Getting started with our conservation webinar today, I'm Holli Kuykendall, national technology specialist for NRCS's East National Technology Support Center. I'm pleased to turn the webinar over to our moderator, Doctor Nancy Adamson.

Nancy is the pollinator conservation specialist for the East National Technology Support Center, and works with NRCS through a joint appointment with the Xerxes Society. Nancy, you may now begin.

Thank you, Holli. Tom Ward sends his regrets. He's our forester here, who set up this program. And we're really pleased to have Richard Strait speaking, so thank you again Richard.

So Richard Strait is the US Forest Service lead agroforester with the USDA National Agroforestry Center in Lincoln, Nebraska. The National Agroforestry Center is a partnership of the US Forest Service research and development, state and private forestry, and the Natural Resources Conservation Service. Richard was born and raised in Iowa and was granted a degree in forest management from Iowa State University. He has worked in urban community, flat land, and conservation forestry, primarily in Nebraska. And he enjoys spending time at home with his wife, upland bird hunting with his dogs, woodworking with friends, and a fair bit of reading all by himself. So he has tons of agroforestry experience, especially through the Agroforestry Center now, and welcome Richard. Thank you so much.

Thank you, Nancy. And I really appreciate the opportunity to address everyone, and I'll thank Tom when he gets back off of leave for his getting involved with this, and thanks to Holli for setting up all the technical stuff. It's really made it easy.

So today, as it was promoted, this is just an introduction to agroforestry. No one is going to be able to walk out of this webinar with the information needed to design a particular agroforestry system. But hopefully it'll give you an idea of some of the basics, as well as some resources with the handouts and the links that you could use down the road. And of course, folks can always get hold of me as they wish. My email will be scattered about, I think here, and a couple places on the presentation.

So since I do have the podium, as it were, I would like to give you a little information about the center. Nancy said we are a Forest Service and NRCS partnership. We're located here in Lincoln, Nebraska. We have both a research staff, and technology transfer or our outreach staff are located here in Lincoln, and our director, Susan Stein, located in Washington, DC. And you'll see there on that slide we also claim Jim Chamberlain. He is our non-timber forest product specialist in Blacksburg, Virginia. He is officially linked to the Southern Research Station of the US Forest Service. But Jim is such a fantastic partner that we just like to claim him as one of our own.

We also do quite a bit of work in coordinating with the specialists at the three NRCS National Technology Support Centers, and we see them as real key on making sure that the information that comes out of this office fits well within existing programs and is not contradictory to NRCS programs and the other information that's out there. And we also find that the Support Center specialists are great resources to take information from everyone out in the field and funnel it back toward the center, so that we can try and create materials and information that's relevant to you folks, wherever you might be.

And so, as you can imagine, as a national center we rely greatly on partnerships. We just can't contain all the expertise and the knowledge that we'd need nationwide for all the programs and issues that are dealt with locally. And so we work a lot with the conservation districts, state forestry, NRCS folks in the field offices and state offices, as well some nonprofit organizations.

So let's get to it. What is agroforestry? Let me read out of the North American Agroforestry textbook, and it says, "It's an intensive land management that optimizes the benefits, both physical, biological, ecological, economic, and social, arising from the biophysical interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock." And if I ever use that in public, somebody ought to just slap me, because it just gets too long and complicated. So we kind of just narrow it down to the intentional combination or combining of agriculture and trees to create sustainable farming and ranching systems. And it's just a whole lot easier to understand that you're combining-- just like the word sounds-- like agriculture and forestry together.

And to help simplify, it we talk about it a forestry as being one of five basic practices here in North America, in our temperate climate. And that's what I want to do today, is run through each of these basic agroforestry practices and give a little bit of background of what they are and why you might be interested in promoting or talking to a landowner or producer about any of these agroforestry practices.

If you're paying attention, you'll notice that although we talk about these as very distinctive types of practices, they're really more a continuum of the density of trees and the ratio of trees to crops or trees to livestock, and sometimes there aren't very clean distinctions between some of these practices. Although we like to define them fairly distinctly, in practice there can be some variation.

So we also-- I find it's sometimes helpful when trying to define an idea to someone who isn't familiar with it to talk about what it's not. And so we're not talking about taking agricultural land and converting it to forest. We're not trying to convince ranchers or farmers to become foresters and forest land managers. Rather, we're talking about agroforestry as another form of agriculture that provides some other alternatives, some other opportunities for producers. So if we think about agroforestry as a suite or a set of conservation practices that help provide benefits

and provisions as well as protection at the farm scale, and so this is really focused on the producer, on their farm, on their operation, and their particular situation.

Because agroforestry by its nature is putting permanent or perennial vegetation on the landscape, there are also a number of conservation benefits that can be realized if it's done well. And so we talk about those environmental issues, the water quality and air quality and wildlife habitat and soil health, and the list can go on and on. And of course, as we work with producers on the landscape, and more and more conservation, whether it's agroforestry or some other conservation, is applied on the landscape, we can actually have landscape scale and watershed scale benefits. So what we think of agroforestry as helping to address those local issues socially, as well as the local issues for the producer.

And this picture is-- You probably realize it's not a true photograph, and it's kind of an agroforester's dream, and it was probably a little bit carried away. We started creating this image using CanVis, one of the tools that we've created here at the National Agroforestry Center. It's a visual simulation software. And the idea of this picture is to let you know and see that these different agroforestry practices can be applied at different places along the landscape, and some of the practices make more sense in some parts of the landscape than others. And you'll see that as we get into these practices.

So let's start with silvopasture. Silvopasture is one of, probably, the more controversial of the agroforestry practices, because it does combine livestock and trees on the same acreage. And if you're a grazing specialist, so you're brought up with the training for good pasture management and good grazing management, trees in pastures is a bad thing. It tends to concentrate livestock. It tends to create sacrifice areas. The cattle congregate in the shade, and there's very little vegetation left, and you get soil erosion and all sorts of soil compaction. And if you're a forester, you're always taught that cows make lousy foresters, because they can compact the soil when they're out there when the soil is wet. They can rub on trees in each other. They can eat some of the regeneration of trees.

And so all those things are true, if it's done poorly. If somebody is just taking livestock and parking them out in the trees, yes, all those things are true. But when we're talking about silvopasture, we're really talking about a fairly intensive land management approach, and you'll see that intensiveness is a common theme for agroforestry practices. We talk about having the intentional integration of these crops, this intensive management. That means lots of hands on, and that we're doing this intentional combination of trees and annual or other perennial crops because we're trying to gain some benefit from those interactions of those crops.

In this case, some of the benefits that we're talking about is-- even our warm season grasses, those that do well in full sun, don't need full sun to meet the maximum productivity. And in fact some partial shade, will help many of

the forages start growing a little bit earlier in the growing season, and it also impacts the quality of vegetation for forage, and makes it more palatable and higher nutrient and higher protein content. So by having the tree canopy, we can improve the forage.

But also by having the livestock there and good pasture management, whether it's some fertilization of that pasture or management, the trees can also take advantage of that nutrient cycling, and so we have some high quality trees in the silvopasture. And because the trees are more widely spaced than maybe an intensive strictly pine plantation, if that's one we were looking at, or strictly a hardwood plantation, we reduce fire risk, because we've spread out the fuel load.

Improved wildlife habitat-- of course, that's all depending on which wildlife habitat your species are interested in. Those species that are forestland or woodland obligates, or those species that are grassland obligates, obviously will not benefit from the combining of trees and grasslands into the same system. But we also are working with folks who are integrating some clumps of shrubs within their silvopastures to create other types of habitat for turkey or quail or other birds that like to have that multistoried woodland canopy. And again, managing that shrub component is an important part of that intensive management.

One of the other benefits for a silvopasture, and you'll hear this a lot with agroforestry, is that by having the forage for livestock income as a part of the tree planting as well is you have annual income while you're waiting for those trees to grow to a size where they are merchantable or they actually have some value with cutting. And for many landowners, having that annual income is very beneficial. It helps cash flow to get from the tree planting time to the tree harvest time, and that's a real key, particularly with limited resource producers, smaller farm operations, to be able to have some annual income while you're growing that high value, long term income off of the trees.

And one other thing we want to say about silvopasture is if a producer's utilizing silvopasture, that they don't need to have all their pastures as silvopastures. In fact, it would probably be beneficial to have some pastures that are open to full sun as a part of their rotational grazing system, so that they always have high quality forage throughout the year and a variety of forages to have that healthy animal.

And I'll make one other comment about silvopastures. Much of the information that you'll see on silvopasture is related to southern pines in the Southern and Southeast US-- loblolly pine, longleaf pine, slash pine, and even starting to see some information coming out on some research related to shortleaf pine. And there is less information available about using silvopasture in hardwood plantings, in mixed hardwood or deciduous trees, broad leaf trees. And we're seeing a number of folks who are expressing interest in that and using the livestock as a component of managing the understory of those trees. We're seeing folks doing research up in Vermont and New York, in Pennsylvania and Virginia, looking at hardwood silvopasture.

We don't have as much research on it, but there are quite a few benefits-- the same benefits-- that can be realized in hardwood silvopasture. There's some research going on at the University of Missouri. The University of Missouri has a center for agroforestry, and that's one of links that is provided for you, and they've been doing some work in oak silvopasture systems, similar to an oak savanna. And there are some folks Minnesota looking at silvopasture.

So silvopasture isn't just for the pine systems that we find the Southeast or in the Pacific Northwest. But we do have a few more questions and not as much research on the hardwood silvopasture.

There we go. So, an example. There's a gentleman down in southern Georgia who had read about silvopasture, and decided get into it Mack Evans, and he has both loblolly pine and longleaf pine. Again, he uses a rotational grazing system, so he's keeping his livestock moving through on a regular rotation, and he also has some pastures that are not silvopastures. And he really likes the longleaf pine, because it has that nice filtered shade. It's just a different canopy structure than the loblolly pine.

And he has also gone in and added pine straw into his operation. And as you can imagine, pine straw and forage, there's a balance that has to occur there-- or a dynamic, I should say, between having enough trees to provide enough needle fall to make it worthwhile raking pine straw and yet enough sunlight coming through those trees to grow forage for livestock. And so it's very much a hands on operation.

And one might wonder, how do you deal with the cow pies raking pine straw? And one of the things that Mack has done is for a wormer he uses a wormer that does not kill, is not toxic. When it passes through the animal, it's not toxic to the dung beetles. And so he'll pull his livestock off-- from where he's going to rake the pine straw, the pull the cattle off about two to 2 and 1/2 weeks prior to raking pine straw. And the cattle has grazed down so the grass is short, and those dung beetles come out and clean up all those cow pies. So he has very clean pine straw with short grass, makes for a great combination. And again, he has to keep an eye on that to see when the forage is getting too low, he can change his operation.

So that's just a very fast overview of silvopasture, and so we'll see if there are any questions. Anything that I skipped over too quickly?

Well, we've just gotten one question, and it's how is agroforestry related to permaculture and silviculture?

Good question.

So silviculture is the art and science of managing stands of trees. That's a Rich Strait definition of silviculture. So much of the science and the knowledge of how to manage trees and stands of trees is important in understanding

how to grow trees in any agroforestry system, because we're not managing necessarily on a tree by tree basis, which is arboriculture. So silviculture adds to the body of science and knowledge of how to manage an agroforestry system.

And permaculture is also a focus on long term, sustainable management. And permaculture is-- I see a greater focus on plant communities, more complex plant communities, whereas agroforestry is a little more toward the conventional agricultures that will have trees and row crops, or trees and some perennial forage, or I've seen people talk about how alley cropping with maybe even irises between rows of trees. And permaculture is looking at that larger holistic landscape.

So they're not unrelated. I think in the continuum from industrial row crop agriculture on one side, permaculture would be clear far to the other side, and agroforestry would probably be on the permaculture side of the continuum. So there are some, again, shared knowledges and information and plant interactions there that are common to both permaculture and agroforestry.

OK, there's one other question. What about forest succession? Does silvopasture allow for regeneration, or do the cattle trample all the growth?

And I just wanted to comment that we'll just stop after this for this section, and then we'll probably have just two questions after each section, and then we'll have time at the end for more questions.

OK.

And that's a really good question on regeneration within silvopasture systems. And for the most part I think the silvopasture systems that I've seen have been largely managed on a more of an even age rotation, where yes, at some point the trees are all harvested and you're back to planting trees again, not unlike many of our pine plantations in South and Southeast. I have seen some work looking at-- in some of the hardwood silvopasture, and even on some of the shortleaf pine-- where we might take a silvopasture out of the grazing rotation for a period, when we see a good seed crop coming on, and allow some of the regeneration to get established to the point that it can handle some grazing pressure and then reintroduce livestock into that. So those are two different ways to maybe manage that.

So let's go ahead and proceed.

So windbreaks-- As was said, I spent a lot of my career out here in the Great Plains, and windbreaks is a very important agroforestry practice. It goes clear back into the Dust Bowl days around here. But I think we'll find that wherever people have moved and introduced agriculture into the landscape that dealing with the wind is an important factor, both for people as well as soil, crops, and for livestock. And the simplest definition of a windbreak

is-- really, we tend to think of them as linear plantings of trees and shrubs that modify the wind speed on the landscape.

Now, if you think about what a windbreak is, it can be made of any number of things. Of course, with agroforestry we're talking about being trees and shrubs. But there are also-- we have perennial grass strips that can act as a wind barrier. We have man-made structures. We have plastic fence. The lower left there is that Wyoming slatted snow fence that you might see out in the Great Plains and in the front range of the Rocky Mountains that control drifting the snow on railroads as well highways. So anything that's up there above the surface of the landscape that interrupts the flow of the wind could considered a windbreak.

But when we're talking about planted windbreaks of trees and shrubs, recognizing that the height of the windbreak impacts the area downwind of that windbreak and how large an area will be protected by the reduced wind speed. And when we reduce wind speed we have a number of benefits. We reduce the evaporation of soil moisture. We reduce the evapotranspiration of the crop. We modify the temperature-- both in the evening and at daytime-- adjacent to the windbreak. When the wind slows down, we can reduce erosion of soil, but we can also cause the snow drifts or deposition of snow.

And all of these factors are related to the density of the windbreak, and we create density by multiple rows, or by the species that we choose. So trees such as hackberry, green ash, oaks, may have a density during the growing season that will be greater than it will be in the wintertime, after they've dropped their leaves, and so we'll want to know what time of year are we really wanting that wind protection. If it's a winter wheat crop, it might be a different time of year than, say, a young growing canola or corn or soybean crop. And if it's an area where we're feeding livestock in the winter, that's a different time of year than one where the cattle might be grazing out in pastures during the summertime. So knowing which direction the wind comes from seasonally, and knowing the type of protection that we need will impact the design of the windbreak.

So what I guess I'm trying to say is that there is not just one windbreak design that is good for every situation. And so depending on your needs and the landowner's needs, that will influence where the windbreak will be located, the species that are selected, the density of that planting, so that we can provide the desired benefits.

And types of windbreaks. On the upper right, we talk about maybe protecting livestock in a feeding operation. And so we keep the snow from drifting into that feedlot area, which reduces the amount of runoff of excess nutrients off in that feedlot area.

The middle picture we call field windbreaks. These are often designed to do one of two things-- or often two things at once-- both reduce the wind speed for the crop-- that is, reduce the evapotranspiration-- and on light, sandy

soils or soils that are susceptible to wind erosion, it can actually protect those young seedlings as they're coming up out of the ground from either getting helicoptered up out of the ground or being sandblasted by soil particles and cutting out the young, emerging plants. The windbreaks can also control that soil erosion, and again, the spacing between the windbreaks will be dictated by the height of the species we choose as well as the overall purpose.

The bottom center picture is a reminder that we can use windbreaks not only to deposit snow in a snow drift, like the picture on the lower right, but we can also use windbreaks to spread snow out across the field, so that we can harvest that snow, harvest that moisture down into the ground for the next year's crop.

And then the far left picture, farmstead windbreaks-- which probably technically isn't and agroforestry practice. But it's certainly part of the farm and ranch operation, and so windbreaks are often used for those purposes as well.

So that's a very fast-- We do a whole week of training on windbreaks and windbreak design, and it's a technical standard within the field office technical guide. And there's quite a bit of information out there on windbreaks, so I didn't want to spend a great deal of time on that, but I will handle any questions if people have any.

OK. You kind of covered this already, but the question is, is it possible to use tree windbreaks as a method to contain fertilizer/water water in the planted area, e.g. if the root zones of the trees are very deep compared to crops planted?

I've seen windbreaks planted on contours. And so that-- In that respect, the row where the trees are planted will often have some other vegetation, whether it's grass or forbs, growing with the trees. And on a contour, then, that would slow the water movement coming downhill, and give it a little more residence time to percolate into the soil and be taken up by the trees. And so in that respect, if I understand the question correctly, I've seen windbreaks be used to take up some of the extra--

Yeah. And the other question is about riparian forest buffers, so that kind of fits right into that question as well.

And we're going to talk about alley cropping and forest farming, and then we'll talk about riparian forest buffers. So Nancy, if you could hold on to that question till then, would that be fine?

Yep.

All right.

Then we'll move on. As advertised, we'll go on to alley cropping. Well, if you think of windbreaks are often planted-- say the mature height of the trees is going to be 30 feet or 40 feet tall, we might plant field windbreaks at 10

times their height apart. So we might have 10 times 40, 400 feet between field windbreaks. Think of alley cropping as having three rows that are much more closely planted.

Some of the research that was done at 40 and 60 feet apart between tree rows and then agronomic cropland in between them, and then I think we're seeing some alley cropping systems where more like 80 to 100 feet, or maybe 120 feet between tree rows, and then crop planted in that alleyway created by the rows of trees. And often the trees that we use in an alley cropping system are high value trees. They might be black walnut. They might be pecan. They might be even a fruit tree, something that produces a crop in and of itself. Even shrub alley cropping systems have been used, where they're planting rows of aronia berries that are being harvested or hazelnuts that are being harvested, and then another crop in that alleyway.

And your selection of trees and crops in the alleyways, again, will be related to the interaction of those crops. Reducing of wind speed by the trees, it'll be taller. There might be some other positive interactions with-- I've seen alfalfa used, and it has the nitrogen fixing going on between the tree rows, and the trees benefit from that.

So people are sometimes concerned about black walnut being used because of the juglone, and we hear about allelopathy, and, really, black walnut-- Your tomatoes certainly don't grow well under black walnut. White pine doesn't seem to grow well next to black walnut. And the blueberry family doesn't seem to grow very well with that black walnut. But for most part, other crops grow just fine around black walnut and pecan. And those trees also work well with an alley cropping because they don't create as dense of a shade as some other tree species. And so again, we're trying to play off of the interactions between the trees and the crop that's in the alleyway.

And why would somebody want to complicate their lives by going to an alley cropping system? And admittedly, when we start combining trees and annual crops and trees and some other perennial crops, life does get more complicated. And so why does someone want to have to have a wider knowledge base and be concerned about these plant interactions?

Well, one is the diversification of farm income. We all know how crop prices and livestock prices are cyclical and up and down, and if we have more diverse suite of crops that we're harvesting and selling, that creates a more stable finances for the producer. Again, alley cropping-- as I mentioned, windbreaks I've seen planted on contours. We'll see alley cropping planted on contours as well, and again, creating some zone of permanent vegetation to intercept the runoff off the field. Again, the taller crop providing that wind reduction or windbreak benefit to protect those other crops. By having diversity of plants in there, we'll also see a greater diversity of insects, and there are many positive predatory insects that can help reduce the insect populations of insects that are detrimental to our crop. The wildlife habitat and the aesthetics are often part of that work environment that's very difficult to put a dollar figure on, but we'll see that kind of interaction with alley cropping systems.

One example, Dan Shepherd down in Clifton, Missouri. They were looking to diversify their operation, and he and his father, when he first started into looking at alley cropping, they were growing bison, eastern gamma grass, and pecans. And when they first started their pecan operation, they actually were planting corn and soybeans between the rows of their pecan trees. And then as the trees got larger and larger, providing more and more shade, they shifted away from annual crops in their alleyways to a forage crop. And so now they can-- Excuse me, a hay crop.

So now they can hay that ground. It makes the grass short. It makes it easy to harvest the pecans. And they still provide that dual income off of that area. And so that's just one example of an alley cropping, of using a high value nut tree as well as that space for a hay crop. And he's found that system to be very profitable, and is built quite the operation that sells pecans. And we've seen other folks combining pecans and cotton. We've seen some pictures of people using fruits trees, and in the alleyways planting irises, and so they're harvesting and selling the iris bulbs. So you're providing that improved microenvironment.

And one thing about alley cropping is that you can shift in and out of alley cropping. You could have alley cropping like this, and if livestock prices are doing well, you could have an additional pasture and manage it more like a silvopasture. And one other thing I'll say. We've seen some alley cropping done with high value trees, and then in the alleyways actually planting willows and another trees that are very rapid growing as a biomass, and then harvesting the biomass from between the tree rows and using that as a fuel source. And we find that biomass growing between those tree rows actually has a higher-- is more productive than grown out in open blocks of trees and shrubs that are used in some of the biomass plantings.

So that's a very fast overview of alley cropping. Any questions?

There's a few questions about windbreaks, but I think-- Oh, well here you go. Let's see. Let's just go ahead, and I'll regroup once we do the next section. It doesn't look like it's specifically on alley cropping.

OK. We can take those at the end then, too.

OK.

I just also wanted to point out to everybody that Richard has provided a whole set of resources from the Agroforestry Resources Center that address all of these issues in more detail. So just so you know, those will all be available.

OK. Thank you.

So forest farming is if we're looking at that continuum of windbreaks, where there's very few trees on the agricultural landscape, forest farming would be on the other side. And it's really trying to grow and managing the

shade and the canopy of the forest to grow some of these non-timber forest products as part of the forest management. And again it's an integration of growing the trees and these other the crops in the understory.

And pictured here, ginseng in the upper left, golden seal mushrooms, even maple syrup. And some people ask is maple syrup an agroforestry product? And I say, well, it can be. You can produce maple syrup as part of an agroforestry system, or you can produce maple syrup as part of a sugar bush that is just producing one single crop. And so just because it's a non-timber crop does not make it part of a forest farming operation.

Again, the economic diversity is an issue. And if we look at land use changes across the United States when it comes to woodlands and forest lands, we're finding that contrary to our agricultural land, which is being consolidated by fewer and fewer landowners, forest lands are becoming more and more fragmented in their ownership, and that many folks are less and less interested in harvesting the trees, or they're not sure about how to do it so they don't want to cut trees. But they still have to pay taxes and they still have to maintain fences and their lane and access roads, and producing some non-timber crops in the understory is one opportunity to create some income from their woodlands.

And just like any of these agroforestry practices on any operation, a person wants to have a good business plan and know what they are going to grow, how it should be packaged, who's going to buy it, how much can be sold in the area where they are located. You need [INAUDIBLE] have that sort of plan figured out before you grow anything, whether it's mushrooms or saw palmetto or firewood or maple syrup or anything else. You just don't start growing it and then go find out if anybody wants to buy it from you.

An example a person who's been very successful with forest farming is Nicola Macpherson in Missouri, and she started into a mushroom growing operation when they were doing some thinnings within their oak timber and then using the branches and the small trees that were thinned out of the woodlands as the material to grow their shiitake mushrooms on. And she as well is now using the thinning from harvest and from thinnings on neighboring woodlands as that material, and growing a high value product. She's done a good job of marketing up into Saint Louis, even though it's well over an hour and a half away, and she's turned this into quite the operation of selling it in farmers markets, to restaurants, to chefs that she regularly provides for, as well as growing mushrooms for other people to sell out of their operations.

And so that's just one example of using the byproducts from forest management and from woodland management to grow another crop, and then the overstory of the trees provides the shaded conditions that are necessary for growing high quality shiitake mushrooms. So that's a nice combination and interaction of forest farming. We'll also hear about people who are growing ginseng and golden seal, some of the herbal medicinals, as well as some of the other craft woods, especially woods that are grown-- not large trees, but are grown on vines and other unique

wood that can be used for crafts and other fine artwork.

So that's a brief overview of forest farming.

OK. Well, there's still a couple questions from the alley cropping, and not any yet for the forest farming, and a couple are real specific, so I'll go ahead and mention those.

How should the trees be laid out on a 10% slope? And then the other question was, is trash from the trees a problem when harvesting?

Both good questions.

So if we're planning an alley cropping on a slope, I would probably look at putting those tree rows no further apart than you might consider planting either a contour grass strips or terraces, and so that-- Depending on the soil and the type of soil and the type of rainfall you have in your part of the country, that's what I would use as a maximum width between the trees on-- And that's a pretty good slope. And again, what equipment are you going to grow, what are you going to grow in the alleyway between, will also influence how wide you put those tree rows. You want to be able to have nice-- whether it's one pass or two passes with the width of your equipment, no one wants to go 1 and 1/2 widths of your equipment up and down in an alleyway. So that's one issue.

The question about debris from the trees. No doubt about it. There is that complication of-- whether there's from wind damage and tree branches falling-- that is an issue whether you're talking about windbreaks or an alley cropping system. Some of the organic matter that comes down from the trees, the leaf fall and finer twigs, typically is fairly positive. I mean, you're adding some organic matter and other nutrients back into the soil.

So I hope I've answered those two questions. All right. Let's go ahead and, if that's all right--

Yep. Move on. Yep.

OK.

Thanks.

So riparian forest buffers is a practice that has been promoted by any number of agencies and nonprofit organizations and watershed improvement groups. And just as it says, riparian forest buffers. So these are buffers that are between our agronomic production, or any operation, and our waterway, whether it's a stream or pond or a lake. And again, we're planting the vegetation there to intercept the runoff, to reduce the amount of nutrients and other chemicals that might be entering that waterway. And often we see riparian forest buffers planted solely as a conservation practice.

And one of the things that from an agroforestry point of view that we like to talk about is that we'd like to-- talking about utilizing species of trees or shrubs in that riparian zone that can also be used as a crop, to grow a crop, another income source, and that-- Even biomass is one area that I think we're seeing some research done on harvesting part of the trees that are in that riparian forest buffer, but still leaving enough of those trees there to maintain the functionality.

And the reason you might look at that is if indeed this buffer zone is intercepting runoff from the adjacent field, at some point the plants have taken up as much phosphorus and nitrogen as they possibly can, and then they become themselves actually a source of phosphorous and nitrogen as they drop leaves and the roots naturally cycle into the soil, and they start adding it back into the system and into the stream. Well, if we can be harvesting a portion of those trees off that site and have it utilized someplace else, we keep that system viable and up and running and continue to uptake a high quantity of nutrients out of that riparian buffer. And so that's one area that we'd want to think about is possibly using that to grow a crop that can actually improve the functionality of these riparian forest buffers.

And then maybe-- There's enough out there on riparian buffers that maybe that's all I'll say right now.

We do have an example of a family out in Oregon who's using riparian forest buffers to provide wood products as well as the usual farmland protection. And they're starting to integrate understory plants into their buffers so they can grow some plants that need shade and grow them in that site rather than having built structures, shade cloth structures, for growing some of the plants that they sell to other producing farmers in the area. And so that buffer serves both in a productive capacity as well as a protective capacity. And I'd like to see more of that done, but recognizing that some of these riparian zones are susceptible to flooding and that may not always be possible. So again, choosing the site well and the species that are adapted to that site are always important.

And that's the-- I just have a couple of summary slides that I can run through unless there are any questions.

Yeah, there are a few questions there going back to the forest farming. Any thoughts about leaf litter disturbance regarding forest farming?

You know, the forest farming can done at varying levels of intensity. Some folks will want to just gently rake back some of the leaf litter to plant the seed of-- whether it's Trillium, Hepatica, bloodroot, ginseng, golden seal, blue cohosh, and that sort of thing-- and then move that letter back onto the site so we have good soil to seed contact. Other folks will incorporate small raised beds under the forest canopy, so that they have a little more controlled environment there. And that's just a little more investment in wood, and maybe some screen on top of that, so that it keeps chipmunks and things out from to glean your seed after you've planted it.

We try to-- we suggest minimizing that soil disturbance, because there's a lot of rich organic matter and good soil fungi growing in those sites. We've also seen some forest farming that it has gone very intensive, where they actually tilled all the area underneath the trees and planted large quantities of ginseng-- is primarily what we've seen that sort of operation done. And that has its own set of problems in that when you start creating that high population of ginseng, you risk populations of insects and foliar diseases starting up on your operation, and that of course cut into your production as well as maybe producing another source of expense. And so we talk about trying to minimize that amount of disturbance in that leaf litter.

OK, I have another question I got a little clarification on from one of your earlier sections. The question says, I would use trees to make a seed bed for my crops. I look for trees that produce a large mass of leaves that after composting can be used to sow seeds over the spring. Have you any advice for me regarding species, varieties of trees, adapted to this need?

Wow, that's a good question, but the problem is I don't have a good answer. Of course, I would probably recommend you look at what are the native species that are adapted to that site, because that leaf fall probably has the right amount of calcium and other nutrients that are recycling in that site. Some of the legume species, like the honey locusts and black locusts, those leaves, they tend not to produce as much leaf litter, and those smaller leaflets are harder to collect up. So I would probably stay away from those for that reason, if you're trying to accumulate the leaves for making a mulch.

Wow, that's a good question. Maybe that person could contact me via email and we could have a little better dialogue on that, rather than me stumble around anymore.

Okie doke. So there's a few other questions. One is about the role of subsurface water movement and denitrification by riparian buffers, and along with that a question-- maybe more of a statement-- no clear cutting on riparian forest buffers?

Depending on which state you're in will have great-- this is on the clear cutting question. Some states have streamside management zone, best management practices. Some are very restrictive. Some are suggestions. And so it would be very important to know what your local laws and regulations are. And in those cases it might be that the species you plant would be one that you could harvest individual trees rather than-- like you said-- clear cut, or if it's a wider buffer, cut some of the trees and leave some of the trees. But definitely there are states that will not allow harvesting within a certain width or distance from the stream bank or from the stream, and those would have to be, obviously, adhered to.

What was the first-- the other question, Nancy?

Let's see. The other one had to do with the role of subsurface water movement and denitrification.

Right.

A couple of our researchers here are really up to speed on these issues, and then we do see that by having a variety of plants within that buffer zone-- we often talk about the grasses on the uphill side, up-gradient of the trees, more adjacent to the crops to slow the water movement. And we have if we have trees and shrubs, now you're talking about plants that have roots occupying some different parts of the soil profile, and are more likely to be able to capture and uptake the nitrogen and other nutrients. And again, by having that vegetation and slowing the water down, we allow some of the biological activity within the soil to have its impact on those nutrients.

And because our trees and deep-rooted grasses also will cycle their roots regularly, those root channels create opportunities or pathways for water to infiltrate into the soil, and allow it to be engaged with the soil biological activity as well as the tree roots and other vegetation. So that's some of the basic ways that-- You know, buffers function that way, and the diversity of species and the types of plants will improve the ability of that buffer to function.

OK, thanks. There's a question.

Any recommendations on row orientation in alley cropping, north-south or east-west?

Yeah. That's a long argued discussion, and for the most part what seems to be-- and it's a very close, it's like a 51% to 49% sort of ratio. But for the trees-- let me see if I can get it right, now-- we often talk about an alley cropping situation that an east-west orientation works best, maybe being a little bit more sunlight down between the alleyways. Again, there are other factors such as the topography that may play into that. But it is very close, but we usually recommend east-west orientation on alley cropping.

OK. And there's a question, are there good trees for browsing livestock? So that would be goats and things, versus grazing livestock like cattle.

I know honey locust and black locust have been used for browsing. I also know that we've seen a number of shrub species that are commonly-- Well, goats will browse on just about anything, but as far as the tree species, I've seen some linden, black locust, the honey locust, and I'm trying to think if there's another one out there that I've seen used for browse. I'm drawing a blank. But I've also seen some goat silvopasture--

Willow, with-- Sorry.

Yeah. Willow would be a good one. Thank you. Willow is another one that has been used for browsing situations.

One of the areas that we could use more research is how to maintain the browse component within the silvopasture system. We have pretty good experience on how to eradicate or nearly eradicate woody component out of understory, out of pastures, or out of woodlands with invasive species. But how to browse to a point that-- just like we do with grass, we take the top 40% to 50% of the grass off and then the livestock off so that grass can recover. We don't have those nice prescriptions for maintaining a browse component within the silvopasture. There's folks working on it at Lincoln University down in Missouri, but that's an area that we could use a few more answers.

OK. There's a few more questions.

For silvopasture, is pest management part of the plan? Pests such as wood ticks in pines may be a problem for livestock.

I know one of the issues that we talk about with livestock in silvopasture is having a good wormer to keep the livestock healthy so they don't rub on the trees. Often if they get parasites, they'll be rubbing on the trees to scratch, and you can reduce some of that by keeping parasites down on the livestock. I don't have any information regarding ticks and livestock, although I find ticks are just about everywhere, not just in the woodlands, but in open pastures and pasture edges as well. So I don't have anything on the ticks.

Rich, do you still have more slides you wanted to go through?

I just have a couple, but the questions are probably more important, since we're closing to the end of our time.

Well, I think-- There are just a few, but I think go ahead and finish your slides, and--

Let me just close with these two slides, maybe.

So we talked about agroforestry and large farms, and more and more our larger farms are looking to produce, as the slide says, food and feed and fiber and energy and protecting air and water and soil and all these issues, and oftentimes we're looking for-- Agroforestry might be a way to help mitigate some of those negative impacts of large operations, of soil erosion and water quality issues. And also we can see agroforestry as being a ability to provide resiliency to that operation by reducing the wind speed and producing a better microclimate to grow crops.

And in small farms, we talk about diversity of product. We're talking about producing food locally, and maybe a higher value crop. Small farms are very difficult to compete on commodity crops, but if they look to specialty crops and producing food crops that are at a higher price point and selling them locally, that might make it easier for them to compete.

And I just want-- We have various publications on our website, and-- I'll just skip that one, and just leave it there. That's our website, and that's my email address. And we're almost out of time.

OK. Super. Thank you so much. We do have a couple more questions, little ones. Does Osage orange work well for a windbreak, our old standby?

Yes, it does. We've seen it used. Oftentimes they haven't been managed well, but more and more folks are looking to use those again, because they're looking at alternative uses of the hedge apples. There's some medicinal concerns. And that's another good one, good forage quality. That and mulberry both have high forage quality or browse quality on the leaves.

And there was one question about using riparian buffers to help with heat sinks around cities, and I know you did mention climate change briefly.

I think that would probably just fit with the whole canopy cover and i-Tree tools that are out there, talking about green space and reducing the heat island effect.

OK. Well, I think that is the end of the session. I don't know if Holli's going to come in, but usually if folks have additional questions they can stay on. But we also want to let folks know some things at the end.

Well, let's-- Yeah, thanks, Nancy. Let's wrap up today. Thanks a lot to Rich. He's been a real pleasure to work with. And Nancy, thanks for moderating the presentation today. And we always like to thank our participants for joining in, because without them we really don't have a webinar. So we had more than 180 people join today's webinar. Appreciate your attendance.

So participants, to provide your feedback about the webinar, and if you selected to earn CEUs, please return to your open browser window to continue the process that's offered by Step Two at conservationwebinars.net. And with that, this concludes our webinar presentation today. Thanks for joining in.