tricky thing, entering into a biocontrol project. You'd need to come up with significant protocols and processes.
- One of the scary things is that when these things hit, we know nothing about them. One of the things we need to do in the future is more work with our academic institutions on germplasm research. For instance, we are seeing some devastating mortality with all ash across the state of New York. It doesn't look good for the future of the species, but one of the positives is that we are finding lingering ash in the middle of these ash stands where all the trees are dying. We find some trees that are surviving.We need research about this. We need to collect the seeds from those lingering ash, and start collaborating across the states and putting all of our resources together. We need to be working with our tree nurseries in multiple states to determine what is it about these trees that makes them resilient, and then see if we can start propagating resistant ash trees.
- More research on survey methods for invasive species. Like eDNA, which is used a lot in aquatics.

Mitigating climate change
- Carbon storage and carbon sequestration
- I'm a biologist by training, not an economist, so I hesitate to delve into the economic piece, but we do need work done on incentives—whether it be carbon credits, or something else.
- I'm really interested in the market structure. The interconnection between the creation of the markets that sustain jobs and create a price signal for carbon. This is one of the top issues I'm looking for. That to me has the highest impact. It could also serve the conservation community. We need to get out of the environmentalist camp and into the mainstream.

Adapting to climate change
- As the climate changes, as our winters change, soil conditions are more impacted. We're going to see keystone species stressed, with forest health implications. As we see changes in species diversity in the stands, going forward, what the stand index is for growth, that impacts the market here in the northeast.
- Fire is not something we talk about a lot, but if we start having more, shorter, dryer winters within forest structures that are not as resilient to fire, I think we might start seeing more fires of a larger

scale. Our species and structures are not as adaptable to fire; they may be smaller in size than you see in the West, but the impact on the landscape could be greater.

Sustainable forestry, forest fragmentation, and working with private landowners

- A better understanding of some of the incentives to get private landowners to participate in different management schemes would be huge. Everything from providing free tech assistance to financial assistance to tax reliefs. Having a clear understanding of what's out there and available is important. A clearinghouse of different tools that are available.
- Vermont started with the Foresters for the Birds program. I think it's one of the best communication tools I've seen in a long time, because it gets private landowners passionate about songbirds and makes the connection between age class diversity and regeneration.
- We want to be proactive about management for threatened species such as the northern long eared bat, little brown bat, and rusty blackbird. The roles of pollinators come up a lot too; there are things we need to understand about what we're doing forest management-wise that affect them. There was a recent proposal for acoustic monitoring for songbirds in forests. We were interested in that, but the project didn't get funded. A project like that could help us stay ahead of issues.
- On the biodiversity side: having some clear understandings of the amount of land to conserve. "Conserve" meaning protect, but also meaning having working lands being able to continue but keeping that forested matrix. The amount and configuration needed to help conserve biodiversity in the present as well as looking into the future.
- One area that we could really benefit from is looking at multiple scales of connectivity. We have a good sense of where cores and concentrations of habitat and at-risk species are, but we don't know where functional connectors are. We can map where the green spaces are, but where are the actual places on the landscape that provide connectivity to allow species ranges to shift? Having that information available at multiple scales is really important in terms of implementation.
- From a resilience perspective, we are dealing with a pretty young forest of about 80 years old. A lot of it has a pretty sterile understory for a lot of reasons. Regeneration and age class diversity are important for long-term resiliency. We are struggling with pairing the long-term resiliency concerns with science that says: this is the best way to address it. How do we communicate that this is an issue, and that we should be doing certain things to address it? It probably needs a much more proactive approach than landowners are taking in the northern forest. If we don't do that, what are the implications for communities and forest products jobs in the long term?

Forest products industry

- Small log harvesting and marketing of smaller harvest products. The resource is changing; the trees just aren't as big as they used to be. There is a need for market diversification.

Rural community and economic development

- There were already some rumblings of trends of people in crowded, expensive urban areas leaving with some forward-minded companies. I think what we will see is more people who want to build a hybrid lifestyle. They may need to be in their urban location part time, but if they have the means they will want to have a second home situation in the northern forest. There is a lot to unpack there in terms of research. And communities. How do you engage with someone who is only there a few days a week? Or maybe a spouse or partner is there full time. Are they invested in the community? I think there is basic civic research there.
- Also, the transportation issues, and the ability of people to access what they need. Broadband is a challenge. We are tired of hearing about it, but it is a real challenge.
- There is active recruiting by state agencies to bring companies up to rural economies. It would be helpful to the business community to say: these are the elements that we think that will make

businesses successful in these communities. Those companies don't stay if it is just based on monetary incentives. We need to find ways of stickiness for companies to stay around.

Recreation

- Social science issues related to recreation. We are seeing usage numbers on our public lands that we've never seen before. One of the good things is that we are learning how important our open spaces and public lands are to the public. The Forest Service and National Forests are seeing these same issues—we need to synthesize information and share it between the national forests and state lands.
- One of the complicated things in the Adirondacks is that it is not a park; there is no gate, you just drive up and try to find a trailhead. We don't have the ability to even measure the number of visitors. How do we start measuring the users? Not only from a carrying capacity issue, but also just to demonstrate the value of our public lands. We need research to help us find use numbers. We need research to tell us what motivates the users to go where they are going. And of course, what are the impacts to the forests and lands?
- I am being challenged to be able to monitor our wild forest lands and our waterways—monitor them and have the indicators that show us when a water body has reached its capacity. I have no idea how to do that; I need the research to help inform me, then I can put some management tools into action.
- Another side of this whole thing is how do we develop the systems to safely and sustainably provide public access to our lands? There is a push for a permit system, or shuttles. How does that work? The risk there is we dump more people off at a busy trailhead. I've also heard people ask about recreation insurance. All of these things about how to deal with and manage the public.
- Trail building and trail density: There are mountain bikers making unauthorized trails. Backcountry skiers are another group that likes their trails to be theirs. Then more groups come in, and then they creep in and create new trails, leading to high density. People are wanting more and more trail networks. We are trying to balance that use.
- There are glade areas with backcountry skiers where wildlife use was an important issue. Dartmouth is doing moose studies. That's definitely an aspect that needs to be looked at closer.
- Backcountry glading is of interest here in Vermont, but it doesn't always have to be in the same place forever. Are there silvicultural techniques that could be used by a landowner to provide temporary backcountry skiing? Could you set up some sort of landowner use where they could access their resource on the land for a period of time, it becomes a backcountry sky area for 9 years, then they shift the management?

Environmental Justice and Equity

- What is going to be more important looking forward is a more explicit consideration of equity. In this case, who pays and who benefits? If we are thinking about ecosystem services, say, instead of quantifying ecosystem services from a forest—who pays to generate those and who benefits on the transfer. Think about air quality—who pays for that and who benefits from that. I don't think we've captured the full benefits of water and air to the region. An equity lens is more important than ever, and the science community needs to be thinking about how to incorporate that.

In addition to your thoughts about the themes/issues that we might highlight in the upcoming RFP for the NSRC, we are also interested to hear your thoughts on the research approaches, partnerships, and products that would be most useful. Do you have ideas or recommendations

related to: research approaches/frameworks, collaborations/partnerships, timeframes, desired results and products?

Collaborations that bring practitioners and researchers together from the beginning to codesign projects and programs

- More work has to be done to find meaningful connections between academia and organizations like mine. I don't have a really quick short answer to that question. Being honest, I think NSRC-supported work has looked at a lot of important regional issues. But it has failed at doing that work with people who are meaningfully engaged in local communities. My pet peeve is when people ask: Will you be a partner? Will you write a letter of support? My pushback is: we like to be good partners, but we would like to be asked before you even get to the point of asking a research question. Engaging more genuinely with the folks who are supposed to be the beneficiaries of the research, not just in one-off, occasional conversations or advisory committees.
- I've been really impressed with some of the collaborations around applied research. There have been collaborations in Maine and elsewhere where they bring various stakeholders together and they can set forth priorities, rather than doing research for research's sake.
- The approach of the Cooperative Forestry Research Unit (CFRU) at the University of Maine is the most familiar to us. Typically, we meet as an advisory committee and go through a series of listening sessions with scientists—we're listening to them, they're listening to us. What issues are we concerned about? What research could they do to answer those questions? We're in a room together. That kind of collaborative approach helps to identify things that are of interest to a number of different collaborators. That's the kind of model we like to work in, where we get input right from the start.
- We have professional foresters who have good working knowledge of the landscapes they manage and have phenomenal observational skills. Is there a way to rethink research and pull some of that together? Could some research be done on private land where the land managers are part of it—like an interview or some sort of pairing of land managers with researchers so it is not research in isolation and private land management in isolation?
- I think there are a lot of private landowners who would be willing to contribute various things to projects: field work or sharing of information. There are things that we can do that are maybe easier than funding or writing a check. For example, we could contribute a cost share for a grant and our cost share is that our foresters take time to go out and take some measurements and make observations and they can do that as part of their day to day.
- One thing that I've been hearing in the natural working lands discussion is don't overlook the small details when it comes to stakeholder engagement—not just the scientists, but the practitioners that will have to be the ones to adopt and use different methods that we might recommend. The Maine Professional Loggers Association has a lot of information on particular tools and equipment that may or may not make sense in a climate-friendly suite of harvesting practices. It's crucial to get them involved early and at every stage of the process.

Deliverables

- We love to have scientists come onto our ground to look at certain things and bring our whole staff out to ask them questions. We like to participate in field trips where the research is presented, and we use the written reports. We also really like interim reports, or progress reports on where things are going. It doesn't have to be a final product; we like to be kept up to speed in the interim.
- I see value in demonstration sites. Sometimes it helps to encourage public agencies to be the models for some of these demonstration sites if needed, to show that we're using a particular

technique and it's working, and we'll be the guinea pigs to prove it before asking landowners or small private NGOs to adopt it.

- Deliverables that involve accessible, clear, and easy to navigate decision support tools. There are a lot of great models out there, but if I can't explain them to someone with my background then I can't expect anyone else to use them. Example: the Nature Conservancy has been working with a consultant on a decision support tool for barrier prioritization and culvert removal prioritization in parts of Maine, with consideration of vulnerable communities. They're bringing in a lot of complex considerations: economics, demographics, biodiversity, transportation…they put together this tool that allows communities to figure out which are culverts most vulnerable to climate change, which are bad for wildlife, and how to prioritize.
- Some of the work that Hubbard Brook put out—for example, the summary data showing the warming concentrated to the winter months—has been helpful in terms of our thinking around infrastructure and logging equipment. Also the Manomet Climate Smart Land Network pulled together a synthesis that has really helped us in our investments. We can't just hope it works out, we need to justify changes to our road planning and road budgets. We need the information packaged in a way to go to our investors to say this is what we are seeing, here are some solutions.

Bringing in future business leaders

- We are really interested in innovative business models and sustainable business models. One of the most critical issues is how we think and talk about these topics at the level of where our students are, and ingrain this in our business curriculum. These are the students who are going to go out and run these mega corporations. How do we leverage that potential? These are multibillion dollar investment firms looking to offset their footprint.
- Look at the model of sustainable seafood and fisheries. This is seed funding essentially for research. I'm thinking about linking business students to the conversation and how to think about mechanisms around finance, how to take research to spur something innovative. I'm so inspired by young people for coming up with solutions.

Synthesis and integrated research

- It would be really helpful if we could start to mine the decades of research that the Forest Service has done so we are not duplicating efforts.
- We need to synthesize existing research. It is very difficult for the practitioner bodies, like my office, to synthesize the research into application.
- I would love to see more holistic research. The way money is doled out for researchers is very piecemeal. It's very rare that money goes into long term projects. I'd rather see 5-year NSRC grants rather than 1-year. To me, there is a need for putting more money into longer term, more comprehensive teams and a coordinated effort to develop an integrated body of knowledge. I really think that's the future. We have journals filled with one-off little stories. There's very little synthesis. We do literature, but we don't really synthesize what we are learning and discuss the strengths and weaknesses of what we have.

Applied research

- A lot of the research that goes on needs to be turned into applied science. The academics need to take it a step further and create directions for applied science so that us practitioners, us land managers, can implement it on the ground.
- I think applied research is important. Something that can be tackled in a shorter span of time and provide maybe not a higher degree of scientific rigor, but enough science to, in a shorter period of time, move to a management decision faster.

- We know we have this carbon issue, and we want to be part of the solution. CAFRI (Climate Applied Forest Research Institute at SUNY-ESF) is developing that research, and they will come up with those data. But then I need to know what we need to do to manage those forests to improve the carbon. I need it to be turned into applied science. My professors at ESF taught me silvicultural practices for different results. Now I need to know the silvicultural practices to increase carbon in the ground. With all this science, people need to be thinking: what does the practitioner need to know?

Support for implementation in rural communities

- There are a lot of opportunities for researchers to communicate in public forums where you can present to town leaders. But beyond just communicating, there needs to be technical assistance for towns and communities moving a process forward. There are structural reasons why some of the very good recommendations from researchers can't be effectuated. They need to think through the actual mechanics of implementing what they are recommending.
- It's not only about communicating and translating the research, which is what I used to think. You have to actually dig in and help people move a strategy forward, because there isn't the bandwidth in these communities. We almost need an AmeriCorps kind of thing—some sort of big effort to get capacity building in these communities.

Is there anything else you would like to share?

Support use-inspired, action-oriented research

- I think just in general continuing to ground ourselves in identifying who the audience is, who's ultimately going to be using these products, and what is the best way to access those options. Make sure those are all built into the projects.
- Scientists should feel empowered to interpret their work and consider taking more chances by explaining what it means, as opposed to saying "we need more research." When it comes to the practical implications of their research, scientists are better guessers than non-experts.
- We appreciate that science and knowledge for the sake of science and knowledge is important. But when NSRC was originally chartered,it really talked about the applied aspects and addressing questions about the region not just for the sake of the research but for informing solutions on the ground. My strongest hope for this next iteration, particularly with very limited money, is that it can be really focused on choosing and supporting projects that meet what the academic community needs but also provide meaningful stuff to the stakeholders.

Recommendations for the crafting of the RFP

- With limited funds, my preference would be that we just take the best projects regardless of what theme or institution they represent.
- It's important in putting together the RFP that the program just be honest about what it's looking for. If it's really geared towards supporting students that's perfectly laudable, but *say* that. In the past, it tried to say the things we've been talking about, but then it did the opposite. That was annoying. It saves the pain for organizations like mine who think oh we could use this! We were responding to what we thought NSRC was asking for. Clarity about what the program seeks so that applicants know. There used to be a 2-step process – submit a concept paper and then be invited back. Don't invite them back if you're not going to accept them. There's a lot of work that goes into that. Just be honest. Organizations like mine are used to getting nos.

- NSRC has the potential to be a crown jewel of use-inspired research to support first-base economies, communities, and ecosystems. The current reboot provides an opportunity to fulfill that potential by enhancing both user input to research questions and themes and the production and distribution of usable results. The process that you and HBRF have designed for stakeholder engagements seems like it will go a long way to address the first item. On the second, I suggest adopting the approach that other federal funding agencies, like the National Science Foundation and EPA Superfund Research Program, use. That is, include a "broader impacts" or engagement and translation section in the RFP that asks applicants to describe the strategy, activities, outputs, and dedicated budget for this work. This will not only stimulate researchers to explicitly consider the broader impacts from the outset, it will also provide more opportunities for forest-centered collaborators who are not research institutions to directly benefit from the program. As such, this element would help build program impact and a broader base of supporters.

Importance of messaging and framing

- We've been asking these questions for decades: How do we induce forest landowners to practice sustainable forestry on their forest lands? This is the nut we've never been able to crack. Thirty or forty years ago with twice the staff, we'd go and sit across the coffee table with private landowners and talk about it, we'd walk the lands with them, we'd draft a forest management plan with them and hopefully they'd implement it. We can't do that anymore. Our conclusion is that they aren't doing it unless it's mandated with a tax law.
- Forest lands are turning over, they are getting subdivided. And if you really care about forests and the condition of the forests, you have to care about these private landowners. Our research does need to be developing the tools, and this could also be social science. For example, we've had our forest stewardship program forever where we go out and sit with landowners and try to get them to do the right thing. Vermont renamed the program a few years ago: Forests for the Birds. Giving the same program a different name made the interest in the program go through the roof. So this is some of the science: what motivates people who own forest land has changed. Fifty years ago, it was the economy and timber. The number one motivation now is wildlife habitat. Forest landowners love their birds.
- What is the language that resonates with landowners? We use a lot of language that I don't know how it resonates. We use "sustainability" and "land stewardship". It's important to use language that resonates and that the public can understand.

Importance of boundary spanners

- There is a whole aspect of educating landowners, policy makers, new researchers, and professionals, and trying to find people like you who are able to bridge. We talk about integrating and good problem solvers in academia forever. But frankly it's not working well. Why is it people compartmentalize so much? The future needs integration. That's why we are polarized. Being a boundary spanning person, I fought my whole career to advance while not narrowing in.