

Zoom: PSC Virtual Training 2026: FHYP-5956 - info@pollinator.org

[starts at 14:14]

[>> W] To the topic being discussed.

[W] Questions for panelists will be answered at the end of the session, using the questions posted again in the Q&A box.

[W] You can contact us at for any questions relating to the program.

[W] If you've missed it, you can scan the QR code on the slide.

[W] If you'd like this webinar transcribed in your preferred language.

[W] And as always, please engage in respect and kindness with each other in the chat.

[W] And one last thing.

[W] Tonight we're going to do something fun.

[W] We're going to do the Moderator's Choice award for favorite question.

[W] So during the question period we'll have Avery choose her favorite question.

[W] And that person will get a fun prize from our bonfire store on our website.

[W] And with that, I'll pass things over to Laura.

[>> W] Okay, great.

[W] Well hello everyone.

[W] Thanks for being here and taking part in the program.

[W] I'm every year I'm super excited to be here and I'm really excited to be kicking off the 2026 class.

[W] So as Anthony said, my name is Laura and I'm the associate director of Pollinator Partnership.

[W] I am based in Victoria, BC, Canada, and I live and work on land that has actually been returned to the Esquimalt and Songhees First Nations, who have been stewarding the land for thousands of years, and their stewardship continues to this day.

[W] So I work to acknowledge this and to contribute to reconciliation in my life and through my work with pollinator conservation.

[W] And I think this connection will become more apparent as we go through the course.

[W] So again, I'm really excited about the program, the new class we have here, and then all the great things that are going to come from it.

[W] So in this first talk, I'm going to go over pollinator foundations, which will be the underpinnings of much of the rest of the information that you'll get over the course of this training.

[W] So some of you may know some of this, but I do think it's important to make sure that we're all on the same page with our foundational knowledge.

[W] And, you know, if a lot of it is a review, you can just kind of enjoy it as an easy first talk.

[W] So in this presentation, I'm going to go over pollination and its importance.

[W] And who are the pollinators.

[W] I'll then focus on bees and why bees are so special in the world of pollinators.

[W] I'll introduce the issues that bees and other pollinators are facing, and I'll show you how bees live, what they need.

[W] And I'll end with introducing how we can help.

[W] And this last part is just going to be a brief overview that is going to be covered in a lot more detail in the later talks.

[W] Like Anthony outlined.

[W] Okay.

[W] Again, just so we're all starting from the same foundations, what is pollination?

[W] Pollination is the movement of pollen from the male parts of the flower to the female parts of the flower.

[W] This can be within the same flower, between flowers on the same plant, or in between plants of the same species.

[W] So this pollen transfer enables fertilization, sexual reproduction, and the production of seeds and fruits, and pollination can occur in a few different ways from gravity, from wind, from water.

[W] But when an animal moves pollen, that animal is called a pollinator.

[W] And pollination is essential to natural ecosystems as we know them.

[W] With about 90% of flowering plants requiring or benefiting from pollinators for seed and fruit formation, and that, of course, for plant formation.

[W] So the pollinators enable plants to reproduce and produce those seeds and plants and fruit that other wildlife relies on.

[W] And this means that pollinators are keystone species in ecosystems.

[W] But in addition to natural ecosystems, pollinators are also essential to food production.

[W] And it's estimated that about one third of our food is a result of pollinators.

[W] And even more importantly than that, one third of the food, much of the nutrient dense food in our diets, and I'll say kind of some of the fun food, too, like chocolate and coffee, are from plants that require or benefit from pollination.

[W] And pollinators are important to humans for many non-food reasons, things that we call ecosystem services.

[W] Pollinators are needed for plants that produce textiles and dyes and pharmaceuticals.

[W] They're also important for helping plants reproduce, that stabilize soils and filter water and prevent runoff and erosion, and pollinators also play a role in supporting other global ecosystem services like carbon sequestration and supporting the Earth's major biochemical cycles, things like the water, nitrogen and carbon cycles.

[W] Okay, so who are these pollinators?

[W] I've been talking about?

[W] Pollinators can be any animal that moves pollen.

[W] And this includes things like birds and mammals, of course, many types of insects and even some lizards.

[W] So our poster from 2010 shows some of this amazing diversity of pollinators.

[W] And bonus mark.

[W] I don't know if you can quite see it, if you can see that I've got our Pollinator Week T-shirt from 2021 that features this poster art.

[W] Okay, so we know that many animals can be pollinators, but the most important pollinators in most ecosystems are the bees.

[W] And this will not be on your test.

[W] There is no test, so don't worry about trying to see all this.

[W] What this shows are the 100 global top global crops on the left and the pollinators that visit the crop flowers on the right.

[W] So this is what's called an interaction diagram.

[W] And what I'd like you to get from this is just an overview of all the major crops or, sorry, all the major groups of insects that are important for crops.

[W] The bees, as I mentioned, are the most important crop pollinators.

[W] And you can see that in the wide yellow bar in the middle, the thickness of the bar represents how many interactions they have with crops.

[W] So this shows that the bees have the most interactions with the most crops.

[W] But other groups of insects, such as the Coleoptera, which are the beetles, the Diptera which are the flies, the Lepidoptera which are the moths and butterflies, and the wasps, among other groups, are also visiting.

[W] Our crop plants may be important for their pollination.

[W] And international or semi-natural ecosystems.

[W] These again tend to be the most important visitor and pollinator, visiting most plants and having the most interactions with flowers.

[W] And in this interaction diagram.

[W] So it's just flipped around.

[W] It shows a typical natural ecosystem.

[W] Flowering plants are across the bottom and gray, and the different pollinating groups that are visiting them are in colors across the top of the diagram.

[W] And from this you can see that the widest bars are the bee groups in blue in the center, showing that the various types of bees and Hymenoptera are the most common.

[W] Floral visitors, but many other groups of insects also visit wild plants and are really important for stable and resilient ecosystems.

[W] And we'll talk more about some of these other non-b groups.

[W] In the third module of this series.

[W] So when people think of bees, they often think about these bees, which are the honeybees.

[W] And I'm going to talk in a bit more detail about honeybees in a few minutes.

[W] But in addition to managed honeybees, there are over 20,000 species of bees worldwide and over 4000 species of bees that are native to North America.

[W] In any one location, you might be able to find 50 or 100 different species, or even more if you know what to look for, and they come in a diverse array of sizes and shapes and colors.

[W] And you can see that in our 2011 poster showing some of the amazing diversity of bees.

[W] Okay, what is a bee?

[W] It seems really easy, right?

[W] We see images of them all over the place and they generally look like this.

[W] But what I want to do is give you a deeper understanding of what a bee really is, and why they're so special to our plants, to our planet, and to us.

[W] Okay, this is not a bee.

[W] This is a dinosaur.

[W] And it seems out of context, right?

[W] But to understand bees, we do need to go back about 150 million years ago, during the time of dinosaurs, when our forests looked like this, there were no flowering plants.

[W] But plants can't move.

[W] But they need to have sex to reproduce sexually.

[W] And they do this through having their pollen, which is from the male part of the plant land on the female parts of the flower of the same species.

[W] So back before flowers and pollinating animals, most plants spread their pollen by wind.

[W] And the majority, 99.99% of pollen didn't land on its target, which are the female parts of the same species.

[W] So plants have to produce a lot of windborne pollen to ensure pollination and reproduction.

[W] Then, at some point, around 140 million years ago or so, plant species that produce flowers evolved.

[W] They were designed to attract pollinators that would then spread their pollen in a targeted way, from one flower to another.

[W] The pollinators got that high protein food source of pollen, and the flowering plants got animals to move the pollen.

[W] So these flowering, pollinator attracting plants could then produce much less pollen.

[W] The first flower pollinators were likely beetles.

[W] And as an aside, here it's the plants that produce the windborne pollen that are usually responsible for human allergies.

[W] So the plants that bees and other insects are using and pollinate, they tend to have heavy, sticky pollen grains that are not airborne.

[W] So how do bees come into the picture?

[W] Well, around that time, maybe about 120, 130 million years ago or so, a solitary wasp that was feeding her offspring a carnivorous diet of mostly other insects, switched to using only pollen to feed her offspring.

[W] And when that happened, she became the first bee feeding at all life stages, almost exclusively on pollen and nectar, and the bees were now the vegetarians of the Hymenoptera.

[W] That's the ants, bees and wasps group.

[W] Also, when bees evolved, this is super cool.

[W] They developed specialized hairs and structures to carry pollen back to their nests, and this directed foraging to collect pollen for their young.

[W] Using pollen carrying structures is what makes them the most important pollinators for most of our pollinated food and in most of our natural ecosystems.

[W] These Pauline caring hairs and baskets.

[W] I sometimes refer to them as the bees grocery bags, because it's what they use to bring the food back home to their babies.

[W] And bees are unique in having these pollen reusable grocery bags.

[W] Other animals don't have these, and this is what makes bees so special in the world of pollination.

[W] They've evolved specifically being the wings for plants moving pollen in a targeted way from flower to flower, resulting in plant reproduction.

[W] And over the last 120 million years, bees and flowers have diversified an incredible amount, evolving together in a process known as coevolution to produce all the amazing and beautiful diversity of bees.

[W] Around 20,000 different types and flowers, around 300,000 different types that we have today.

[W] And this co-evolution has resulted in many unique flower bee interactions and unique ecosystems that are tied to the place they evolved.

[W] We'll delve more into the implications of that co-evolution in the fourth module, where we talk in more detail about creating habitat for pollinators.

[W] Okay.

[W] And I really like this.

[W] A visual representation of bee diversity, a great picture by Stephen Buchmann.

[W] And this is one of the largest bees in the world.

[W] The carpenter bee and one of the smallest bees in the world.

[W] The fairy bee on its l.

[W] And in addition to these extremes, there's of course everything in between in terms of size and shape and hairiness and color.

[W] Okay, so what is a bee and why are they so special?

[W] Well, mainly what I want you to take from this is that they're they're not just honeybees.

[W] Also they're not wasps.

[W] Rather they evolve from wasps to be the vegetarians of the Hymenoptera with specialized pollen carrying structures to bring food back to their young.

[W] So they're not interested in your food.

[W] They're not likely to sting you.

[W] And they're great pollinators because they've evolved to use pollen and nectar for all life stages.

[W] They're diverse, they're docile, and they're critical to life on Earth as we know it.

[W] So we now have this amazing diversity of native bees in North America, with about 4000 different species that are essential for our natural ecosystems, ecosystem services that humans rely on.

[W] And they're really important for agricultural production.

[W] But unfortunately.

[W] We do know that some populations and some species are in decline, which Anthony will go into in a bit more detail.

[W] But first, I want to talk more, as I said I would, about how honeybees fit into our North American landscapes and economy.

[W] So the honeybees that we have here today are not native to North America.

[W] They were brought to North America in about 1622, around 400 years ago, mainly for the purpose of wax and honey production.

[W] Colonies of honeybees are kept in artificial hives, and numbers of hives were increased by humans over the next few hundred years and brought to almost all the locations across the continent.

[W] Colony numbers peaked around the end of World War two, with about 5.9 million colonies in the US, and after that there were declines in the number of colonies, mainly because honey, honey bee honey demand fell and prices fell.

[W] Okay, so we're going to pause here for a quick poll so you can participate too.

[W] And I don't have to do all the talking.

[W] Anthony, if you can pull up the poll.

[W] We're asking our honeybees in decline.

[W] And the options are yes.

[W] No.

[W] And I'm not sure.

[W] So we'll pause for a couple of seconds here for you to answer.

[W] Okay.

[W] Anthony, can you pull up the results.

[>> W] Yep.

[W] So I'm seeing 64% saying yes, 24% saying no.

[W] And then 12% saying not sure.

[>> W] Okay.

[W] Very cool.

[W] I think there's been some shifts over the years in the percentages here, which is, which is very cool to see.

[W] So they're actually not in decline since about the I'll switch my slide here since about the 1990s, the number of managed honeybee colonies in the US has been about 2.5 million.

[W] And contrary to what many in the public are hearing, the number of managed honeybee colonies in the US and Canada has pretty been pretty stable over the past few decades.

[W] But what is happening is that there are increasing health issues that manage honeybees are facing, resulting in a lot of colonies dying each year.

[W] This makes it quite hard for honeybee keepers to maintain colony numbers and provide colonies at the right time for crop pollination services, but so far, hard working beekeepers have managed to maintain numbers by splitting strong colonies, importing queens and small colonies.

[W] So there is definitely a decline in honeybee health.

[W] But so far not a decline in the number of honeybee colonies.

[W] There's a caveat here with colony losses that have been worse than ever some years in the last couple years, this could start translating into declining overall numbers of honeybee colonies.

[W] But so far, we're not seeing that.

[W] And this is a really serious agricultural problem.

[W] When you look at the estimated contribution of honeybees in the US being about 15 billion per year in added crop value through their pollination services, without honeybees, large scale agriculture would have lower production, likely resulting in higher food prices.

[W] And as mentioned, honeybees are experiencing these unprecedented yearly loss and health problems.

[W] But this is primarily an agricultural issue and not a conservation issue per se.

[W] And this is one of the areas where the waters have gotten muddied at times in the conversation in terms of how to help food production, bees, conservation and natural ecosystems.

[W] With the sometimes misinformed messaging to the public, many well-meaning people are trying to help the pollination crisis by keeping honeybees.

[W] And there could be a lot of reasons to be a beekeeper, to pollinate crops, to produce honey, which we can't get from our native bees here in the US and Canada, for we can from some other bees down a little bit south in the bottom part of the US and in Mexico, we might be somebody might want to be a beekeeper for hive products like wax, or for education, or even for reasons like it being a fulfilling hobby.

[W] But it should be understood that honeybee keeping itself is not a conservation action.

[W] And there is concern that beekeeping outside of agricultural use can in some instances negatively impact native pollinators.

[W] So I want to emphasize honeybees are integral to our current agricultural production in North America, and they do need support.

[W] Things like funding for monitoring and research for better control of pests and diseases, and research and breeding to improve stock.

[W] And they need places where they can access diverse and abundant floral resources in order to keep them healthy and reduce colony loss.

[W] But this course is going to mainly focus on conservation of native pollinators.

[W] But we're also happy to say that many of these actions will also support managed bees.

[W] Okay, when we're talking about threats that pollinators are facing, our native bees, other native pollinators and managed pollinators are facing really similar pressures.

[W] Some of the main threats are habitat loss, which includes loss of nectar and pollen, and loss of nesting and overwintering sites.

[W] Pesticide exposure, parasites and diseases.

[W] Invasive plants and climate change, which includes warming temperatures, altered precipitation, and extreme weather events.

[W] And these pressures interact with each other so that pollinators are more susceptible to negative impacts of one factor in the presence of other pressures.

[W] Okay, so I'm going to turn it over to Anthony now to talk a bit more about the issues facing pollinators and the status of native bees and other pollinators in North America.

[>> W] Okay.

[W] Thanks, Laura.

[W] All right.

[W] And just a warning that the next few slides might get a bit gloomy as I talk about the issues, pollinator pollinators are facing.

[W] But don't worry because things will get more positive at the end of the presentation, I promise.

[W] So as Laura just mentioned, and as you can see in this diagram here, there's just there is not just one factor alone that is impacting pollinators.

[W] Again, it's a combination of several factors interacting with each other that are impacting pollinator health and their populations.

[W] So one of the main factors impacting pollinators is habitat loss and fragmentation.

[W] The connectivity of pollinator habitat from one space to the next is crucial when thinking about bees, particularly since they vary in the distance that they can forage to find flowers for pollen and nectar.

[W] Honeybees, for example, can forage relatively far distances to find flowers, which you can see on this slide here in the outer ring, bumblebees like to stay closer to their colonies and forage approximately two miles or three kilometers away from their nest, which you can see in this middle ring.

[W] And then solitary bees, often quite small in size, only forage a few meters to maybe a kilometer or a half mile from their nest, which is shown in the inner ring.

[W] So with such small foraging ranges, this demonstrates the importance of planting more gardens and green spaces for pollinators to create better habitat connectivity.

[W] This ensures that pollinators don't have to expend all of their energy looking for food sources.

[W] Even small spaces such as balcony gardens can connect habitat and provide pollinators with resources so that they don't have to spend all of their energy trying to find food.

[W] So we'll be covering the different types of pollinator habitat in upcoming modules, so stay tuned for that.

[W] Next up are pesticides.

[W] So some types of pesticides including insecticides and herbicides can be harmful to bees and other pollinators.

[W] As shown in this diagram.

[W] Some pesticides can move through ecosystems not staying in the place where they were originally applied.

[W] This can create problems since they can get absorbed and move through the soil.

[W] Where many types of bees make their nests.

[W] So not only are those ground nesting bees now affected by pesticides, as they are feeding on the pollen and nectar contaminated flowers, but their nests may also get contaminated as well, which can impact their health.

[W] And with certain pesticides, there are two ways that they can impact bees and other pollinators.

[W] There are the lethal effects, which are when pollinators are directly impacted, which leads to increased mortality.

[W] And there are also sublethal impacts to take into consideration.

[W] Sublethal effects are those that don't immediately kill an individual bee, but make it harder to survive.

[W] Examples of this include an altered gut microbiome.

[W] Learning memory impairment, reduced foraging, impaired orientation, decreased reproduction, and increased susceptibility to pests and disease, which leads to my next slide on pathogens and disease.

[W] So just like how humans are susceptible to diseases.

[W] So to our pollinators, one of the most well known parasites of honeybees specifically is the Varroa mite, which is seen here in the left picture.

[W] That small little red mite is Varroa and they feed on bee larvae and adult bees.

[W] Varroa mites are destructive by reducing bee health directly, and they also serve as a vector for

[>> W0] You can see in the picture on the right.

[W0] These are just two of the many types of viruses and diseases that impact pollinators.

[W0] So next we have the effects of climate change.

[W0] So looking at the graph on the left we have a study that was observing the bloom time of blackcurrants which are the green dots in comparison to the time when bees emerge from their nests in the spring, which can be seen by the red triangles.

[W0] So different climatic cues are used by plants as a signal to bloom, and by bees to emerge.

[W0] With changing climate conditions, this study found that the divergence between blooms form and when bees emerge, increased by 40 days, meaning that flowers are blooming when their pollinators are not active, and bees were active when their food sources were not blooming.

[W0] So for some species of pollinators that only live as adults for a few weeks to a couple of months, this gap can be detrimental.

[W0] Another study also showed that due to an increase in the carbon dioxide levels in the atmosphere, the concentration of protein in goldenrod pollen, which is the flower seen in the picture on the right, has decreased and will likely continue to decrease.

[W0] So not only are Bee is missing the time window for food in some cases, but they may also be eating less nutritious food as well.

[W0] And climate change is also impacting species ranges.

[W0] So this diagram shows the shrinking range for bumblebees.

[W0] Bumblebees require specific climatic needs, and some species are being squeezed into smaller and smaller geographic zones.

[W0] Because of this, with temperature and climate change as shifting ranges for other animals and plants northward and southward, which you can see in the green images on the right.

[W0] For some bumblebee species, unfortunately, they are being squeezed into smaller zones.

[W0] This results in some species disappearing in regions where they were historically and commonly found.

[W0] And of course, there are many pollinating species that are migratory that travel super far distances every year.

[W0] Examples include the monarch butterfly, different types of hummingbirds, and some pollinating bats as well.

[W0] These pollinators rely on specific types of plants for their nutritional needs, and they carry out their long journeys following nectar corridors across the continent.

[W0] If the flowers and plants these migratory pollinators rely on are not blooming at the time that they're traveling, or if the ranges of the plants are shifting due to climate change, it's harder for them to sustain the energy they need to make it to their final destination.

[W0] Finally, we have invasive species.

[W0] Invasive, meaning that these species are not historically found in an area or ecosystem.

[W0] So pollinators have a close connection with the plants they visit, particularly native plants in their environment since they have co-evolved together over a long period of time.

[W0] Even though invasive plants themselves may not necessarily have a direct negative effect on pollinators if they are outcompeting and dominating naturalized areas.

[W0] Important plant pollinator relationships can be altered.

[W0] Although invasive plants can often be seen attracting types of generalist pollinators that visit all kinds of flowers like honeybees and bumblebees, pollinators themselves might not be getting the nutritional value they need, as they would with native species.

[W0] With that being said, not all not not all non-native plants are invasive, and many can still provide pollinators with nectar, pollen and places to shelter.

[W0] So we will get into the distinction between different types of plants and how to plant diverse habitat for pollinators.

[W0] In our upcoming modules.

[W0] So, continuing on the topic of invasive species, here's a study that looked at how bee populations were impacted in the northeast United States with the rise of of invasive species.

[W0] So you can see here in these three graphs, we have years along the bottom axis, axis.

[W0] And then the number of species on the other axis here.

[W0] So we have non-native species in the bottom, one bumblebee species in the middle graph.

[W0] And then non bumblebee native bee species in the top graph.

[W0] So what we see here is that species richness declined somewhat for native bees.

[W0] But there was a strong decline in bumblebee diversity which you can see in the middle graph.

[W0] What's interesting is despite large increases in human population density and development and land use over time, native species richness declines were not large outside of some bumblebees.

[W0] However, bumblebee species richness declined by 30%, and over the same time, invasive species increased nine fold.

[W0] What this means is that while some species are experiencing stable populations and a select few are even increasing in abundance and range, generally where researchers look, we are finding that we are losing biodiversity and many important species are declining or experiencing range shifts.

[W0] So with all this being said, here is why.

[W0] Learning about pollinators and the issues they are facing is important.

[W0] This is a list of some of the federally listed pollinator species that are at risk.

[W0] So on this list we have bats, birds, bees, moths, butterflies, and other important pollinating insects such as flies and beetles.

[W0] There are more than 1600 endangered or threatened animal and plant species in the in the United States under the Endangered Species Act.

[W0] In Canada, there are more than 800 plant and animal species that are considered at risk.

[W0] According to the Committee on the Status of Endangered Wildlife, and many of these species also share a border with Canada, the US and Mexico through population ranges and migratory routes.

[W0] So the work that we're doing and that we're going to be presenting to you over these modules will be really important to reversing this trend that we're seeing.

[W0] Okay.

[W0] So that covers the doom and gloom part of the presentation.

[W0] And now I'm happy to pass it back to Laura, who will talk about ways that we can help pollinators.

[>> W0] Or did we lose.

[W0] You.

[W0] There.

[>> W0] Sorry.

[W0] I'm here.

[W0] Great.

[W0] Yeah.

[W0] So sorry.

[W0] That has been a lot of doom and gloom.

[W0] And I'm really sorry that we did need to go through that.

[W0] It's an important part of it, of course.

[W0] And thank you, Anthony, for doing that part.

[W0] But what we're going to do now is get into the really great part.

[W0] And the great part is, in addition to all of you being here.

[W0] So I want to emphasize that that is part of the really good news here that a lot of people are willing to and want to try to help pollinators.

[W0] And so we can in very meaningful ways.

[W0] So how do we help the bees and other pollinators?

[W0] The main thing that most people and organizations can do is to create habitat for pollinators.

[W0] To spread the word and to support conservation efforts, which can be done in a lot of different ways.

[W0] Much of this course is going to focus on how to create high quality habitat that will support bees and other pollinators, and we'll also discuss outreach actions later in the course.

[W0] And we can create habitat for pollinators in almost any terrestrial environment.

[W0] Of course, in park and conservation areas.

[W0] But what this course focuses on is how we can create habitat in what we call working lands, and also in urban areas, large and small studies have shown that habitat will help and make a difference for pollinators by creating habitat areas and supporting others that are creating habitat, you can interrupt that synergy of negative stressors and significantly help pollinators.

[W0] So unlike many conservation issues that are much harder for individuals and organizations to tackle, pollinators can really be a good news story.

[W0] We're able to make impactful contributions to their conservation through habitat creation.

[W0] Okay, well, what does that mean to create habitat for pollinators?

[W0] Let's dive a bit now into what bees need and look at how they live, because an understanding of how they live will form the foundation of how you can effectively help them.

[W0] As people are most familiar with honeybees, we'll start with them.

[W0] But honeybees are quite unique in the bee world.

[W0] They're very different from most of our native bees.

[W0] Honeybees have colonies with 20 to 40,000 foragers.

[W0] They recruit their sisters to rewarding floral patches.

[W0] They can forage on lots of different types of flowers.

[W0] They store honey so they can get through periods of poor weather in the winter, and they can forage at farther distances than most native bees.

[W0] These things that make them unique are also the reasons why we farm and manage them for crop pollination and honey, and why they're so ubiquitous and somewhat the ambassador.

[W0] Be familiar to almost everyone on the planet, whereas North American native bees are mostly solitary, meaning each female is her own queen.

[W0] They have they each have their own nest.

[W0] Most nest in the ground, and some in twigs and holes above ground, and they fly.

[W0] They have a short flying season, with adults only living a few weeks for most of them, and many specialize on certain types of plants.

[W0] The solitary native bees don't store honey, and they tend to forage close to their nest, often within only a few hundred feet or meters.

[W0] They don't defend their colonies because most don't have colonies.

[W0] Here's the life cycle of a typical native bee.

[W0] Most of our native bees, whether they live in tunnels above or below ground, they live like this.

[W0] So let's start here at number four in the spring, adult male and female bees emerge from their nests.

[W0] That's the place their mom laid the eggs last year.

[W0] Their parents are now dead, and the new bees have never seen the world before.

[W0] The males often sit around on flowers with their buddies or patrol the nests, and where the females are emerging.

[W0] And these guys, they drink nectar and they look for females to mate with.

[W0] Then they die after a couple of weeks.

[W0] So it's probably a good life, but a pretty short life.

[W0] The mated females then start collecting pollen and nectar and they bring it back to their nests.

[W0] They make pollen and nectar lumps.

[W0] They lay an egg on it.

[W0] Then they close up the chamber and then they do it all again.

[W0] And depending on the species and the resources, female bees lay around 15 to 40 eggs.

[W0] Then in a few weeks, maybe 4 to 6 weeks, they die to those adult females.

[W0] So we only see the flying stage of a native bee for a few weeks.

[W0] But we see all different types of bees during the warm season because they emerge at different times.

[W0] So most of the life cycle about 10 to 11 months, that's number 1 to 3 of our native solitary bees is spent below ground or in above ground tunnels where we don't see the bees.

[W0] Then in the spring, it starts all over again with the new adult bees.

[W0] And some of our bees, mainly the bumble bees, but also the stingless bees that are in the bottom part of the US and into Central and South America do live in colonies.

[W0] Since the native bumblebees are a bit different from our other, more solitary native bees, I'll quickly go over the bumblebee life cycle.

[W0] So in the spring, a female that has mated, she's a queen bumblebee emerges from her nest, and what she does is she starts looking around for food, collecting some nectar and pollen, and she finds a nest site, often under the ground or burrowed into debris on the ground, or sometimes in cavities above the ground.

[W0] And what she does is, after she's laid her first set of eggs and provisioned them, those females emerge and they're worker females, so they're sterile females, and they emerge and they start foraging.

[W0] And the queen now stays in her nest for the rest of that season, laying eggs and the worker bees.

[W0] They come out and the colonies build up over the summer.

[W0] They can get to 50 to a few hundred bees.

[W0] Those worker bees.

[W0] And so they're collecting that pollen and nectar throughout the through quite a long summer season.

[W0] And then towards the end of the warm season, the Queen starts producing new reproductives.

[W0] These are new males and queen bumblebees, and these come out of their nests and they mate with the same species, but from other nests.

[W0] Then everybody dies off except for those mated queens.

[W0] And those mated queens now need to overwinter so they find places.

[W0] They bury themselves under debris, under leaf litter, and they go into a diapause and overwinter to emerge in the next.

[W0] In the next spring.

[W0] Okay, so now that you know how bees live throughout the year, we can start to get into what they need to survive and to thrive.

[W0] And what you need to think about when creating or managing areas for them are three main things.

[W0] And when we talk about these three main things that bees need, it's also what most other pollinators need as well.

[W0] So what they are is first.

[W0] And you can see now why I put this first, because the nesting

[>> W1] So we need to have those nesting and overwintering habitat for them.

[W1] We also need floral resources for that pollen and nectar that they need.

[W1] And sometimes for plant material too.

[W1] And we also need areas that are not exposed to harmful pesticides.

[W1] So we're going to get into the nitty gritty of each of these elements in module four.

[W1] And some of you may worry that providing food and shelter for bees and other insects might cause hazard to people.

[W1] There is actually very little risk of getting stung from native bees and other native North American pollinators, as most aren't protecting colonies there.

[W1] They really just ignore people.

[W1] Remember, native bees are not wasps.

[W1] They're vegetarians.

[W1] They're interested in mating and flowers.

[W1] So this is my daughter many years ago, sitting in a nesting aggregation.

[W1] And I wasn't able to share sound.

[W1] But I think you can see all the bees flying around her and bouncing off of her.

[W1] And this was at a local school, which was actually great because oops.

[W1] Was really great because the local school knew enough not to get rid of these colonies.

[W1] And those were anthophora bees.

[W1] I've worked on native bees for almost 30 years now, and I've never been stung in the field by a bee in the lab.

[W1] Yes, I'm going right into bumble bee colonies and things, but, you know, even with bumblebees that do have small colonies putting up about a half meter or a couple foot perimeter around a nesting entrance should be enough that no one is going to get stung, you know, unless you put your finger right in the hole or something, you're probably not going to get stung if you just stay back and don't bug their nest site.

[W1] And you can check out our pamphlet that goes into more detail on why you don't need to be concerned about increasing the risk of bee stings when creating pollinator habitat.

[W1] Anthony will post this and any other resources we talk about in the module on our classroom web page.

[W1] So I'm going to end by highlighting that providing habitat for pollinators does a lot more than just supporting bees.

[W1] These habitats have many other values, and you can see this outlined in our 2020 poster.

[W1] Pollinator habitat provides water filtration, carbon sequestration, support for biodiversity, mental health benefits, and many other benefits that are important to people and the planet.

[W1] Okay, so thanks everyone.

[W1] That completes the bulk of our first module.

[W1] I'll turn it back to Anthony to provide a bit more information about the next module.

[W1] And then we'll go to our question and answer session.

[>> W1] Great.

[W1] Thanks, Laura.

[W1] Yeah.

[W1] Just quickly one final slide and then we'll get to our Q&A period.

[W1] And I saw someone posting in the chat about loving carpenter bees.

[W1] And so we have a nice carpenter bee picture on this final slide here.

[W1] Okay.

[W1] Just to wrap things up.

[W1] So recordings and resources will be shared on the course information page by the end of the week.

[W1] And we will send you all an email with that update.

[W1] Once everything is ready to go.

[W1] Our next live session will be next Tuesday, February 17th.

[W1] At the same time using the same zoom link that you use today.

[W1] And that'll be module two on Indigenous Perspectives, featuring an amazing guest speaker, Brad Howie.

[W1] So definitely tune in to that.

[W1] But now we'll pass things over to Avery, who will lead our Q&A period.

[>> W1] Hi there everybody.

[W1] And I'd like to start by saying thank you so much for your engaged questions in the chat and in the Q&A box.

[W1] It was great to hear how interested you guys are and curious about what we're talking about.

[W1] And I'd like to assure you that any questions that we don't get to today will most likely be answered in our coming modules, and you're always welcome to reach out to me and our other moderators with specific questions.

[W1] As you're curious.

[W1] So I'm going to get started with a question for Laura about invasive versus native species.

[W1] Naturalized species.

[W1] And I think some people are kind of wanting a bit firmer definitions.

[W1] What these are native.

[W1] Are honeybees invasive or just not native?

[W1] So let's start with some clarification on.

[>> W1] That.

[>> W1] Okay.

[W1] We're starting with really controversial topics.

[W1] Yeah.

[W1] So we most of the bees that you're going to see around you that are not honeybees, most of them, the vast majority of them are going to be native bees.

[W1] And we're going to get more into bid.

[W1] And how to recognize bees, because unless you have already studied this, which I know a lot of you have, but for those that haven't, you might not even recognize a lot of our native bees as actually bees.

[W1] So we'll get more into that in the I can't remember the sixth module.

[W1] I think it is where we talk about bee identification and IDing different groups.

[W1] So so just to start off there, honeybees are the major ones that are not native here.

[W1] And most of the others are native.

[W1] So we definitely do have some other bees around.

[W1] And there's just a study that came out the other day about some increasing non

[>> W2] Most are native.

[W2] For our purposes here.

[W2] So yeah, in terms of the definitions, there are different definitions for for these.

[W2] And depending on if you're going to call something invasive or if you're going to call something it's non-native or it's naturalized, there's a lot of very specific definitions.

[W2] And they can definitely change for different organisms.

[W2] They can change in different by different groups that are defining these things.

[W2] But when we're talking about native bees and non-native bees, we're talking about native bees that have evolved here for thousands and thousands and thousands of years.

[W2] So they have been here.

[W2] They have not been brought over by any recent human movement of them.

[W2] They have been around and for a long time, and that's about 4000 different species.

[W2] When we're talking about ones that are non-native.

[W2] non-Native is like an umbrella category.

[W2] So within non-native we can have things that are invasive, but everything that's non-native is not necessarily invasive.

[W2] And we'll talk more about that in the plant section too. Now.

[W2] Yeah.

[W2] Getting into the, you know, more controversial part, some people will call honeybees invasive I.

[W2] And at pollinator Partnership we we don't take that that stance on them.

[W2] Honeybees are an agricultural organism.

[W2] There are definitely some feral colonies, some locations.

[W2] But for for the most part they are managed by humans.

[W2] They're like sheep or something else that has been brought over and bred for agriculture.

[W2] Yeah, noxious is another level of invasive.

[W2] So so that's even a more serious when we have noxious.

[W2] So when we have when we talk about honeybees and whether we're going to talk about whether they're, they're invasive or they're just non-native, you know, it really depends on who you're talking to right now.

[W2] But I will say from our from from us and our stance, honeybees are livestock in Canada.

[W2] Yes.

[W2] Thank you.

[W2] They're considered livestock in Canada.

[W2] You have to go to a vet to to get different treatments for them.

[W2] So we don't generally consider them invasive in that way.

[W2] It can be quite.

[W2] It can be quite a hot button topic.

[W2] It is a hot button topic right now.

[W2] So what we look to do with this sort of honeybee native bee is we're trying to increase habitat for all we know, our honeybees are at about half the number they were at the end of the Second World War, and we know we need them for agriculture.

[W2] So we need to find a way to get along.

[W2] So yeah, I didn't go too much into the actual definitions.

[W2] I'm sure if people wanted, you know, dive into actual definitions of invasive versus non-native versus noxious, you are more than welcome to do that.

[W2] But it it can vary based on what site you go to.

[>> W2] Did that.

[>> W2] I think that answered.

[>> W2] It.

[>> W2] Thank you so much, Laura.

[W2] I think that cleared up the question for a lot of people.

[W2] And we're going to move on to a question about native bees versus managed bees again.

[W2] And I think a lot of people are curious about how we can balance our efforts between supporting managed honeybees and prioritizing native bees in our habitat and conservation efforts.

[>> W2] Yeah, yeah.

[>> W2] Suggestions?

[>> W2] Yeah.

[W2] So definitely by, you know, it's the a rising tide lifts all boats kind of thing.

[W2] So you know we do want to increase habitat for all our pollinators.

[W2] And that's our managed pollinators which are honeybees.

[W2] But we also have other managed pollinators too.

[W2] And for our native bees now there are definitely times where we we in places where we probably need to be cautious about where we are putting honeybees and how many honeybees we have in different locations.

[W2] So possibly in places where we have threatened endangered species or very high diversity, we know that putting honeybees there will likely take a lot of the resources out of the environment.

[W2] We want to be very careful about those situations.

[W2] Now in agricultural settings, things are a bit different.

[W2] We're not trying to necessarily conserve because we can't conserve huge amounts of biodiversity and biodiversity, like a natural ecosystem.

[W2] We're using this land for food production.

[W2] So in those cases, using those areas to help support honeybees, I think is quite appropriate by planting things like cover crops and more habitat integrated within our agricultural landscapes that will support native bees too, but that will also support honeybees and probably an appropriate place to have honeybees in terms of what people can do.

[W2] So beekeepers, if they are keeping bees in certain areas, also planting habitat can be very useful.

[W2] And I think the sort of rule of thumb is about an acre of habitat for a colony.

[W2] So if you can offset what your colony is going to take out of the environment with planting habitat or supporting habitat creation or maintenance, somehow that'll go a long way to supporting all bees.

[>> W2] Awesome.

[W2] Now, the last question will go into about honeybees, and I saw this question repeated several times is do Varroa mites only impact honeybees or are other species vulnerable?

[>> W2] Yeah, Varroa mites only impact honeybees directly.

[W2] But what Varroa mites also do is they transmit diseases and some of those diseases can be transmitted then to to native bees.

[W2] And there are some good studies, some recent studies that are coming out that are showing that, that these diseases can be transferred.

[W2] So Varroa mite themselves.

[W2] No.

[W2] But the diseases that they are transferring among honeybees and two honeybees can be transferred, some of them to native bees.

[>> W2] All right.

[W2] We also saw a few questions about climate change, specifically about how climate change is affecting pollen nutrition, and also some of the relationships between bee species emergence and bloom cycles for plants.

[>> W2] Yeah.

[W2] So for that one, what we're seeing with climate change and bloom times and bee emergencies is that it just creating a mismatch with when flowers are actually starting to bloom from those heat cues, light cues.

[W2] And then when bees are emerging.

[W2] So when you get that mismatch, like I was mentioning in that study, you're getting bees that are emerging when their flowers might be out of bloom or not blooming yet, or you have flowers blooming and their pollinators aren't aren't necessarily ready to emerge in the spring.

[W2] So there's definitely that factor at play in terms of the the nutrition.

[W2] You have less protein in the pollen that was shown in the goldenrod study in Europe.

[W2] So when bees, when they're going to flowers require so they're going to flowers for pollen but also for nectar pollen being their protein so that their wing muscles are nice and strong so they can fly.

[W2] And nectar has their carbohydrates.

[W2] So they have a ton of energy to fly around and forage for their larva.

[W2] So with that decrease in protein in the pollen, obviously it'll create a less healthy diet for bees going forward.

[W2] So that was an interesting study that was done on goldenrod.

[W2] But similarly like there's so many other factors that climate change is kind of impacting pollinators on.

[W2] So like I said, like the migration corridors for migratory pollinators and species ranges being squished like bumblebees.

[W2] So with climate change too, it's it's harder to see with your own eyes I guess like from day to day.

[W2] But when you start to look at the long term trends of like year long, like multiple year long studies, you start to see that these populations are are being impacted by climate change.

[>> W2] Thanks, Anthony.

[W2] Going back to the beginning of our presentation, we have a question about pollination efficacy.

[W2] So when you're determining which animals are the most important pollinators which we establish for bees is that because they visit the most crop plants, does that also mean that bees pollinate the most crops as specialists?

[>> W2] Okay, two parts here.

[W2] So yeah, we know a decent amount about what pollinators visit, what crops.

[W2] We know less about the efficacy, quite a bit less.

[W2] So there are definitely studies.

[W2] I've done studies on the efficacy of different pollinators on different crops.

[W2] But we don't know a lot about that.

[W2] We do usually see that that bees are very effective pollinators of most crops.

[W2] I found that flies hoverflies, which we'll talk about in the fourth webinar, are quite effective pollinators too, of a lot of the crops that I've I've studied, moths can be quite effective pollinators of some crops.

[W2] Anthony is going to talk about that in the third webinar about these different pollinators and how effective they are and what we know.

[W2] You know, the overall answer is we don't know a lot about what our crops need, what they're getting.

[W2] We know a bit about the visits that they're getting.

[W2] In some situations when researchers have been there and done that work.

[W2] But we definitely know a lot less about the efficacy of different groups of pollinators.

[>> W2] We have another question about pesticides.

[W2] So this person was asking if pesticides not meant for pests on plants, but for other purposes.

[W2] For example, mosquito sprays or medication for ticks and fleas in pet diets could also affect bees.

[>> W2] Yes they can.

[W2] Yeah, we we do.

[W2] We do know that some of these controls for different pest insects can impact can impact bees.

[W2] There's you know, they're not that specific.

[W2] Most of our control agents, they're definitely not specific to species.

[W2] Sometimes they're specific to a larger group.

[W2] Like they might affect only moths but not bees.

[W2] Like the cry proteins.

[W2] But yeah, most of our most of our pesticides that we're using on insects, there's a likelihood they could also hurt bees.

[W2] So insecticides are things that kill insects.

[W2] So there there's a lot of studies done.

[W2] And the regulations in Canada and in the US.

[W2] I'm actually not sure about how it's done in Mexico as much, but we have standards for testing pesticides on bees.

[W2] It's mostly done on honeybees.

[W2] Not a perfect system, but we do have mitigation measures.

[W2] And there's warnings on labels and cautions on labels when we do know that there is an impact on bees.

[W2] So it's really important to read the labels to to first try to do some integrated pest management, try to tolerate pests.

[W2] There's many ways, many things we can do before getting to pesticides.

[W2] But we'll talk about this in some of our habitat modules too.

[W2] But we want to be very careful if we are going a pesticide route that we are reading the label and following the label because they're there for a reason, and they are the law too.

[W2] So.

[W2] So yeah, we do need to be quite careful with insecticides.

[W2] Also some other pesticides too.

[W2] We're finding we're finding some impacts.

[W2] But you know, the big ones, the majority that are going to cause direct impact to our bees and other pollinators are the insecticides.

[>> W2] And I'll just say, too, that we do have some resources on our website that I'll post on the course page.

[W2] That will be really great to reference.

[>> W2] Yeah, we do have some about mosquito abatement and how to how to think about pesticides and mitigate risk.

[>> W2] Right.

[W2] We're getting to the end of our Q&A session for this module.

[W2] And I thought we could do a question that I saw repeated a few times about some of our favorite experiences working with bees or favorite plant pollinator relationships.

[W2] So I'll start.

[W2] I think the relationship between the southeastern blueberry bee and highbush blueberry is one of the most interesting and beautiful relationships in the plant pollinator world.

[W2] The Highbush blueberry blooms in the early spring, and these bumblebees, or *habropoda laboriosa*, so they're not bumblebees.

[W2] But they're another native ground nesting bee species.

[W2] They emerge at the same time that the blueberry plants bloom, and they're actually more effective pollinators of blueberries than honeybees.

[W2] So many farmers will import honey bee colonies to pollinate their blueberry blooms.

[W2] But really, it's this unrecognized work of the southeastern blueberry bee that's resulting in higher yield and better fruit quality for growers.

[W2] So you can see them if you live in the Southeastern United States.

[W2] They're very fast and very cute, with very big eyes.

[W2] And I think we have some pictures of them in further modules.

[W2] So, Laura, if you'd like to share one of your favorite stories or experiences or relationships.

[>> W2] Yeah, I would have to say and I will bring this up in a later module, but I love goldenrod.

[W2] And goldenrod gets mistaken for ragweed and which is a native plant too, but it can cause allergies.

[W2] It has that pollen that is airborne, and people think because I guess it blooms around the same time, maybe vaguely looks similar, but people think that goldenrod, which we have pictured here is ragweed and it's causing allergies, but it's not.

[W2] It's got heavy, sticky pollen grains.

[W2] And so I in my previous house that I was in, I had a big patch of goldenrod right in front of my door.

[W2] And when that goldenrod was in bloom, I was late for everything because I would walk out my front door and I just had to stop, and I was just like, my jaw would drop every time because I would see five, six different species of bees.

[W2] I would see butterflies, I would see different spiders and flies on it.

[W2] And, you know, I could probably see about 10 to 15 different species just stopping there for a few minutes in front of my goldenrod.

[W2] So yeah, I think that's that's one of my favorite happy moments.

[>> W2] For me it's probably I want to try to keep it northern, but like the leafcutter bees here in the wild, roses that bloom, I love seeing the leafcutter bees visit the wild roses, but I

also like seeing them use those strong jaws to cut out the little semi-circular holes in the leaves, which they then use to bring back to their nest to insulate their nesting cavities.

[W2] And we'll get into the different types of bee species in a bit more detail and further modules.

[W2] But yeah, I just think the leafcutter bees are so cool and how they also carry their pollen on the underside of their abdomen, so they usually do like a funny dance when they're visiting the roses to collect that pollen to bring back to their nest.

[W2] Just really cool types of bees.

[W2] Yeah.

[>> W2] Awesome.

[W2] Thank you guys for sharing.

[W2] I think something that unifies the panelist crew for PSC is that we all love bees and find native bees beautiful and fascinating and inspiring.

[W2] So hopefully throughout this course we can share some of that with you all.

[W2] And we're all looking forward to it.

[W2] So the last question I'm going to answer, or I'm going to suggest we answer, is what I deemed the winning question of this session.

[W2] And I selected it because I think that it talks about information that we're not going to cover in future modules.

[W2] So it's very specific to module one.

[W2] And I just kept thinking about it as I was reading through the questions.

[W2] So thank you, Robin Brick for submitting this question.

[W2] And the question is how structurally different is insect fur from mammalian fur.

[W2] And I think it's kind of getting at why are bees good pollinators.

[W2] What about their fur structure makes them a good pollinator and is bee hair convergently related to mammal hair through convergent evolution?

[W2] Or is.

[W2] it something else?

[W2] So if Laura, you want to talk a little bit about the structure of bee hair and why it helps them pick up pollen grains.

[>> W2] Yeah, nice.

[W2] Great question.

[W2] And I love that.

[W2] That's the pick.

[W2] So yeah.

[W2] So I would say not that I have, you know, done a deep dive in this, but I'm pretty confident to say that it's convergent evolution, which means that it did not evolve from the same source.

[W2] This, this hairiness, this fur, as mammals did.

[W2] Our our bees came from wasps, mostly wasps that did not have a lot of hair and bee hairs are so cool because they're what we call plumose.

[W2] And they have these feather structures on them.

[W2] And that's a defining characteristic of bees as these plumose hairs that have pollen that stick to them.

[W2] They also have electromagnetic type properties that have the.

[W2] So the pollen can kind of leap to them, even in some cases.

[W2] Other insects have have this a little bit too.

[W2] But the hairs on them are particularly pollen loving, and the pollen will will stick to those hairs.

[W2] But yeah, with the plumose hairs are just, yeah, really cool on bees.

[W2] And if you're ever unsure if something is a wasp or bee, pull out your microscope and you can look at those hairs.

[>> W2] Well.

[>> W2] Thank you Laura and Anthony for answering so many amazing questions and for all of our participants whose questions weren't answered, we'll circle back to most of you and get you the answers that you're you're looking for.

[W2] And curiosity questions are always welcome.

[W2] So with that, I'm going to pass it back to Anthony who's going to wrap up our first session.

[W2] Thank you everybody.

[>> W2] Thanks, Avery.

[W2] And congrats again Robin on winning the question of the night.

[W2] So we will email you and we'll send you something fun from our Pollinator Partnership bonfire store okay.

[W2] Well thanks again, Avery.

[W2] Thanks, Laura, for your amazing presentation.

[W2] And thanks to all of you for joining us tonight.

[W2] And we'll see you again next week on Tuesday.

[W2] Thanks, everyone.

[W2] Enjoy the rest of your night.

[W2] See ya.

[W2] Laura, thanks so much.

[W2] See ya.

[>> W2] Thanks, Anthony.

[W2] Thanks, Avery.

[W2] Bye.