Changing Climate, Changing Forests: A Hubbard Brook Roundtable
May 5, 2015

Interview synthesis and catalyst for dialogue

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The following text is a combination of direct quotes and paraphrasing from interviews conducted with the people attending the Hubbard Brook Roundtable on climate change and changing forests, to be held May 5, 2015 at the Hubbard Brook Experimental Forest in Woodstock, NH. We have attempted to record faithfully the comments that were shared with us. No doubt, there are places where our own biases may have slipped in as we have made choices on what and how to report and synthesize what we have heard. This paper cannot aspire to the standards of science; rather, it will serve, hopefully, as a catalyst or "straw person" for discussion at the roundtable.
— SG and DS

1. How are you personally involved with issues involving the forested landscape in New Hampshire and beyond?

Omitted

2. Are there changes to local forests that you have observed or anticipate observing in the near term? Which of these are or might be attributed to climate change?

Changing conditions

The duration and timing of winter is changing: before we could do 15-16 weeks of winter logging operations; now we have 12 weeks. We used to start December 1 and now it's the last week of December through March 15.

In the 18 years I've been with the company, our winter timber operations are now 2-3 weeks shorter.

More frequent thaws; snow is more intermittent.

Continued decreases in snowpack and increases in frequency of freeze-thaw events lead to damage to plant roots and arthropods and increases nutrient leaching into waterways.

Drought conditions are increasing.

Bogs are shrinking, with encroachment of more woody plants.

Deluges and flash floods happening more. Culvert blow-outs; roads washing away. Used to have dry summers where you could do logging; now we have deluges of 2.5 inches in summer.

Certainly the increases in precipitation are a huge impact of climate change. To me this is more of a direct impact. This can affect tree species, water quality, soil moisture.

Changes in forest composition

Recently, an underplanting of red oak saplings has taken off like bandits, which surprised me. The planting was a pre-emptive strike against climate change. Never had red oak on our place before.

Seeing tree species changes on wetter sites. Regeneration is very grassy – is final stand going to be different than in the past?

Tree growth and regeneration: I'm not sure we've measured this response yet. We hear people saying that they're seeing this, but I'm not sure we've measured this directly.

We are seeing big changes to species, but connections to climate change are difficult to discern.

- We're seeing red oak seedlings in Hubbard Brook now when we'd never before.
- Hemlock wooly adelgid and emerald ash borer: killing these two species. There is at least some connection to climate change because these pests do better when not killed off in winter. Still controversial.
- Maple sugar decline is a big change we are seeing – regeneration failure or mortality. The climate change link is not necessarily there but not out of the question.
- Mountain paper birch is taking a beating. Probably a connection to climate change but controversial. Trees die for a lot of reasons. Some evidence for susceptibility to heat waves and drought. Also related to age.
- Spruce was in decline but doing pretty well now – not attributed to climate change. There's a pretty good chance that climate change will make spruce happier – red spruce is affected by cold winters.

Wildlife

Moose is the poster child of climate change. Moose populations are declining because of temperature changes and increases in winter ticks. 90,000-120,000 ticks can infest a single moose, causing anemia and other weaknesses.

This year we see wildlife impacts, including dead bluebirds in nesting boxes. More are wintering in NH now and then the cold winter clobbers them. We see tree swallows hunting over snow looking for insects.

One of the natural controls of deer has been our winters and snow depth, so this is an animal that might cause changes and problems.

Hard to know what changes are due to climate change

What we observe are changes to hydrology, meteorology, and biogeochemistry. What's much harder is to pick out the signal in forest response. Forests are responding to so many stressors. The signals we can see clearly are temperature, snowpack, streamflow, phenology — leaf out and bird arrival. Changes to species composition are harder.

It's hard to separate out the impacts we're seeing. The big impact is beech bark disease we've observed at Hubbard Brook. Insect outbreaks are huge things that are going to impact the forest and some of them can be related to climate change.

Sometimes I think people call all the invasives climate related, but they really aren't.

We have to be clear that some things are directly attributed to people, not necessarily climate change. Development pressures have an overwhelming impact on forests.

It's hard to generalize. I'll never forget walking out on one of our properties when I first started working here; walking through a sugarbush. The forester said that these trees used to seed out every 3 or 4 years. Now it's every 10-12 years. That's an observation that's not unique in the woods here in NH. Whatever is going on, we ought to know more about it. Our largest asset is our land.

We see some changes, no way to say they are due to climate change. The sugar maples are not thriving. We're seeing issues with forest health: insects, fungus, diseases — we need guidance on these issues! We have a big problem with firs dying due to acid rain and depletion of calcium in the soil.

3. How would you characterize the forests of the future—25, 50, and 100 years from now—based on your observations and your current information about climate change?

Future depends on forest management and development.

My fear is that we are going to still have business-as-usual thinking in terms of forest management and in 100 years we will have continued fragmentation and forests that aren't worth much. Everyone is still doing a single-stem selection process, ending up with the same thin-looking forest. What does the science say about this practice? My hope is that we begin to think more systematically about how we develop communities, pull our communities back into town centers, and have large amounts of conserved forestland. Not anti-development, but smart development.

Some forest types will be affected more than others; it really depends on actions taken now to protect connected habitats so that species can change ranges.

Changes will be sped up by forest management. The capacity of trees to invade and survive as seedlings — for them to become canopy trees — there has to be disturbances to the canopy. So if you're cutting down trees, you're likely to be favoring trees that are going to migrate. So you could be encouraging migration northward and up-elevation. We're going to see these species changes on a decade scale.

We have an issue of how to pass on the privately owned forest lands. We have two boys and were hoping to pass on our land to them, but they have gone in other directions.

I think there's going to be tremendous pressure from population growth and agriculture, especially when you consider what climate change is going to do to the Southwest and Southeast.

Forests are going to be more stressed.

Impact of pests and diseases
Impact of more extreme events
Drier periods, in longer intervals, could lead to more fires
Precipitation changes will affect some species
Forests are going to face chronic stress with heavy impact of extreme events.

Habitats and species associations are going to change.

Mix of plant species will change. Will see more red maples and hardwoods; spruce-fir segments will be stressed.

Climate change will affect different parts of the ecosystem in different ways. More mid-Atlantic animal species, not just birds. Snowshoe hares and bobcats might not do as well. But systems are complex and unpredictable.

High-elevation habitats will decrease.

I fear we will lose lowland balsam fir.

I'm expecting major changes to species composition — hemlock being totally gone — we've already seen this at Harvard Forest — and new species will move in. There's a good chance that we'll lose all the ash trees in NH (due to emerald ash borer). These things have happened in the past. In terms of function, I don't think there will be major changes. Overall I think the forests will function the same way.

There seems to be some evidence at Hubbard Brook for expansion of species that are temperature and moisture limited in their ranges, like red oak and white pine. These don't occur in our permanent plots, but we are now seeing seedlings. There's a pretty good chance that the forest is going to be gradually changing, especially at the edges of the pine forest and the northern hardwood forest.

Another thing that's going to make an impact is deer. As snowpack gets shallower and as moose retreat, white-tailed deer will expand. White-tailed deer are a regeneration problem. Forests near towns could see this effect.

What am I worried about for the future? Damn near everything. Water quality! We have a broad water problem: riparian habitats and species susceptible to climate and insects. The dry getting drier and wet getting wetter.

I expect big changes; how fast and how disturbing? No good information yet. A lot of our mature species may be in trouble in 100 years and revive itself with new mix. Could be awful in the transition, especially for forest industry.

We will see little change.

100 years is a short time frame when considering forest change. Understory changes may occur sooner.

100 years out the forests won't look that different: to the naked eye they will look similar. But there will be subtle differences, shifts in nutrient cycling and carbon storage. I don't think it's catastrophic.

We don't know.

Yes we plan for the future, but forests – and markets, people – are dynamic. I have an aversion to pundits making predictions. But we know that things will change more dramatically in the next 30 years than in the past 30 years.

4. What forest changes will have the greatest impact on you as a forest landowner, land manager, decision-maker, or researcher?

Forest structure and composition:

Invasive pests and diseases like beech-bark disease.

We pay particular attention to growth rates. If you're in a period of transition, will that affect growth rates? We always try to keep our forests at the tipping point of never harvesting more than we can grow.

As far as tree growth and species composition, to me that's a big crapshoot. Our forests aren't particularly all that natural to begin with because of our agricultural history. We have more white pine than we should have – and we're benefiting from that today.

I think that people will be pretty resilient as forests change because of how we've managed our lands over time. There will be winners and losers, as people like to say, but we don't know what those are. I'm managing for what I see here – managing for diversity and trying to fit the right tree for the right site. When it comes to predicting what trees we should manage for, I'm on less solid ground. I don't think we know that answer. Right now we manage for diversity, but that could be the exact wrong answer.

I hope that there are some people at the roundtable that have thoughts or opinions about this question about composition – with scientific basis other than conjecture.

Insects and diseases will be our primary things to monitor on our timberlands.

Changes to seasonal conditions:

Winter harvest is going to require the soonest adaptation: shorter winters, wetter conditions affecting logging operations. This will ripple into the rest of the economy.

It's going to be warmer and wetter in the Northeast, and for our operations we need it to be frozen and dry.

I wonder whether altered freeze-thaw cycles will affect maple sugaring.

Anyone who relies on winter snow is going to have to adapt. Snowpack and summer droughts will be some of the biggest changes landowners will face.

Extreme events:

The severity and return intervals of significant storms: these will tax state agencies. Ice storms, flooding, forest fires.

We feel a great urgency to better understand the impacts and consequences of extreme events and how these fit into the forests of the future.

Our average weather will be made up of more extremes.

Policy changes:

Policy changes at the government level, not forest changes, will affect us most. A carbon tax could be a bonus, but if diesel goes up that will cause problems in heavy industrial settings. Everything we've done in response to climate change in terms of investing in renewable energy has been a response to tax policy changes.

How a landowner manages their land is going to change: there are going to be different markets beyond just timber. Carbon market, recreation market, water market — there's a lot of value in forestlands today that the economy doesn't directly recognize. What's going on in CA and Europe in recognizing C markets is just the beginning of a whole new way of thinking. There will still be timber values, but I think people will manage the land for much more than just standing timber value. I think that's a good thing. I think the sooner we think about and monetize the value of the land in these ways, the better.

5. [A.] What actions can landowners, land managers, or policy/decision makers take to mitigate climate-induced changes, or to otherwise adapt their use of forests to a changing climate? [B.] What decisions are to be faced by these groups as the impacts of climate change are increasingly evident on our forests? Consider decision-making at the individual, municipal, state, and federal levels.

Management:

Manage for uncertainty; understand vulnerabilities.

Landowners and foresters have to encourage resilience in their forests — best defense is diversity. Maintain higher stocking levels: more volume/acre. Move the resilient species farther north through management. That's my job. White Pine and red maple will do well. White Pine voracious gobbler of CO2.

Connected forests are important: maintain connectivity by managing heterogeneous forests. Strive for resilient forests at the landscape scale. Follow the lead of the Harvard Forest group: the Wildlands and Woodlands vision.

We need to make management decisions that hedge against climate change. Our philosophy has always involved diversification. How to do that while protecting against changes in age class, arrival of pests, and other problems?

Avoid creating more stresses. While I worry about more regulations, you can offer incentives for landowners to keep forests intact. Celebrate good land management practices. Keep in mind that many people don't own land solely for financial reasons – there's a pride of ownership. Help people identify themselves as land stewards.

We really don't know what the answers are, so anything we do is likely to be as wrong as it is right. So I think flexibility and being adaptive to how you're managing your land is important. Because private landowners have a fairly short land tenure, there's adaptation built in because people die or move away and then there's another management regime. Our land ownership pattern has this flexibility built in. I'm not arguing against the long-term view – it would be wonderful if we could all be purposeful and long term in our forest management. But the truth is that our land ownership pattern doesn't support that approach.

We've spent a lot of time in the past 5 years updating our management plans. One of the things we are concerned about is the long-term asset value of these lands. Do we want to participate in carbon markets or certification programs? Part of the challenge of carbon markets is being prepared to enter them properly.

I think that everyone will adapt – we're all going to have to. In NH they have 100 year rotation of the forests. Foresters think long term and that's a neat thing about forestry. If foresters are thinking about what species are going to do well here in 100 years, in terms of species composition, think about where logging occurs: wet areas, for example. The soil moisture issue is going to be an interesting impact that land managers will need to consider.

On a closer time frame – 25 years – think about which extreme events will have an impact. Hazard tree assessment – looking for trees that are injured and try to take care of those before a big storm.

It's clear that it's going to be a lot warmer in 50 years. If we aren't proactive about changing the genotypes of the forest, the forests are going to be in rough shape by the end of the century. How much genetic variation is there for the species to adapt on their own? Maple syrup operators are already intensively managing genotypes: breeding for sweet trees. We aren't doing this for timber reasons yet. We could breed trees for being adapted for warmer climates.

Land managers: we have to store carbon in the forest—grow solid wood products—give up burning chips for electricity—worst thing happening for biosphere.

As foresters, we take our cues from the land as to how species are responding now. We make thinning choices based on what's thriving: we always monitor for health and vigor. We don't have a bias against particular species.

Development and Infrastructure:

Zoning for development: how each town handles development permits.

Change the culverts, bridges, and roads to accommodate more precipitation.

Consider recent history of more all-season winter roads; they cost more, but in some places they might reduce risk.

In the past we did everything NOT to build summer roads versus winter (frozen) roads; summer roads are much more expensive requiring gravel and fabric. But now we're investing in summer roads which are much more predictable; taking increasingly more volume in summer now than in winter months.

Policy:

Implement a cap-and-trade program: free market, attractive to both sides of the aisle

One of the things the Forest Society would like to do is to model how a landowner can participate in a carbon-type market. And if the only landowners who can participate are large landowners, that leaves a lot of people out of the discussion. From our perspective, the markets we want to encourage are those that can include small- and medium-sized landowners.

It seems that there's so little we can do at the local level to have an impact. I'm on board with local changes because they raise awareness and that is positive. But when you think about the big sources of carbon in the atmosphere, it's not at the local level. I just don't think voluntary individual decisions about lifestyle are going to have an impact. You need broad-scale political changes. For instance, the EPA has a new carbon policy for power plants: that's the kind of thing we have to go after – it's a huge problem and we need big solutions.

At the federal level, carbon taxes that would push people away from fossil fuels — this would have big implications for forests. We also need support at the state level for keeping forests as forests. This will be important for mitigation *and* will support forest management.

6. What climate-related scientific research currently or recently undertaken at Hubbard Brook is most pertinent to landowners and managers? What other science-based resources do you use and/or are currently available to landowners and managers?

Hubbard Brook:

We provide the background understanding of the hydrological, chemical, and biological pulse of the ecosystem, and we make these data available. For example, the dilution of streams — no one else is seeing this. Sometimes we get pressure to be more silviculturally relevant, but we can't be all things to all people.

We've done work on changes in streamflow – people have expressed interest in this. The extreme events are important – understanding ice storms and severe weather.

Winter biogeochemistry: There are soil frost changes that Peter Groffman discovered: in a big soil frost you get nitrogen coming out: this is a very interesting response that people don't know about and has implications for water quality. Changes in winter biogeochemistry are important to maple sugar and other forest products.

Hubbard Brook work about what trees are best adapted to changing climate, for example: sugar maple more sensitive to frost events than red maple.

Soil work at HB is fascinating. Growing trees it's all about the soil! Soil dictates what can grow on a site. As nutrient levels change: changed a lot by acid deposition and will be changed more by climate change. Very important how this will change what trees can tolerate, and what soils will support which species.

Long-term bird studies that show changes in nesting practices over time.

The question about genetics and physiology of important species and how that relates to the demographics of their regeneration. And pests and pathogens. We don't do a lot of that at HB and probably more of that should be done. The research at HB has not had a focus on tree physiology and tree genetics. We have good info on demography (births, deaths, migration, seed production), but don't have a good idea about mechanisms.

Other:

Individual foresters and auditors
Climate Smart Land Network / Manomet Center for Conservation Sciences

Cooperative Extension
Forest Notes from the Forest Society
New England Forestry Foundation (NEFF)
Natural Resources Conservation Service (NRCS)
Silviculture and wildlife management research; Bill Leak's new silviculture guide (USDA Forest Service).
Forest Guild (http://www.forestguild.org/)
Cary Institute of Ecosystem Studies
State wildlife biologists
Publications like Science Daily
Studies like snow cover and ice-out times brings reality to climate changes happening in NH.
At UNH-EOS Climate Change Research Center projections are brought to a level that can be used by communities.

7. What new areas of climate research would be most useful to landowners and managers?

My biggest wish list item: more hydrological modeling of future responses to precipitation at the landscape level — even small landscape level, beyond the watershed scale.

Interested in winter conditions; cold snaps; intense cold in early spring.

Higher-order interactions; robust studies that demonstrate that interactions are actually occurring.

Would like to see the whole field of resource conservation concentrate more on studying the human mind instead of just ecosystems. Social science. Human behavior as it relates to climate change.

How are summer deluges affecting soils?

Ask questions that could lead to practical advice, e.g., should we create bigger buffers around vernal pools? Should we encourage greater use of certain species? Are certain tree species more resistant to damage from ice storms?

Not enough understanding of understory vegetation and how that might change.

Structural elements of forests: how climate change will affect individual plant species because of changes to precipitation, temperature, and snowpack.

There's an increasing interest among landowners to manage land for wildlife.

Synthesizing what we know with regard to what we know about the impacts of changing climate on the ecosystems of the Northeast. And also synthesizing what we should do about it. I think we're on much less solid ground on this last question about what we should do about it.

We haven't done a ton with invasive species at Hubbard Brook – to me this is something that would be really important for landowners to know about it. Biodiversity is another topic – if we lose some of the keystone species – beech, sugar maple – will have a huge impact on biodiversity. We haven't done a lot to think about quantifying these changes. Tree species might not change as quickly with climate change

as things that are more mobile like insects. We could also help landowners understand what species might thrive in the future – how to manage for the "winners."

8. Under the broad topic of climate change, what information are you most interested in hearing about from forest scientists? AND/OR, what information are you most interested in hearing about from landowners and land managers in this region?

From landowners and land managers:
Is there an information need—a translation and delivery need? Or is there a need to support implementation: empowering landowners to integrate information into management?

What do you see, what are you actually worried about? What capacity do you have to respond to changes? Which enabling conditions would help you respond? What information do you need? What would be useful for you going forward?

I'm interested in hearing the key questions that forest managers have – always amazed when you walk in the woods with foresters, you get a different perspective – the real-world knowledge about things that researchers haven't thought about thoroughly. From a research point of view, should we start doing research on assisted migration and what thrives in certain areas? Finding out the questions that foresters have is key. They're thinking about climate change a lot – I want to know what they are thinking about.

From scientists:
I would be interested in hearing if there's documented shifts in species composition and regeneration; rates of forest composition change. The long-term data perspective is really important to me.

Landowners are interested in hearing about climate change effects on valuable tree species – and the time frames involved. They want to think now about which species to encourage. What changes can we expect to see in the future? How can we manage forests to prepare for these changes? How can we better articulate uncertainty and how do we manage for uncertainty?

Drought cycles and how different species have the ability to react. What will be the composition of the forest in drought?

I'm interested in hearing about the impact of a changing climate on insect pests and invasive plants. What silvicultural techniques can we use to manage these?

I'd like to see scientists share more stories (and pictures) that can hook people on nature.

9. [A.] What are three ways this flow of information, knowledge, and perspectives—back and forth between scientists and land owners and managers—might continue beyond a single roundtable event?
[B.] One of the goals of the Hubbard Brook Roundtables is to build ongoing, sustainable, practical relationships that benefit community members and research scientists. What purpose(s) might these relationships serve for you and/or your colleagues?

[A]

Pamphlet, brochure, or fact sheet

I would love a pamphlet I could mail to landowners: Are you concerned about climate change? Here's the best summary of what we can do. Written for the lay person, 10 pages max, gets to the management level, talks about practices.

E-newsletter

Look at the Northern Forest Center newsletter/digest as a model: aggregation of articles and information from a scientific perspective with executive summaries written for a lay person.

Community forum, town-hall meeting, or community-based working groups

Roundtables: there aren't many opportunities for people with different interests to get together. Might be better to do roundtables geographically around a shared sense of place, where there's a common focal point.

A forum for sharing information on a regular basis; in-person meetings better than electronic. But I'm leery about unstructured meetings that can lead to burnout. We need to clearly articulate goals going forward, for example, developing a list of research needs or deciding how to share information through stakeholder filters.

Work with existing networks and conferences to disseminate information:

Saving Special Places conference
Maine Land Trust conference
NH Land Trust Coalition: 28 different trusts. They are always looking for resources.
Northern Forest Center good at disseminating information.
Forest Guild – can provide information for hands-on management techniques related to climate change.
Cooperative extension is a major force. People trust them. Their main job is to translate science.
Land trusts can serve as conduits to landowners with information from scientists. We work continually with landowners on a variety of topics, including invasive species and how to restore habitats.
Society of American Foresters
Timberland Owners Association
NH Tree Farm committee
Regional Conservation Partnerships/Wildlands and Woodlands

Field excursions

We've had success bringing small groups of people to the forest for three days and two nights; researchers, Fish and Game, grad students, administrators, land managers.

Twitter or moderated chat on the internet

Old methods of public workshops and lectures don't work anymore. I'm a big Twitter fan. You can pick and choose various sources of information on specific topics.

Radio shows: e.g., NHPR's The Exchange

Public lectures

Science cafes, science pub nights
Speakers' bureau of Hubbard Brook scientists

Webinars with good topics, where people can interact and ask questions.

Hubbard Brook website

Information on the Hubbard Brook website must be written for the public – it's always a translation issue. Scientists must have a philosophy to do this. Graduate students might be required to summarize their work in a 3-page document that is understandable.

Op-ed articles

Op-ed piece is good for getting information out, but the flow back isn't great.

[B]
We need a way for practitioners and other community members to be able to share with scientists any data or long-term records that they have. This could be really useful to scientists!

First let's ask, what outcome or product would be useful to landowners? For me as a scientist, data is what I need – for publication, for my life. What is the flip side for landowners? What is a magnifier for them? Is it a scientist visiting one of their meetings? Is it a white paper?

Could our lands be used to help researchers? What can we do as a large landowner to help research?

Scientists should be pushed not to be isolated from the rest of us.

I want to keep my research rooted in reality. It really helps to hear from people from different fields who can actually use the knowledge I build. Everyone draws these distinctions between basic and applied research — I do basic research but I like to think everything I do can be applied at least at some level. These relationships are important for keeping that connection.

10. Climate change can be a polarizing topic in our society. What are some ideas for how we might productively engage with stakeholders and community members with a broad range of perspectives? What topics, approaches, needs, or interests should we consider?

Tapping into peoples' identities as land stewards is a strong value in the Northeast. Empower people to be the experts of their land — give them the responsibility as stewards.

This is where I think citizen science has a place — and social media. Focus on observations, not politics. Fun, interactive experiences engage everyone. Photo submissions, conversation.

There are people whose views are so entrenched that their viewpoints won't change, but a large number of people are in the middle. Not worth the time to convince skeptics.

Take climate change out of the discussion. You can disagree about drivers but agree on responses.

Social scientists can help determine why people believe what they do; why their fixed ideas help define who they are.

Try to reach people from multiple angles and in multiple settings, including nontraditional settings like churches.

Avoid speculation. If there are holes in the argument, it will confirm people's prior beliefs about uncertainty surrounding climate change.

Because scientists talk in gobbledygook, citizens don't understand it or believe it.

Do something rather than talk about it.

A problem with scientists is that they will not categorically say what is happening. That's the nature of science, but it provides openings for climate and science doubters.

Don't mention climate change; talk wildlife about bird habitats. Birdwatching is fastest-growing activity. Talk recreation. And look at the direct impacts—these are the trends we are seeing.

The way to get the people on the ground engaged is to have them understand that there are things happening in their backyard and their community that are going to be not in the long-term interest of their children and grandchildren.

I was really impressed with what happened with the acid rain in the past. The scientists laid the groundwork but it was the people in the grassroots that made the policy changes happen.