INSECTS & BUGS

BACKYARD WORKBOOK

Hands-on Projects, Quizzes, and Activities for Kids

Jaret C. Daniels, PhD

INSECTS & BUGS

BACKYARD WORKBOOK

Hands-on Projects, Quizzes, and Activities For Kids

Jaret C. Daniels, PhD

Acknowledgments

I would like to thank my loving wife and best friend, Stephanie, for her unending patience, sense of humor, and support. She makes our life together truly wonderful. I also want to thank our many doting cats. They regularly keep me company during projects like this and quickly alert me should any of the assorted insects in our home escape. Lastly, I wish to thank my parents for encouraging my early interest in the natural world. It resulted in a continuously rewarding and always surprising career.

Edited by Brett Ortler
Cover and book design by Fallon Venable
Photo Credits on pages 118–119

Insects & Bugs Backyard Workbook: Hands-on Projects, Quizzes, and Activities for Kids

Published by Adventure Publications, an imprint of AdventureKEEN
310 Garfield Street South, Cambridge, Minnesota 55008
(800) 678-7006
www.adventurepublications.net

Printed in the United States of America
ISBN 978-1-64755-159-9 (pbk.)

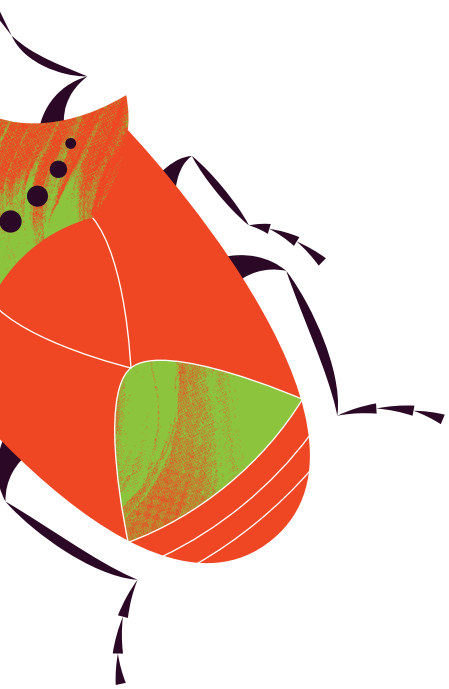
Safety Note

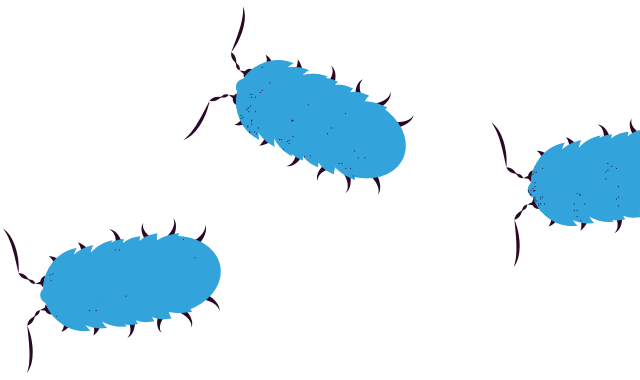
Learning about bugs and insects is a lot of fun, but whether you're in your back yard or at the beach, you always want to stay safe.

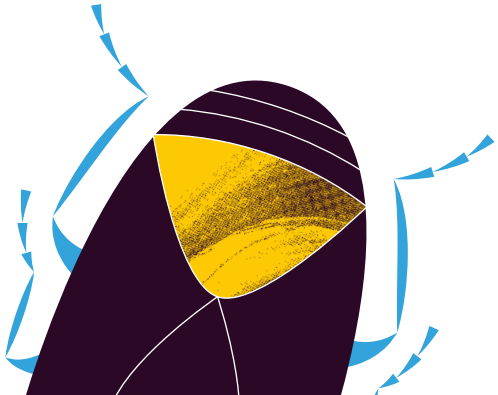
Follow these guidelines:

- Never go out alone! Always bring an adult.
- If you're venturing far, bring a map, a smart phone, or a GPS so that you don't get lost.
- Always bring water to drink. It's dangerous to be out all day with no water!
- Bring a hat and wear long clothes to protect you from the sun. You may get hot, but at least you won't get burned!
- Wear insect repellent to protect you from mosquitoes, ticks, no-see-ums (biting midges), and chiggers.
- Never go into rivers, lakes, or oceans because the water may be deeper or faster than you realize.
- Never go onto private property. This means that someone else owns the land. If you see signs that say "no trespassing," turn around right away!
- Always carry a flashlight if going outside at night.
- Avoid handling bugs. Many can bite, sting, pinch, or otherwise cause irritation. This is particularly true with bees, wasps, ants, centipedes, and scorpions. If you or someone in your family is allergic to stings and bites, don't closely approach insects and always be aware of your surroundings.
- Use caution when turning over logs, rocks, or other objects, or when reaching into cavities or crevices, and wear gloves if you plan to do so.
- Some bugs have irritating hairs or secretions. Always wash your hands after collecting.

Table of Contents







Amazing Insects

Insects are amazing. They are easy to find in almost any outdoor space. They come in an incredible variety of different sizes, shapes, and colors, and they can be both creepy and attractive. In fact, about 1 million different insect species are known to exist, making them the most diverse group of animals on Earth. Insects are also super abundant. This means that if you tried to count all the insects on the planet, you would end up with a really, really, really big number.

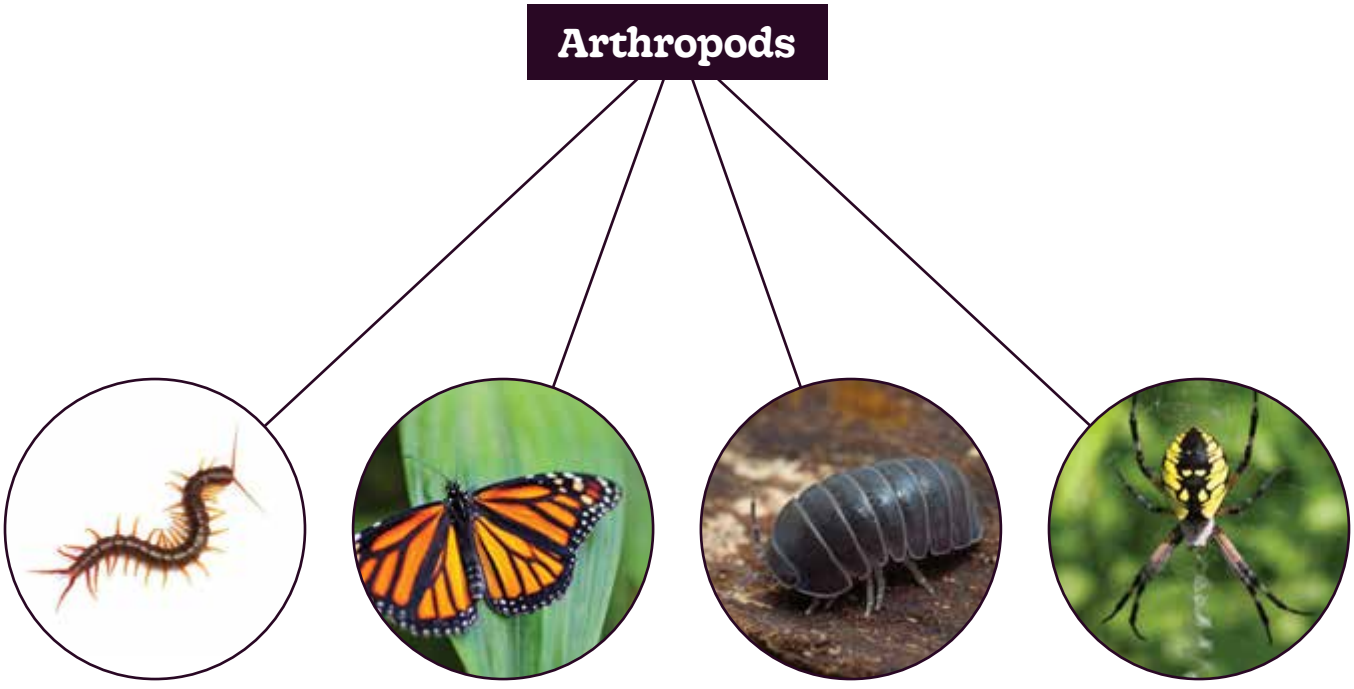
Fast Fact

At any one time, scientists estimate that there are some 10 quintillion (1,000,000,000,000,000,000) insects around—or about 200 million insects for every single person. That's a lot of insects!

What is an Insect?

Now, if you want to find, observe, or study insects, it helps to know what an insect is. For starters, insects are often called bugs. When you use the word "bug" you probably are referring to a range of small, creepy-crawly critters such as spiders, centipedes, millipedes, and scorpions, as well as insects. All of those small organisms belong to a large group called arthropods. Arthropods have an external skeleton (called an exoskeleton), a segmented body, and jointed appendages such as legs and antennae. There are several different groups of arthropods: hexapods (insects and springtails), crustaceans, arachnids (spiders and ticks), and myriapods (millipedes and centipedes).

Insects are by far the most well-known and commonly seen arthropods. They are also the largest group of arthropods.



Fast Fact

If you picked out any one living thing on Earth at random, there's a very good chance that it'd be an insect.

Insect Anatomy

All insects share the same basic body plan, with three main body sections: the head, thorax, and abdomen, as well as six legs and two antennae. The **head** is the first body section. It has two compound eyes, two antennae, and mouthparts. The **compound eyes** are used for seeing. They are composed of hundreds of smaller individual eyes. Above the eyes are two segmented **antennae**. They are used for sensing touch, taste, or smell. Insect antennae come in many different shapes. The head also has **mouthparts** used primarily for feeding. They are most commonly used for chewing or sucking, and the type of mouthparts vary between insects. Some adult insects lack mouthparts altogether and don't eat. As adults, they survive on stored food and only live to reproduce.

Diagram of Insect Anatomy

1. Head
2. Thorax
3. Abdomen
4. Antennae
5. Compound Eye
6. Foreleg
7. Middle Leg
8. Hind Leg
9. Forewing
10. Hindwing

Examples from the Insect World:

A Tiger Beetle's head with jaws

A Wheel Bug's beak

A fly's sponging mouthparts

Real-World Diagram of Insect Anatomy

1. Head
2. Thorax
3. Abdomen
4. Antennae
5. Compound Eye
6. Legs
7. Forewing
8. Hindwing

The **thorax** is the second body section. It has six legs attached, two on each of the three segments. The **legs** enable an insect to move. They may also be used for other tasks such as digging, jumping, and capturing or holding prey. The leg has several parts. These include the femur, tibia, tarsus, and a tarsal claw. Many adult insects may also have **wings;** some, like flies, have two wings, while others, such as beetles and bees, have four. Wings are used for flying.

Examples from the Insect World:

An Eastern Lubber Grasshopper's thorax

Close-up of the legs and feet of a Western Honeybee

Close-up of a damselfly's wings

The final body section is the **abdomen**. It is also the longest and has the most segments. The abdomen has a series of small holes on the side, one pair on each segment, called **spiracles**. They are used for breathing. While also found on the thorax, they are most noticeable on the abdomen.

Examples from the Insect World:

Spiracles on a Tomato Hornworm caterpillar

Close-up of a German Yellowjacket's stinger and abdomen

A Goldenrod Soldier Beetle's abdomen

Activity: Label the Parts of this House Fly

Label the head, thorax, legs, abdomen, and compound eyes.

Quiz Time

1. How many wings does a house fly have?

_____

2. How many wings does a butterfly have?

_____

Answers on page 105! ☞

What's *Not* an Insect?

Many arthropods, such as spiders, millipedes, centipedes, and sowbugs and pillbugs, are often lumped together with insects, but they are different.

Here is a look at what's *not* an insect.

Spiders are familiar animals, and while they are almost all totally harmless, some people are afraid of them. In fact, they are great to have around, as they eat mosquitoes and other annoying bugs. Together with ticks and scorpions, spiders are arachnids.

Zebra Jumping Spider

Spiders are easy to identify; they have a body that is divided into two sections (the cephalothorax and abdomen), eight jointed legs, and no antennae or wings. Their mouth also has a pair of jaws called chelicerae and two sensory organs called pedipalps, which function much like an insect's antennae.

Warning: While most spiders prefer to hide or run away from people, many spiders can bite, so don't handle them.

Finally, all spiders produce silk, and some create large webs for catching prey. They can be found almost anywhere, from on the ground, in your house or garage, under logs or rocks, and, if you look close, even hiding in plants or on flowers.

Black Yellow Garden Spider

Millipedes are shiny, often dark colored, worm-like creatures. They have a long, and somewhat hardened, tube-like body with many visible segments. Most segments have two pairs of small, jointed legs. While the name millipede means "thousand legs," millipedes only have up to a few hundred legs, and they crawl slowly across the ground. If disturbed, many millipedes curl up into a spiral.

Despite their strange appearance, millipedes are completely harmless. Most millipedes are scavengers and feed on dead leaves and decaying plants and wood. They are most often found in dark, damp locations such as under logs, rocks, mulch, or even in flowerpots.

Centipedes look similar to millipedes but have a noticeably flattened body. They have only one pair of jointed legs on each segment; these legs extend outward from the side of the body. Unlike millipedes, centipedes can move quickly, especially if disturbed, often scurrying in a snake-like motion.

They are ferocious predators and active primarily at night. During the day, they can be found in dark, damp places such as under logs, rock, mulch or leaves.

A Millipede and a Centipede

Warning: Don't touch or hold centipedes, as they can deliver a painful bite.

Earthworms have long, tube-like segmented bodies, but unlike insects or other arthropods, they don't have an exoskeleton or any jointed legs. They instead have a fluid-filled body cavity surrounded by muscle. A combination of fluid pressure and muscle action keeps the earthworm's body shape and enables it to move.

They require moist environments, and are commonly found in soil, under leaf litter, rocks or logs. Earthworms are very beneficial decomposers, feeding on decaying plant material, small microorganisms, fungi and animal waste. While they may be slimy, earthworms are completely harmless.

Earthworm

What's *Not* an Insect?

Sowbugs and **Pillbugs** are weird-looking organisms that resemble tiny armadillos. They aren't insects, or even arthropods at all. Instead they are small, gray, land-dwelling crustaceans called isopods that are related to shrimp and crayfish. They have hard, shell-like coverings made up of several plates, three body sections, seven pairs of legs, and two antennae.

While sowbugs and pillbugs are very similar looking, pillbugs can roll up into a ball when disturbed, which is why they are sometimes called "roly-polies." Both are active at night and feed on dead and decaying plant material. During the day, they can be found under leaf litter, logs, or rocks.

Snails and **Slugs** are slow-moving, slimy invertebrates called gastropods. They are commonly found in yards and gardens. Both have a fleshy, typically brown or gray unsegmented body without legs, and two pairs of retractable tentacles off the head. The upper two tentacles have eyes. Both snails and slugs secrete mucus or "slime" to help them move and prevent them from drying out. Snails, but not slugs, also have a hard shell for protection.

Sowbug

Pillbug

Snail

Slug

Activity: Insect—or Not?

Circle the pictures below that show insects.

1. Spider

2. Wasp

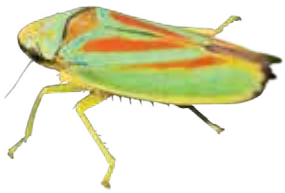
3. Centipede

4. Earthworm

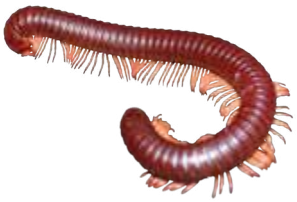
5. Carpenter Ant

6. Pillbug

7. Butterfly



8. Leafhopper



9. Millipede

10. Scorpion

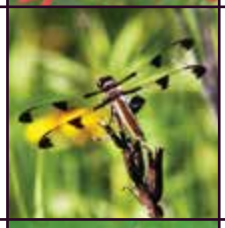
11. Beetle

12. Grasshopper

Answers on page 105! ☞

Get to Know the Major Groups of Insects

There are more than 20 major groups (orders) of insects, but the most-common and familiar insects belong to a few major groups. By getting to know them, you can learn to identify many of the insects you'll see around.

Insects			
Coleoptera Beetles		**Hemiptera** True Bugs	
Lepidoptera Butterflies and Moths		**Blattodea** Cockroaches and Termites	
Odonata Dragonflies and Damselflies		**Mantodea** Praying Mantises	
Hymenoptera Bees, Wasps, and Ants		**Phasmida** Walking Sticks	
Orthoptera Grasshoppers, Crickets, and Katydids		**Ephemeroptera** Mayflies	
Diptera Flies		**Dermaptera** Earwigs	

Activity & Quiz Answers

Page 13, Activity: Label the Parts of the House Fly: 1. Head 2. Compound Eyes 3. Thorax 4. Legs 5. Abdomen

Page 13, Quiz Time: 1. 2 2. 4

Page 17, Activity: Insect—or Not?: Insects: 2, 5, 7, 8, 11, and 12

Page 25, Activity: Bee, Wasp, or Ant Challenge: 1. Wasp 2. Wasp 3. Bee 4. Wasp 5. Ant 6. Bee 7. Wasp 8. Bee 9. Ant

Page 32, Quiz Time: 1. C. House Fly 2. D. In water

Page 35, Quiz Time: 1. D. 11 inches

Page 44, Activity: Native or Non-native?: 1. Native 2. Non-native 3. Non-native 4. Non-native 5. Non-native 6. Non-native 7. Non-native 8. Native 9. Native 10. Non-native Bonus: 2, 4, 5, 6, 7, 10 are all Invasive

Page 70, Activity: Which Insects Can Sting?: 1, 2, and 6 can sting

Page 71, Activity: Which Insects Taste Bad: 1, 2, and 3 taste bad

Glossary

Abdomen: The last and usually the longest or largest section of an insect's body. It contains the reproductive, digestive, and excretory systems.

Arthropods: An invertebrate animal that has an external skeleton, a segmented body, and jointed appendages such as legs and antennae.

Complete Metamorphosis: The process by which insects that pass through four distinct stages when developing: egg, larva, pupa, and adult. (Butterflies are an example.)

Entomology: The scientific study of insects.

Exoskeleton: An insect's hard (or generally hard) outer body covering, which provides protection and support.

Head: The first of three main sections on an insect's body, consisting of eyes, mouthparts, and two segmented antennae.

Herbivores: Organisms that feed on plants.

Incomplete Metamorphosis: The process by which insects that pass through three distinct stages when developing: egg, nymph, and adult. (Grasshoppers are an example.)

Insects: The largest and most diverse group of arthropods. They can be separated from other arthropods by having a three-part body consisting of a head, thorax, and abdomen.

Osmeterium: A bad-smelling forked organ that swallowtail caterpillars can use to defend themselves.

Parasitoids: Organisms that live in or attach to the bodies of other organisms, primarily insects and arthropods, eventually killing them.

Predators: Organisms that capture and feed on other organisms.

Glossary

Proboscis: The long, tongue-like mouthparts of an insect. These mouthparts are typically found in butterflies and moths and are used for sipping liquid food, such as flower nectar.

Spiracles: A series of small holes along the sides of an insect's body, which it uses to breathe.

Thorax: The second of three main sections of an insect's body. The thorax supports structures that enable the insect to move; these structures include three pairs of legs and one or two pairs of wings.

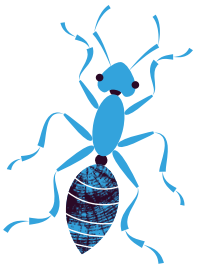
Bug Bingo

Test your bug knowledge with a game of Bingo!

Have an adult help you cut out the following four pages so that you and your friends can go on a Bingo hunt for beetles, butterflies, praying mantises, and more! Here's how it works:

Look for examples from the most-common and familiar orders of insects noted in each square. When you find one, cross out the square with an X or color it in. Keep searching for the things in the squares until you've made a row, column, or diagonal line of 5 connected squares.

Take note that the center square is a free space! Everyone gets that square.



Cut along this edge—be careful when handling scissors!

B I N G O

Soldier Beetle Order Coleoptera	**Tersa Sphinx Moth** Order Lepidoptera	**Mourning Cloak Butterfly** Order Lepidoptera	**Water Strider** Order Hemiptera	**Carpenter Ant** Order Hymenoptera
Eastern Tiger Swallowtail Order Lepidoptera	**Fall Field Cricket** Order Orthoptera	**Robber Fly** Order Diptera	**Giant Water Bug** Order Hemiptera	**Ladybug** Order Coleoptera
Cockroach Order Blattodea	**Firefly** Order Coleoptera	FREE SPACE	**Leafhopper** Order Hemiptera	**Bumblebee** Order Hymenoptera
Paper Wasp Order Hymenoptera	**Earwig** Order Dermaptera	**Lubber Grasshopper** Order Orthoptera	**Pond Damselfly** Order Odonata	**Green Lacewing** Order Neuroptera
Mayfly Order Ephemeroptera	**Walking Stick** Order Phasmida	**Crane Fly** Order Diptera	**Cicada** Order Hemiptera	**Praying Mantis** Order Mantodea

Sketch, Measure, and Describe What You Find #1

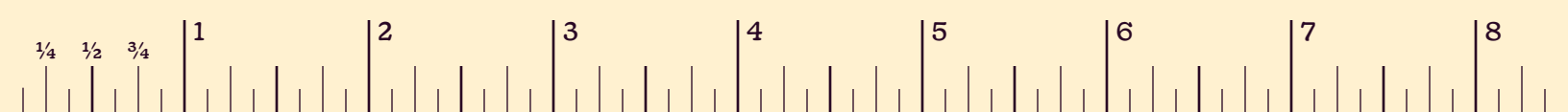
Scientists record their observations, as it makes their findings easier to study (and to share with other scientists). Use the blank page below to sketch some of the neat bugs you find. To help make them easier to draw, you may wish to temporarily capture them in a clear plastic jar. This way, you can closely observe an organism without it getting away.

Use the ruler on the bottom of this page to measure their size. Then, for each bug, describe them in more detail. Record their color, where you found them, the time of year, and any unique features. Scientists use information (data) like this to help study species and determine what they are. Once you have finished, use a field guide to see if you can determine what kind of insect you saw. You may even be able to identify the particular species!

Description
Size, date, location, temperature, order, etc.

Sketch

Cut along this edge—be careful when handling scissors!



B I N G O

Pond Damselfly Order Odonata	**Carpenter Ant** Order Hymenoptera	**Crane Fly** Order Diptera	**Mourning Cloak Butterfly** Order Lepidoptera	**Cicada** Order Hemiptera
Praying Mantis Order Mantodea	**Lubber Grasshopper** Order Orthoptera	**Eastern Tiger Swallowtail** Order Lepidoptera	**Mayfly** Order Ephemeroptera	**Paper Wasp** Order Hymenoptera
Green Lacewing Order Neuroptera	**Firefly** Order Coleoptera	FREE SPACE	**Leafhopper** Order Hemiptera	**Bumblebee** Order Hymenoptera
Earwig Order Dermaptera	**Cockroach** Order Blattodea	**Tersa Sphinx Moth** Order Lepidoptera	**Giant Water Bug** Order Hemiptera	**Robber Fly** Order Diptera
Soldier Beetle Order Coleoptera	**Walking Stick** Order Phasmida	**Water Strider** Order Hemiptera	**Fall Field Cricket** Order Orthoptera	**Ladybug** Order Coleoptera

Sketch, Measure, and Describe What You Find #2

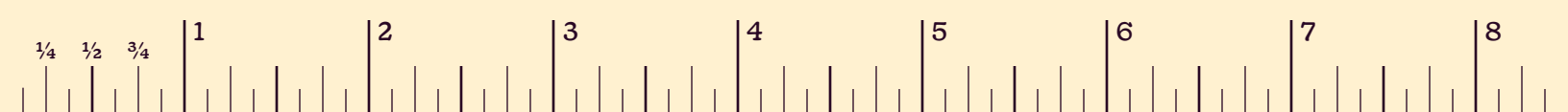
Scientists record their observations, as it makes their findings easier to study (and to share with other scientists). Use the blank page below to sketch some of the neat bugs you find. To help make them easier to draw, you may wish to temporarily capture them in a clear plastic jar. This way, you can closely observe an organism without it getting away.

Use the ruler on the bottom of this page to measure their size. Then, for each bug, describe them in more detail. Record their color, where you found them, the time of year, and any unique features. Scientists use information (data) like this to help study species and determine what they are. Once you have finished, use a field guide to see if you can determine what kind of insect you saw. You may even be able to identify the particular species!

Description
Size, date, location, temperature, order, etc.

Sketch

Cut along this edge—be careful when handling scissors!



B I N G O

Earwig Order Dermaptera	**Paper Wasp** Order Hymenoptera	**Fall Field Cricket** Order Orthoptera	**Mayfly** Order Ephemeroptera	**Robber Fly** Order Diptera
Eastern Tiger Swallowtail Order Lepidoptera	**Mourning Cloak Butterfly** Order Lepidoptera	**Lubber Grasshopper** Order Orthoptera	**Firefly** Order Coleoptera	**Giant Water Bug** Order Hemiptera
Cockroach Order Blattodea	**Soldier Beetle** Order Coleoptera	FREE SPACE	**Leafhopper** Order Hemiptera	**Carpenter Ant** Order Hymenoptera
Tersa Sphinx Moth Order Lepidoptera	**Pond Damselfly** Order Odonata	**Bumblebee** Order Hymenoptera	**Ladybug** Order Coleoptera	**Praying Mantis** Order Mantodea
Water Strider Order Hemiptera	**Walking Stick** Order Phasmida	**Cicada** Order Hemiptera	**Crane Fly** Order Diptera	**Green Lacewing** Order Neuroptera

Sketch, Measure, and Describe What You Find #3

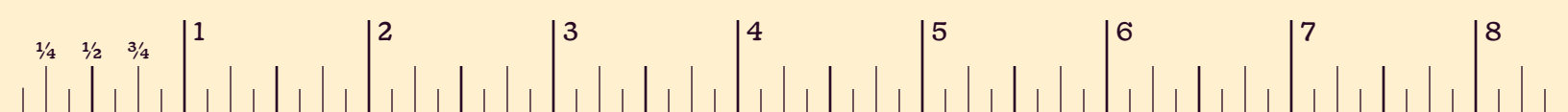
Scientists record their observations, as it makes their findings easier to study (and to share with other scientists). Use the blank page below to sketch some of the neat bugs you find. To help make them easier to draw, you may wish to temporarily capture them in a clear plastic jar. This way, you can closely observe an organism without it getting away.

Use the ruler on the bottom of this page to measure their size. Then, for each bug, describe them in more detail. Record their color, where you found them, the time of year, and any unique features. Scientists use information (data) like this to help study species and determine what they are. Once you have finished, use a field guide to see if you can determine what kind of insect you saw. You may even be able to identify the particular species!

Description
Size, date, location, temperature, order, etc.

Sketch

Cut along this edge—be careful when handling scissors!



B I N G O

Giant Water Bug Order Hemiptera	**Tersa Sphinx Moth** Order Lepidoptera	**Crane Fly** Order Diptera	**Water Strider** Order Hemiptera	**Lubber Grasshopper** Order Orthoptera
Praying Mantis Order Mantodea	**Cicada** Order Hemiptera	**Robber Fly** Order Diptera	**Soldier Beetle** Order Coleoptera	**Earwig** Order Dermaptera
Green Lacewing Order Neuroptera	**Firefly** Order Coleoptera	FREE SPACE	**Leafhopper** Order Hemiptera	**Bumblebee** Order Hymenoptera
Paper Wasp Order Hymenoptera	**Ladybug** Order Coleoptera	**Carpenter Ant** Order Hymenoptera	**Pond Damselfly** Order Odonata	**Eastern Tiger Swallowtail** Order Lepidoptera
Mayfly Order Ephemeroptera	**Walking Stick** Order Phasmida	**Mourning Cloak Butterfly** Order Lepidoptera	**Fall Field Cricket** Order Orthoptera	**Cockroach** Order Blattodea

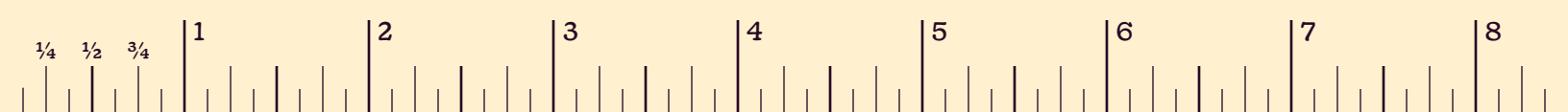
Sketch, Measure, and Describe What You Find #4

Scientists record their observations, as it makes their findings easier to study (and to share with other scientists). Use the blank page below to sketch some of the neat bugs you find. To help make them easier to draw, you may wish to temporarily capture them in a clear plastic jar. This way, you can closely observe an organism without it getting away.

Use the ruler on the bottom of this page to measure their size. Then, for each bug, describe them in more detail. Record their color, where you found them, the time of year, and any unique features. Scientists use information (data) like this to help study species and determine what they are. Once you have finished, use a field guide to see if you can determine what kind of insect you saw. You may even be able to identify the particular species!

Description
Size, date, location, temperature, order, etc.

Sketch



Recommended Reading

Daniels, Jaret. *Insects & Bugs of North America: Your Way to Easily Identify Insects & Bugs* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2019.

Daniels, Jaret. *Backyard Bugs: An Identification Guide to Common Insects, Spiders, and More.* Cambridge, Minnesota: Adventure Publications, 2017.

Daniels, Jaret. *Butterflies of the Northeast: Identify Butterflies with Ease* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2019.

Daniels, Jaret. *Butterflies of the Northwest: Your Way to Easily Identify Butterflies* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2020.

Daniels, Jaret. *Butterflies of the Midwest: Identify Butterflies with Ease* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2016.

Websites

Seek by iNaturalist (www.inaturalist.org/pages/seek_app): This application uses the camera on your smartphone or tablet, along with image recognition, to help you identify insects, plants, and other organisms.

BugGuide. (www.bugguide.net/node/view/15740): An online resource providing identification, images, and information on insects, spiders, and their relatives for the United States and Canada.

Butterflies and Moths of North America. (www.butterfliesandmoths.org): An online resource providing information, images, and occurrence data for butterflies and moths.

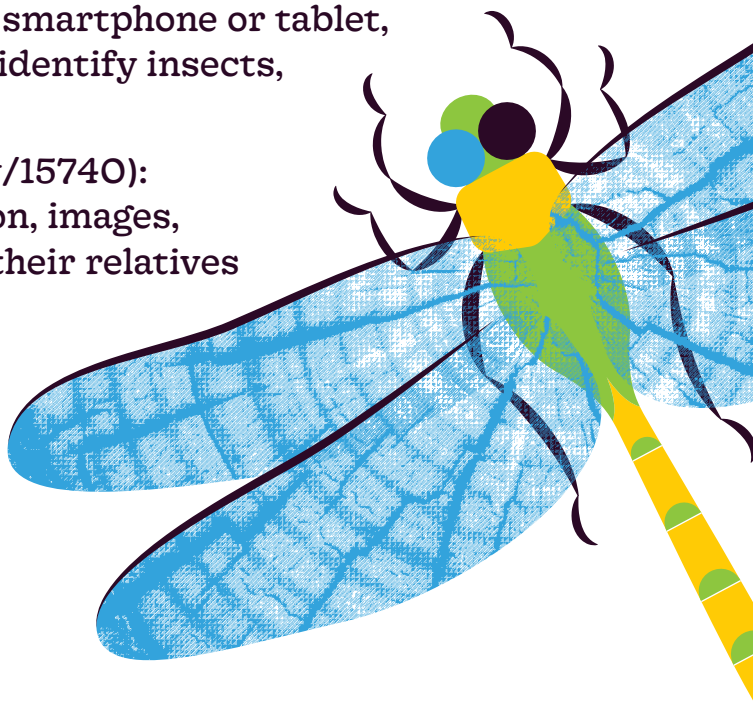


Photo Credits

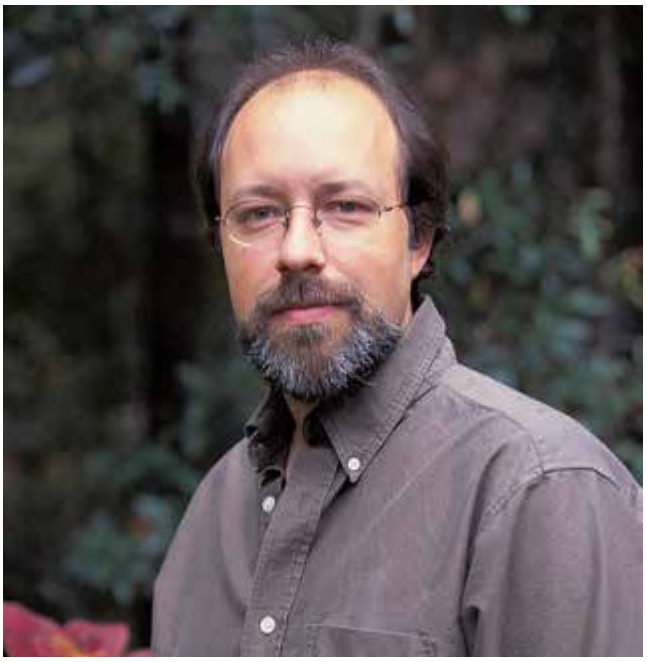
Cover and Interior Illustrations by Fallon Venable

All images copyright by their prospective photographers.
Brett Ortler: 15 (top), 22 (wasp), 23 (crane fly), 33 (egg),52, 53 (ants), 53 (earthworm), 53 (beetle), 55 (ambush bugs, bees, beetles, butterflies, flies), 62 (craneflies), 62 (beetles), 65 (beetles and walking sticks), 75, 76, 83 (all), 85, 87, 99; **CDC/James Gathany:** 57 (mosquito larvae); and **Jaret Daniels:** 120 (author photo).

Images used under license from Shutterstock:
Lost_in_the_Midwest: 73 (top); **abcphotosystem:** 57 (water striders); **Achkin:** 35 and 62 (mayflies); **Adam Tremel:** 18 (odonata), 21 (twelve-spotted skimmer dragonfly); **Akvals:** 18 (hemiptera), 27 (dog-day cicada); **Aleksandar Grozdanovski:** 16 (snail); **Alex Staroseltsev:** 19 (lady beetle); **Alice Day:** 12 (bottom left); **Amelia Martin:** 59 (ants); **an_nature_photography:** 25 (4); **Anatolich:** 57 (dragonfly nymphs); **AndrewASkolnick:** 57 (giant water bug); **Anest:** 53 (centipede); **Ankor Light:** 27 (woolly aphid); **annop youngrot:** 18 (diptera), 23 (house fly); **Anton Kozyrev:** 19 (colorado potato beetle), 34 (green stink bug); **Apostle:** 98 (bottom left); **ArtEvent ET:** 60 (earwig); **ashok india:** 60 (millipede); **Auhustsinovich:** 100 (top left); **Ben Petcharapiracht:** 98 (middle left); **Bildagentur Zoonar GmbH:** 70 (3); **Bill Kennedy:** 27 (red-banded leafhopper); **Bill Kennedy:** 59 (boxelder bugs); **BOb Pool:** 17 (pillbug); **Breck P. Kent:** 31 (chrysalis); **Brenda McGee-Paap:** 63; **Brian Lasenby:** 18 (phasmida), 26 and 34 (walking stick); **Butterfly Hunter:** 17 (butterfly); **ButtermilkgirlVirginia:** 62 (praying mantis); **Cameramannz:** 35 (caterpillar); **Cathy Keifer:** 35 (polyphemus moth); **Charlie Floyd:** 45 (8); **Christian Buch:** 23 and 35 (green bottle fly); **Christian Ouellet:** 18 (orthoptera), 24 (lubber grasshopper); **Cindy Creighton:** 18 (ephemeroptera), 28, 37, and 39 (mayfly); **Conrad Barrington:** 31 (larva), 59 (centipedes), 79 (right); **crystaltmc:** 17 (millipede); **D. Kucharski K. Kucharska:** 45 (6); **Daniel Prudek:** 43 (bottom left), 70 (2); **Danut Vieru:** 12 (top center); **Dark Egg:** 23 (hover fly); **David Byron Keener:** 71 (5); **dba87:** 16 (pillbug); **Deep Desert Photography:** 47; **DeRebus:** 45 (4); **Diane N. Ennis:** 24 (carolina grasshopper); **DJTaylor:** 62 (moths); **Dmitry Demkin:** 96 (left); **DONGSEUN YANG:** 57 (diving beetles); **Doug Lemke:** 34 (dragonfly); **Dr.MYM:** 12 (bottom right); **Dustin Rhoades:** 11 (top left); **Eddie Gibson:** 12 (top left); **Eddie Phantana:** 59 (termites); **edstines:** 61 (orb-weaving spider); **Elliotte Rusty Harold:** 17 (beetle), 19 (eastern firefly); 22 (bumblebee); 35 (ant); 70 (7); **Ernie Cooper:** 8 (crustaceans); 57 (water boatmen); 65 (katydids); **Evgeny Haritonov:** 93; **Federico Crovetto:** 14 (top); 60 (jumping spiders); **Fotema:** 58; **Frances van der Merwe:** 35 (aphid); **frank60:** 45 (10); **Frauenversand Cleopatra:** 53 (earwig); **gabrielmcg021:** 37 and 39 (monarch butterfly), 71 (2); **gan chaonan:** 60 (cockroach); **Georges_Creations:** 65 (praying mantis); **Ger Bosma Photos:** 43 (top left); 45 (2); **Gerry Bishop:** 11 (top center), 33 (nymph); **guentermanaus:** 18 (blattodea); 26 and 53 (cockroach); **GypsyPictureShow:** 74; **haireena:** 101; **Henri Koskinen:** 18 (dermaptera); 28 (earwig); 62 (green lacewing); **Henrik Larsson:** 17 and 55 (spider); **Herman Wong HM:** 44, 45 (7); **HHelene:** 34 (earwig); **High Mountain:** 97 (middle right); **Ian Grainger:** 27 (shield bug); **Igor Nikushin:** 60 (centipede); **Ihor Hvozdetskyi:** 43 (middle right), 45 (5), 65 (spiders); **Ingrid CH:** 11 (bottom); **irin-k:** 13; **J Gillispie:** 65 (caterpillars); **J.J. Gouin:** 61 (paper wasp nest); **James W. Thompson:** 71 (1); **Jason Patrick Ross:** 35 (orange sulfer butterfly); **Jay Ondreicka:** 53 (sowbug);

Jennifer Bosvert: 25 (8); **JGade:** 17 (leafhopper); **Jim and Lynne Weber:** 45 (1); **John Bradford:** 61 (moth caterpillars); **Josef Stemeseder:** 71 (4); **ju_see:** 9; **Julian Popov:** 98 (bottom right); **K E Magoon:** 97 (top left); **kallen1979:** 70 (1); **Kelly Marken:** 23 (halteres on crane fly); **Kendall Wiggins:** 55 (praying mantis); **Kent Sievers:** 43 (top right); **Kevin Collison:** 18 (lepidoptera), 20 (giant swallowtail butterfly); **Kira Immordino:** 97 (bottom left); **Kras_Stock:** 22 (ant); **Kwanbenz:** 100 (bottom right); **kzww:** 17 (earthworm); **Laura Dinraths:** 16 (slug); **Leena Robinson:** 31 (pupa), 100 (bottom left); **LegART:** 59 (bark beetle); **Maarten Zeehandelaar:** 95; **Maciej Olszewski:** 25 (7); **Macronatura.es:** 60 (silverfish); **MakroBetz:** 7; **Malachi Jacobs:** 34 (red-legged grasshopper); **Maple Ferryman:** 24 (fork-tailed bush katydid); **Marek Mierzejewski:** 20 (mourning cloak butterfly); **Marek Mnich:** 35 (green lacewing); **Martina Simonazzi:** 57 (backswimmers); **Mary Terriberry:** 91; **Matee Nuserm:** 17 (grasshopper); **Matt Benoit:** 45 (9); **Matt Jeppson:** 20 (cecropia moth), 36 and 39 (luna moth); **Maxim Novikov:** 59 (spiders); **McGraw:** 98 (middle right); **Media Marketing:** 51; **Melinda Fawver:** 17 (carpenter ant), 20 (tersa sphinx moth); 62 (antilion); **melissamn:** 67; **Michael Siluk:** 16 (sowbug); **Michael Siluk:** 21 (tule bluet damselfly); **Michal Ziemski:** 59 (earwig); **Micheal Benard:** 23 (robber fly); **NadyGinzburg:** 73 (bottom); **Napat:** 81; **Napat_M:** 60 (house flies); **Natalia Kuzmina:** 56; **Nataliia Yankovets:** 49; **natmac stock:** 21 (meadowhawk dragonfly); **Naxim Nikiforov:** 11 (top right); **newsony:** 61 (ant nest); **Nina B:** 97 (bottom right); **Nopparat:** 100 (top middle); **NOTE OMG:** 42 (left); **Ondrej Prosicky:** 8 (hexapods); **Paul Brennan:** 98 (top right); **Paul Reeves Photography:** 12 (bottom right), 18 (hymenoptera and coleoptera), 19 (six-spotted tiger beetle); 21 (damselfly perching and sedge sprite damselfly), 22 (yellowjacket), 24 (fall field cricket), 25 (1, 2, and 3), 37 (banded woolybear), 39 (banded woolybear), 42 (right), 54 (top); 55 (day-flying moths and wasps), 59 (carpenter bee and wood wasp), 69 (all), 70 (6 and 8), 89; **Paul Sparks:** 43 (bottom right), 45 (3), 70 (4); **Pavel Krasensky:** 17 (wasp); **photographyfirm:** 15 (bottom); **prasom boonpong:** 17 (centipede); **Protasov AN:** 6, 43 (middle left); **Puttachat Kumkrong:** 8 (myriapods); **Rabbitti:** 30 (adult); **Randy R:** 35 (milkweed bug); **RattiyaThongdumhyu:** 79 (left); **RomBo 64:** 37 and 39 (bumblebee), 100 (top right); **Ron Maxwell:** 32 (adult); **Ron Rowan Photography:** 8 (arachnids); **Rose Ludwig:** 21 (dragonfly perching); **Russell Marshall:** 25 (5); **Sacha Ye Gauthier:** 70 (5); **samray:** 55 (robber fly); **Sari ONeal:** 34 (white-lined sphinx moth), 71 (3); **Serguei Koultchitskii:** 34 (giant swallowtail); **Silent Shoot:** 27 (milkweed assassin bug); **Steve Bower:** 18 (mantodea), 29; **StudioNewmarket:** 35, 36 and 38 (june bug); **SunflowerMomma:** 102; **Susan Schmitz:** 17 (scorpion); **Suzanne Tucker:** 37 and 38 (firefly), 86; **tea maeklong:** 26 (termites); **TechnoSavage:** 54 (bottom); **The Downeast Artisan:** 97 (middle left); **TheLazyPineapple:** 65 (grasshoppers); **T-I:** 64; **Tom Franks:** 14 (bottom); **tome213:** 53 (spider); **tviolet:** 97 (top right); **Viktoriya A:** 98 (top left); **Vinicius R. Souza:** 34 (lady beetle); **Vitalii Hulai:** 32 (bottom); **Vitolga:** 57 (whirligig beetles); **watchara panyajun:** 35 (cockroach); **Wirestock Creators:** 25 (6); **wjarek:** 96 (right); **wnarong:** 25 (9); and **yanikap:** 12 (top right).

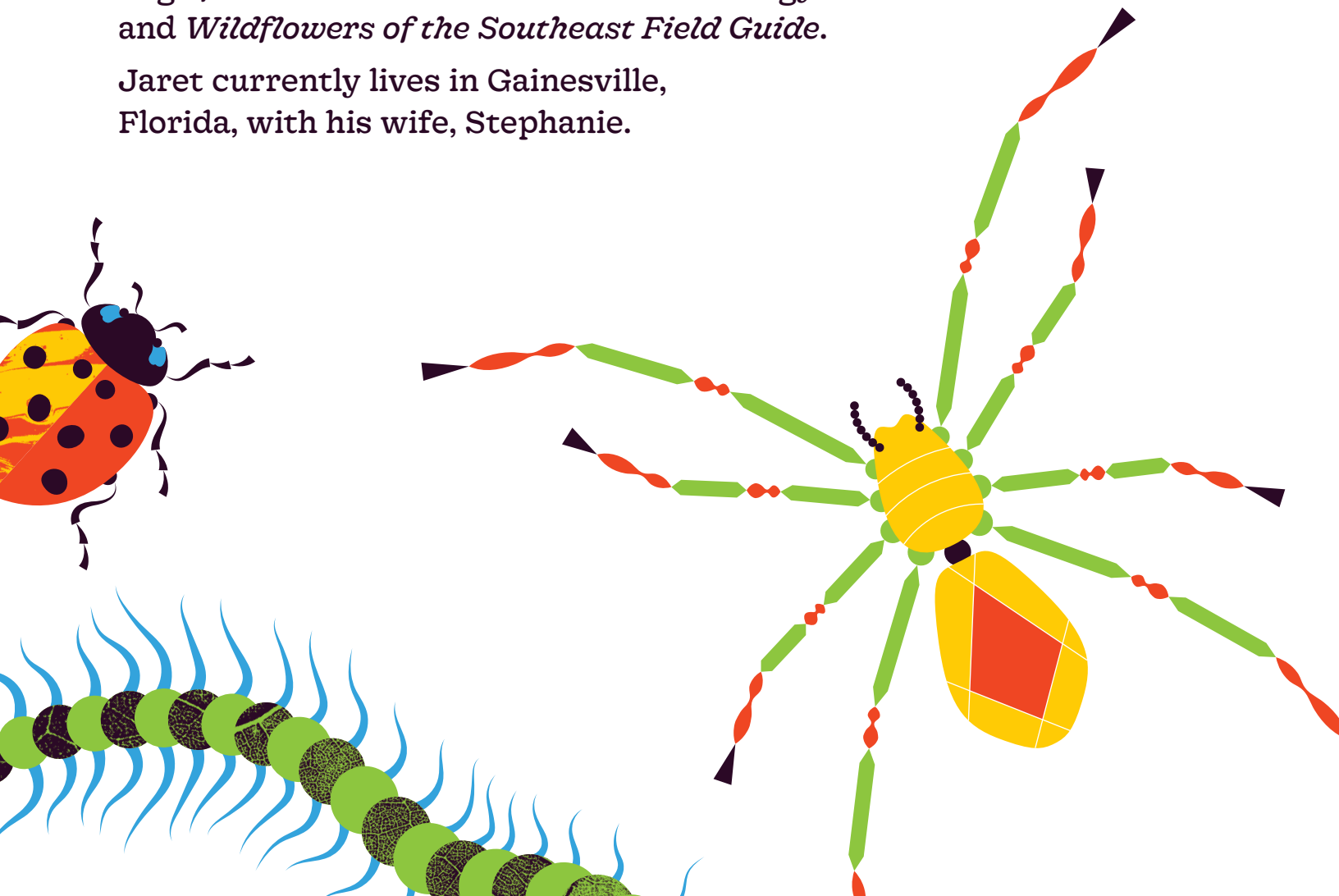
About the Author



Jaret C. Daniels, Ph.D., is a professional nature photographer, author, native plant enthusiast, and entomologist at the University of Florida, specializing in insect ecology and conservation.

He has authored numerous scientific papers, popular articles, and books on gardening, wildlife conservation, insects, and butterflies, including butterfly field guides for Florida, Georgia, the Carolinas, Ohio, and Michigan. He is also coauthor of *Insects & Bugs for Kids: An Introduction to Entomology* and *Wildflowers of the Southeast Field Guide*.

Jaret currently lives in Gainesville, Florida, with his wife, Stephanie.



Take a Hands-on Approach to Learning about Insects & Bugs

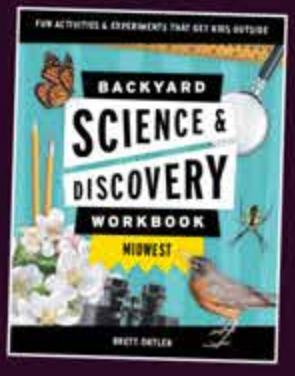
Insects and bugs provide incredible opportunities for getting outside and discovering nature. There are so many kinds to see and appreciate—even in your backyard or at a nearby park.

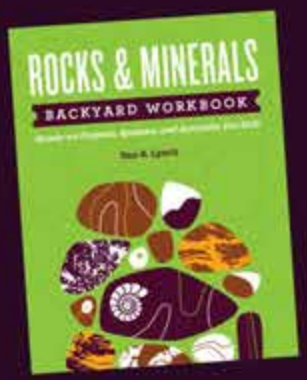
This workbook puts students in control of their own learning. Creative activities and simple projects engage young learners, providing a perfect introduction to hypothesizing, experimenting, and observing the world around them.

Inside You'll Find

- Fun introductions to a variety of insects and bugs
- 22 hands-on science projects
- Interactive activities that foster an appreciation of nature
- Expert information from an entomologist

Get the *Insects & Bugs Backyard Workbook*, and get started on a lifetime of discovery!





Further enhance your child's education with the nature and science workbooks for your region.

Adventure Publications
an imprint of AdventureKEEN

JUVENILE NONFICTION
SCIENCE & NATURE

ISBN 978-1-64755-159-9
9 781647 551599