Hi everyone, thanks so much for attending today to learn about pesticide reduction to protect pollinators and other invertebrates in residential landscapes.

To set the stage, pesticides include insecticides, fungicides, herbicides, and others – but these are three we're often concerned about in terms of pollinator conservation.

In this title slide we have a bumble bee, *Bombus mixtus,* visiting a checkermallow flower.

Declining Insect Diversity and Abundance

- Studies indicate insect declines worldwide
- Many pollinator species are imperiled, including bees and butterflies

Hallmann et al. 2017, Lister and Garcia 2018 Sánchez-Bayo and Wyckhuys 2019. Thomas et al. 2019, Saunders 2019; Forister et al. 2019

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Many of you may already be aware of this, many recent studies are documenting declines in insect populations and communities worldwide. In particular, many pollinators – including bees and butterflies – are imperiled.

The data is patchy, since many insects are not carefully monitored, but the data we do have almost all points to decreases in populations around the world. We know enough to know that it's essential to take action to conserve pollinators, as well as other insects.

Photos: Howard F. Schwartz / Colorado State University; Bugwood.org

Drivers of Insect Declines

Habitat Loss
- Land-use change
- Agricultural intensification
- Invasive species

Climate change

Pathogens and disease

Pesticide use

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There are several key drivers of insect declines that scientists agree on.

A major one is habitat loss, in particular due to agricultural intensification especially large monocrops that produce no food for pollinators, like corn and soybeans. These areas typically also have high amounts of pesticides and row-to-row farming.

There has also been accelerating land use change, in particular urban sprawl, in many parts of the country and world.

Invasive species are also a concern, as they can outcompete the native host plants species insects rely on.

Climate change is another major driver of insect declines, as well as pathogens and disease.

The final driver is what we're focusing on today – pesticide use. Insecticides kill insects directly, and in low quantities can cause subtle yet harmful effects like diminished reproduction, colony growth, and ability to find food. Even pesticides thought to be safe for insects, like certain fungicides and herbicides, are recently

drawing more scrutiny as studies are finding harmful impacts.

When we make our residential spaces tidy by removing plant diversity and using pesticides, we are making those spaces hostile to most insect life.

Our society uses pesticides heavily, and part of the reason why is that we believe they are essential. The pesticide paradigm is the unspoken and almost unconscious assumption by industry, state, and the public, that chemical pesticides are absolutely necessary, safe, and effective. Most of you likely don't fully accept this…although you may well have been faced with an issue and wanted to reach for a pesticide in the past

We hope we can further disprove this paradigm today, as none of those adjectives "necessary, safe, and effective" are wholly true.

Urban Pesticide Use

Urban Landscapes

- Often used for cosmetic reasons
- Can wash off from grass, patios, and impervious surfaces
- More pesticides are used per acre in urban areas than in many agricultural areas.

Photo: Matthew Shepherd

Atwood & Paisley-Jones (2017)

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When we talk about pesticides, we often think about agricultural areas, but they are commonly used in urban areas as well. In fact, more pesticides are used per acre in urban areas than in many agricultural areas.

In our communities, pesticides are often used for cosmetic reasons to maintain manicured landscapes. They can wash off from grass, patios, and impervious surfaces and end up in our waterways – often at levels that are risky to aquatic ecosystems.

Atwood & Paisley-Jones (2017). EPA Pesticides Industry Sales and Usage 2008 – 2012 Market Estimates. U.S. Environmental Protection Agency.

More than Insecticides

Fungicides

- Often classified as "practically non-toxic"
- Linked with subtle yet harmful impacts
- Synergize with certain insecticides

Herbicides

- Eliminate flowers
- May impact bee navigation
- Can interfere with bees' gut microbes

Photo: Nancy Lee Adamson

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Sources: Mullin et al. 2010, David et al. 2016; Park et al. 2015; Degrandi-Hoffman et al. 2015; Balbuena et al. 2015; Motta et al. 2018

We're obviously concerned about insecticide use because of the immense direct and indirect impacts they have on pollinators, but we also want to emphasize that we're concerned about more than just insecticides. In particular, there are both fungicides and herbicides that have been shown to have negative impacts on pollinators.

Fungicides are often classified as "practically non-toxic", but some have been linked with subtle yet harmful impacts. For example, symptoms resembling malnutrition were noted after exposure to some fungicides. Also, some types of fungicides interact synergistically with certain insecticides, which means they increase the toxicity to bees when present together.

The main impact of herbicides is that they remove flowers from the landscape, which provide the pollen and nectar that bees rely on for food. There are some studies that suggest that glyphosate may impact bees' abilities to navigate, and interfere with bees' gut microbes and make them more susceptible to disease.

You Can Make a Difference!

Residential landscapes can play a huge role in conservation at the individual site-level and at the landscape level

Stephanie Frischie / Xerces Society

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So when it comes to invertebrate conservation -- what can you do at home? Bees need flowers for food, nesting habitat, and to be protected from pesticides. Something that is really exciting is that cities can be important havens for pollinators and other beneficial insects. And, it doesn't take that much time or space. Yards and gardens are obvious spots to make a difference, but this includes all of us – people who live in apartments with some communal space can work to make it pollinator friendly, or garden with pots or hanging baskets. If home isn't an option, consider encouraging pollinator friendly landscaping practices at work places.

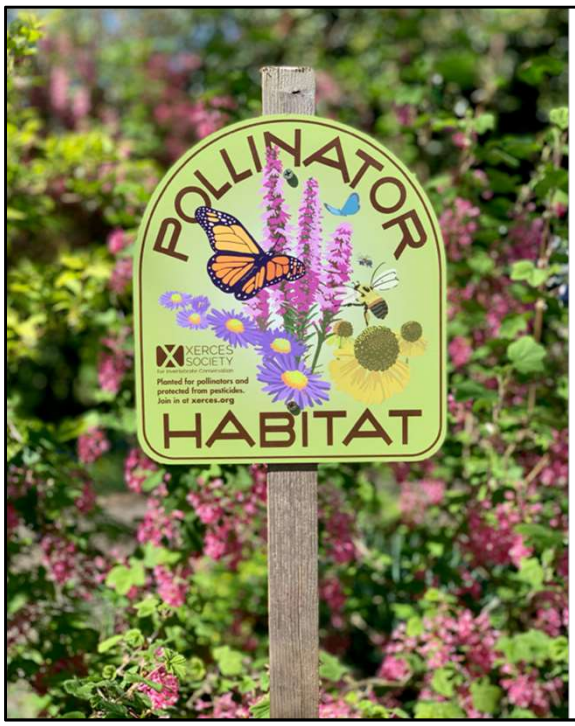

Photo: Suzann Ganarhan

Addressing Pesticides

Yards and Gardens

Ultimate goal: avoid pesticide use

Manage your yard to prevent pests

Confirm the “pest” is truly a problem

Use non-chemical management practices

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Protecting pollinators from pesticides isn’t just about making sure the product you buy doesn’t have a warning sign about bees. The first, most important step, is not considering pesticide products to be your first line of defense if you have an unwanted plant or insect in your yard.

Especially in yards and gardens, ultimately we would like to see elimination of pesticide use, First and easiest, think about eliminating aesthetic uses of pesticides.

To do this, you should manage your yard to prevent pests – which is something we’ll go into more detail about, a lot of it is keeping your plants healthy.

The next step is to monitor your yard for what insects are visiting it. If you do get pests, before intervening confirm the "pest" really is a problem (oftentimes it is just a blemish and can be ignored, or managed without any pesticides).

Finally, when you determine management is needed, seek out non-chemical management before ever reaching for a pesticide. This can take time to build garden resilience and learn about non-chemical solutions, but eventually this is what we’d encourage you to do.

Building a Good Foundation

- Right plant, right place
- Water appropriately
- Build healthy soils
- Don't crowd plants

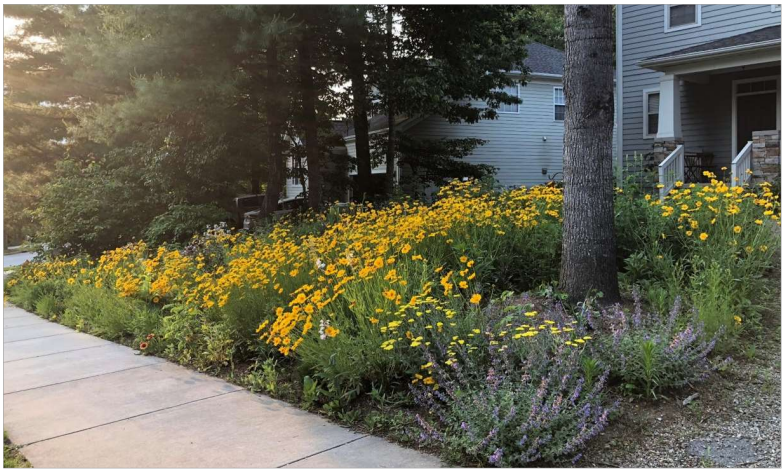

Photo: Tim Sorrill.

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What can you do, practically, to prevent pests? As you manage your yard habitat, you should focus on preventing issues rather than treating pests if they arise.

Start by choosing the right plants for the local conditions, or as people say "right plant, right place". If you have a sunny, dry yard – plant drought tolerant species. If you have a wet or shady yard, use plants that grow well in those conditions. If you put a plant that loves shade into a hot dry place, it's either going to die – or be really stressed just trying to survive and not have resources to fight off pests or diseases.

Next, you want to water appropriately to provide plants with the correct resources: not too much, not too little. The best options for garden watering are soaker hoses or drip irrigation, not the overhead sprinklers that go back and forth. Those overhead sprinklers tend to water just the top inch or two of soil, and promote shallow root growth. What you want to promote is deep root growth, so that your plants can withstand heat and drought stress later in the season. These sprinklers can also increase the risk of fungal disease by damaging leaves and leaving them wet overnight.

The next thing to think about is to build healthy soils, with correct nutrient and pH

values. You can get inexpensive soil tests through soil labs, often through your local university of extension office that can tell you if your soil is deficient in anything.

The last thing is to ensure your plants are spaced out so that they receive good sunlight and airflow, which will make them less stressed and less susceptible to issues like powdery mildew.

Though these are all good gardening tips in general, this relates to pest outbreaks because stressed plants have a more difficult time mustering defenses against infection or infestation.

Plant Diversity = Prevention

Diverse plantings tend to be more resilient to damage and stressors and support natural enemies

Photos: Xerces Society/Mace Vaughan; Bryan Reynolds; Elijah Talamas/USDA

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Another thing to consider in your yard is plant diversity. Including a variety of flowering plants can reduce the threat of pest infestations that could impact your entire garden. Most insects are beneficial in some way! A diversity of plant species provides complex habitat structure and resources for natural enemy populations.

Natural enemies are arthropods that either eat or parasitize pest insects and provide pest control – like lady beetles, lacewings, or parasitoid wasps. Diverse plantings have been shown to boost natural enemy diversity, and in turn these will help suppress pests in your yard.

Here are a few examples that you might find in your yard. In the middle we have an assassin bug, a type of predator, and the top right is a parasitoid wasp emerging from a stink bug egg.

So what types of plants do you want to pick? Many of the same plants that support pollinators will also support beneficial insects. Many beneficial insects rely on pollen or nectar at specific periods of their life cycle, or can use these floral resources to supplement their diets when insect prey are not available.

A key is to have a diversity of plant types, flowering durations, and textures, because these are what create complex habitat – they provide a variety of food and refuge or microhabitats.

Prioritize native plants and include diversity for season-long bloom – different bee and natural enemy species are active at different times of the spring, summer, or early fall, so making sure flowers are always blooming in your yard is important.

As we talked about a few slides ago, select plants suitable for your site (soil, sun, moisture)

Try and find plants grown with bee-safe practices, from nurseries that share your views and try to curtail pesticide use through more sustainable practices. Avoid plants treated with highly toxic and systemic pesticides.

Finally, avoid cultivated plant varieties, as many of these produce less pollen and nectar for pollinators.

Hidden Pesticide Risks

- Mosquito control
- Perimeter / foundation treatments
- Insecticide use on trees

Photo: Bee City USA – Decatur, GA

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Beyond gardens, I want to mention that there are other “hidden risk” areas that can expose wildlife to pesticides at home. One of these is mosquito spraying, which often utilizes toxic and broad spectrum insecticides. Not only is spraying harmful to other insects, but many sprays only target adult mosquitos, which isn’t effective long term. Instead, the most effective way to control them not allowing their populations to build.

Adults lay their eggs in still water, where they hatch and develop. This entire process takes only 8 to 10 days and mosquitoes only need an inch or less of water to reproduce, so water that stands around for just over a week can lead to a population explosion.

Dump water from buckets and trash cans, look for hidden flower pots that may have filled with rain, and clear clogged gutters. Finally, every few days, dump and refill water sources like pet bowls and bird baths to prevent any mosquito larvae from completing their life cycle. Talk to your neighbors and local vector control agency to see if you can coordinate a community wide prevention effort.

Another risk is treatments from pest control companies designed to kill nuisance

pests like spiders and ants, or treatments to deal with structural pests. Obviously people don't want termites or carpenter ants, but there are less toxic management practices that don't include barrier trenches filled with pesticides. This can be especially risky when habitat plants are grown right near the edges of houses that have been treated. Contact us or the Xerces Society for resources and ideas to deal with these pests via less harmful strategies..

Another hidden risk area are trees! Tree doctors or arborists often treat sick looking trees with a fungicide or insecticide. Some commonly used systemic insecticides on trees can last for a long time in woody plants – particularly injections or soil drenches. We're not saying never to treat a tree, but consider whether the pest actually threatens the health of the tree, and whether it will keep coming back and require treatment every year.

Home Garden Pesticide Risks

Plants bought at nurseries

- Across the country, pesticides have been found on nursery plants
- Neonicotinoids, other insecticides, and fungicides detected even when labeled ‘bee friendly’ or ‘we do not spray neonics

Sources: Stoner et al 2016. Halsch et al 2022
Photo: Nancy Kennedy

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Lastly, another hidden risk for pesticide exposure in the home garden is plants purchased from nurseries.

The demand for nursery plants to be aesthetically appealing, pest free and damage free is really high. That, combined, with interstate rules to reduce pest spread leads to significant pesticide use in nursery production. A number of studies have found neonicotinoids and other pesticides contaminating plants, including a study the Xerces Society performed with partners, where they sampled milkweed at retail nurseries in 15 states across the country. Milkweed samples had an average of 12 pesticides present, including plants labeled ‘bee friendly’ and ‘we do not spray neonics’.

What can you do? Three steps to take when buying are to: ask for organic plants, avoid plants treated with long lived highly toxic systemic insecticides and get to know nursery practices to be sure they are using pollinator-friendly production. Even if your local nursery doesn’t know the answer, this will demonstrate consumer demand for bee-safe plants.

If you don’t know whether the plant you bought was grown in a pollinator-

friendly manner, assume it might be contaminated. Actions you can take to limit harm include: assume the soil your plant comes in is contaminated, so dump as much of the soil as you can so that the plant doesn't take up more pesticides from it. Net the plants to prevent pollinators from coming the first year- plants can have high concentrations of pesticides in leaves, pollen, and nectar.

Yards as Habitat

- Tolerate some plant damage – it means insects are using the habitat
- Embrace ecological beauty

Carolina chickadee. Photo: Will Parson/Chesapeake Bay Program/Flickr

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Finally, we want to conclude by encouraging you all to think of your yard as habitat, and to accept some insects and even some holes and feeding damage on your plants, because ultimately, this means your yard is being used by a broad community of insects, birds, and other animals. We hope you can embrace the idea of your yard having “ecological beauty” as well as conventional aesthetic beauty.

For example, caterpillars feeding on leaves means you are providing resources to butterflies. In turn, these provide resources for birds, like this Carolina chickadee eating a caterpillar pictured here.

An insect that feeds on your plants isn’t necessarily a pest – in fact only about 2% of insects are considered pests – the other 98% are actively beneficial to you or the ecosystem. While foliage being fed on won’t look perfect, this herbivory isn’t going isn’t going to kill hardy plants.

The landscape choices we make in residential landscapes have wide reaching impacts on biodiversity - and eliminating pesticide use is a way to make a huge, postive difference.


Questions?
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