And with that, I'm going to turn over the introduction of today's topic and speaker to our guest moderator, Sudie.

Thanks, Holli. Like Holli, said, my name is Sudie Thomas. I'm a wildlife biologist in South Carolina for the Natural Resources Conservation Service, and I just want to say a little bit about NRCS in case people aren't familiar. We are a federal agency operating under the umbrella of the USDA, the Department of Agriculture. We're one of the agencies charged with facilitating Farm Bill conservation programs.

And these programs assist private landowners and other clients in conserving, restoring, and protecting natural resources. A few examples of the natural resources targeted for conservation are soils, usually in agricultural settings, wetlands, and wildlife habitats. More recently, much focus has been turned towards beneficial insects. And NRCS now emphasizes the protection of and habitat enhancement of beneficial insects through Farm Bill programs and conservation practices. In that effort we work closely with the Xerces Society to promote beneficial practices, pursue further investigation into the potential impact of conservation practices, and to educate landowners and the general public through workshops, publications, and training sessions like this one today.

So today I get to introduce Nancy Lee Adamson, who's going to be your presenter. She is a pollinator conservation specialist, and she really works double duty. She works jointly for the Xerces Society for Invertebrate Conservation, and she also works with the NRCS East National Technology Support Center. So everyone is in for a treat, because Nancy always presents a lot of useful information about farming for beneficial insects. She has a lot of experience and knowledge on the subject and you will see that she is pretty passionate about beneficial insects and pollinators.

I had the pleasure of working with Nancy in workshops in South Carolina, where I learned a lot. So if you ever get a chance to get out in the field with her, you're going to learn a lot about insect ID, plant ID, and habitat enhancement. So here is Nancy on the subject of farming for beneficial insects and the conservation of native

pollinators, predators, and parasitoids.

Hello, everyone. Thank you so much for joining us today. And I want to thank Holli for heading this up. And for Sudie helping to moderate. She has a big task trying to coordinate all the questions coming in. Everything she said about me in the field is true of her. If you go out in the field, you'll learn a ton. So thank you. All righty.

Well, just a little introduction to the Xerces Society. Xerces has been supporting insects and other invertebrates, which includes mollusks and crustaceans and other animals without backbones, for 40 years. We take our name from the first butterfly to go extinct in the US due to human activities, the Xerces blue butterfly. So we do all sorts of work to support invertebrates, but a big part of our work is pollinator conservation. We work closely with the USDA Natural Resources Conservation Service, and thanks, Sudie, for that introduction to NRCS.

USDA has always supported pollinator conservation. The 2008 Farm Bill responded to widespread concerns over pollinator declines, especially Colony Collapse Disorder, which really brought home the pollinator and pollination crisis. So both Farm Bills--we don't have the 2013 quite yet, but hopefully the new bill is going to include pollinators in all USDA conservation programs, as well.

Mace Vaughan and Eric Mader, the heads of the Xerces pollinator program, recently reviewed NRCS programs that can be used to support pollinators. The program is a little bit longer, 90 minutes instead of 50 like today, and includes lots of details on plants. So even though it's oriented towards NRCS staff, I think it would be really valuable for anybody interested in habitat conservation. And there're several other webinars online. If you're interested in bees, there's one on common bees and best bee plants of the east. I am in the East National Tech Center, so for those of you in the midwest and the far west, my experience is more in the east, just so you know that.

The NRCS is able to help pollinators through habitat development and helping growers implement IPM practices. IPM is Integrated Pest Management, and I'll talk about that a little bit more later. I know most people are pretty aware of what that is,

but IPM helps reduce the need for and non-target impacts of pesticide application.

These same practices are vital for supporting other beneficial insects, such as predators and parasitoids, that help control pests on crops. We also call them natural enemies of pests. So wasps, spiders, some flies, beetles and bugs are predators eating other insects.

Parasitoids are parasites that kill their hosts. We use the term parasitoid--they are parasites, but most parasites don't kill their host. Parasites tend to be much smaller than their host, while many parasitoids are about the same size as their host.

Just one other little thing. Most of the day today, we'll be talking about beneficial insect plantings, but those are also called insectary plantings.

Today we're taking a look at the value of diversity in agriculture and at benefits of arthropods and nematodes. So arthropods--technically, spiders aren't insects--include spiders and insects. Then we'll take a look at ways to support them with habitat, food, shelter, and protection from pesticides. We'll see how much time we have for establishment and long term management, and then a little bit on additional resources.

Biological farming is another name for sustainable farming, but the phrase biological reminds us to take advantage of natural processes and relationships to improve management. Increasing diversity on a farm has a lot of associated benefits, which include reduced herbicide use, lower pesticide use, and more nesting opportunities. We'll look at a few examples shortly of specific ways diverse habitat supports beneficial insects to improve farm production.

Organic producers, who tend to have diverse farms to begin with, are required to enhance biodiversity on their farms. Adding pollinator and other beneficial insect habitat is a good way to add even more diversity and further promote ecological balance. Some farms may find that simply advertising no or reduced pesticide use and knowing their customers is as important as organic certification.

In North Carolina and other states, Departments of Agriculture are encouraging

communities to support local economies and farmers by buying locally grown produce. In tandem, agri-tourism helps people connect with farmers, understand why local produce can sometimes be more expensive, and perhaps increase their willingness to pay a little more up front. The local produce prices may not be that different from produce shipped in. At a sustainable agriculture meeting in Virginia, a farmer shared his conviction with an audience filled with young people that this buy local movement was here to stay, not a short-lived trend, but part of increasing awareness that we all have a role in building strong local communities, communities that are more resilient through economically rough times.

Field borders and hedgerows designed to support beneficial insects can also add flower power in terms of beautification and income from cut flowers or berries. Other benefits of planting for beneficial insects include protecting watersheds and providing wildlife habitat, especially species needing open, early successional habitat, such as many ground nesting birds, grassland birds. The more diverse the planting, the greater the insect diversity, which means better diets for all sorts of wildlife.

We'll be focusing on wild natural enemies and native pollinators. Insects, in general, are vital to all of us: at the base of food chains, they sustain our ecosystems. How we treat insects has a direct impact on other wildlife, our watersheds, and our well-being. Insects are just as good a food source for other insects as they are for birds, mammals, and other wildlife. As many of you know, these are cocoons of parasitic wasps that, as larvae, feed on the insides of this hornworm. They are nearly ready to emerge as adult wasps, tiny and ready to mate and lay eggs on other hornworm caterpillars.

Taking advantage of relationships between pests and their natural enemies to improve farm productivity means rethinking insect control. In any predator-prey system, whether it's wolves and rabbits or wasps and hornworms, if we wipe out both populations in one fell swoop, it takes predators a lot longer than pests to return to that ecosystem or agricultural field. Many insecticides kill not only pests, but the predators and parasitoids that help control them. Adding field borders,

diverse hedgerows, leaving areas fallow or maintaining natural areas close to farmland provides refuge for beneficial insects so they have food, resources and shelter when the crop site is barren, and can recolonize the next crop that is planted.

Conservation biological control is part of integrated pest management-- and I talked about that a little bit-- managing farms in an integrated way to reduce pest pressure, monitoring levels of pests or pest damage, not just spraying on a set schedule regardless of pests' presence. Predators and parasitoids are sometimes called beneficial insects, sometimes natural enemies, with "of pests" implied, or biological control agents. Beneficial insects also include pollinators. While many crop pests are common across our landscapes...

..a lot of biological control is very regionally or locally specific. Extension is often the best source for locally relevant biocontrol information. And I've put up the eXtension website here. That's a national cooperative effort among extension across the country. When you go there, if you type in conservation biological control, it generally will bring up resources in your region. But also, each agricultural university has an integrated pest management program, so they're really the best source of what's currently known.

There's lots of new research in this area. It's a really exciting part of entomology because of all the good things associated with reduced pesticide: lowering costs and improving pest management.

Biological control is not aimed at eliminating all pests, but maintaining a healthy ecosystem so pest pressure remains below economic thresholds. Even though you see insects in your field or in your garden, or you might see quite a bit of damage, for instance, to leaves, there can be a good bit of herbivory sometimes without it actually affecting production.

In agricultural systems we've actually come up with economic thresholds to understand when that insect damage is reaching a level that's going to affect the bottom line or affect the harvest. It's actually surprising sometimes how much

damage there can be without having an effect. When we're talking about using biological control, it's just to slow pest population growth rates. Again, if both predator and prey are wiped out, it takes predators much longer to recover.

I also wanted to mention that Xerces Society worked with NRCS to develop this conservation biological control tech note that will be out later this summer. It's in draft form now, and there will be a webinar on August 29 that is highlighting integrated pest management and taking a closer look at this document itself. So tune in again. It'll be on this same conservationwebinars.net website.

We have a pretty good idea of the value of natural enemies for crop production. But as you can see in this photo-- and maybe you can't see, it's so tiny--a lot of these parasitoids, in particular, are easy to miss. The mottled tortoise beetle, here, is a sweet potato pest smaller than the tip of my pinkie, so this little wasp is pretty minute.

As in any predator-prey system, pests repopulate a crop more quickly than predators. Spiders are generalist predators, so in habitats without crop pests, pollinators make a good feast [referring to photo]. Parasitoids are parasites that kill their hosts and are often specialists. If you like that ???biological control agent??? terminology, you might call these ???special agents.???

Adult predatory wasps are omnivorous, and catch prey to provide to their carnivorous young. She will lay one egg on this cicada after placing it in an underground nest.

Parasitoid wasps lay their eggs on other insects, such as aphids. Their larvae hatch, eat their host, then pupate, usually killing their hosts.

Some larger wasps are also parasitoids. Scoliid wasps paralyze and lay eggs on white grubs, such as June beetle or Japanese beetle larvae. As adults, they consume pollen and nectar. Many parasitoid adults feed on nectar and pollen, though their young may specialize on certain species.

This adult syrphid fly is a bee mimic, feeding on pollen. It's young, this little fly larva,

smaller than the aphid it's eating, is a voracious predator. Flies overwinter in leaf litter or in the soil, so it's important to maintain undisturbed natural areas adjacent to farmland to support them.

Many predatory flies mimic bees. Though we know some fly bites are painful, flies don't have stingers. Prey may not expect what they see as a bee on a flower to be dangerous or aggressive.

Beetles overwinter in leaf litter, soil, and rotting woods, so having some undisturbed natural areas near agricultural fields can help in maintaining populations. They overwinter in leaf litter, soil, and rotting wood, so same story. Some natural area is really good support close to the farmland.

Lacewings are predaceous as adults and larvae. Lacewing larvae will eat one another, so lacewings have developed this stalk for their eggs. Usually there's half a dozen or more in a row, and they're usually not on the fruit. They're more likely to be found on the stem or the leaves. So if the larvae hatches from that egg, it will climb down the stalk, but it tends not to climb up the other stalks to eat the eggs. If they were all sitting there, they would eat them up. So here, the green lacewing larva is eating white fly larvae, just the right size.

It can be hard at first glance to distinguish a pest bug from a beneficial predator bug, like this assassin bug. Until you start looking for predators or parasitoids, you may not notice them. So it's really important to remember that if there are pests present, chances are there's going to be good predatory or parasitoid insects or other arthropods present, as well.

Habitat near crops provides harborage and food for predators and parasitoids when crops are harvested. When we're talking about pollinators, most of those can fly in and out of the crop if it's there. They can go fly someplace else. But some of our predators, especially spiders, can't fly around, so it's really important to have that habitat close by.

Besides habitat patches, maintaining soil health can also help reduce pest problems

by supporting healthy plant growth and beneficial soil arthropods like nematodes. I guess they aren't arthropods. They're in their own group, the Nematoda. Nursery operations depend on beneficial nematodes sold commercially to manage fungus gnats and thrips. This is one beneficial nematode that gets used quite a bit.

We'll take a few minutes to talk about the importance of pollinators and their habitat needs. Since our most important crop pollinators are bees, most of our pollinator work related to the Farm Bill is aimed at supporting bees. Native bees are vital for crop pollination. And here you can see examples of how many different species we have.

But even though we've known how important they are for quite a long time, it wasn't really until Colony Collapse Disorder that we've realized that we really have to start supporting them, to make more of a concerted effort to support them. This research that came out in 2003 looked at the effects of native bees visiting crops versus honeybees. And they found that in 41 crops around the globe, wild pollinators, which mostly are native bees, significantly increased production, versus only 14% of crops with honeybee visits.

In those where fruit set was improved by both groups, wild and honey bees, wild bees improved set twice as much as honey bees. This isn't to diminish the importance of honeybees. We can't manage a lot of our other bees the same way. We can't bring in tens of thousands in a day to the crops, so we're not diminishing the value of honey bees.

The reason that some of our other bees are more efficient has to do with the fact that many of them are solitary. Oftentimes honey bees specialize. If there are lots of sisters foraging, one group can just forage for nectar, and other ones might just forage for pollen. In this case, you can see the honey bee is collecting nectar from this apple flower, so she's not going to be particularly effective as an apple pollinator.

Whereas these solitary bees--and I'll talk a little bit more about the different types of bees, but most of our bees aren't social, so every trip, they need to collect nectar

and pollen--these two mining bees (or digger bees) are diving in through the top of the flower to get to the nectar, in this case. In this case, she's gathering pollen, but in both cases, they're going to be a lot more efficient in terms of apple pollination. They're going to pick up a lot more pollen to carry to the next flower they visit.

Another reason that behavior affects pollination is our wild bees, our native bees in North America, do what's called buzz pollination. That's just vibrating the anthers of flowers to release pollen. Honeybees can vibrate their wing muscles, but not at the right frequency to release pollen for those groups of flowers. Those are in the tomato, Solanaceae family (the nightshade group). They're the same. And also Ericaceae, the heath family.

Whole Foods market staff decided to do a little demonstration of how important bees are for our food. They took out 237 of 453 products, about 52% of the produce items normally sold at the store. They removed things like apples and avocados, eggplants and squash. And this is what the shelves looked like after they removed that.

Insects really matter. Despite our increased awareness of the importance of protecting pollinators, we've recently seen some terrible losses. In addition to the continued high losses of honeybees shown in this chart, just last month in June about 37 million bees died in Ontario when corn coated in a neonicotinoid pesticide was planted.

The first day of pollinator week in Portland, Oregon, trees in the parking lot of Target were sprayed, apparently off-label, on linden trees for aphids--so really no need for any spray at all. The aphids were not going to be hurting the linden. They sprayed them when they were in flower. 50,000 bumblebees were killed. We believe it's the biggest mass killing of bumblebees that has been documented.

Despite our tremendous understanding of the crisis, we're still seeing terrible things happen like this. So it's not a time to be complacent about supporting pollinators. I think people really are aware of these problems now and want to do things to help. If people find out you've been listening to a beneficial insect talk or a pollinator talk,

they'll probably want to know what you learned. So don't take it for granted.

How can we better support pollinators? Everything that we do to benefit our native bees and wild bees is going to benefit honey bees, as well. And it will also benefit all of those other beneficial insects we were talking about, predators and parasitoids.

Sometimes I forget to mention that honey bees--the reason we talk about native bees or wild bees is that honeybees aren't actually native to North America. They were imported during colonial times. We do have some wild honey bees. Some honey bees become feral. And we also have a couple other species that aren't native that have naturalized.

But most of our bees are native. And as I showed a little bit earlier, on that earlier slide, we've got about 4,000 species of native bees and the greatest diversity in the southwest. So, sorry to jump around there.

We've got three groups of native bees based on nesting habits. And the reason we like to think about them in these terms is that when we're trying to support habitat for native bees, it's helpful to understand their nesting needs. They all need forage and nectar and protection from pesticides, but their habitat needs vary a little bit depending on their nesting habits.

The vast majority of our native bees are solitary, and that means that they don't work cooperatively. They don't have a queen with daughters working together. They mate when they emerge, and then the female will make nests for her young. [Excuse me. I have a little bit of a cold.] Then she'll collect nectar and pollen and provision the nest on her own. That's also one reason that they're particularly efficient, because they only have a short time to do that.

Bumble bees are our social native bees, and they really love any habitat that would look like it would be good for mice. They actually like to nest in abandoned mice burrows. Besides providing forage, conserving brush piles and unmown areas is the best way to support bumble bees.

I usually tell farmers that if they have a messy corner on the farm--maybe

somebody's been bugging them to clean that up--all they need to do is add a sign saying ???pollinator habitat.??? I really can't emphasize enough that those messy areas are really important for conservation. Usually, as long as people know that unmown areas are intentional, then they don't mind them. If they think it's just not cared for, then they might worry about it. This is a big issue in terms of roadside management.

Sorry about that (coughing break). So let's see. All righty.]

About 70% of our native bees are solitary, ground nesting bees.

Hi, folks. I'm sorry I'm muting there a little bit to cough.]

Our ground nesting bees nest in the ground. They excavate about one or two or three feet, while out west maybe 10 or 15 feet into the ground, and their nests look a lot like ground beetle nests. If it's a time when they're active--they're usually active for probably several weeks, maybe even a couple months--if you just observe the holes, you'll be able to see the females will be in and out within a few minutes, bringing provisions.

About 30% of our native bees are cavity nesters, or tunnel nesters. They depend on existing cavities, mostly. We have carpenter bees that will excavate nests and have big, strong jaws for that. But most of our cavity nesting bees depend on existing holes. So dead wood and wood-boring insects, two things that we generally think of that we might not always want to have, unless you're a birder, are really good for our native bees.

Sudie, maybe this is a good time, if there are any questions, we could take a little break.

There's one question. We're going to take more questions at the end, if other folks come up with some other questions, I'll be sure and type them in. I have a question from Paul. He's asking for a recommended ratio of bee habitat to cropland when you're creating or enhancing or setting aside such areas.

Paul, we're going to talk about amounts of habitat in the next section. So if you still have more specific questions, let me know at the end, if that's OK.

I have one, since you were talking about the different wasps and flies. Just from observing pollinators, I used to look at a flower and say, oh, that's not a bee, that's just a wasp. But now that I've learned all this about beneficial insects, I was just wondering if you assume most of the wasps and flies are beneficial?

Yes. In general, most wasps are considered beneficial, because they're going after smaller insects, and most of our pest species tend to be smaller insects. And then flies, I don't know what percentage are considered beneficial. So that's a good question. But if you're an ecologist, you know that those flies are providing food for other wildlife, too.

In today's talk, we're using the term beneficial pretty narrowly to refer to insects that are specifically beneficial for crop pests, but in general, insects are vital for our ecosystems overall. And so sometimes it's not always easy to label things as good or bad.

Right. Well, we had one more question, since we're on the subject. Like yellow jackets. If yellow jackets move into the messy section of the field, are there ways we can get something else to move in?

Not all wasps are social. Yellow jackets happen to be a social species, and they're actually still considered beneficial. The only time you probably need to worry about yellow jackets is when they're close to your house or if they're in your yard where you're mowing.

Just like bumblebees, they have annual colonies. So they start out with just one yellow jacket in the spring. And it's just by the end of summer that they have a colony that is worth defending. So they usually aren't aggressive until the end of summer. If you really just don't like yellow jackets, that's probably not a satisfactory answer, but that's the story. If you have more questions about that just email me.

I think we'll go ahead and move on. Is that OK, Sudie?

Fine.

All right. Insect diversity and abundance in crops depends on natural habitat on or close to the farm. So here is a nice example. It's an apple orchard, and there's a mixture of grassy area and shrubs and trees. Right now we're just seeing a native rose is in flower, but I'm sure there're other things.

The nice thing about this habitat is, it's diverse. Having as many different kinds of niches as possible, there happens to be more hedgerows in the background, so the diversity is really important.

A big question, and this was Paul's question, how much habitat is needed? It's really hard to say. Usually most farmers can't just take out good farm land-- they end up usually planting in marginal areas.

In this particular study in Pennsylvania, where they have very large apple orchards and they depend on honey bees for a lot of their apple pollination, they looked at areas of the orchard that were adjacent to???they looked at who was pollinating apples in areas in the center of those orchards that were farthest from the edge, and which bees were pollinating in the areas closest to the edge habitat. They found that native bees really provided all the pollination service in the areas closest to the edge. They were able to recommend to farmers rather than putting honey bees in those edge areas, if they did feel like they needed to hire honey bees for pollination, that it was better to put those in the center of those large areas, and then take advantage of the edge.

Part of the answer to that question is that bees-- based on their size, the farther they have to travel, the more energy it's going to take. At some point it's not efficient for them to provision their nest if they have to travel too far. The closer the crops are to the natural habitat, the more likely you're going to have native bees visiting. So sometimes we like to say within 500 feet is a good estimate.

And then diverse habitat is best. Studies have looked at natural enemy and crop pollination by wild bees in different types of landscapes. The more diverse the

habitat--and I mentioned this earlier, but if you're interested in looking at the research, I've included some references???the better.

There's been some really terrific work by Glynn Tillman down in Georgia looking at using insectary plantings. Providing sources of nectar or pollen for insects is called an insectary planting, versus a trap crop planting. She also used trap crops. Trap crops are when you plant a crop to attract pest species away from the crop that you're trying to harvest for income. They???re a little bit different than an insectary, where you're trying to invite beneficial insects or support them.

But in any case, in her study she looked at this little parasitoid wasp that infests the eggs of this stink bug. By providing buckwheat as a source of nectar, she had 2 1/2 times the rate of parasitization of stink bugs. Really dramatic effects. So here's the buckwheat, and here's a syrphid fly. I didn't have a picture of that wasp on the buckwheat. And if you wanted to look at some of her research, I've included a link there.

When she added milkweed as a source of nectar, looking at a different parasitoid. This is a fly, Trichopoda, and she lays her eggs on the adults or on large nymphs. The larvae will burrow into the adults or nymphs and eat it rather than the eggs. So it's a little bit different way of parasitizing. When she added milkweed as a source of nectar, she had five times the rate of parasitization on the green stink bugs--so really, really dramatic increase in parasitization with just the addition of cover crops.

A lot of times people say, ???If we're leaving these messy areas or we're planting these areas that maybe look messy to me, is that going to increase pest pressure? Are we going to have more pests coming in???? Studies have looked at this and they found that natural enemy populations are higher and pest pressure is lower in complex patchy landscapes that have these type habitats???fallow fields, field margins, or wooded habitats. Any kind of natural area adjacent to the farms.

David Orr here in North Carolina did do some research looking at packaged beneficial insect mixes. You can get mixes of plants that are specifically called beneficial insect mixes from organic seed companies and different companies.

Sometimes they include a lot of annual species. In most of our NRCS plantings, we plant perennial wildflowers, unless you're doing cover crops. But he did find that some of those mixes included evening primrose, and that that did tend to invite some moth species that were pests. So he developed his own mixes that didn't include evening primrose.

One other issue is that, depending on the farm system, certain wild flowers that we might want to plant may already be very present in those areas, or they could present a problem as a pest plant. So just be aware when you're talking to the farmer in certain landscapes if any species tend to be more aggressive. Sometimes that aggressiveness is good for establishment, but if it's also causing any kind of weed pests, then you don't want to use that plant.

Here's the study that looked at how much habitat is needed for beneficial insects, not just pollination but parasitoids. So in this canola pest control study, when they had less than 20% of the land-- so as long as 20% or more of the surrounding landscape was a natural area--they had adequate parasitization of their pests. Notice that the threshold here wasn't 100% infestation or parasitization of the pest species. Just by having about 1/3 of the pests infected, or parasitized, that was adequate biological control. The threshold meant that harvesting the crop would still be profitable.

In general, bigger is better, but most farmers aren't going to be able to take out their best farmland to plant these habitats. Oftentimes we're just recommending planting areas that are marginal, or instead of mowing the edges of farmland, letting things grow up, or incorporating hedgerows into your agricultural systems or your garden landscape. Providing habitat is not only just providing diversity and forage and good sources of nectar and pollen, it's also protection from pesticides. Sometimes people ask about planting these circular irrigation systems. They'll have little corners that would be good for pollinators. You could just leave those to grow up, or enhance them with some pollinator plantings.

You just have to be aware if pesticides are being sprayed on that crop, are those

going to affect those patches? If pesticides are sprayed at a time when those areas aren't in flower, then that may not have a detrimental impact. You just have to be aware that if you are creating habitat, how is the adjacent farmland being managed? Is that going to support those insects?

I see it's already about 10 of, so I'm just going to go through some of this a little bit quickly. These materials are in a PDF list of web links that I've put together for pollinator habitat. It does include some information on biological control. But this document is in that list and it's available online, and it's looking at ways to reduce bee poisoning. Its being updated to include some information on more native bees.

A big issue that people often are concerned about are neonicotinoids, and those are the ones that I talked about a little bit earlier. I have a good bit more information about neonics. If you download the slides, there's text with all of these. And the main thing is that neonics are systemic insecticides, so that means that they're taken up into the plant. They become part of the plant. So every part of the plant has these materials in it.

If bees are consuming nectar or pollen, if there's just a small amount of residue, it can still affect them. Large doses are lethal, but small doses do affect foraging and other things, learning behavior.

So these are things that we recommend. Avoiding application during or before bloom. Avoid repeated use. These have a very long life, so they might still be active after three years. Repeated use annually can really increase levels.

And then, do we really need to use these things for getting rid of aphids on linden trees? I don't think so. There're organizations like Bee City USA who are trying to work with municipalities and communities to plant native plants and reduce pesticide use in areas where there's no agricultural need. So that's called cosmetic or ornamental use.

A lot of homeowners don't realize that the products that they're buying have neonics in them. We have a report, and that is listed here. You can download that. That's

also in the list of web links that are provided with the webinar. It looks at what we know about neonicotinoids.

So I tend to work a lot with sustainable or organic farmers, and there seems to be a little bit of disconnect. Sometimes people think that because it's organic, that it's not toxic. And so this is a real place where NRCS staff can help people remember that just because it's organic, it still is toxic to bees. And there's lots of different options that people use that are not really insecticides, but help control pest problems. So these are some things. I'm not going to go into a lot of detail here, just for the sake of time, so we can have a few more questions.

One thing for ground nesting bees, a lot of organic farmers use tillage to help control weeds. We encourage them to just avoid deep tillage. Reduce tillage as much as possible. If you do need to till, if you can just do it lightly on the surface then you're going to have much less of an impact on ground nesting bees. Lots of other alternatives.

I have a little section here on habitat. The main thing I want to talk about is that bees, in general, have longer tongues than most of our flies and wasps. If you are interested in supporting beneficial insects, some of that plants like mountain mint that have smaller flowers are especially good for all insects. Bees love them, too.

All the NRCS programs require plantings that include three plants that bloom in the spring, three that bloom in summer, and three that bloom in the fall. We want to provide forage throughout the growing season. Diversity just increases insect diversity, and that's good not only for other beneficial insects, but all wildlife. You're going to improve the diet of other critters. And then I have some establishment tips here, and you can read those later if you want to take a look at that.

The one thing people always are talking about, if you're supporting wildlife, and these beneficial insects are the same, once we have an established area, or we have a managed natural area, we don't want to disturb any more than 1/3 a year. But that can be hard in areas where there's high rainfall, so I try to encourage people to not disturb any one area at one time. You might mow one spot in the early

spring and then another area a little bit later in spring. You probably don't want to mow during ground nesting bird season, so maybe again at the end of summer mow another little patch. Just spread out if you need to mow every year due to equipment or just because you have really fast growing trees. Spread out disturbance through the whole season.

Again, we have this terrific Conserving Pollinators While Addressing Other Resource Concerns [webinar] that was a presentation that Mace and Eric did, if you're interested in learning more about NRCS programs. It's a great program on habitat in general, so I think it'd be worthwhile, even if you're just interested in habitat for wildlife.

This is an example. NRCS supports integrated pest management, and the practice they use is numbered 595. In order to learn more about this, you would want to visit your local district conservationist. Just like extension has extension agents, in NRCS the local person that you would deal with is the district conservationist. You could go to the main website to find out in your state and in your county who is that person and make an appointment with them to learn more about programs. Even if you don't need financial assistance for any of our conservation programs, you can still get lots of really fantastic technical assistance.

These are some of the resources that you can get through USDA-NRCS, and I include links to this in that PDF web links that will be posted with the show. Xerces has a ton of publications online. We have a whole website dedicated to conservation biocontrol, and so I've included that link here and on the PDF web links.

wildflower-rich habitats support beneficial insects and other wildlife. We have a Bring Back the Pollinators campaign, and we have a pledge form. The form just mentions all the basic things that people can do-- plant habitat, avoid pesticide use, and then help spread the word. They can do that online by going to our website.

Remember to plant flowers as native as possible and reduce pesticide use. Thank you all. Sorry to run out of time here, but if you are interested in asking some questions, we'll be here for another 10 or 15 minutes. And thank you, Holli and

Sudie, so much.

A couple of questions did come in, so you ready?

OK.

There was a question about herbicides, and if you know if there are any known herbicides that are detrimental to pollinators or beneficial insects?

Can you hear me OK? I'm not using the headset. I'm using the speakerphone now.

You're a little far away.

OK, I'll use the headset. In terms of herbicides, we don't know that much about toxicity. Hello? You there? Can you hear me?

Yes.

OK. Mainly you just want to follow the same principles. If you are going to use herbicide, try to mow areas so there aren't things in flower when you're spraying. We do know that a number of fungicides are toxic to insects, and so you really want to try to avoid spraying fungicides when insects are around, as well, or when things are in flower.

There was another question about the chemical used to treat for mosquitoes.

Yeah. So we have a terrific publication online. If you go to our main website and you just search for mosquito management, we have some guidelines. But it really varies with what is being used. If they're using Bt there's a-- well, actually, I'm not sure. I'm getting mixed up with gypsy moth spraying. So I'm just going to refer you to our website. It's a terrific guide.

Another question about when you're establishing or permitting these pollinator habitat areas, are native grasses beneficial to include in those mixes?

What was the question?

The question was whether or not to include native grasses when you're establishing wildflowers or protecting habitat.

Most of the NRCS pollinator plantings include grasses. In the past, a lot of the grassland plantings would include forbs. It was about a 60% grasses to 40% forbs mix. We would reverse that, or having just 1/3 grasses would probably be enough.

We recommend using the smaller stature grasses like little blue stem, or things like that, that aren't going to shade out the perennials as they're getting established. But yeah, you definitely want to include some native grasses in the mix. Over time, you might need to disk that to thin out the area if you want to encourage nesting habitats for birds.

In some of our publications, we include the fact that the native grasses are also host plants for some of the butterflies, and that they provide some structure, some cover.

So another question is about artificial nest structures, bee boxes. Is there a recommendation of how many to install per acre?

In general, unless you're planning to actively manage bee boxes, we don't really encourage the use of bee boxes. If you want to have them because it's fun to watch the bees or it's at an educational center and you want to use it to help teach children, that's fine. But what happens if you have a lot of concentration of nest boxes, unless you're managing them well and carefully, then that might become a sink. You might actually be causing problems for the bees, because diseases and pests will locate them over time and devastate those populations.

If you do want to add nesting areas, besides planting plants with pithy stems or managing some open ground for ground nesting bees, you can make small bundles of bee nests using some native bamboo or things that will disintegrate over time. Those don't really have to be managed. They'll naturally decay, and you just put up new bundles periodically. We do have a lot of specific information on nesting if you are interested in that on our website, and I do include some links to that in the PDF, as well.

Here's a question about some of the states where there's really large row crop farms. And the question was whether populations are better or worse in those areas, and if there are any population maps.

I am not that familiar with the research that has looked at the impacts on that. I know there is some new work on that. But in general, it's a question--

He's talking about mostly in these row crops that are more wind pollinated. The question is all the herbicides that are used, is there--

Right. Yeah, because for instance, bees will collect pollen from corn, and if it's toxic. We don't have good data on that, as far as I know. But that's a good question. So maybe if that person can write to me, I'll try to find some more details and let you know. Do you mind contacting me?

There's a couple of quick questions you might be able to answer quickly. There's one about the medication used by beekeepers to control varroa mites. Does it reduce the immunity that a honey bee has? Do you know, Nancy? I know you're talking more about native bees.

Yeah, the medication for varroa mites is tough on bees. It can reduce the fecundity of queens, and it needs to be used really judiciously and cautiously.

One more quick question was about that specific canola study, and the question was whether that was an organic or conventional farm?

That's a good question, and I don't know the answer. But I can look up the study and let you know. So if you can write to me, that would be good, so I who is asking. I guess maybe we'll have a record of who sent the questions?

Yes. I think so.

So I can follow up with those two questions.

And I think you pretty much answered most of the questions that were sent in, either through a direct question or through your presentation, and I think it's 10 after.

Well, I'll chime in. Thank you very much, Nancy, for the great presentation. And I always just personally enjoy your presentation and those that are provided by the Xerces Society. The photos are just wonderful. No matter where they're coming from, they're great photos and we appreciate your effort in pulling your presentation together. So thank you, Nancy, for your time.

Also, thank you, Sudie, for your time and for being our guest moderator today for the East National Technology Support Center. I will conclude the webinar at this time, and look forward to your participation next time. Thank you very much.

Thanks.