Zoom: PSC Virtual Training 2026: XQQW-0377 - info@pollinator.org

Participant: Wordly [W] English (US)

[>> W] By Avery Rowe.

[W] And while we wait for a few more folks to log in and join us tonight, I'll put up our housekeeping slide.

[W] So this week's recording will be posted on the course information page by Friday of this week.

[W] Please put questions in the Q&A box and we will answer them at the end of the session.

[W] If you have any questions or need help with anything about the program or tonight's session, you can reach out to us at pollinator.

[W] Org.

[W] You can scan the QR code on this slide, or use the link we sent to you in the chat or by email.

[W] If you would like this webinar translated in your preferred language.

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

[W] And we suggest that you write down in point form or 1 to 2 sentences the key takeaways from each training.

[W] While you're attending live.

[W] And this will make it easier when filling out the step one form when when it's sent to you in April.

[W] Okay.

[W] And tonight we will continue with our fun prizes with the Host Choice Award.

[W] So I'll pick my favorite question at the end of the session tonight.

[W] And the winner will receive a fun pollinator themed prize.

[W] Okay, so let's get to know our guest speakers for tonight.

[W] So Amanda Smith and Steve Sass are co-founders of Indiana Nature LLC, which includes the educational initiative Indiana Nature Net and its corresponding social media outreach.

[W] Their popular Facebook group In Nature contains the Great American Indiana Nature Projects, which have engaged thousands of Hoosiers to collaboratively build a database of moth, butterfly, tree and wildflower populations in the state's.

[W] Amanda resides in Hamilton County, Indiana, where she is Superintendent of Natural Resources and Education for Hamilton County Parks, and Steve resides in South Bend, Indiana.

[W] Indiana owns a small business specializing in electronics and volunteers as a conservation focused civic leader.

[W] Welcome, Amanda and Steve and Kristen Lear is the Agave Restoration Program Director in charge of Bat Conservation International's Binational Agave Restoration Initiative.

[W] She got her start in bat conservation in sixth grade when she built and installed bat houses for her Girl Scouts silver Award projects.

[W] Since then, she has worked on bat research, conservation, and education projects around the world.

[W] Kristen earned her PhD in Integrative Conservation from the University of Georgia.

[W] Her PhD work combined natural and social science approaches to aid in the conservation of the endangered Mexican long nosed bats in northeast Mexico.

[W] Kristen is a National Geographic Explorer, a if then ambassador working to encourage girls and young women in Stem fields, and a lifetime member of Girl Scouts.

[W] She is also passionate about public outreach and education, giving numerous Bat talks at schools and organizations around the world, leading public bat walks and bat house, building workshops, and making numerous media appearances.

[W] So welcome, Kristen.

[W] Thank you for being here.

[W] All right, everyone.

[W] And with that, let's get the presentation started.

[W] So who are the pollinators?

[W] Well, we've learned that bees are important pollinators, especially the many species of native bees we have here in North America.

[W] And we'll get to more information about the biology and identification in a future session together.

[W] But for tonight, I want us to learn more about pollinator groups that often get overlooked.

[W] So I'm talking about the bats, beetles, flies, butterflies, moths and mammals and yes, even reptiles that are pollinators and keep our ecosystems healthy and our landscapes blooming with beautiful flowers.

[W] So let's start off with beetles.

[W] When we look back in the history of the earth, beetles are some of the oldest recorded pollinators.

[W] Actually, one of the very first pollinator relationships we know of is from a species of beetle on a flower most closely resembling a magnolia.

[W] 200 million years ago.

[W] Beetles have tiny hairs on their body, called setae, that help them carry pollen from flower to flower, and many types of plants are beetle pollinated, including strawberries and ornamental plants like magnolia.

[W] When observing native plants, you can usually find different species of beetles crawling around or honestly likely mating under the leaves or right on the flowers themselves.

[W] Beetles tend to get a bad reputation because their habitat, or, sorry, their habit of clustering in large numbers on plants, and they are often referred to as messy pollinators, messy because of how they eat right on the flowers, leaving bits of pollen everywhere.

[W] Although some species can be a cause of concern when it comes to growing crops, there are so many beneficial species of beetles that provide essential services to the local ecosystems.

[W] So next we have flies, including flies and bee flies.

[W] Flies are one of the most overlooked groups of pollinators.

[W] Surfeit flies, also known as hoverflies, which can see here in the picture on the right, are important pollinators.

[W] But they also play a crucial role in keeping pest populations down.

[W] This is a huge benefit in agricultural landscapes since the larvae of syrphid flies eat pests such as aphids that can decimate crops.

[W] One of my favorite aspects of pollinating flies is how closely they resemble other pollinators, like bees and wasps.

[W] So check out these pictures I took doing field work.

[W] The pictures on the right are both drone flies, and the picture on the left is a bumblebee.

[W] The flies look almost exactly like the bumblebee, having similar color banding, body shape, and even the way this species flies around resembles that of a bumblebee.

[W] As we can see here, flies can be pretty hard to tell apart from bees, but the trick is that flies have large eyes that often fuze together in the middle of their head.

[W] They have short, stubby antennae, as opposed to the long antenna that bees have, and they have only two wings, as opposed to four.

[W] A cool fact about fly pollination is that they are often attracted to bad smelling flowers.

[W] So while to humans, these flowers might not have a lot of appeal to a fly, that putrid smell is exactly what they're looking for when looking for food.

[W] Also, if it wasn't for flies, we wouldn't have chocolate.

[W] The the production of chocolate depends on the pollination services of the highly specialized chocolate midge, which you can see in the illustration here.

[W] Chocolate midges use their tiny bodies to work their way into the intricate flowers found on cacao trees, transferring pollen and allowing these trees to produce large seeds from which chocolate is produced.

[W] Next up are birds, which are a which is a really popular group that enchants and mesmerizes many people around the world.

[W] So do we have any fellow bird enthusiasts in our session tonight?

[W] I can tell you firsthand that I've had my pretty wacky birder moments, including spending hours trying to capture the wings of this hummingbird while visiting a flower.

[W] So globally, there are roughly 2000 species of pollinating birds that mostly live in the tropics.

[W] In North America, the primary groups of pollinating birds are hummingbirds, which are some of the most beautiful birds with bright and interesting color combinations, and their feather plumage.

[W] Around the world there are pollinating birds known as honeycreepers, honeyeaters and sunbirds.

[W] One of the amazing aspects about pollinating birds is how their beaks have evolved into those, into these amazing structures that are perfect for reaching into flowers and drinking nectar.

[W] And they need a lot of nectar to fuel their high energy lifestyle.

[W] An interesting fact about bird pollination is that plants that receive bird pollination show twice as much diversity in their genetics than those pollinated by insects, and this is because birds cover such a large distance when they fly and can pollinate flowers that are quite far from each other.

[W] They also cross many different types of habitat when they're flying, visiting different populations of flowers, and this type of pollination is great for ecosystem health.

[W] Then we have ants.

[W] Now this is an incredibly complex group with intricate and complex social behavior and hierarchies.

[W] And while they might not be the best pollinators, since they're not necessarily built to be efficient pollinators, they do help with plant reproduction.

[W] This is because ants are constantly churning soil and moving seeds in their environment.

[W] A large part of their diet is the outer layer of seeds, which they store in anthills, and which spreads the seeds around the forest floor.

[W] Next, we have mammals, so this group includes nectar feeding bats, which Christine will talk about in a bit.

[W] And in the mammal family, we have also the honey possum.

[W] So this little creature isn't found in North America, but can be found in Australia.

[W] Then on the right, we have one of our larger pollinators, the black and white ruffed lemur, which is found in Madagascar.

[W] These pollinators have a close relationship with the travelers tree and are able to open the trees flowers with their strong hands in order to reach the nutritious nectar inside.

[W] And a study has recently shown that there is a possible connection with the Ethiopian wolf and pollination, so these wolves were observed spending quite a bit of time eating the nectar from the Ethiopian red hot poker flower, as seen in this picture here.

[W] So in the process, the wolves get pollen and all over their snouts, which then gets transferred from flower to flower.

[W] So more research is needed to study this relationship.

[W] But this is the first large carnivore facilitating plant reproduction and considered pollinator.

[W] Then we have reptiles.

[W] Shown here is the blue tailed day gecko.

[W] So scientists suggest that lizards like the one shown here potentially take over the pollinator world in places where there might not be as much insect diversity and where they have formed close relationships with the plant species, such as on oceanic islands.

[W] Similar to other pollinators, they carry pollen on their snouts from flower to flower.

[W] They help in seed transport and dispersal, and they are eating as they are eating seeds and research points to possible a possible underestimation of their pollinating services.

[W] So there's currently ongoing research and a need for more research on the benefits of reptile pollination.

[W] In the first module, Doctor Laura moran talked about how bees evolved from wasps.

[W] Wasps being the cousins, to bees that eat other insects.

[W] So although species like the social yellowjackets give wasps a bit of a bad reputation because of their defensive behavior and interest in our picnic foods, many wasps species play an important role in pollination as well as pest control, making them beneficial.

[W] Insects.

[W] Wasps are apex predators in the insect world, having sleek and aerodynamic bodies so that they can fly quickly and efficiently to catch other insects, which they use as food.

[W] So since they don't have the pollen collecting hairs that bees do, they aren't as efficient pollinators as bees.

[W] But they do require pollen and nectar from flowers for energy, and can especially be seen in the fall foraging on goldenrod and helping with wildflower pollination.

[W] And some of you might be wondering why I have a picture of figs on this slide.

[W] And believe it or not, figs rely on tiny and highly specialized wasps for pollination and have one of the most interesting and strange pollination systems in nature, which I will summarize for you now.

[W] So figs are enclosed flowers that have the reproductive sections on the inside.

[W] So this tiny female fig wasp will crawl through a tight tunnel located at the bottom of an unripe fig, and in doing so will actually lose her wings as she squeezes through the walls of the tunnel.

[W] Once inside, the female wasp pollinates the internal flowers as she moves around and transfers pollen and completes her life mission by laying her eggs and then dying inside the fig.

[W] After her eggs hatch.

[W] Male and female wasps mature and mate, which is then followed by male wasps chewing their own tunnel out of the fig.

[W] Unfortunately, this is the end of the road or tunnel for male wasps, as they are born without wings or the ability to fly, and so they die inside the fig and are digested by the enzymes.

[W] The female wasps are, however, are born with wings and use the tunnel excavated by the males to fly free in search of another fig, to pollinate and lay their own eggs in.

[W] So this amazing pollination system demonstrates the complexity of plant pollinator relationships and how both plants and pollinators rely on each other for survival.

[W] And finally, we have mosquitoes, which I know some of you might find really surprising, but for better or for worse, mosquitoes do play an important role in pollination.

[W] We all know that female mosquitoes drink the blood from other animals, but what some of you might not know is that they actually use this blood as food for their larvae, in addition to blood, they also consume the sugars and flower nectar to fuel their flight and provisioning.

[W] Here in North America, at least 15 species in the genus Aedes are known to drink the nectar of small flowered greenish orchids.

[W] The pollination system here is really interesting.

[W] So as the mosquito prepares to leave the flower of the orchid, her head comes into contact with the reproductive organs in the flower's column.

[W] And when this happens, two golden pollen eggs get stuck on her head.

[W] Cross-pollination occurs when she visits a second flower on a different plant, and these pollen eggs are then deposited.

[W] Of the 15 species of Atys communists, also known as the snow pool mosquito, is the best studied as it is common in northern regions on summer tundras and bogs where these little orchids may thrive.

[W] All right, so I'll finish off my section with a couple of poster images showing the diversity of pollinators.

[W] And I especially like this one that shows the pollinator day and night shifts.

[W] And with that, I'll pass things over to Doctor Kristin Lear, who will now talk about pollinating bats.

[>> W] Awesome.

[W] Let me pull up my screen.

[W] Thank you all for joining.

[W] I'm very excited to talk about bat pollinators because I'm I'm a bat conservationist, so I could talk about bats all day long.

[W] And bat pollinators are a pretty cool subset of bats. Let's see.

[W] Can you all see?

[W] See the presentation.

[>> W] Looks good.

[>> W] Okay, perfect.

[W] So welcome to the world of pollinating bats.

[W] These are often the the forgotten pollinators as we have heard of.

[W] And this is why I like to share about why bats are important pollinators.

[W] So I'm Kristin Lear from the NGO Bat Conservation International.

[W] BCI works around the world to end bat extinctions, and some of the work that we do is focused on protecting bat pollinators.

[W] So before I dive into bat pollinators specifically, I want to give a little bit of bat 101.

[W] So bats are the only true flying mammal in the world.

[W] Flying squirrels are not capable of true flight.

[W] They are just gliders.

[W] So bats have that claim to fame as the only true flying mammal.

[W] They are found on all continents except Antarctica, and there are now 1500 species of bats known around the world.

[W] And these are just some of the cool bat species that we can find around the world.

[W] They are super diverse in terms of size, colorations, what they eat, where they live.

[W] These are some of my favorites, but just show this huge diversity.

[W] And bats do make up 20% of all mammal species in the world.

[W] They are not rodents.

[W] They are not super closely related to rodents at all.

[W] And they they make up a lot of mammal species, second only to rodents.

[W] And like I mentioned, they are found on all continents except Antarctica.

[W] So really they're found in tropical rainforests, deserts, grasslands, urban environments, really everywhere you can think of except Antarctica.

[W] So pollinating bats are a specific kind of subset of bats.

[W] There are about 100 bat species that eat nectar, so about 7% of bats are eating nectar from flowers.

[W] Different types of flowers, and different different types of bats.

[W] And these pollinating bats pollinate over 300 plants around the world.

[W] By coming into contact with the flowers, with the pollen and then spreading that pollen around.

[W] And these are some of the products that we get from bat pollination.

[W] So bananas are pollinated by bats.

[W] So wild bananas historically are bat pollinated.

[W] And without bats we would not have bananas.

[W] Coconuts are another bat pollinated plant, as well as agave plants, which I will share more about shortly that we use to make products like tequila and mezcal.

[W] So all of these are brought to us by bats.

[W] So again, thank thanks bats for bringing us these awesome, awesome foods.

[W] Now, I always like to talk about bat versus bird pollinators.

[W] Who is the better pollinator?

[W] Because I also a birder.

[W] But bats are very close to my heart, so I like to look at this picture and see which one has more pollen, has a higher pollen load, and we can easily see that it is the bat that has the higher pollen load.

[W] So many times bats are better and more efficient pollinators than insects and birds, because they often spread more pollen, they tend to be much less adapted to hovering like hummingbirds, so they throw themselves onto the flowers and get much more covered and have these higher pollen loads.

[W] And not only do they carry more pollen, they also spread that pollen over farther distances than insects and birds.

[W] So some of these bats can travel up to 40 miles even more one way from their roost in a night to go feed and forage on different flowers and spread that pollen around that 4040 mile radius, and then return to the roost before before the sun rises.

[W] So they are helping maintain these populations, these healthy populations of plants.

[W] Now I want to talk about some of the bats that are near and dear to my heart that BCI is working to protect through our agave restoration initiative.

[W] So there are three species of nectar feeding bats in the southwest, US and Mexico that migrate annually between these two countries.

[W] We have the endangered Mexican long nosed bat on the left, which is endangered internationally by the IUCN, and in the United States.

[W] And then we have the lesser long nosed bat, which was recently in 2018 delisted from the US Endangered Species Act.

[W] And the Mexican long tongued bat, which is near threatened.

[W] Now, all three of these bats are migratory, so these are the range maps of the two long nosed species that migrate annually between central and southern Mexico all the way to the US southwest in Arizona, New Mexico and Texas.

[W] So they're migrating north.

[W] And the crazy thing is that it is primarily pregnant females that undergo this over 750 mile migration while they are pregnant, which is, as a mom, that is a crazy feat to think about doing something like that while pregnant.

[W] But along that way they are, you know, relying on the nectar of agave plant.

[W] So these agave flowers, if you've ever seen been in Tucson or in Mexico, these giant agave plants that have these towering stalks with thousands of little flowers with sweet nectar.

[W] So they're getting the bats, are getting the sweet nectar to fuel that migration.

[W] And of course, in turn, they are pollinating the agave as they're getting covered on their heads and their bodies with agave pollen and spreading that around to help maintain healthy agave populations.

[W] Now this these agaves are particularly important in the northern portion of these bats range in northern Mexico and in the southwest US, where in many spots, agave plants are the only natural nectar source for pregnant females and for mother bats.

[W] So this is a a big newborn baby that these moms are going out and feeding on only agave nectar in some of these areas.

[W] And so healthy agave populations are critical for helping these females survive and raise their young.

[W] Now, agave plants are also very, very important plants for people.

[W] They are, like I mentioned, harvested to make products like tequila and mezcal and other local products.

[W] Their their stocks and their leaves are used for fences and livestock fodder.

[W] And their the whole plants themselves are planted to help control erosion.

[W] And as living fences.

[W] And I just think agaves are beautiful, iconic parts of the landscapes where they are found.

[W] So they are they're worthy of protection in and of themselves.

[W] But unfortunately, as with many habitats around the world, this is the landscape that these little mother bats are finding as they are undergoing this migration due to habitat fragmentation, unsustainable grazing, agricultural conversion, wildfires.

[W] Wildfires, drought.

[W] This is the landscape they are finding more and more without any agaves to feed from.

[W] And unfortunately, this loss and fragmentation of agave habitat is one of the primary threats to the Mexican long nosed bat and leading to its population declines.

[W] So what if we could turn landscapes that look like this into beautiful landscapes that look like this?

[W] With healthy agave populations, many agave is blooming to help feed these bats, but also to help support rural communities who use agaves for their livelihoods.

[W] That's the goal of Agave Restoration Initiative is to restore these healthy agave landscapes, both within that migratory corridor and near known bat roosts.

[W] To support these bats, as well as to support people.

[W] And these red stars are where general areas where we have agave restoration work happening with local communities and local private landowners across that binational corridor.

[W] Currently working across nine US and Mexican states.

[W] And don't get all, you know, the details of these logos, but I did want to show that this is an all hands on deck very collaborative effort.

[W] We have over 100 partners ranging from local NGOs, universities, federal and state agencies, industry all working on this effort to restore agaves for bats and people.

[W] So achievements to date.

[W] So what have we achieved?

[W] So we work to collect native agave seeds from each region where we work to create regional supply chains of native seeds.

[W] And to date, we've collected over 1 million seeds for these restoration efforts and for regional agave seed banks.

[W] We support local nurseries, so we support the building and the maintenance of community nurseries and NGO nurseries in both countries.

[W] And to date, we have supported 26 of these greenhouses to grow agaves.

[W] Of course, we have to go out and plant once we once we start growing.

[W] You can see here the baby agaves.

[W] We collect the seeds, grow them for 2 to 3 years in these nurseries.

[W] Then they are ready to go plant back out on the landscape in priority nectar bat areas.

[W] And to date, we have planted over 185,000 of these agaves in both countries, which is a quite fun endeavor if you ever get the chance to plant agaves, it's a fun, fun activity.

[W] And then we also work at a broader, more holistic level to protect agave habitat and restore degraded land.

[W] So we have to make sure that the actual land itself, the soil, the water, the native natural habitat is healthy so that those baby agaves can survive and thrive long term.

[W] So we support regenerative agriculture and ranching in both countries, working with communities and private landowners.

[W] And to date, we have supported the restoration and protection of 5800 hectares of land, with communities and landowners, and of course, bats often get a bad rap.

[W] So environmental education is a big part of what we do and we to date have led programs.

[W] We and our partners have led programs reaching 26,000 kids and adults locally and over 1.5 million people worldwide through virtual presentations.

[W] And we have also established community science networks or community monitoring networks to monitor these nectar bat populations and agave populations in both countries.

[W] And a really cool thing we've recently developed.

[W] This is a project I've been leading for a few years, is the use of environmental DNA or Edna, collected from both blooming agaves, the flowers and collected from hummingbird feeders to survey for these these bats and distinguish these bats from each other.

[W] Whereas traditional methods you have to capture the bat in order to distinguish which species it is.

[W] This Edna method can distinguish these bats down to species level without having to capture them and bother them.

[W] So we've been working to swab these blooming agaves across this binational corridor, as well as work with local community scientists to to swab their hummingbird feeders.

[W] And we've collected over the past few few years, over 1000 samples collected and had some really exciting discoveries.

[W] We have discovered the endangered Mexican long nosed bat in Arizona for the first time using this Edna method from the community scientists who are participating from their hummingbird feeders.

[W] And we just recently published last week another discovery of a 100 mile range northward range expansion of this endangered Mexican long nosed bat in New Mexico.

[W] So we're this Edna approach is really finding some cool, cool stuff that can be applied to other pollinator species as well, from pollinating plants.

[W] I always like to end on how can you help bats?

[W] Because I think this is something everyone can contribute to no matter where you are.

[W] So if you have a garden or a school school garden, you can plant night blooming flowers that attract nocturnal insects that insectivorous bats can eat.

[W] And of course, if you live in an area with agaves or other other plants that support nectar bats, you can of course plant those.

[W] But these gardening for bat tips if you're interested, we have a website with more tips, as well as some local regional native plant lists for night blooming flowers for certain regions.

[W] So check this out and I'll share this link after or this presentation after.

[W] But in general, these are night blooming native flowers, often herbs and aromatic flowers and fruit trees often are good for attracting bats and if possible, do not use pesticides for for bat gardens.

[W] It's best to avoid that as much as possible.

[W] In general, you can also provide water like ponds and large natural pools for bats.

[W] Because bats do drink water directly from water sources, bird baths are not big enough.

[W] They need to be at least ten feet long, but you can if you have a pond, support bat water sources, and if you have old snags like trees that have hollows or cracks in them, or exfoliating bark, if you can leave those standing when possible.

[W] And if they're not providing or posing health or a safety hazard.

[W] These these cracks and crevices are really good habitat.

[W] Roosting habitat for many bat species.

[W] And then of course, if you have a natural bat roost that is being removed or you're trying to evict bats from your house, you can put up a bat house to help support another roosting site for bats.

[W] So again, check out Bush's website.

[W] We have guidelines on what to look for in a bat house and how to how to install them.

[W] If you have kids or a Scout group or church group or school group, you can adopt a bat from a bat organization like BCI.

[W] Of course, you don't get a real bat, but your donation supports bat research and conservation, and you get a plushie bat and information about the species that you're adopting.

[W] So again, check that out.

[W] And I want to make sure we have time for the other presenters and questions.

[W] But please follow BCI on social media.

[W] And here is a QR code to learn more about our agave restoration initiative.

[W] So thank you and I will stop there.

[>> W] Amazing.

[W] Thank you so much Kristen and all the resources that were listed on those slides.

[W] I will post to the course information page, which will make it really easy for you to to go check those out.

[W] And with that, let's pass things over to Steve and Amanda, who will now talk about butterflies and moths.

[>> W] I think Steve's getting her program loaded.

[W] And you're muted.

[W] Still.

[>> W] Can you see it now?

[W] Yes.

[W] You have the program.

[W] Super.

[W] Okay, you can hear me and you can see me.

[>> W] And is it in presentation mode?

[W] I'm seeing other tabs.

[>> W] Oh okay.

[W] All right.

[W] Yep, yep.

[W] Let's let's figure this out.

[W] You are correct.

[W] This.

[W] All right.

[W] Yep.

[W] I am in presentation mode.

[W] Okay I'm going to stop share for a second and figure this out.

[W] And get right back over here.

[>> W] Well it's a great presentation by Kristen.

[W] So thank you very much I, I think I heard it last year but I learned more this time too.

[W] So very good.

[>> W] Thank you I always love talking about bats.

[>> W] Okay.

[W] How are we doing now?

[>> W] That looks perfect okay.

[>> W] Super.

[W] Well sorry about that.

[W] Thanks everybody for joining us tonight.

[W] This is.

[W] We're coming.

[W] Amanda and I are coming to you live from the state of Indiana, where we have been involved with Lepidoptera from a advocacy and education standpoint for a number of years.

[W] And so we're going to we're going to jump in and hopefully entertain you.

[W] And inspire you to become more involved in the conservation of these fascinating animals.

[W] Start out by talking about what Lepidoptera is exactly.

[W] It's it's an order of insects.

[W] It's one of around 40 different orders of insects.

[W] Here's a few of the more common ones that you see on the screen.

[W] Now, most of these you're probably familiar with.

[W] So Lepidoptera consists of the butterflies, the moths and the skippers.

[W] And if we take a closer look at the order of Lepidoptera, we can see on this slide up on the on the top right hand side, we have the papilionoidea, which is the superfamily within the order of Lepidoptera that consists of all of the butterflies and the skippers in the world, and the other superfamilies that you see listed here.

[W] And this is not all of them.

[W] Taxonomy, particularly with with insects, seems to change fairly often.

[W] But these are.

[W] These other ones are all moths.

[W] And so to give you a an appreciation for just how many moths there are in the world, there's about 40 some superfamilies of moths compared to the one superfamily of butterflies and skippers.

[W] And what's the the the stat.

[W] Amanda.

[W] It's 1010 to 1 or something.

[>> W] 10 to 1.

[W] So for approximately every, for every one species of butterfly, you have about ten species of moth.

[>> W] So there's a lot of moths, but we don't necessarily notice them as much for obvious reasons.

[W] They, they they're predominantly night fliers.

[W] So the word Lepidoptera itself comes from the Greek based word of lepis, which means scales combined with pteron, which means wings.

[W] So scale covered wings.

[W] And we can see in this microscopic image, this is a wing of a, of a Lepidoptera, and it almost looks like little roofing shingles.

[W] The wings themselves are transparent.

[W] The scales are what give them their coloration.

[>> W] And there are some species that have that don't have scales on parts of their wings.

[W] And in different areas like the tropics here in Indiana and in the Midwest, the the clearwing moth, the hummingbird moths are a good example of that.

[W] And if you've ever touched a moth or a butterfly with your fingers, you've sometimes felt or seen maybe a little bit of powder almost looks like pollen, but it's actually the wing.

[W] Those scales that have essentially just disintegrated between your fingers.

[W] So you can I don't suggest doing that to moths or butterflies because it's not good for them, but you've probably encountered it.

[>> W] And particularly as they age, they're you'll see butterflies and moths that their wings are looking kind of beat up, and that's when they're actually losing their scales.

[W] What do we have here?

[>> W] This is a not microscopic, but it's a very close macro shot of a cecropia moth.

[W] So you can see these scales here.

[W] Much more fuzzier maybe than what that other slide showed showed.

[W] But you can see these scales essentially creating the color that we see on the moth.

[>> W] Well why are they called butterflies.

[>> W] Good question.

[W] As a naturalist kind of more generally I sometimes will deep dive into a species first, starting with their name.

[W] We talked about Lepidoptera, but the word butterfly is is curious.

[W] And I was I was curious as to where that came from.

[W] It's mixed and folklore has some tie into it.

[W] Back in England there was a a myth or legend that witches would turn into butter or to butterflies and steal butter at night, and then also the there's the brimstone butterfly in England.

[W] So this isn't a butterfly that we see commonly or we don't see in, you know, in the States at least.

[W] But it is truly the color of butter.

[W] There are some more yellow butter colored butterflies, at least here in the States.

[W] But over there, this is definitely one.

[W] And then in, in France, the parking ticket.

[W] Pronounce it for me.

[W] Steve Papillon.

[W] So if you get a if you get a parking ticket, it's called a papillon, which also means butterfly.

[W] And it has that kind of flapping yellow like like maybe the wings of a butterfly.

[W] I obviously want to find a butterfly on my windshield over a parking ticket, but.

[>> W] And I can't help but point out that butterflies are neither made of butter nor are they flies, right?

[>> W] Yes, so.

[W] But it is.

[W] It's cool to kind of look back.

[W] It's kind of unknown.

[W] I guess the answer is, who knows?

[W] But there are some ties in history.

[>> W] So we'll talk a little bit about insect morphology.

[W] So here's here we have a beetle.

[W] But insects all have these same sort of body parts.

[W] So we have their head thorax and abdomen three body parts on all insects.

[W] Insects also have three pairs of legs and one pair of antennae.

[W] And we'll see that same sort of patterning in Lepidoptera.

[W] Also, this is a common pug moth which is a a fairly as the name would imply, common moth in the eastern United States.

[W] And we can see the head and we can see the, the back end, the abdomen.

[W] And if we look kind of closer, we can see the thorax in the middle.

[W] And we can see the one pair of antennae.

[W] We can see, well, one of or two I guess, of the of the legs.

[W] The other ones are underneath the, the wing.

[W] But if the wings, if we were to flip it over, we'd see two more sets of legs there.

[W] Another interesting thing about legs.

[W] There is a family of butterflies, the Nymphalidae, which are also called the brush footed butterflies, which include a lot of our common butterflies in North America, where the front legs have actually presumably with with time over, evolution become reduced to the point of being almost not there anymore, unusable.

[W] So if you ever see a butterfly that looks like it has four legs, look closer at it and may have.

[W] There might be a front set of legs that you're just not noticing that have shrunken.

[W] One common question that people ask are what are the differences between butterflies and moths and skippers?

[W] And from a morphological difference, the the easiest traits to look at would be that butterflies typically have relatively small bodies and large wings versus skippers and moths are the opposite.

[W] They have relatively large bodies to small wings.

[W] Another, more conclusive identification is by looking at the antennae, butterflies and skippers both have club like structures on the ends of their antennae.

[W] Moths are not clubbed.

[W] There are several different types of moth antennae which we'll get to in the next slide, but they're never clubbed.

[W] Also, butterflies and skippers are diurnal or day flying versus moths are typically, but not always, night flying insects.

[W] Here's a closer look at those antennae.

[W] The the large picture is a moth that has what are what are called filiform antennae, which are the whip like antennae.

[W] Notice there's no no club on them.

[W] They're just kind of long, straight, almost thread like.

[W] But we also have if we look down at the bottom left picture. What.

[W] That's a, what moth is that in the bottom left.

[>> W] The..

[W] The scape moth.

[>> W] The yellow yellow colored scape moth.

[W] Yeah.

[W] This one, this one has like if you look you see like a comb like like structure on one side of the antennae.

[W] That's called a pectinate antennae.

[W] Some moths have a comb on two sides of the antennae, which are called bipectinate.

[W] And other moths will have four sets of combs, which are called quadrate pectinate.

[W] And the antennae can be distinctive for identification of the genders, sometimes in moths and many moths, the females exist really just for reproduction, so they'll just kind of plant themselves and wait for a male to find them while they're admitting their pheromones.

[W] And the males of that species will oftentimes have much larger antennae because they need to have greater senses to be able to find where the females are at.

[W] A little bit of some of the body parts, and we're not going to go very heavily into this, but all Lepidoptera have two sets of wings.

[W] So we have two fore wings and two hind wings.

[W] And this diagram just talks about some of the different regions on the wings that that have names to them.

[W] And this is really necessary if you start getting into the nuts and bolts of doing identification is to know the terminology.

[W] If you pick up a butterfly or a moth, a field guide, for example, they'll often talk about these various parts of the of the bodies of the of these animals.

[W] And then a lot of butterflies and moths will have lines on the wings too.

[W] And depending on where the lines are located on the wings, they're given certain names.

[W] So for example, the median line is the one that's right in the middle of the of the wing.

[W] If it's in more towards the front it's called an antemedial line.

[W] And so on and so forth.

[W] And the veins on the wings also have designated names to them.

[W] And this system is called the Comstock-needham system was developed by John Comstock and George Needham, a couple of entomologists, in 1898 for use in identification, identification of of various species and families will have different traits, and this doesn't apply just to Lepidoptera, flies, and really all all of the winged insects will also are also part of the Comstock Comstock-needham system of identification.

[W] Also probably worth mentioning that these veins that are on the wings, think of them kind of like the rungs of an umbrella that that serve to hold the structure of the wing together, and they're made out of a of a chemical called chitin, a polysaccharide called chitin, which is a it's the same compound that is in the exoskeletons of insects.

[W] Like if you ever step on an insect and it crunches, that's the chitin.

[W] That's, that's doing that.

[W] Chitin is also found in shellfish.

[W] Lepidoptera go through a life cycle, which is called complete metamorphosis, which is a four step life cycle beginning with the.

[W] In this case, we could we could jump in at the life cycle at any point.

[W] But we're going to start with the adult.

[W] This is what an imperial moth.

[W] Amanda.

[>> W] Yes.

[>> W] And the imperial moth is a is one of our larger silk moths.

[W] And in eastern North America.

[W] And the adult is going to lay its eggs if adult female, hopefully it's it's been able to mate and and lay eggs.

[W] But when it lays its eggs, it doesn't just lay them willy nilly, it doesn't lay them on a car windshield like the parking ticket or a piece of concrete.

[W] It lays the eggs on the food source that the hatched larvae are able to eat.

[W] So when the larvae hatch, in this case, this moth chose to lay her eggs on the leaf of a Quercus alba or white oak, which is one of the what are called host plants.

[W] For this particular, the larvae of this particular species of moth and imperial moths help remind me.

[W] Amanda.

[W] I mean, they're they're somewhat generalistic like oak trees are not the only thing that they can eat, but it's certainly one of the things that they can eat.

[>> W] Yes, for.

[>> W] Sure, that the imperial moth in particular, we I mentioned, is kind of one of those sea cows of the caterpillar world.

[W] They eat a lot of different species.

[W] So.

[>> W] So once the larvae are hatched, they go through a series of growth cycles called instars.

[W] And this is what a a fifth instar larvae would look like compared to the previous image, which was the first instar.

[W] And they grow quite rapidly in a short amount of time.

[W] There's an.

[W] analogy that you have for this.

[>> W] This probably isn't true for every species, but in general, with caterpillars, they will increase their size by about 2000 times between that first hatch from the egg and their fifth instar.

[W] So and that would be about the equivalent of a newborn baby growing to the size of a school bus just in in to kind of compare it.

[W] And that's and for many butterfly and moth that can be within the span of two weeks.

[>> W] It's very critical at this point to be able to have the adult has to be able to find a proper food source for its young, or reproduction cannot take place.

[W] So once it reaches that fifth instar, it's eaten up a ton of food and stored up a bunch of energy.

[W] It pupates.

[W] And here's where the miracle occurs, and it turns into the adult butterfly.

[W] And again, this complete metamorphosis, one one of the the characteristic things about it is that you see a very, very different life form between the the larvae and the adult in, in this in these types of metamorphosis, there's our adult.

[W] So the host plant is very important.

[W] I feel like I've been talking too much.

[W] So I'm going to let you talk about this.

[>> W] Actually I am trying to answer some questions in the chat.

[W] So keep going.

[>> W] Oh okay.

[W] All right.

[W] Well then I'll keep going.

[W] But if you want to jump in, feel free I will.

[W] So dietary specialization is is a one of the most characteristic things about Lepidoptera.

[W] We see that more so than probably any of the other insect orders that I can think of are the common ones, which means that the when we're talking, when we talk about dietary specialization, we're typically talking more about the larvae, what the the foliage that the larvae can eat.

[W] And in this case, this is the kind of the poster child, the monarch larvae on a on a milkweed plant and milkweed, of course, is toxic to most things.

[W] But monarch butterflies have been able to circumvent the toxins through a process called specialization, whereas they are able to eat this.

[W] The downside to specialization is that it oftentimes results in animals that can't eat much of anything else.

[W] But we're all most of us are familiar with the monarch and the milkweed.

[W] But as I mentioned, it's this is kind of a characteristic feature of the Lepidoptera specialization.

[W] So in here we have a a black cherry tree, which is one of the more common trees in the eastern US, which contains a chemical that converts the hydrogen cyanide when ingested by mammals.

[W] At least so humans as generalists can eat a lot of things.

[W] We can go to the grocery store and choose from hundreds of different food items.

[W] Black cherry is not one of the things that we can eat due to its its chemical toxicity, toxicity, which is a defense mechanism.

[W] On the other hand, we have the eastern tiger swallowtail.

[W] That's the caterpillar, one of the instars of the caterpillar in the bottom middle, which is one of the hydrogen or, excuse me, black cherries.

[W] One of the things that eastern tiger swallowtail can eat and it's so it's it's a specialist on on this and some other genera of plants and that's of course the adult butterfly on the right hand side.

[W] Now this I'm going to make you do okay.

[>> W] So related to host plants, we have more slides on this.

[W] But host plants are are really important.

[W] And if you are looking to attract especially moths and butterflies to to your yard, the you know, what they eat as caterpillars is critical.

[W] So they've, you know, so they'll have a place to actually spend their lifespan.

[W] So in some cases the name of the moth or butterfly can help you determine what it probably eats.

[W] The Virginia creeper.

[W] Sphinx is a Virginia creeper host species.

[W] So as an adult, it's not really going to to worry about the Virginia creeper, but as a caterpillar.

[W] And then the female would most likely lay their her egg, her eggs on Virginia creeper.

[W] The basswood leafroller is, as you might guess, a basswood specialist.

[W] So or it's eating basswood leaves, primarily American basswood.

[W] In our case, the Canadian.

[W] The Canadian Sphinx doesn't have the name of its host plant in its title, but it is primarily an ash tree host, so this is important.

[W] Especially, I'd assume, many of us in the Midwest and and certainly into Canada have know about the emerald ash borer, the invasive insect that came over from Asia and is causing, you know, pretty much a serious decline in all of our ash trees that will have a ripple effect for species, in particular, that have a very close association with them and as a host.

[W] And then the showy emerald is a beautiful little moth.

[W] And this also doesn't have the name, a primary name or the name of its primary host species and its title.

[W] But it is it eats the it eats poison ivy leaves.

[W] So.

[W] And a lot of a lot of times those of us that are near poison ivy definitely kind of make that out to be a complete bad guy.

[W] And it is obviously got some issues for humans, but a lot a lot of wildlife in particular, some caterpillars depend on the leaves for a host species, and that's the showy emerald.

[W] I just saw the question.

[W] So showy emerald moth.

[W] And then this is a great slide that definitely will help to at least within one super family of the Lepidoptera group.

[W] So this would be the Bombycoidea.

[W] These are the beloved moths, the Luna moth.

[W] It includes the really big moths that some are big, but some aren't.

[W] But the Cecropia and the io.

[W] And so what we've done here is listed them by their common name, and included the number.

[W] Next to them is how many genre of plant they can eat.

[W] So you can see the cecropia moth, for instance, can eat 74 different genera of plants.

[W] And then I can let Steve kind of walk us down that list there.

[>> W] Yeah.

[W] As we go from left to right, we are seeing specialists becoming extreme specialists.

[W] So over in the middle we've got the regal moth that can feed from moth.

[W] Caterpillar can feed from 19 different genera of plants.

[W] But over on the far right we're getting down into species that can only feed on one, 2 or 3 genera of plants.

[W] So the downside to specialization is that if something were to happen to one of 1 or 2 of these plants, we we these these animals cannot simply just go switch to eating something else.

[W] In many cases they would go away.

[W] So it puts them at greater risk.

[W] Certainly.

[W] How do they find their host plants?

[>> W] This is really cool.

[W] And and we have a good example of this.

[W] Essentially the moths and butterflies are picking up on what's called the volatile organic chemicals or compounds sorry VOCs.

[W] So you've seen this term when you've gone to buy paint for your house or, you know, somewhere outside low VOC.

[W] So it's not going to put off that paint smell.

[W] Plants also have these volatile organic compounds.

[W] The in this case moths and butterflies are have these incredible sensors typically on their legs that can smell where these plants are.

[W] So in the case of the monarch, most of us know they are a specialist on milkweed.

[W] So they have these receptors on their legs that can essentially kind of find that.

[W] And then the salt and pepper skipper is a host species on a type of was it a sedge type of sedge I believe.

[>> W] Yeah I think so.

[W] Where grasses sedges.

[>> W] Yeah a.

[>> W] VOC is something that we pick up when you, when someone's mowing the grass.

[W] That grass smell is a VOC.

[W] So you can imagine if you were to, you know, walk out into your front yard and smell VOCs like moths and butterflies.

[>> W] You'd be smelling every species, potentially of plant in your yard or in your area, which would be an amazing feat.

[W] So because this is a pollination program, we should probably talk about pollination, right?

[W] So butterflies and moths are are not the most maybe efficient pollinators that that job belongs more to bees.

[W] But they are important pollinators and they're specialized pollinators in many cases.

[W] So you know here we've got the silver the silver spotted skipper, which is the most common of the skippers in at least in eastern North America.

[W] And, and I see this, these in the summertime dancing around to different flowers and getting nectar and pollinating them.

[W] But over on the left hand side, we've got kind of a different situation going on there.

[W] I'll let let you kind of explain what's happening with that.

[>> W] So the yeah, the, the snow bear or snowberry clearwing is essentially using its proboscis, much like the silver spotted skipper.

[W] But this one, that type of moth in this case, it's the day flying moth.

[W] So that's why these types of rules aren't always perfect, but it is using its legs to delicately kind of dance upon the the top of the petal and then using its proboscis to get into the to where the nectar lies.

[W] Nectar, by the way, is it's it's about it's got a high sugar content and nectar is essentially just a, a byproduct.

[W] It's a, it's a way to get pollinated.

[W] So it doesn't really help the plant at all.

[W] It's attracting pollinators in this case to take it.

[W] So if you go back to the bat versus hummingbird slide, you can imagine the bat is or the bird, the hummingbird is very delicate and is just sort of hovering over the leaf.

[W] It's not getting a ton of pollen on it.

[>> W] Silver spotted skipper is is really kind of working the flower, and it's probably getting more pollen on.

[>> W] It.

[W] And on the other hand, we have a lot of Lepidoptera that are not pollinators at all.

[W] And this is an example of one Cecropia moth is a giant silk moth.

[W] And as an adult it lacks a digestive system.

[W] So it is its existence as an adult is only for reproduction, and they only live for a few days, and hopefully they mate and they pass on their their genes to the next generation.

[W] So you know what percentage of butterflies and moths are pollinators?

[W] I, I don't know that science really knows the answer to that because there's there's not really been enough research, particularly with moths because they're doing their, their, their business at at night.

[>> W] Yeah.

[W] In that case, that question came up in the chat and I it was a great question.

[W] I knew we were going to get to it.

[W] But the like the cecropia moth that was pictured doesn't even have mouthparts.

[W] So as an adult, as a caterpillar, it's eaten all the time, but it's eating the leaves.

[W] And so one of the questions we're going to also answer related to kind of what's the benefit of it if it's not pollinating?

[W] And we could certainly talk a long time on that, but we have a few slides.

[W] So you'll see that.

[>> W] Yeah.

[W] Go ahead.

[>> W] So I don't remember what we were going to talk about with this one.

[W] These are just more more examples on the on the left hand side.

[W] That's a silphium that's being pollinated by a lot of different butterflies.

[W] Kind of a magnet in for butterflies and bees in the summertime.

[W] But over on the on the right hand side we've got moth pollinators again.

[W] And they, they typically are more specialized than, than the butterflies are as adults.

[W] Here's an example.

[W] This is a a white lined sphinx moth.

[W] Hayley's lineata.

[W] And here we see it's it's long proboscis.

[W] If you look at the plant this is one of the phlox marsh phlox.

[W] And if you don't know if you can see my cursor here with the the reproductive parts of the flower are way down at the base of the, of the tube of the flower itself.

[W] So you have to have something that's a really long appendage to be able to get in there.

[W] A bee or a wasp or not going to be able to pollinate that or even a butterfly.

[W] You've got to have something that really has a super long, maybe some butterflies would, of course, but but this moth is particularly suited for pollination.

[W] Of that.

[>> W] You can actually.

[W] See the pollen on the proboscis in that, in that photo.

[W] So it is it is moving pollen.

[W] So but these, these types of fliers are going to be a little bit just not carrying as much pollen.

[W] Insects see in the UV light the UV spectrum which we don't.

[W] So this is an example.

[W] I took my UV flashlight into a dark room.

[W] And there's really cool pictures that I didn't have.

[W] We didn't have permission to use, so I thought I would just crudely replicate the UV light if for the slide.

[W] So you can.

[W] This is kind of a crude way of showing how that flower looks different in the UV spectrum.

[W] By the way, many caterpillars actually will shine under UV light, and I've talked about this in the past that I, in the summertime, will take my UV flashlight out sometimes and

look for caterpillars in my trees and probably provide a lot more conversation for my neighbors than I would know.

[W] So the pollination though, and it is pretty common for people to talk about moths not being very efficient pollinators, or maybe not even as high that we've done a lot on butterflies, and a lot of the research on moths have been with those sphinx moths, which are very good or.

[W] Well, they're they are, you know, nectar kind of, you know, rock stars.

[W] And you see them at flowers like the hummingbird moths and others.

[W] But there's been very little study on what moths are doing at night in particular, kind of the non sphinx moths.

[W] And so this is the common looper.

[W] It's kind of, you know, one of those brown moths that people would probably pass right by, but they will congregate on the flowers at night that stay open at night.

[W] And they are doing a lot more pollinating.

[W] And there's now actually recently been more studies on moth pollination, especially these kind of messy pollinators that are not real specific to a certain type of flower, but just sort of roam around and they're doing a lot more pollinating than people realize.

[W] You can see this moth actually is carrying pollen grains in its eyes.

[W] Those, those, those pollen grains are sticking to its eyes.

[W] So it's it's moving pollen around in ways that may not be as elegant but still important.

[W] This this slide here shows this is common milkweed on the left.

[W] And and you can just see those moths.

[W] This is mostly, I believe the celery leaf or moths or possibly some other things.

[W] And they're just covering these flowers.

[W] Milkweed is a great nighttime kind of if you want to do.

[W] And we have a little bit of a slide on nighttime pollination gardens.

[W] But I would urge anyone to go out if you especially have a white colored flower that does not close at night, or in this case, mauve, or kind of a light colored flower, go out when it's dark and take a look and see.

[W] You will probably find moths on it pollinating as they try to get nectar, and then the golden stowaway is actually the color of golden.

[W] Well, is the color, it's yellow.

[W] And it it definitely knows that it's yellow.

[W] And it will find a yellow plant and stow away on that plant while looking for nectar and pollinating.

[>> W] So here's the slide that gets into if they're the ones that aren't pollinators, what are they good for?

[W] It's important to know that that Lepidoptera, particularly caterpillars, are primary consumers.

[W] And so they're they're the ones that are eating the foliage of plants and becoming food for everything else that's up above them on the food chain, particularly birds.

[W] There they are critical to bird survival, especially during mating season.

[W] These are all pictures that I took literally in my backyard of, well, not two of them.

[W] Three of them.

[W] Three out of the five were from my backyard, but they're all birds.

[W] In the month of June, and they're all carrying caterpillars in their mouths, and they're taking them back to their nests to be able to feed to their young.

[W] And they need an awful lot of them to to raise a clutch of, of young.

[W] So they're critical to bird survival.

[W] And we get away from pollination a little bit.

[W] But but it is really, I think, worth worth mentioning that they are critical to the food web.

[W] What we've done in some of these, in some of these slides is we've put some of the host plants next to some of the pictures of the Lepidoptera just for a reference, like if you want to know how to attract these animals, you know, this is what you one of the things that you would you would plant caterpillars.

[W] Yeah.

[W] Go ahead.

[>> W] Well I was going.

[W] To say the host plant thing.

[W] So this is for Indiana and probably other parts of the Midwest.

[W] But we we have a slide later that really talks about doing the research in your own area for your host plant.

[W] So some of these host plants, if you live in a different state, have a very different ecoregion region, some of these species might not even occur there.

[W] Butterfly species or moth species, as Steve mentioned, they are.

[W] Caterpillars are very high on the on on the menu for particularly birds, but they don't want to be eaten.

[W] They actually don't want to, you know, become a bird lunch.

[W] So there's a lot of different chemical and or just defense mechanisms that we have shown here that will go through that will, you know, are interesting, but also are ways to not be eaten.

[>> W] The caterpillars in this page all have a a stinging defense mechanism to them.

[W] The saddleback caterpillar moth I like to refer to as the like the Swiss Army knife of defense mechanisms.

[W] It has these these barbs on it that have chemical stingers on them.

[W] It also has these false eyespots on, you see on the left hand side, that's not its head, that's the posterior of the of the animal.

[W] And typically when we see these false eyespots, they're intended to lure a predator away from the critical areas of the body.

[W] So the hickory tussock moth, the American dagger moth all have some stinging mechanisms to them.

[W] These are relatively uncommon.

[W] Or this is this defense mechanism is relatively uncommon in Lepidoptera.

[W] Most rely on trickery to not be eaten instead of chemical defense mechanisms.

[W] Aposematism is is a term that that means a defensive coloration, a warning coloration.

[W] These are not all Lepidoptera, of course, so we've got a monarch butterfly, a large milkweed bug, a swamp milkweed beetle, and a and a red milkweed beetle that are that all have that similar coloration.

[W] They're all part of the milkweed community, and all of them absorb the toxins from the milkweed, and all of them become toxic themselves.

[W] And so we've got signaling going on here to other things that may want to eat them that, hey, I'm, I'm poisonous or I'm at least distasteful.

[W] Batesian mimicry is a term that refers to a harmless creature that is imitating a, a creature that is harmful.

[W] And the viceroy butterfly is is thought to be a monarch of a monarch.

[W] Mimic.

[W] Other scientists have argued, because the viceroy is a specialist on willows, and willows contain a salicylic acid, that it too is contains some toxins, but it's it's also argued that it's trying to look like the monarch, to be able to elude predators from being able to think that it's tasty.

[W] And on the left, the right hand side, the spotted a pardalotes caterpillar doesn't have a stinging mechanism to it, but it kind of looks like it does compared to some of the other ones that do that we looked at.

[W] Here's the the hickory horned devil, which is the caterpillar of the what walnut sphinx moth.

[W] Well, royal sphinx moth.

[W] Royal sphinx moth okay.

[W] And this, this is a completely harmless caterpillar.

[>> W] And the caterpillar.

[W] I mean, it's the size of a hot dog, and I literally seven inches long, and it looks super fierce, but it's actually very friendly.

[W] But it's it's trying to look as scary as possible.

[>> W] I don't know if I'd call it friendly, but certainly not harmful anyway, right?

[W] Yeah.

[W] I mean, so.

[W] There's other lots of different examples of Batesian mimicry that Carolina sphinx that has this, this snake like defensive posturing that maybe it's going to fool a predator into thinking that it's it's a harmful snake.

[W] Eyespots also come in very frequently, both in the adult and the caterpillar form.

[W] So the Polyphemus moth, if you saw that at night, you might think that it's an owl staring back at you.

[W] The Spicebush swallowtail.

[W] This is where.

[W] And we have another.

[W] We have another slide that shows some of the instars of the spicebush swallowtail.

[W] But these again these are fake eyespots that are replicating a snake.

[W] Perhaps we also have Lepidoptera that mimic other insects.

[W] So these are all moths and they're all completely harmless.

[W] But they're they're looking like they are either harmful or distasteful.

[W] So the two on the the two to the left, the lesser peachtree borer and the willow borer are wasp mimics.

[W] And the painted lichen is what a firefly mimic. Right.

[W] And fireflies are just they're distasteful to birds and bats, right?

[>> W] Yes.

[>> W] A crypsis is another defense mechanism, blending in with your surroundings.

[W] The fall cankerworm moth I, I walked past, I don't know how I saw it on the branch I when I took that picture, but there it was on the right hand side, the giant swallowtail.

[W] This is an early instar and this is a bird poop mimic.

[W] As an early instar.

[W] We have lots of examples of these unpalatable bird poop mimics.

[W] For lack of a better scientific word.

[>> W] Yeah, I mean, it.

[W] Turns out birds don't want to eat their poop.

[W] So moths in particular will.

[W] And some caterpillars will look like bird poop to try to not get eaten.

[W] It's it's amazing.

[>> W] Yeah.

[W] Like kind of like this.

[W] So here we, we used to when sometimes when we do like live shows we'll, we'll we'll say all right which one's the, the bird poop and which one's the moth.

[W] And it's, it's pretty obvious, but but the one on the, on the left, the, the actual bird poop.

[W] You could probably convince me that that was a moth, I guess.

[>> W] Certainly from a distance.

[W] Which is why I have, you know, I always joke, I have a lot of photos of bird poop on my phone.

[W] So accidental.

[>> W] And this is an example of a moth that uses both Crypsis and Batesian mimicry.

[W] So the io moth, when it's at rest.

[W] And this is a bad example because it's on the side of a building.

[W] But normally you would see these like on a leaf and probably on a leaf that has that similar coloration to it.

[W] So it's trying not to be seen, but if you startle it, it opens up its forewings.

[W] And there's the, the rear wings that have the eyespots.

[W] And it might be just enough of a startle to be able to escape predation.

[W] Here's our our tiger swallowtails again.

[W] Tiger Tiger swallowtail butterfly caterpillars.

[W] The first instar is a is a bird dropping mimic.

[W] And then as they as they age, they eventually turn into like these little snake mimics.

[W] The pipevine swallowtail is a is a toxic butterfly because it eats a pipevine, which is a toxic vine, and it has the reputation of being like the only one of the the toxic swallowtails, but the other swallowtails are thought to mimic it, so the spicebush swallowtail, completely edible and tasty to birds.

[W] It looks an awful lot like the pipevine swallowtail defense their tails.

[>> W] Yeah, tails are very interesting, and you'll see this in both swallowtails and like the Luna moth, those.

[>> W] Tails are not just gorgeous, but they also are there to essentially trip up for the Luna Moths case.

[W] The echolocation of bats.

[W] So bat is the bats are one of the primary predators of flying caterpillars.

[W] Sorry.

[W] Flying caterpillars.

[W] Adults.

[W] Adult moths at night and the tails are are actually playing with the echolocation.

[W] And so in many cases when the bat echolocation it will locate the moth.

[W] But the tails is is where it centers its, you know, attack at and in some cases it the the bat will just kind of jump or will get the, the hind wing or both hind wings, the moth itself, the and the critical parts of the moth.

[W] The body itself is left to fly away, even sometimes with a lot of wing missing.

[W] And again these, the Luna moth only lives for maybe five days total.

[W] Its main job is to find a mate and reproduce, so as long as it can withstand a few days and maybe a few attacks, it's it's it's a win for it.

[W] So the one on the right is almost certainly a bad attack.

[W] And then there's a few.

[W] There's this moth actually has kind of a, an organ similar to an ear that can detect the echolocation clicking sound of a bat.

[W] And they will immediately divert their flight pattern to, to not come in contact with the.

[>> W] Bat.

[W] And then this caterpillar has one of the few that I know of is the.

[>> W] Walnut sphinx moth.

[W] And it can whistle it well.

[W] It's almost sounds like a scream from what I've heard online, but one of the spheres spherical, which are the tiny dots on the side, it will, if it's going to be attacked by, let's say, a chickadee or a bird, it it will whistle, make a loud whistle sound, which startles the bird.

[>> W] Parasitism is common in caterpillars.

[W] Wasps will lay their eggs on caterpillars, and the eggs will hatch and the larvae will grow, and the caterpillar also grows.

[W] And when the caterpillar reaches a certain size, the larvae will literally eat it alive and pupate on the body of the caterpillar.

[W] This is wasp keeping the the.

[W] The number of Lepidoptera in check.

[W] But many other caterpillars are thought to be parasitoid mimics.

[W] So in this case we've got like the white mark, white marked tussock moth on the left hand side, which which kind of looks like it's been parasitized but it hasn't.

[W] So but it might be enough for an animal to want to avoid it.

[>> W] Steve, before you go back, I wanted to just to mention, and this isn't a slide, but it just occurred to me we should make one.

[W] And caterpillars probably are probably in the pollination group.

[W] But if you look at the cecropia moth caterpillar there, I wanted to point out there are other larva that you might see in your garden or in parks and things that are caterpillar like cat moth or butterfly.

[W] Caterpillars will have prolegs.

[W] So you can see that caterpillar is holding on with those, those legs, their moth and, and butterfly caterpillar will never have more than five prolegs.

[W] The, the ones on top like close to the head.

[W] That's not touching the branch.

[W] Those are actually the real legs that will develop into the the six legs.

[W] The prolegs are these little guys with suction cups.

[W] So they will have either 2 or 5.

[W] But sawflies is another type of larva that's commonly found.

[W] And they will have more than five prolegs.

[W] So just kind of fun.

[>> W] So Christine spoke about, you know, how bats are in trouble.

[W] And this is this is kind of like the recurring theme that we hear with just about any sort of nature on earth that they're in trouble.

[W] Right.

[W] So there was a, a study that Michigan State University did a few years ago, or no, last year, that where they compiled all of the data from various scientific butterfly and moth or butterfly surveys over the past 25 years.

[W] And they determined that we've lost one out of every five individuals is no longer present in 2025 than was 25 years ago.

[W] So we've lost 20% or so of our 22% of our individuals of of of butterflies.

[W] And the reasons for decline are, you know, it's kind of the same sort of thing that we hear for most things other than the last one.

[W] Habitat loss is, is the big thing, and it is habitat loss is as a big problem for plant, plants and animals everywhere.

[W] Pesticide use, invasive species, climate change, all of those things are super critical or super harmful to the populations of these animals.

[W] But also light pollution comes into play with moths also because they rely on dark skies to be able to to do their life cycle.

[W] So, you know, what can we do to help?

[W] It's I'll let you talk about this.

[>> W] There are definitely things that we can do.

[W] Habitat, as mentioned, is kind of the top on the list.

[W] And even a small bit essentially, if you can cut the amount of grass, you know, maybe year to year just kind of decrease the amount of grass if you're not playing soccer or croquet on the grass, really try to consider what value is it to you?

[W] I think this is Steve's house actually on the on the right hand side, and he's really gone with that.

[W] And there are ways to do that within an HOA.

[W] And there's if if there's not, then possibly join a board and get on there and start making some change.

[W] So adding host plants, shelter plants and nectar plants.

[W] So pollination is important.

[W] And that's what we're here tonight to talk about.

[W] But it's it's very helpful to kind of think about the entire life cycle and how that's benefiting the entire food web.

[W] Climate change, you know, advocating for that.

[W] Volunteer and donate your time for invasive species removal, for instance, sometimes, you know, time is more valuable than money in in many ways.

[W] And then practicing citizen science, we have the picture there in the middle just to kind of talk about the importance of going to meetings, whether it be Hoa's or your local municipalities, and learning what you can about how to make change.

[W] We have a lot of common areas our libraries, our schools, you know, the clover leaves and things that could be habitat.

[W] And that really takes voices to to push that through.

[>> W] And I added the citizen science bullet because of the previous slide where we talked about the butterfly decline.

[W] One of the reasons why we know that there was such a butterfly decline is because there were citizen scientists who were out there doing these monitoring routes and reporting butterfly numbers from year to year to year to year.

[W] So it's we can all do something here.

[W] Pesticide uses.

[W] You know, that's a no brainer.

[>> W] Yeah I can.

[>> W] Talk on that a bit.

[W] The pesticide use in general is going to kill insects.

[W] And the one that we see right now that's really prolific.

[>> W] Yes.

[W] Indiscriminately.

[W] These targeted treatments for mosquitoes are.

[W] Are are not really explaining exactly what it's killing.

[W] So these barrier treatments they're killing mosquitoes.

[W] If they're in your yard in the middle of the day, which is probably unlikely, but.

[W] And then but they're killing really.

[>> W] Any insect within that, within that spray.

[W] So there are other ways that you can treat for mosquitoes better ways, less costly ways.

[W] And then also, you know, just even I personally feel like the responsibility should be to, to keep ourselves as mosquito free as possible through a few different ways, as opposed to assuming that we could spray a chemical to sterilize the yard from a mosquitoes, but to other things as well.

[W] Somebody just asked what kind of invasive species are primary threat to Lepidoptera?

[W] Since I mentioned invasive species, we don't have a lot to we don't have a slide on that.

[W] But I'll just say the one kind of poster child right now, at least in Indiana, was the Callery pear or Bradford pear or Cleveland pears that were planted over the last 30 years.

[W] And every neighborhood.

[W] Those trees, to my knowledge, still support zero species of caterpillar.

[W] So they nothing eats those trees.

[>> W] And this is one example.

[W] I think, you know, with with invasive species.

[W] The big thing is that they're they tend to push out the native species, and the native species are the things that these animals need for survival.

[W] They can't make most of the time, they can't make use of the exotic imported things.

[W] So we gotta probably wrap things up here.

[W] Leaf litter.

[>> W] And that's a very that's where a lot of the chrysalis and cocoons go in.

[W] The winter time.

[>> W] And so if you can leave it or at least move it, maybe to an area like a brush pile or something that can help.

[W] This was a little slide that we put together of a typical eastern North American landscape.

[W] And this is a 100% exotic landscape going from left or left to right.

[W] We've got a Crimson king, Norway maple, a Chinese butterfly bush.

[W] We've got invasive winged euonymus burning bush along the foundation.

[W] We've got hostas, which are not invasive, but they're Chinese.

[W] We've got the Callery pear tree and we've got a blue spruce, which is fine in western United States, but it's not part of the ecosystem in the eastern part of the United States.

[W] We can and we added these little flags just to kind of show where where all these things are native to.

[W] And this is kind of the great American landscape or what's become of it.

[W] But what if we did something like that took something like this and we converted it using native plants?

[W] In this case, we've got a plants that are all native to eastern United States, tulip tree, nine bark, white oak, eastern redbud.

[W] And now we can have a landscape that is supporting Lepidoptera and supporting pollinators without using any exotic plants.

[>> W] And those plants too are like this slide kind of segues into that.

[W] In our case, we could fly an Indiana flag over that yard and know that those species, with the exception of the turfgrass, were all species that were native to our ecoregion in Indiana.

[W] And so we would.

[>> W] Recommend that you find your ecoregion and look for plants that are not just native to America, but native to where you live, in particular by state and maybe even by eco region.

[W] So there are tools that will help you find your native plants, and then you can deep dive into that to find where to you know, where you can buy them and start that journey.

[>> W] Light pollution we talked about before and we've got have you ever seen those those shots from outer space where Earth, you can see just how much of it we've lit up now.

[W] Very detrimental to these nighttime flying insects.

[W] So keep your your yards and your properties as dark as you possibly can if if possible.

[W] This was we mentioned citizen science.

[W] And there's a lot of things out there.

[W] iNaturalist is one that a lot of people do.

[W] We do our own little one in Indiana called the Great American Indiana Lepidoptera Project, and we've been able to have some, some, some substantial fines from just people getting out and looking and taking pictures.

[W] This is a butterfly that's silvery blue.

[W] That was thought to be extirpated from Indiana until one of our, our, our users found it in a county in the northeastern part of the state.

[W] Doll's clearwing.

[W] I don't remember the story behind this one.

[W] This was one that also was was the first Indiana sighting.

[W] Maybe.

[>> W] Yeah, we had not.

[>> W] Indiana had not been on the map for this species until some of our friends found it.

[>> W] So the moral of the story is, if you can participate in some of these citizen science initiatives, they they actually really do contribute data that is used for conservation.

[W] Kyoto moth isn't a is an exotic moth that we've been kind of seeing move across North America that turned up in Indiana.

[W] So that's the end of our presentation.

[W] This is our contact information.

[W] If you would like to get a hold of us, we'd be happy to answer any questions.

[>> W] Thanks, Steve.

[>> W] Back over to you, Anthony.

[>> W] That was great.

[W] I've never heard of mimicry like parasitic mimicry in caterpillars.

[W] That is really cool.

[W] Okay, I'm going to take over the screen here for a couple minutes, and then we'll get to a Q&A.

[W] So you might need to stop sharing.

[W] Steve.

[>> W] Oh, sorry.

[W] There we go.

[>> W] Okay.

[W] Great.

[W] So just a couple housekeeping slides before we get to the Q&A.

[W] So again, the recordings and all the resources mentioned tonight will get posted to the course information page, which I'm sure most of you are familiar with at this point.

[W] But there's the login and the password, and we'll send a follow up email with that information along the theme of the last presentation on Lepidoptera, the new Pollinator Week logo was just released, featuring the Spicebush swallowtail and the caterpillar, which is an amazing species.

[W] And we're excited to announce that the swallowtail butterfly, or all swallowtail butterflies, are this year's pollinator of the year.

[W] Okay, and the final wrap up slide.

[W] So our next session will be next Tuesday, March 3rd.

[W] And that'll be module for creating habitat for pollinators.

[W] Overview at the same time, same link that you use tonight.

[W] And with that I'll pass things over to Avery and we'll try to answer a couple questions.

[W] Just being mindful of everyone's time.

[W] But Avery, over to you.

[>> W] Thank you to all our speakers for an amazing series of presentations.

[W] And we're just going to do an abbreviated Q&A session because we are short on time.

[W] So I'd like to start with a question for Christian, for Kristen, Barbara Lowe asked or wondered, she says, I'm sure you've experienced folks that are iffy about bats and possibly worried about rabies.

[W] Do you have a spiel for those that have that kind of concern, or try to show them the bright side?

[>> W] Yeah, absolutely.

[W] So yes, bats tend to get a bad rap in general in terms of the rabies, less than one half of 1% of bats in the wild are estimated to have rabies.

[W] So it's it's not a very common thing among healthy bat populations, you know, that being said, if you find a wild bat on the ground, you know, out during the day, you know, it's it could be sick.

[W] So just like with any wild animal, you don't want to go up and touch it.

[W] But yeah, in terms of having bats in your backyard or putting up a bat, house bats are already there.

[W] In many of these environments.

[W] The bats are are there.

[W] They're flying around.

[W] They're eating whether you see them or not.

[W] So putting up a bat house, for example, or creating bat habitat is not going to lure bats that aren't already in the area.

[W] Does that make sense?

[W] So so you're not you're not bringing them where they shouldn't be.

[W] And yeah, in terms of like potential contacts, like if you put up a bat house, you know, don't put it like right above your window or your doorway on your house or right next to a walkway where you spend a lot of time just, you know, common sense to reduce any potential interactions.

[W] But they're already there.

[W] So just common sense things, just like with many wild animals.

[>> W] Yep.

[>> W] I'd also love to note that we had tons of comments in our chat about how cute the photos you included were, and how charismatic bats really can be.

[>> W] Yes.

[W] Thank you.

[W] I agree.

[>> W] Moving on to a question about Lepidoptera for Amanda and Steve.

[W] Amanda Thomas is wondering, as spring weather patterns have been trending earlier for my region, are there planting strategies you would recommend that can help buffer against timing shifts?

[W] She specifically wondering if you have things in mind for pollinators emerging earlier in the season?

[W] While food sources may not have yet emerged and migratory species needing food at specific times of year are in our corridor.

[>> W] That's that's a real problem for some species.

[W] And here in Indiana, we had a species of butterfly called the Karner blue, which was present in the Indiana Dunes region just south of or along the coastline of Lake Michigan.

[W] The Karner blue is a specialist on Lupinus perennis, which is the wild lupine that we have growing in eastern North America.

[W] That's the only thing that it can eat.

[W] And in 2012, we had a crazy weather pattern, the Karner blue butterflies have two broods.

[W] There's a spring brood and a summer brood in the spring.

[W] We had a week of 80 plus degree weather in April that threw off the timing of the the emergence of the lupine with the the spring brood of the Karner blues.

[W] And then later that summer, we had an extreme drought.

[W] And when the summer brood emerged, there were nothing but wilted leaves for it to eat.

[W] And we no longer have Karner blues in Indiana.

[W] They're now considered extirpated from Indiana.

[W] So in terms of a strategy, I don't know.

[W] That's a tough one.

[W] You know, with with a crazy climate event like that, I don't know how we could possibly have what we could have done to prevent it.

[W] It only eats one thing, and the one thing that it eats is, you know, is 100% affected by the, the, the the change in the climate pattern.

[>> W] I would.

[>> W] Probably like they say to do with your 401 K, just diversify as.

[>> W] Much as you can.

[W] And you know, just I think that would be the best bet.

[W] And the.

[>> W] More habitat that there is, you know, and again, if we can band together and, and get some of these places that are public funded and, you know, lands whether or not they be the, the, you know, land trusts and all of these things, but even some of these other common places that you see within our, our communities and getting some of that converted into habitat, in my opinion, would be another way to stem that for the most part,

nature, you'll see swings and ups and downs and in some cases, a species on the brink will will definitely succumb to that.

[W] Like the Karner blue, the monarchs.

[W] A great example, unfortunately, of that in particular because of its migration strategy.

[W] But the you know, as long as we can diversify species and, and, you know, grow that exponentially, that will help a lot.

[>> W] The, the, the example that I gave was of an extreme specialist, but those comprise kind of the minority of the species that we have.

[W] So I agree, I mean, diversifying the plantings for.

[W] So if the Karner blue butterfly were able to eat other things and we had those other things available to it, it could have served as a substitute.

[W] But this I want to talk real briefly.

[W] One question that we hear a lot is whether or not we should be planting species that are more southern to adapt better to climate change.

[W] In other words, where I'm at in northern Indiana, people are saying, well, the climate 20 years from now is going to be like the southern tip of Indiana.

[W] So should we be planting the more southern species here in northern Indiana?

[W] And most ecologists that I've talked to say no, because we're we're disrupting that balance.

[W] Again, they're we're taking things out of range because we think that they'll grow better.

[W] Instead, we should be not planting cultivars, which are genetic clones.

[W] We need to get more genetic diversity into our into our urban lands, especially.

[W] So, you know, maybe we plant ten oak trees and five of the ten won't make it because of climate change, but the other five might.

[W] And they'll pass on their genes.

[>> W] I think we have time for one more question.

[W] Those are some great answers.

[W] Thank you.

[>> W] All right.

[W] Our last question is for both of our presenters.

[W] And the question is for Mary Hash when setting up a pollinator garden and being mindful of the diversity of pollinators, is it okay to mix plantings that are pollinated by different groups, or is it better to have pollinator specific areas of plants?

[W] Let's start with Kristen.

[W] Kristen.

[>> W] Yeah.

[W] So in terms of bats, most of the bats that you all are going to be encountering are not pollinating nectar feeding bats.

[W] They are insectivorous bats.

[W] The pollinator bats that I talked about today are only in like far southern Arizona, New Mexico and west Texas.

[W] So it's mostly insectivorous bats that are eating the nocturnal insects that are flying around those plants.

[W] So I will defer to the insect experts on what what's the most effective to get that insect pollinator network?

[>> W] I was thinking, as we were talking earlier, that it was kind of ironic that, you know, we're we were talking about the ways that Lepidoptera evade bats.

[W] And, you know, you're talking about how Lepidoptera or bats, you know, eat insects.

[>> W] So I'm.

[>> W] Encouraging them to eat the insects.

[W] Yep.

[>> W] Right.

[>> W] Well, you know, it's all about having a balance of nature, but maybe Amanda, do you want to take that that question though, in terms of like what the the planting strategies?

[>> W] I think I think again, diversify a monoculture.

[>> W] Is never good, whether that's lawn or, you know, anything else.

[W] So so different heights different.

[W] As long as it's native to your area it's beneficial to something even.

[W] I mean, obviously poison ivy maybe is not the best thing to put in your yard for diversification, but in the right place, every plant does well.

[W] So finding something that can survive your yard but heights, blooming times, all of it.

[W] We have a phlox, for instance.

[W] The the the the blue phlox or wild blue phlox.

[W] Yeah, that comes up really early.

[W] It's not one that we would normally plant in our yards, but it's pale purple or blue even maybe white.

[W] And it's pollinated by by one type of sphinx moth, the sphinx moth, which is the earliest sphinx moth that comes out.

[W] So there is a relationship that something beautiful or maybe not beautiful until you learn the story has with a plant and and it's, it's it's got a lot of each plant has a lot to it.

[W] So I encourage.

[>> W] People to to study their own ecoregions.

[W] Find out what you're not, not just what the the natural vegetation was of your town, but also of your neighborhood.

[W] And that will tell us like go visit nature preserves that are nearby and look and see what's growing there.

[W] And that will give you a good basis for what was there to begin with, what will probably thrive in your own property, and what will fulfill the ecological needs of the the animals that rely on on the plants that are native.

[>> W] And one other thing, one other thing on that.

[W] And we kind of touched on it when.

[>> W] You saw some of the words with the plants, the host plants, but don't neglect the woody species that are native to your area, shrubs and trees in particular, for hosts, plants, that's really where you're going to get the most diversity of species.

[W] The the flowers are beautiful.

[W] And they they do provide the pollination resources, although some trees do as well when they flower.

[W] But don't neglect putting in as many shrubs and trees as you can within your landscape.

[>> W] It's particularly important with Lepidoptera because we have to.

[W] If we don't have the host plants, we can have all the pollinator plants in the world, and we're not going to be able to support their life cycle.

[>> W] Thank you so much for that answer.

[W] And with that, we are going to wrap up the Q&A session.

[>> W] And you know, Avery, I think that last question is going to be my pick of the night for the the winning question.

[W] So whose was that again?

[>> W] That was Mary Hash.

[>> W] Mary okay.

[W] Congrats, Mary on winning the question of the night.

[W] And we will get in touch with you about your prize. Awesome.

[W] Thank you so much, Kristin.

[W] Steve, Amanda for your amazing presentations tonight.

[W] Thanks, Avery for leading the Q&A.

[W] And thanks to all of you for being here, and I hope you enjoyed this session on Overlooked Pollinators, and we'll see you again next week.

[W] Thanks, everyone.

[>> W] Thank you everybody.

[>> W] Thanks everyone.