

Oaks in New England Forests: keystones for Biodiversity and Resiliency.  
December 11 ,2021

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Good morning everyone who's joining, we're going to get started in just a few minutes at the top of the hour so hang in there.

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Okay, it's just after 10 so I think we'll get started and hopefully a few other folks will be joining, folks are logging in as we speak.

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So good morning and welcome to this webinar, presented by the Mohawk Trail Woodlands Partnership.

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Our theme today is oaks in New England forests: keystones for biodiversity and resiliency, and we're excited to have two guest speakers today who will be focusing on research related to oaks and biodiversity, as well as applied science and resources focusing

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on how to care for our oaks into the future. My name is Lisa Hayden and I'm the Outreach Manager for New England forestry foundation.

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This is a nonprofit focused on land conservation and sustainable forestry, and I'm hosting today in my liaison role as administrative agent for the Mohawk trail Woodlands partnership also assisting today in the background is forest policy fellow Connor

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Rocket from NEFF and Kate Conlin Chair of the partnership's forest conservation Standing Committee.

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And before we get started, I just want to briefly mention some logistics about our zoom webinar format that we're using today.

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All attendees will be muted except for the speakers and hosts, but we welcome your questions or comments in the chat box.

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And if you're not so familiar with zoom if you look to the bottom of your screen there should be a green, sorry not green.

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Just it's a white button that says chat. And if you click there it'll open up a window and you can enter your cursor in and type in your questions into that box.

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And we're planning to take a few brief questions after the first speaker but we'll take the bulk of the time for questions at the end of the webinar, and hopefully we'll also have some time for discussion between the speakers to address your questions.

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Also Today's webinar is being recorded with captioning and the link to the video will be shared in a follow up email.

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And before turning to our speakers, I'd like to introduce Beth Girshman of Conway, Here she is back again.

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Chair of the education outreach and research Standing Committee of the partnership, just to say a few words on behalf of the organization.

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Thanks, Lisa. Good morning, it's great to see you all here today.

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This is the first of what we hope are many educational events for landowners, municipalities, forest land management professionals, and the general public, the Mohawk trail Woodlands partnership is currently funded through state targeted funds from Massachusetts

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State of Massachusetts. grant funded projects are also through federal, state and private monies.

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If you have an idea or request for future educational programs please get in touch with us through our website, Mohawk trail Woodlands partnership.org.

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The partnership area consists of 21 towns in western Franklin and northern Berkshire counties. Our goals include, working with landowners to permanently protect forested land, and to encourage sustainable management practices, increasing natural resource

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based economic development and employment through outdoor recreation and tourism and development of local wood products, improving fiscal stability of municipalities with funding for services related to outdoor recreation, management of town forests and

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assistance with climate resiliency programs. Thanks for attending our program today.

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Great. Thank you, Beth.

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And now I'm going to introduce our first speaker. So Desiree if you want to be getting your slides queued up while I introduce you the morning.

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Dr Desiree Narango is David H Smith conservation Research Fellow, and postdoctoral researcher at the University of Massachusetts Amherst, as well as the US Forest Service, Northern Research Station.

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She has a PhD in entomology and wildlife ecology from the University of Delaware, and an MS in natural resources from Ohio State University. Desiree's research focuses on understanding wildlife habitat relationships and plant, animal interactions and

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novel human dominated landscapes.

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Her ultimate goal is to find data driven conservation solutions for land managers to help preserve biodiversity and species interactions in our rapidly changing world.

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Her current research focuses on understanding tree preferences and diet relationships of insectivorous migratory birds, using forests throughout New England.

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So, I'm going to turn it over to Desiree. Thank you.

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Gotta unmute there.

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Awesome. Thank you so much for that introduction Lisa and thank you everyone for being here.

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I'm really excited for this opportunity to share with you a little bit about what I've learned about the incredible importance of oak trees to biodiversity, because you know as a, as someone who studies species interactions.

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As an ecologist I usually do so from the perspective of the entire plant or tree community, but throughout my work especially in recent years there's been this constant thread where oak trees are come up again and again as being beyond valuable for wildlife

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habitat. And so it's become really more of a central focus of my work and my interests in recent years.

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And so today I'm going to talk to you a little bit about what kind of wildlife diversity that oaks support vast variety of wildlife that's out there, and provide to you a little bit of evidence for their incredible value for ecosystem function in New England.

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Um, this is a quote that many people have heard lots of times is that the best time to plant a tree was 20 years ago, but the second best time is now and this is incredibly true, because the benefits of every tree that you plant will be experienced long

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after you're gone.

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The trees that you add the landscape now will experience hundreds of years of growth, hundreds of years of stability and then hundreds of years of decline before their eventual death.

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So, really, that tree that you plant is providing centuries of support for local ecosystems it's a real legacy.

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So the choice you make and what trees you plant or how you manage them really matters in the long run. And we all know that trees vary in how they're adapted to local conditions, how resilient they are or how they provision to climate adaptation, and

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of course how they support your own personal needs and values as well and so this is where I come in as an ecologist. I really want to do my part to provide the quantitative data that you need to make sure that biodiversity conservation is a part of that

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equation as well.

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Because from my perspective, one of the primary ways that people can manage wildlife habitat is through the ways that they cultivate trees and plants from the ones that you cut down the ones that you plant in their place the mature trees that you retain

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each one of those seemingly small decisions has had the additive effect of completely transforming the tree communities that have survived to occupy the present day.

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For example in parts of New England tree communities have shifted dramatically from a primarily oak dominated forest to one that is now

male dominated since European colonization and oaks are now down to only 10% of the forest throughout the region.

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And these changes to forest communities have important implications for wildlife habitat but we've really only scratched the surface of the importance of individual tree species in general to these relationships. In several indigenous cultures oaks have

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been described as the tree of life, and I think that that's an incredibly accurate and beautiful description of this tree. I also want to acknowledge that celebrating the value of oak trees for biodiversity is not a new idea, it's rooted in indigenous

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knowledge because these peoples have known about the tremendous value of oaks for people and wildlife for thousands and thousands of years.

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So I acknowledge that. And I also want to share with you some of the fantastic diversity of oak trees that I've learned about. And first, we'll talk about some of the wildlife that depend on oak leaves for the resources.

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And we'll start by talking about our insect communities which turns out that more than 90% of our plant eating insects are specialists for some at, to some degree, and what that means is that these insect species have adapted over evolutionary time to

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feed on very particular host plants. And this is because they've overcome those nasty defensive chemical compounds that are found in the leaf. They also adapt to the morphology of the plant or the phenology the timing of that plant as well.

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And so that we know that when insects jumped to oak trees and were able to take advantage and overcome the tannins that are found in the leaf that they then radiated into a tremendous diversity of plant reliant insects from our Hemipterans, the leaf hoppers, the Coleoptera our

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beetles. And of course, the Lepidoptera are butterflies and moths.

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And for our moths the numbers are extremely striking in diversity so Massachusetts supports, at least 2249 different species of moths, the genus *Quercus* alone supports, at least 511 of those species or 23% of the moth and butterfly biodiversity

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that's out there, and these species have fantastic different kinds of colors and beautiful morphologies like the checkered fringed prominent here on the left, the skiff moth in the middle, and our variable oak moth, just beautiful, amazing critters that

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although you know they eventually turn into moths and butterflies they spend the majority of their life cycle, relying on the trees that they feed on and so these oak trees are incredibly important for supporting those insect populations.

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These oak trees are also supporting several species

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of charismatic ... Luna moth and of course our spiny oakworm which is specialized for some of our scrub Oaks. Our oaks are support 14 species of Massachusetts butterflies including the viceroy, the white admiral, and the eastern tiger swallowtail.

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Although we can plant flowers all over the place and conserve Meadows for these butterflies when they're in their adult form, they spend just a small portion of their time in that form again, most of their life cycle is spent as caterpillars feeding on plants

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Our oak support lots of different kinds of insect diversity and our galls which can be beautiful and amazing in their own right, we have more than 800 species of oak galls that are found on our oak trees.

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And our oaks are also supporting

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our nocturnal symphonies, instances of katydids and cicadas, you can thank your oaks trees, providing resources

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and habitat for these species because your summers just would not sound the same without them, And of course because of all this insect diversity ee also have lots and lots of insectivore or diversity like neuropteran lace wings, spiders and of course

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our songbirds who from across the globe, more than 70% of our songbirds are mostly insectivorous throughout their life cycle so more than 50% of their diet is reliant on insects.

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So in this way, we need to conserve the trees that conserve our insect diversity, which is very intimately related to our bird conservation as well,

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because oaks are wind pollinated we don't actually, we don't often think of them as being very important for our pollinators. But recently I've come across some really interesting papers that kind of refute that idea.

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So actually, for some of our bee species and other pollinators, like, *Andrena* and *Osmia* two types of solitary bees.

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Researchers from back in the day have found that more than 90% of the pollen, that they're provisioning their brood was coming from Oak trees. And this is really interesting because even though oak trees aren't necessarily relying on bees and other

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pollinators for reproduction. The bees are relying on them because these are really important resources to feed their young in order to complete their life cycles.

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And as we get more advanced in our technologies like DNA barcoding to figure out these interactions between bees and their pollen. I'm very confident that we'll find many more species that are relying on this nutrient rich pollen from Oak trees.

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One of the most apparent food resources that are provided by Oaks, are of course, the acorns. And in fact, if we look across the United States, at least 96 different species of vertebrates are relying on acorns, and this is just a tremendous amass of

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nutrient rich food that erupts into the landscape, and so lots of species have adapted to take advantage of this wonderful food.

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Of course, this includes lots of different kinds of bird species like our Jays that assist in Oak dispersal by taking acorns all over the landscape. Our woodpeckers are also both dispersing seeds and relying on them to survive the winter, but oak acorns

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are also really important to some species that we wouldn't quite think of as being acorn users like our waterfowl wood ducks. Also our rails and of course many game bird species like turkeys grouse and quails comes out.

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In addition to these large species there's also a lot of smaller songbirds that rely on acorns as well.

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In fact, I, before I got my PhD I worked on a species called the rusty Blackbird which is declining by over 90% It's a species of conservation

concern in New England, and we had many observations of rusty black birds eating oak acorns that had fallen into

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puddles because at that point the acorn was able to be teased apart to get that nutritious meat inside. And in this study by Martin in 1951 he had documented many different passerine songbirds that rely on acorns and things that you wouldn't think of like

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Goldfinches, house finches, Carolina wrens, and titmice. Our acorns are also supporting lots of mammalian diversity as well like our squirrels and our mice that we know have these boom and bust cycles that occur in accordance with acorn masting.

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And then our bear and our deer, and other herbivores that are relying on these acorns in order to make it through the winter, so just a vast variety of mammalian diversity relies on that food source.

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In addition to the acorns and the leaves and the

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pollen there's many species that rely on oak leaf litter. Oaks produce tremendous volumes of leaf litter that stick around on the forest floor for a long period of time.

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And this is a really important resource again for our own intact leaf litter for overwintering habitat, like our Luna moths that make their cocoons in that leaf litter, as well as our, our queen bumblebees that we need to initiate colonies

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the next year, they all bury into the leaf litter under oak trees in order to complete the overwintering period.

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We also have some interesting butterfly species like the red banded Hairstreak that we know feeds only on dead oak leaves. So it's not just that they need the oak leaves they need them in a certain life stage as well they only use them when they're dead.

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And so without the oak trees we wouldn't have this fantastic hairstreak butterfly as well.

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Oak trees are also called everciduous trees which is a very fancy term which means that the leaves are staying on well pass senescence. And so by oak trees retaining these leaves on their trees, not only does it deter herbivory so that the tree can



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more resilient, but it also provides really important overwintering habitat and shelter from cold and weather for insects, as well as for some species but then winter here in New England like the golden crowned Kinglet.

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And actually when we, when we look at the diets of golden crowned Kinglets which forage primarily in these dead leaves, we see that more than 90% of their diet are insects, even in the dead of winter.

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And of course leaf litter provides tremendous important habitat to support our beneficial predators like our Carabid beetles that are keeping populations of pests insects down and provide important foraging substrates for our birds and again, despite you

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know it being cold and snowy up here in New England, many of our bird species are relying on insects, even in the overwintering period.

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And so, oak trees are supporting tremendous moths, butterflies, and birds and bees and beetles and mammals and so much more. But on top of all of this biodiversity value, they're also, they also have been supporting us for millennia by providing timber

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and fuel.

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They have incredible mutualisms with edible fungi like hen of the woods. They also store more carbon than any other woody plant group across the world more than 2.98 billion metric tons of carbon, and they provide superior shade for cooling us

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during the hot summer months, prevent soil erosion, and also absorb massive amounts of air pollution so these trees are just doing so much with everyone that's planted.

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And so, I would argue that oaks are really just a super tree, because when we want to find synergies between climate adaptation biodiversity conservation and our personal health and well being

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You can't go wrong with having oak trees on your property.

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And so a lot of my research, you know, these are more descriptive ways of saying why oak trees are important, but a lot of my work has in recent years has started to quantify

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To what extent are important, both in New England but also beyond and across the United States.

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And for most of this work, I focused primarily on looking at this tri-trophic relationship between oak trees, and, and other trees in our ecosystems, insects and arthropods like our caterpillars and our spiders and our insect eating birds, as well.

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So before I shared with you that oak trees are supporting at least 511 different Caterpillar species in Massachusetts. But the important thing to keep in mind is that that amount of Caterpillar diversity is really uncommon on trees, and when we look

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at entire native tree communities, they can vary quite a lot in the amount of Caterpillar diversity that they support. So, in contrast tulip trees in Massachusetts are only supporting about 10 species and actually they only support 10 or less Caterpillar

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species, no matter where you go in the tulip tree distribution.

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And so, my colleagues and I were really interested in trying to quantify the species interactions between oaks and the other plants in in different communities across the United States.

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And so I had this really kind of fortunate opportunity to work with Doug Tallamy who was my PhD advisor, and my colleague Kimberley Shropshire who put tons and tons of work into amassing a gigantic database of plant Caterpillar interactions across the

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United States, looking at more than 24,000 different interactions from more than 3600 historical host plant publications so these are entomological literature where people have recorded plants that they found different Caterpillar species on.

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And then from more than 2000 different plant genera.

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And so what we found is that when we look across the United States and it doesn't matter whether you're in Massachusetts or Texas, or Ohio, or Washington State,

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We see that the distributions of species interactions are consistently skewed where most of the tree community and the plant community is

supporting very little of that Caterpillar diversity, and there's just a handful of plant genera that are supporting

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the lion's share of that Caterpillar diversity, and I should also mention that most of the all of this work is at the genera level for trees and that's because that's the level that we have information on, having that nuanced species level interaction

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data for caterpillars is just not available at the scale at the continental scale that we were trying to make with this research.

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And so it turns out that when you look across the United States just 14% of our plants are supporting more than 90% of the caterpillar species that are out there.

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But when we looked at the, the identities of the plants that were supporting most of the caterpillar diversity we were seeing the same trees come out again and again and in this case for both Arizona and Michigan oaks are consistently on top.

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And so when we look at the average amount of Caterpillar diversity that oak trees support we see that they're above and beyond, more beneficial than any other tree that we studied supporting on average more than 20% of the caterpillar diversity.

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And so going from that we wanted to try to quantify the effects of having oak trees in a landscape or alternatively, what would happen if we took oak trees out of a habitat, how would that affect the species interactions with caterpillars.

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And so we use these methods to basically simulate if we took oak trees out how many species would lose an interaction, how many species would you lose entirely and how would that affect stability of these food webs as well.

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And we used all of these different metrics in a way to just score different plants in terms of their contribution to food webs.

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And what we found out is that across the United States there were about 20 different of woody plants that supported above average scores of contributions to plant Caterpillar diversity, and of those 20, only about 10 were considered outliers, and oaks

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we're above and beyond had the highest score across the entire continental US.

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And so because of this disproportionately high score we call these plants keystone species, which is another way of saying that these trees are a key component of supporting the rest of the food web in a way that if we took out oak trees that we would

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lose all of those interactions and the foundation of the food web

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for other species.

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Of course all of this data was based on host plant literature records, I'm not actually going out in the field and sampling caterpillars and so we wanted to make sure that the scores that we derived from that data science are also reflective of what we

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would find if we did field sampling. So we compared Pennsylvania hedgerow scores of caterpillars that we found on about 20 different types of trees with scores that we derived from this host plant literature.

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And what we found so here this dashed line is a one to one relationship if they were perfectly aligned, and our scores were extremely correlated with one another and primarily this is due to most of the tree species, not supporting very much Caterpillar

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Diversity, abundance, or biomass at all. And our, and our Quercus, our oaks, up here on the top really driving that relationship because they have high scores both from the literature and from in the field, they're always supporting, most of the caterpillar

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diversity and abundance.

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At this point in the talk you might be like, oh wow you're talking a lot about caterpillars but I actually don't want caterpillars on my tree. And so this is where I'm going to talk about, you know, some of the other benefits of oak trees so in addition

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to supporting a lot of Caterpillar diversity. I also had this wonderful undergrad who looked at survival of caterpillars as well. And so what he found is that no matter what season that you're in spring summer or fall caterpillars that are found on

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oak trees are suffering, the highest mortality, so they have the most predators that are on these trees that are helping to keep those Caterpillar populations down so that they don't overwhelm that tree and cause any negative effects and that is what

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we want, we want to have food webs that are both diverse, but also stable.

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And so what was the primary predator that was feeding on these clay Caterpillar models that Garrison put out. They were primarily birds, because for birds Caterpillars are incredibly important food resource.

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And we see again and again in the literatures that birds tend to prefer caterpillars over other food resources, in part because they have really high protein, which is important for growing bones and feathers.

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They have really high calories which is important for efficiency, a little power packet of food, and they have really high carotenoids which is important for immune function.

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And so we see that birds are always kind of keying into the places where they can find lots of Caterpillar food resources and birds are not the only ones that rely on caterpillars in fact caterpillars are the key component that bridges the plant community

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to the rest of the terrestrial food web. Feeding things like beetles, chipmunks, spiders, frogs, salamanders, lots of things rely on caterpillars.

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And so if trees vary in the amount of caterpillars that they support, we wanted to test whether birds could actually recognize that that was an important food resource for them in they're foraging while they're feeding their young.

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And so I did a study that was published in 2017, focusing on the Carolina chickadee, which is the cousin to your black-capped chickadee up here, and

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we used again these literature to identify the number of Caterpillar species that are found on each plant to see how well that birds prefer them.

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And what we found was this beautiful linear relationship in native plants, where the more Caterpillar species that a bird supports the more

that these chickadees are preferring them relative to other trees in the landscape.

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And again, our oak trees which in the Mid Atlantic are supporting about 532 Caterpillar species were above and beyond the most preferred tree that these birds forged in to feed their young, constituting more than 28% of the observations throughout the,

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The two years of this study.

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And so while we were following these chickadees around to see where they're foraging we were also seeing a tremendous diversity of other birds that were in the process of their spring migration.

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So these were birds that didn't necessarily breed in the areas that we were studying, but they were making their way from the Amazonian rain forests, up to the boreal forests of Canada, and they have to find important food resources

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along the way. This is a really important component of New England for us of supporting all of these migratory birds making their way to the basket of boreal forests.

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And so while we were studying these oak trees and following these chickadees around, we ended up documenting more than 50 different species of migratory bird and over 20 different species of warbler.

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And again, I didn't mention this, but this isian urban areas in Washington DC, where I where I studied these chickadees. And so it was really kind of eye opening to see all of this tremendous species of conservation concern that were using these trees,

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and the majority of observations that we had of these migratory birds were happening in these large mature oaks.

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All of all of the migratory bird diversity as well.

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And so during that study I was focused on chickadees so I didn't quantify the amount of observations of migratory birds, but fortunately one of my colleagues, Eric Wood has done this in the forests of Wisconsin.

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And so he looked at eight migratory insectivorous birds including warblers, vireos and gnat catchers. And here he found that compared to

relative availability, that oak trees both red oak and white oak were strongly preferred relative than any

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other deciduous woody tree that was in their forest communities. So it was very clear from Eric's study that these particular trees were doing the lion's share of supporting, most of the foraging and diet resources for these insectivorous birds during migration.

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And there's been lots of other studies in New England and beyond that has also looked at breeding birds that find that are our insect eating birds are preferring these oak trees for foraging they also prefer areas with high dominance of oak trees for for

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breeding and having their territories. So they're really just an incredibly important resource for supporting the insect community, which then supports

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this insect eating bird.

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Some of my current research it is headed is that we know that these trees are supporting lots of caterpillars and other insects, we know that birds like to prefer to forage on these oak trees, but since oaks are declining throughout New England, especially

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in our urban and other human dominated area, we want to know whether taking out the oak dominance of those forest communities is influencing the diversity, nutrition, and condition of these insectivorous birds, especially when during migration.

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So in Springfield Massachusetts I'm currently catching birds in areas that vary in Oak dominance so that we can look at both diet and plasma metabolites as a measure of condition.

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And then, the, the other kind of aspect of my work that I'm currently focusing on is then taking what we learn at a local scale and expanding that to a landscape scale.

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And so we've been using basal area tree predictions from Forest Service data, linking that with Caterpillar data that's spatially explicit so that we can look at how food is distributed across the landscape.

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And so this is kind of this is a kind of a new way of looking at how and how food is distributed for birds, so that we can then link that to bird

community data to, to see whether we can identify hotspots for conserving insectivorous birds throughout

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the region.

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So that's all I have for you I know I'm running a little bit on time but my take home message for you today is that oaks support a vast array of fantastic wildlife oaks again are our keystone species for supporting both insect food webs as well as bird

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food webs. And we have more work to do to look at that. And finally, that oak management can create synergies between biodiversity conservation, climate adaptation and human well being.

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And so I encourage you from this talk to consider oaks the Tree of Life, possibly the most important broad leaf tree in the country. And that and to think about what your part can be in future conservation through the way that you manage your tree communities.

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And with that, I'll take any questions that you have. And thank you so much for your time today.

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Wonderful. thank you, Desiree. That was great.

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So we do have a few questions that have come up in the chat. A few of them I think might be addressed by our next speaker so if not we will come back to them but one question here.

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Whoops, I just lost it.

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Okay, I, I have noticed oakshot increase a lot on the oak leaves found in the hilltowns. Can you speak about that at all.

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I'm sorry. Can you repeat that.

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The questioner asks I have noticed oak, shot, shot. Yes. Oh, that's a New England turn.

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Can you can you describe what you mean by that.

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Let's see. They responded.



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Levi if you want to add some more detail about that.

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If you're speaking about herbivory, oh little holes okay I thought so, yeah, I wondering if that was like a New England term.

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Yeah, so, um, herbivory

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So when you see holes in in leaves, it can come from a lot of different resource sources, it can be chewing from caterpillars. It can be even bees will take leaves to go and ants will take holes that of leaves to go make their nest.

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Most of it is, and of course there's herbivory from mammals as well. And so you know I would encourage you to think about oak shot as not a bad thing, right, if we have trees that are completely defoliated like in LDD moth, *Lymantria*,

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that's a bad thing that's not good for oak trees, but a little bit of herbivory is okay and what we want to do is have insect populations on those trees and have bird populations that will help keep that insect population down to a reasonable level

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on in our Hilltowns, we have more moth diversity than I've ever experienced in my life. And so that's a good thing though, like that's a really good thing or oaks are doing great.

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When our invasive species aren't out of control. And so it could be just a tremendous diversity that we have in our rural areas and that's something to be celebrated.

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Great.

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So there's one other question here that maybe you can touch on I think Logan may address this too but the question is what particular invasives, plants or insects, etc.

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are putting oaks at risk in our region.

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Yeah, so I mean the big one is LDD moth, *Lymantria dispar*, which is a species of invasive caterpillar.

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that can completely defoliate oak trees.

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They can be kept down by a fungus but but when they do get out of control, they can, they can cause some tremendous effects on the nutrition of our oak trees as well.

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There's also an invasive

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oak disease that, that, that can cause tremendous effects and I'm not an expert on pests and pathogens. I do know that there are invasive insects that are found on oak trees that aren't doing very much at all, they're there they're pretty benign.

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And when we actually sample the insects that are on oak trees on healthy oak trees, the majority of insects that we find on them, are native beneficial species.

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So, in absence of your oak experiencing tremendous health

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effects from an overwhelming number of insects, invasive insects, your trees are perfectly fine in most cases.

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You do have to two questions that are asking how you feel about the recent oak cutting in Wendell State Forest I don't know if you're familiar with that specific harvest and as you can speak about that at all.

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So I can't speak specifically about that because I don't know the context of how the oaks are being management, managed at Wendell, I don't live too far from it but I know that's been a concern in the community.

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The thing about oak trees is that a lot of them especially white oaks depend on, they're very shade intolerant, and in previous eco you know in historical ecosystems oaks were able to get huge so that they eventually died, and had a huge canopy gaps

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and huge amounts of sunlight that then allow the next generation of oaks to come up and unfortunately with the way that we manage forest habitat, how young our forests are in New England,

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we just don't have that level of disturbance anymore. And so, although I'm not going to speak specifically about Wendell I will say that what we

need to do is have not just you know more oak trees, we need to have a diversity of structure in those forests

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as well which includes both mature trees, but also space for the next generation to come up as well because that will create for us that are more resilient in the future.

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Great. And I think we'll just take one more question here before we turn over to our next speaker.

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But Lori is asking, we are planning to plant red and white oak and Rowe Massachusetts. White oak is a more Southern tree in New England is Rowe too far north for them to reliably survive, you have any thoughts on that.

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Oh gosh, this is my caveat where I say that I'm only a recent transplant to New England so I don't know where that is.

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I will say that, you know, white oaks, which are more shade intolerant,

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You know when we look among different oak species, you know, especially as an entomologist white oaks are always on top, they're always supporting just amazing bird diversity and insect diversity, and when we look at the number of birds that are foraging

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on white oaks, the amount of insects that we find on on white oaks, they, they are on top.

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You know, whether it's going to be fit in your particular situation and your ecosystem would be something to talk to a local manager or an arborist about because in addition to your latitude, you might be like close to a city or, you know, in an area

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with poor soil so in order to figure out what oak is best fit for you. It'd be best to talk to somebody more specific about your conditions. And the last thing that I want to touch on is that the Forest Service is very interested in how a future How can

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we have oak management into a future climate. And so this includes not just, you know, do we have to think about southerly species and how oaks are going to increase in in latitude in the coming century we know that oaks are

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I don't want to use the word invading but colonizing ecosystems that they haven't before like in the forests of Hubbard Brook.

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But we also have a wide variety of different oak genotypes from different areas and so some of the folks that are thinking very heavily about climate adaptation are thinking about, oak plantings into the future for what New England will be like now but also

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what it will be like in 100 years and so hopefully we can add some biodiversity perspectives from that work as well.

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Great. Well go for white oaks because they're great.

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Wonderful, thank you Desiree so much that was wonderful. Thank you.

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And we're going to turn now to our next speaker to be sure we have enough time, so Logan if you want to be loading up your slides and I will introduce you. We're welcoming today Logan Johnson who is Northeast Region coordinator for the Forest Stewards Guild,

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who will be discussing a new oak resiliency assessment tool for southern New England for us and he's hopefully going to address some of the questions that have come up too, through his presentation.

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Logan is excited to work with people interested in helping others discover the forest as a sustainable natural resource that communities depend on. Raised in rural Washington County Maine, Logan earned a Bachelor of Science in Biology and a Master of Forestry

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degree from the University of Maine. His experience includes an 11 month AmeriCorps service term as a land stewardship coordinator for Buzzards Bay coalition in New Bedford, Massachusetts.

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His work with the Guild focuses on woodland owner outreach, forest climate change resiliency, and fire science.

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And just a reminder, you can type your questions into the chat for Logan as well, and take it away Logan.

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Thank you Lisa and thanks to everyone at New England forestry foundation and the Mohawk trail woodland partnership for inviting me to speak today and I also before I get started wanting to say I appreciate Desiree's acknowledgement of indigenous peoples

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and their ongoing relationship with oak in our forests.

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So today I'll be talking about this.

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Increasing oak resiliency partnership in southern New England. First I'll orient you to the Forest stewards guild the who we are and what we do and then primarily will discuss why we're focusing on increasing oak resiliency and what we are doing to move

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the needle to promote oak across the landscape.

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So the forest stewards guild is a national nonprofit organization that focuses on making ecologically, economically and socially responsible forestry the professional standard.

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Our mission is to practice and promote forestry that maintains the integrity of forest ecosystems and the human communities dependent upon them, and we achieve this mission through a combination of research, policy analysis, training, education, to some

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degree advocacy in boots on the ground action in the northeast that boots on the ground action comes in the form of collaborations, like this increasing oak resiliency in southern New England project.

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We're somewhat unique in the environmental nonprofit sector, as we have both a professional membership where we have over 700 members nationally who conform to a set of six guiding principles, and these are made up mostly a natural resource professionals

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and foresters, but we also have affiliate members as landowners and student members, and as a guild member one of the one that makes the commitment to take on a series of guiding stewardship principles as I mentioned in their approach to forest management

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and the most important principle is what we call the first duty principle which states it is our first duty as a forest or landowner is to the forest in its future.

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And so we are a national program or northeast office is located in Portland, Maine where I'm calling in from but we also have offices in Asheville, North Carolina,

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Minnesota and Wisconsin, Oregon, and Santa Fe, New Mexico is where we are headquartered.

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Some of our northeast programs include woodland owner outreach which includes this oak resiliency project will discuss today. We also do a lot of work with the woman owning woodlands and network nationally, forestry for the birds programs in Maine specifically,

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and beyond.

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We focused on creating climate change community of practices we do a lot of work with the North Atlantic fire science exchange to talk about wildfires and prescribed fires in northeastern forests in responding to emerald ash borer and other invasive insects

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as they come through our region.

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So why oh why are we focusing on oak today. And just to frame the conversation I want to define what is resilience and resilience is actions that focus on increasing the capacity of the ecosystem to cope with climate change and other stressors,

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while maintaining its fundamental characteristic. So keeping oak forest as oak forest for the long term.

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So why oak? 70% of forest of southern New England are dominated by oaks, this forest type faces pressures that compromise its long term health and ability to regenerate. Current threats include heavy deer herbivory and defoliation from *Lymantria dispar*

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and I'll say this term once, *Lymantria dispar* is formerly known as Gypsy moth. The etymological Society of America has retired this term because of its derogatory phrase for the Romani people of Eastern Europe until, they are working

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on finding a new common name but for the duration of this presentation I'll refer to the moth as *Lymantria dispar*.

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Well trends of seasonal drought and climate change pressures compound other disturbance factors. widespread canopy mortality impacts wildlife species that depend on oaks for food and habitat causes safety hazards in residential neighborhoods,

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or on roadsides and can deal a significant financial blow to private landowners who are relying on oak for income. Amid these contemporary threats, silviculture prescriptions that once worked may now fail to secure healthy oak regeneration and new

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approaches are needed, and what I mean by that is we need to secure the next generation of oak as well as focus on maintaining the oak on the landscape today.

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Compounding these issues that 70% of the forests are dominated by oaks, most of the regions for us, 70% consists of primarily small parcels owned by family forest owners and individuals.

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Thus the landscape skills shift depends on effective landowner outreach and education, if landowners primary goals may include timber management, recreation, wildlife habitat, legacy, carbon or a combination of these outcomes, and we need to focus on balancing

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these objectives over the long term. And given the ecological importance of oak species in the regions for us, all land management approaches stand to gain by integrating measures to promote the long term resiliency of this forest type.

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And I'm just going to paraphrase a quote from one of our partners on this project Tom Worldly of the University of Connecticut cooperative extension program, Tom says, If you manage for oak, you'll get oak in the maple and birch and beech in the forest,

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but if you don't manage for oak you'll only get the maple, birch, and beech in the forest and so we really need to be creating space for oak. In our forest. I'm looking at these pictures that are here on the left is a tree that's being defoliated by *Lymantria dispar*,

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in the center is sprout stumps being defol..

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being browse by deer, and on the right is just a stand that has been impacted severely by *Lymantria dispar* but looking at the system as a whole, we want the young trees we want the older trees, and we want the landscape as a whole to be resilient to

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these stresses.

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So our project goals. With support from the United States Department of Agriculture for service landscape scale restoration program, we are working with state agencies and nonprofit partners in Rhode Island, Connecticut and Massachusetts to increase

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resiliency in southern New England Oak Forest.

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Through this collaborative initiative, including a regional professional learning exchange, landowners stewardship summits, and hands on resiliency assessment tools,

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we aim to increase Forest Stewardship activities that support oak resiliency across the landscape, empower natural resource professionals with tools for assessing oak forest health, build landowner awareness of regeneration challenges and solutions, and foster

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communication between state and agencies about strategies for addressing oak forest resiliency and regeneration challenges. And so some of our partners are listed here: the Massachusetts Department of Conservation recreation, My MassConn Woods,

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Massachusetts division of Fish and Wildlife also known as Mass wildlife, as we focus on Massachusetts today, but in Connecticut the Connecticut Department of Environmental energy and and Environmental Protection, Connecticut Forest and

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parks Association, UConn College of Agriculture health and Natural Resources extension in the Connecticut agriculture experimental station. And then in Rhode Island Providence Water, the Rhode Island Department of Environmental Management, Rhode Island Woodlands

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Partnership, and Sweet Birch Consulting.

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So, what are the activities that we're doing to increase this oak resiliency across the landscape. So far I've outlined who the Forest Steward Guild is, why we are focusing on oak, in our project goals.

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So for the rest of my time I'll be focusing on these activities, which include workshops for professionals, educational events for landowners, this oak resiliency assessment tool that is primarily for professionals but somebody who is really engaged as a

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landowner would probably be able to benefit from using the tool as well, and then our overall regional oak forest resiliency synthesis.



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So, workshops for professionals. These are designed for natural resource professionals, including foresters and wildlife biologists to discuss methods and strategies for regenerating oak.

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We've collaborated to deliver workshops and field tours to members of the Yankee division of the Society of American foresters. Society of American foresters or SAF is the largest professional membership Association for foresters and other natural resource professionals,

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the Yankee division is comprised of SAF members from Massachusetts, Connecticut and Rhode Island, we've held many workshops with them and have plans to do more in the future.

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These also include demonstration areas and field tours, pictured above is Christopher Riley of sweet birch consulting, LLC, who's a key contractor on this project with the guild at Norcross wildlife sanctuary owned property in Wales Massachusetts,

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known as Well Back Ridge. And in this photo you can see Christopher standing among a sea of oak regeneration which is exactly what we want to see as foresters as we prepare for the next generation of oak trees in our forest.

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Another example of these workshops for professionals was a Quabbin reservoir webinar and field tour, and this was testing a new type of hybrid event where we had a webinar and field tour combo, where we hosted a two part series on oak forest at the Quabbin

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with Massachusetts Department of Conservation and Recreation division of water supply and protection, and researchers from Harvard forest and the UMass Amherst, and the webinar was open to anyone who could attend, with no cap on participants because

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we could do it safely from our own homes, but our field tour was limited to about 20 folks to really come together and talk about the the challenges that they have with managing oak on the landscape and some of the opportunities that we have as well.

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From Quabbin's perspective, the primary goal is to manage for the watershed and so we want to be sure that the forest is there to help provide that quality of water that all the residents who rely on that water source are getting what they need.

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So next I'll talk about educational events for landowners, and initially landowner gatherings were supposed to take the form of stewardship summits, like what you see on this screen today.

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However, due to events that took place in March 2020 we had to pivot and develop some new strategies for engaging these landowners. And so we've created some creative events for those including a communicating with landowners about resiliency webinar,

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forest management from a landowner's perspective which was really interesting take

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hearing a landowner talk about forest management and how they interact with their forester in the process, and I think it's a really great webinar to go back and watch to really for a forester to watch it,

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figure out how they might want to talk to their clients and for a landowner figure out how they want to talk with the forester that they want to hire to work with them on their property.

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We also did a landowner Town Hall and follow up question in a web sessions, and then an open mini series for forest landowners.

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The mini series had episodes focused on wildlife, which featured Brian Hawthorne of mass wildlife, forestry and the planning processes around it with Fern Graves at the Rhode Island Department of Environmental Management, and climate change, which featured

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Andrea Urbano of the Connecticut Department of Energy and Environmental Protection.

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So I'm going to stop here for the oak forest resiliency assessment workshops and the assessment tool that we've been working on. So working with the forest ecosystem wandering cooperative at the University of Vermont in the northern Institute of Applied climate

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science we've developed an oak resiliency assessment tool. And this tool allows users to consider how resilient oak dominated forest on a property are to climate change and various stressors.

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Users rate the degree to which certainly impacts affect the forest and the adaptive capacity of the forest to respond to the impacts. And based on the impacts in adaptive capacity ratings the tool generates a report with an overall vulnerability score of

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low, medium or high. Additionally, the report includes detailed descriptions of issues of concern in the forest and resistance, resilience and transition pathways, which I won't spend too much time on, but just focusing on that resilience piece, what can

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what actions can we take to promote resiliency of oak forest into the future.

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And so to get the tool in users hands and train them how to use it, we are hosting a series of workshops geared for both foresters and landowners. We've held one official workshop to date with informal trainings interspersed in those, and we're planning

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more workshops for 2022. But just to focus on the tool a little bit, thinking about the impacts in adaptive capacity and how they generate a report that ends in an overall vulnerability score.

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So on the impact side the big questions; are the potential impacts likely to support or disrupt the health and function of the system. And these impacts include increases in extreme precipitation events, increases in storm frequency and intensity, elevated

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drought risk, elevated risk of wildfire, invasive plants, insects and forest pathogens, deer herbivory, reduced habitat for Northern tree species, higher sea levels, and damage to forests roads and trails, as well as an overall rating, so that explains

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all of the different impacts that we're trying to think about as we're managing you know forest.

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And then on the adaptive capacity side, the big question is how resilient is the system to potential impacts. The things that improve adaptive capacity include the forest condition, and given the past land use, level of landscape connectivity--is it a big

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forest block or is it a fragment forced block with a bunch of buildings around it?

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Overall tree health, species and structural diversity, ability to compete with more shade tolerant species like maple, birch and beech, ability to compete with invasive plants, the abundance of species adapted to current and expected future conditions, oak regeneration

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Potential, and stewardship planning and implementation capacity, as well as an overall rating. So for all those impacts and adaptive capacities, there is a sliding scale on a one to five to rate, how big of a deal the impact is or how big of a deal that

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adaptive capacity is, and they funnel into the tool to generate an overall vulnerability.

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And this is what the tool generates. So, overall site vulnerability for this test run that we had was moderate, And you can see the the scale over here on the right.

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So you have very supportive on impacts, or very disruptive on impact so a very disruptive it means you're going to have more of a higher vulnerability, whereas if you're less disruptive, you'll be on the lower side of vulnerability and same be said for

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adaptive capacity, either a low adaptive capacity means that you're going to have some issues to deal with it or with a high adaptive capacity, you're you're in good shape and so where we want to where we want to be is in that very supportive of potential

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impacts and high adaptive capacity if you're in that range that's a great place to be. But if you're in any of these other moderate to high vulnerability phrases areas of this graph, you might want to think about taking action.

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And I just wanted to stop to recognize the tool development partners including the Forest Stewards Guild, Northern Institute of Applied Climate Science, and the Forest Ecosystem Monitoring Cooperative.

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In fact, on Thursday this week and we're going to be giving a brief talk at the forest ecosystem monitoring cooperative its annual conference with a colleague of from the northern Institute of Applied climate science to share this with their community.

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Lastly I want to talk about our regional oak forest resilience synthesis activities for the oak resiliency project is ongoing and in 2022, as we look back at the entire three year project, we will compile key findings to help continue the momentum

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developed from this project.

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But one place that you can look for all the resources developed during this project and additional ones that provide value are on the Forest Stewards Guild the web page for oak resiliency and on this webpage you can find our oak resiliency toolkit, where

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you'll find outreach materials designed for forest landowners, communication resources for foresters, silviculture field tools for foresters, wildlife resources, and research for understanding how oaks grow and how we can manage them.

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So how can you get involved, whether you're a landowner, forester, or other natural resource professional or interested public you can get involved with this project.

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A great place to start is by visiting our oak resiliency web page as I discussed on the previous slide, and explore the resources in the tool kit and I'll share some of the key ones at the end of my presentation.

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If you're a forest landowner you can get in touch with your local service forester, that's a great place to start.

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As is their job to help answer the questions that you have about your, your forest.

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You can also join an oak resiliency assessment tool workshop and use the tool to help us collect data on oak resiliency throughout the region so we get a full southern New England, look at how resilient, or how vulnerable oak is across the southern New England

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landscape.

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And lastly, keep a lookout for resiliency focused events. When we schedule an event we advertise through many of our partner channels throughout southern New England and I'll be sure to share upcoming opportunities with NEFF and the Mohawk Trail Woodlands Partnership

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to be sure that everybody on this call, can, can get involved.

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That is all I had to present on, I am happy to answer questions at this point.

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So thank you very much.

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Great, thank you. Logan.

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Wonderful.

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Wonderful. I'm whoops, I'm going to go back to a couple of questions that were expressed earlier that I think might be in your court. Let's see here and I just lost it.

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We have thunder going on here in the background in December, so hopefully we all stay connected for a few more minutes.

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Okay, there's oak shot.

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Well, perhaps you could. Oh sorry, Lisa. Did you find it. Yes. Okay. So okay, from Dave: Do you and your colleagues have a vision of the ideal balance of oaks to other species and forests.

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Then it says, since of course the other native species do also matter. And then also mentions deer browse which of course is a big issue I think but could you address the balance perhaps if that's something that the group has looked at.

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Yeah, that's a great question and I appreciate it and I want to go back to that paraphrase quote from Tom Worldly of UConn: if you manage for oak, you'll get Oak and Maple, birch and beech and all those other species that matter.

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But if you don't manage for oak, you're at risk of losing oak from the landscape because of all the stressors on it and so if we really focusing on managing oak

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Then we have the ability to manage for all those species that that do matter it's about a whole forest ecosystem rather than just the tree species, a lot of the time, but that tree species is really important to keep on the landscape and we need to need

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to take action to make sure that it's there in the long term.

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Great. And now, was there any particular emphasis on deer browse as part of the assessment tool. Yes, so deer browse's impact and ability to withstand deer browse is one of the adaptive capacity so we were thinking about deer browse pretty significantly

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but I have also heard other browse is also an issue from moose and turkey and the like. And so, in those workshops for professionals, we really talk a lot about deer browse and what we can do on a smaller scale things like tree tubes when planting

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might be effective at keeping the deer from munching on the nubs or the buds.

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In other instances fencing is a really expensive option but it keeps deer out to allow that regeneration to get to a point where you can take the fence down and allow it to grow naturally.

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And then one. One thing that's being tested throughout the region, including in New York and Cornell University is really leading the charge on this is slash walls which is if the timber harvest is to occur use the residuals, that, that are left on site

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to create a wall to keep deer out to allow that allow those seedlings and saplings to really get established, and then over time the wall will decompose, and then the wildlife will be able to gain access to that space again.

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Great. And I did have a question from a landowner that came in is from registration mentioning, and this relates to what you commented on a bit but one problem I have noticed is that oak seem to be preferred food for beavers and moose.

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When moose and beaver populations increase as they are now I predict that oaks will become more and more difficult to find. I've seen beaver go right past nice alternative hardwoods so they can get to an oak which they seem to favor.

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And what moose do to young oaks is frightening so just one observation there I don't know if you can comment on that at all. But yeah, I think my answer is going to be similar to what it just was, but it's an issue.

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Well, wildlife need the food as a resource but we need to make sure that that resource is able to grow up and be as an established oak tree so it's providing mast, the acorns have provided great food source to.

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So it's a great food source, we want to be sure it's on the landscape in the long run, but we recognize that that there's this delicate balance

between wildlife impacts on oak and what can we do to make sure that we establish oak for the future, now.

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It well that going back just a step, they're going to munch on the oak.

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It's inevitable.

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But if we can protect some of those seedlings and get them up into the, into the canopy. Then we're going to have better success in the future.

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Great.

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Okay. And if Desiree is still on I don't know this was another question which I'm not sure you both can address but somebody had a question about, you know mentioning the importance of oak leaf litter, any info yet on the possible effects of jumping worms

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on the forest. If and when they spread across the state, do we really know for certain that they are as bad as some people say, and I don't know if you either of you can address that question or not, but I'm happy to let Desiree address the question,

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and if she doesn't have a response I can, I can do my darndest Ah, yeah I don't know if my is my answer will be satisfactory I mean, in addition to jumping worms, most of you know, most of the earthworms that are out there,

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The majority of them are invasive and they are a big problem for leaf litter. I work in a, in a forest that in Springfield that if you move like a, like a half a meter of leaf litter, you can pick up like you know 25 earthworms and actually none of them

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are jumping worms they're all the

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European Night crawler I forget I forget the scientific name for it.

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But part of that is because we don't have that balance in the ecosystem right, so we we want to have a more robust native insect community that can keep those earthworms down, we want to like reduce the introductions of those Earth earthworms into the ecosystem,

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and we need to have trees that are going to be able to support that are going to provide this huge volume of leaf litter as well, so again I mean we have so many things happening there's, there's so much stuff but the more intact habitat that you have,

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the less likely that those earthworms are going to overwhelm. It's when we have these tiny small forest fragments, and we extirpate the native insects and birds species to help keep those populations down that's when that's when they get out of control,

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Really, so that will probably one of the best things that you can do is expand the amount of natural forest that you have and connected as best as possible.

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Great, thank you.

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And here is just a comment from Dave: last weekend we discovered our first woodland white oak tree and Heath, that we had seen in 27 years of spending time in that town.

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We're very excited to say the least.

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And then there was a comment from John.

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And this is like a forestry related comment it looks like: the shift in tree species composition from, from Oak to maples primarily red maple that Desiree spoke of results in large part selective or high grade cutting that does not open adequate canopy

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gaps to regenerate shade intolerant oaks. And I'm not sure if either of you wants to address that but that's a comment. Oh, yeah, so I'm so glad that you provide that clarification on on the point that I made because that's exactly the point that I wanted

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to make is that the tree communities that we have now are novel, like regardless of whether you're in the inner city, a small Hilltown or way out in the middle of intact forest, they're completely novel and that's all due to our decisions that we made or

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the decisions that our ancestors made hundreds 100 years ago. And so, so really it just goes to show the importance of you, you know, carefully thinking about how you're going to manage your land, going into the future.

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Because you can you know if you want oak habitat because you feel that it's important you can make those choices to you know conserve it and promote it in the future.

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Great. We have a couple go ahead question. Yeah. Um, John asks: somehow the oak forest the Massachusetts and elsewhere managed themselves fine before the pilgrims arrived.

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Why do they need our management now?

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I'm best to answer that question. Um, so, yes, the forest we're in good shape. Before colonizers arrived in North America but what is important to recognize is there were indigenous peoples in these landscapes stewarding the forest and while it might have

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been a different type of stewardship, it was happening and so they were on the landscape burning, things were happening and just because there wasn't this intense timber management that happened after the fact, doesn't mean that they weren't managed before,

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and they're just made this differently. And then as we look to the future,

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These forests are really new.

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We really cleared the forest over time. And so this is a next generation of forest that has grown up, and that they need to be stewarded in a way for for us to promote those resiliencies, because our land use history has been so poor we need to really rehabilitate

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these forests to make them, make them more resilient for the future because if you have an overstocked area then, then you're just stagnating the forest and they're not going to grow and they're not going to capture as much carbon as you want them to

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and so you need to go in and remove some to enhance the growth of the forest over time.

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Okay, that was a great answer.

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Just wanted to say that. Yeah, and just reiterate like this is just a completely novel ecosystem, than the one that was experienced pre

colonization, like we have different soil chemistries, we have different temperatures like in addition to climate change

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If you look at just land use change and landscape-level development, it, it puts so much different conditions for these forests to have to deal with that you know it's in our best interest to be stewards it's in our best interest to care for our environment

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environment in a way that supports us that supports ecosystems, wildlife. There's something good to be said about that, you know, we don't want to say we're going to control everything although in some cities that kind of has to happen but you know we

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want to get to a point of stability, but it's going to need a little bit of help to get there.

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Okay. Yeah, and we can we can probably talk about this question, the rest of the time and I'd be happy to you but I also want to be respectful of everyone else's questions.

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But just one thing I want to say is professionals like me have dedicated our lives to understanding this topic. And that, in most cases they're doing what they think is best for the forest in the future so I just want to throw a shout out to the people

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that are making this work happen and their, their desire to increase the resiliency of these forests.

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Great.

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And then somebody mentioned that on the jumping worm issue there is a workshop coming up in January apparently at UMass which I do have some information about not at the tip of my tongue but we can try to include that in the follow up resources that we

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send out. Apparently it's two whole days of research about jumping worms if folks want to dig in on that.

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That sounds very exciting.

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I can't wait.

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Okay, and I don't know, let's see. Are there other questions. Yeah, that might be best for Logan about specific oak management.

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He's talking about the Wendell, the aforementioned Wendell harvest. It sounds like you're saying that reproduction of oak is the challenge to having oak in the future.

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The goal of cutting in Wendell was to promote the growth of large vigorous oaks while creating openings that oaks can successfully reproducing. Do you agree with this approach?

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Without kind of knowing the forest management plan and the operation strategy there, that that sounds like it makes sense to me.

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Desiree brought up the term structure earlier and I think that that's really important. One of our project partners at the Norcross wildlife Sanctuary,

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They were they did an oak oak inventory, including the seedlings, so things below six feet tall, saplings things above six feet tall, but not quite in the canopy yet, and over story canopy which is everything over five inches in diameter, diameter.

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And so what they found was, they had a lot of seedlings. And they had a lot of over story oak, but they didn't have a lot of that sapling oak and so they're missing that layer of the forest and so by creating those openings, you're allowing light to reach

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the forest floor to generate more of those seedlings in hopes to get them up to that sapling stage, while maintaining the overstory oak canopy so you're really managing for two objectives there, you're managing for the current forest condition

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Now, and you're managing for the current of the future forest condition that you're looking for, which is a heavy oak dominated forest. And in those oak dominated forest,s you get all the other hardwoods that you're looking for Maple, birch and beech, but with

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oak losing ground you want to make sure oak has has that ground to to thrive.

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I'm going to share an anecdote that is not New England, but I think is relevant so I, So, prior to doing my graduate work I worked on a very

extensive forest experiment, managing for cerulean warbler which is a mature forest,

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you know, Oak associated warbler species more southerly than here, but we were, you know, it was really kind of incredible, so all the points that Logan's making about allowing sunlight to hit the floor so that oaks can regenerate are completely true

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and I can say, you know, from my experience some of these harvest so like things like shelterwood harvests where we leave mature trees behind to be the mother trees for the next generation.

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And then we create all of these smaller gaps for the sunlight to come in our are extremely productive, after a couple of years past that harvest, the trees just go bananas with growth.

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There's lots of vertical structured structural diversity and heterogeneity of habitat that allows for a lot of for insect populations to thrive for the birds that rely on those insect populations to go bananas and so species that we typically associate

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with interior forests will actually utilize those.

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Those cut areas, very heavily because there's lots of cover for shelter there's lots of food for reproduction. And so you know it's it's it can be, we need to have that kind of heterogeneity in the landscape as well in order to promote diverse wildlife,

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going into the future and so I like the way that Logan framed in, in like managing for the mother trees, and then also managing for the, for those next generations as well that can be an extremely valuable approach.

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And that kind of along those same lines with timeframe.

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Logan maybe you can speak to someone's concern that an acre of 100 year old unharvested trees absorbs many times the amount of carbon dioxide than an acre a five year olds.

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So perhaps you can speak a little bit to the timeframe of our woods and how that. what's going on with that.

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Yeah, thanks for that question. That's a great one I did drop in the chat window the science of carbon forestry webinar that the Forest stewards

guild hosted in April this year, featuring Bill Keaton at the University of Vermont whose an international

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expert on all the growth forest carbon, carbon sequestration and storage but just to back up to onto the on the topic a little bit there's, there's a difference between sequestration, the rate in which trees bring in carbon, and storage, the amount of carbon

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a tree is storing and so we need to separate those two points, and the research shows that sequestration, the rate in which carbon is captured is actually higher in younger trees.

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That's because they're trying to really bring in that carbon to put on growth.

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Once they're older, they're storing a lot more carbon. So those older oak trees are storing a lot of carbon but they've really kind of plateaued on terms of how much they can bring it at a time.

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And so just understanding that difference is really important, a younger forest is going to capture more carbon quickly, but an older forest is going to store carbon over the long term.

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The one really important aspect of this in terms of storing carbon is take the forest management examples we've been talking about where you remove some of the oak in favor of increasing the regeneration of oak and allowing the trees that remain

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to grow larger and capture more carbon, that oak is then transformed into a wood product that is also storing carbon. And so there's really, all of these intense dynamics going on around carbon forestry and a lot of things to balance out.

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Just to back up even further. I got into forestry because I was interesting the carbon world, and the more I learned the more I understand that we need to check off a lot of boxes in order to really make the forest, be its best at capturing and storing

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carbon for the long term. And so some of these strategies are getting at that.

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Great, there was one other point related to what you were talking about a minute ago but Don asked: should we prune other trees nearby to allow

oaks to have more space and, of course, this may be dependent on the site specifics but you can comment on

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that at all.

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So space for for oak trees.

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Pruning just definitionally. No, because pruning is removing the limbs. Thinning is the term that we use in forestry for creating space and so a crop tree is the tree that you're going to leave on site to continue to grow. In silviculture, which is the

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art and science of forestry,

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you want to create space and eventually sustainable get to a point where the canopy closes and all the branches are touching. And when all those branches are touching there's not a whole lot of room for the trees to continue to grow and so by thinning a few

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trees out you'll allow that one crop tree to grow larger. That's just one specific example in a lot of instances in forestry, which I haven't said yet is the answer is it depends and you should talk to your forester about what options are best for your

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land.

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And you know in in in heavily developed areas too there is something to be said about having trees growing and groves rather than singly because that can help them to be more stable in a soil system and be more resilient to a big weather system that comes

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in, versus a single tree that only has its own roots to keep it in the soil so yeah like like Logan said it depends, there's nuance, for your condition on how you might want to manage it.

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That's funny because Pat says: in my experience, oak tends to show much more decline when they compete with other oak, and they compete really well against other trees if they have a head start.

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So, there goes your idea of site specific conditions right, everything being so specific. No and and I guess, you know, what is the definition of decline for you so it is it, they're not growing fast enough, is it I mean, I would be surprised if they

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were dying because they're growing next to each other so maybe it's just that the timeframe that you're observing hasn't really reached the full potential of that of that small oak community.

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Great. Um, I think unless I'm missing anything and others can point out if I am but I think we might have covered most of the questions here so if anybody has any final things they want to ask in the chat.

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Or if Logan or Desiree have any other points they wanted to revisit.

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Well one point I wanted to revisit was oaks projections in a warming climate.

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So we work closely with the northern Institute of Applied climate science as I've mentioned and they're responsible for some pretty neat publications on winners and losers and projections for climate change and Oak is projected to do well in a warmer

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climate.

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However, you have all these other stressors that are in there too so it's really hard to figure out how successful something's going to be, If you don't know what the next test coming in, it's going to, going to be so we really want to make sure that

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it's secure. Regardless of future conditions.

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Yes, it might thrive but those other species and maple especially, it is taking up a lot of room and is really getting a stronghold in the region. And so other species have a chance outcompete it to.

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And just to add to that so you know there's lots of different species of trees where we have like incredible disturbances happening and so like emerald ash borer and

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you know what, I forgot what I was trying to say, Oh yeah, I've had to say that part of the resilience of these tree populations is having the populations to seed individuals that might be resilient to those changes so we know like for example in ashes,

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that not every ash tree dies. Right. Some of them are actually fine, and they get emerald ash borer and then they deal with it and they grow and they are right.

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And so if we preemptively remove a lot of those trees from the landscape then we're removing the genetic diversity that we need for a population to bounce back from disturbances.

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And so that's one of the things that we can think about for oak trees because you're right, we don't know what's going to come in in the future and like unfortunately those sort of introductions are inevitable.

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But we if we have, I mean, we're going to try to get people to not do that but you know if we have nice stable populations with genetic diversity,

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You know that's going to help those oak populations be more resilient into the future as well no matter what happens.

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Great.

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Here's another question that popped up from Janet: any prospects for reintroducing wolves and mountain lion to curb deer overpopulation. and I don't know if you can address that.

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So, do you want to take it Logan, or I'll take it.

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Well, yeah. Okay, so, um, people have a lot of feelings about wolves, and mountain lions in places where wolves have populations that are doing okay, not good, but okay,

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there's a lot of pushback about that so whether they'll be introduced to this area I feel like will be a pretty big long shot for a long time in the future.

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And we also like don't have tremendous amount of intact habitat to support the kind of territories that these large carnivores need. But that said, I mean there are mountain lions that are dispersing from increasing populations in South Dakota and they're

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making their way, but they have a whole Midwest to get past before they get here so I think it's going to be a really long time before we have natural dispersal.

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And I think that social pushback is going to also, you know, get in the way of any intentional introductions of the species.

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And so right now we can't rely on that for deer control we need to do human interventions.

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Yeah. And just to build off that I want to reiterate the point of humans that this is a very densely populated landscape, even in the more rural areas of southern New England it's still densely populated compared to Midwest states and further

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out west so reintroducing a species like that that has human implications to it is a really

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it's a really big policy challenge that probably needs to get worked out.

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But there are coyotes in the landscape, and they are doing well. So, I'm sure that they're doing their fair share of controlling deer populations. And I know that they've been getting bigger and more healthy populations so that's something to consider

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as a proxy. In that instance.

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Okay.

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And here is another question. Can you briefly talk about the hemlock and hemlock woolly adelgid, are we making progress to save these trees?

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If you have any thoughts on that specific.

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So, hemlock woolly adelgid.

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It's really cold dependent.

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And so it really went through the Mid Atlantic states really quickly because they didn't have those cold winter temperatures that really kill off the insect.

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And so, Massachusetts, I think is a little bit more than that colder colder region so it's going slower but it's still happening and will continue to happen, where I live in Maine,

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it's kind of hit the coast where it's the temperatures are a little bit more regulated but it's having trouble making its way inland, because of those colder temperatures and so it's really cold dependent.

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I'm not really sure what there is to do in terms of management, and it's a really, really delicate delicate issue but unfortunately it's not looking, looking promising.

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Okay. Yeah, I don't have much to add to that except that my personal experience with having hemlock woolly adelgid on my hemlock trees, and our UMass extension had had mentioned that for a lot of the trees that are in this in this westerly region are able

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to handle these low densities and we have so much dispersal of woolly adelgid, they hop on birds, they hop on mammals, they do all kinds of things so it's really, really, it's extremely hard to control even more so than something like emerald ash

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borer or Lymantria.

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And so, um, yeah it can have, it can really transform hemlock ecosystems.

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And I can't speak to whether we can make progress on it except to again, try to cultivate populations that have that genetic diversity so that we have individuals that can withstand low density populations.

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Great.

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I think we've covered most of the questions and Kate and Beth unless you see anything else that you want to address. We're about at 11:30 so there's any final thoughts you can enter it in the chat, I think we'll probably wrap up because this was sort of

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our expected timeframe,

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anything else to add. I'm not seeing other questions so I just want to thank Desiree and Logan so much for sharing your expertise with us this morning, and I appreciate everybody joining us.

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It seemed like with the weather outside it was a good day for a virtual walk through, through the oaks so thank you everyone for coming.