

FUN ACTIVITIES & EXPERIMENTS THAT GET KIDS OUTDOORS



BACKYARD

SCIENCE &

DISCOVERY

WORKBOOK

PACIFIC NORTHWEST



ROBERT NIESE, PHD

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PACIFIC NORTHWEST



ADVENTURE PUBLICATIONS

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ABOUT THIS BOOK

What does it mean to be a naturalist? Naturalists are more than just overenthusiastic nature-nuts. We are observers—we explore, we discover, and we document. In the words of MythBusters' Adam Savage, "The only difference between messing around and science is writing it down." We keep journals, take notes, and accumulate our observations through time to gain a more complete understanding of the world and how it varies from place to place, season to season, and year to year.

But we are not only observers, we also must be educators. Naturalists are the quiet stewards of our public lands and wild places. We defend these habitats through education. By learning about rocks or birds or flowers, we are cultivating genuine connections to nature, which, hopefully, leads others to become stewards as well.

This is my goal with this workbook—to help young learners connect with the natural world and to practice being naturalists. This book encourages exploration, careful observation, and curiosity. And I hope that, by educating these young minds, they might become naturalists too.

This book features 25 hands-on science projects, such as raising caterpillars, making mushroom art, identifying animal tracks; 10 simple, fun introductions to the region's habitats, birds, seasons, and rocks and minerals, and more than a dozen independent inquiries to help you make hypotheses, observe nature, and practice your skills as a naturalist.

Every piece of the natural world is an exciting opportunity for discovery. Whether it's a rock, a bug, or a feather, connecting to nature inspires curiosity and discovery. These are the hallmarks of fun and genuine learning.

So get outside, flip over rocks, put leaves under the magnifying glass, collect cones—do it all and record and share your observations! That's what makes it science!

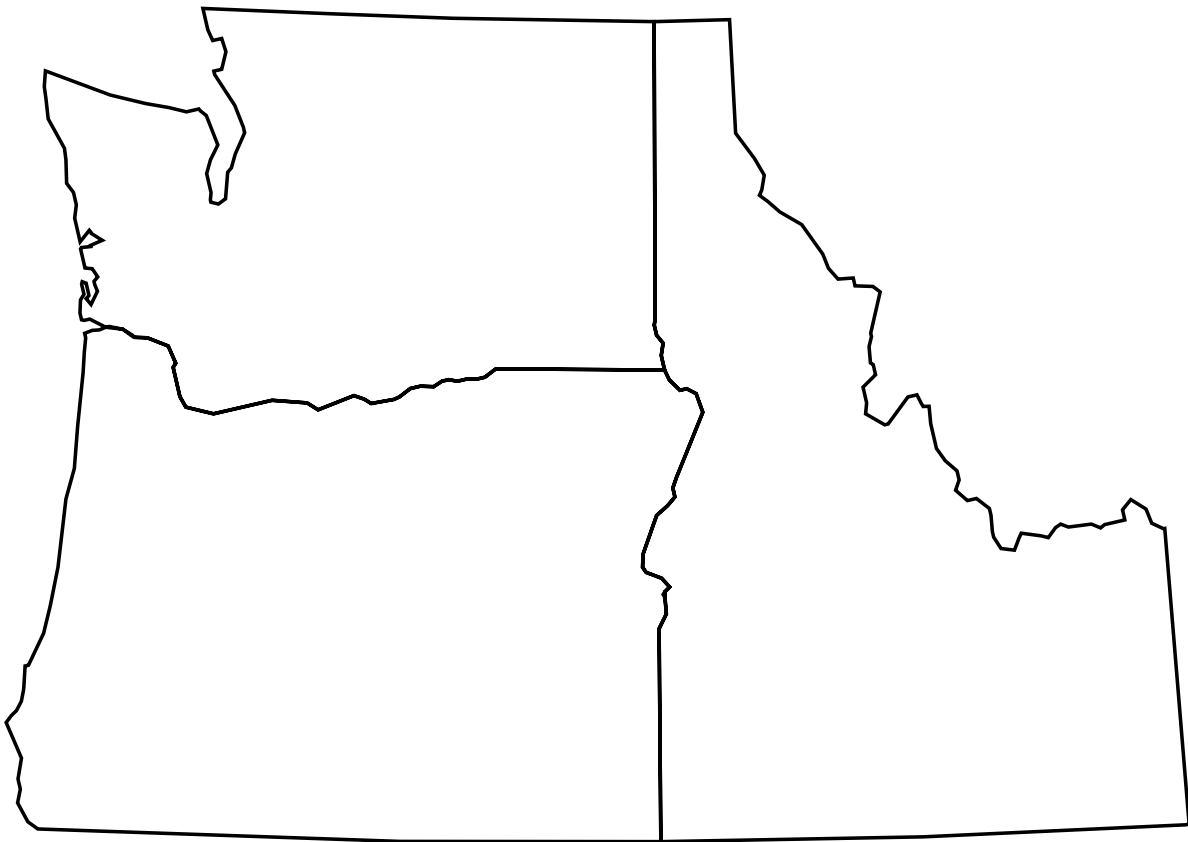
Robert Niese

GEOGRAPHY OF THE PACIFIC NORTHWEST

Also known as Cascadia, the Pacific Northwest includes all of Washington, Oregon, and Idaho. Some naturalists consider parts of California, Montana, Canada, and even Alaska as part of the region as well. Practice your geography and label the states below.

Bonus points if you can name the state capitals of each one.

Answers on page 140!



ID _____
OR _____

WA _____

GET TO KNOW THE PACIFIC NORTHWEST'S BIOMES

A **biome** is a community of animals and plants that live in a specific kind of climate and environment. The Pacific Northwest has some of the wettest and driest biomes in North America! Getting to know our region's biomes is a great way to learn more about your state and the habitats that exist in your very own backyard.

You've probably heard of some biomes before: deserts, rainforests, and so on.

The Pacific Northwest is home to three major biomes:



1. Coniferous Forests



2. Temperate Rainforests

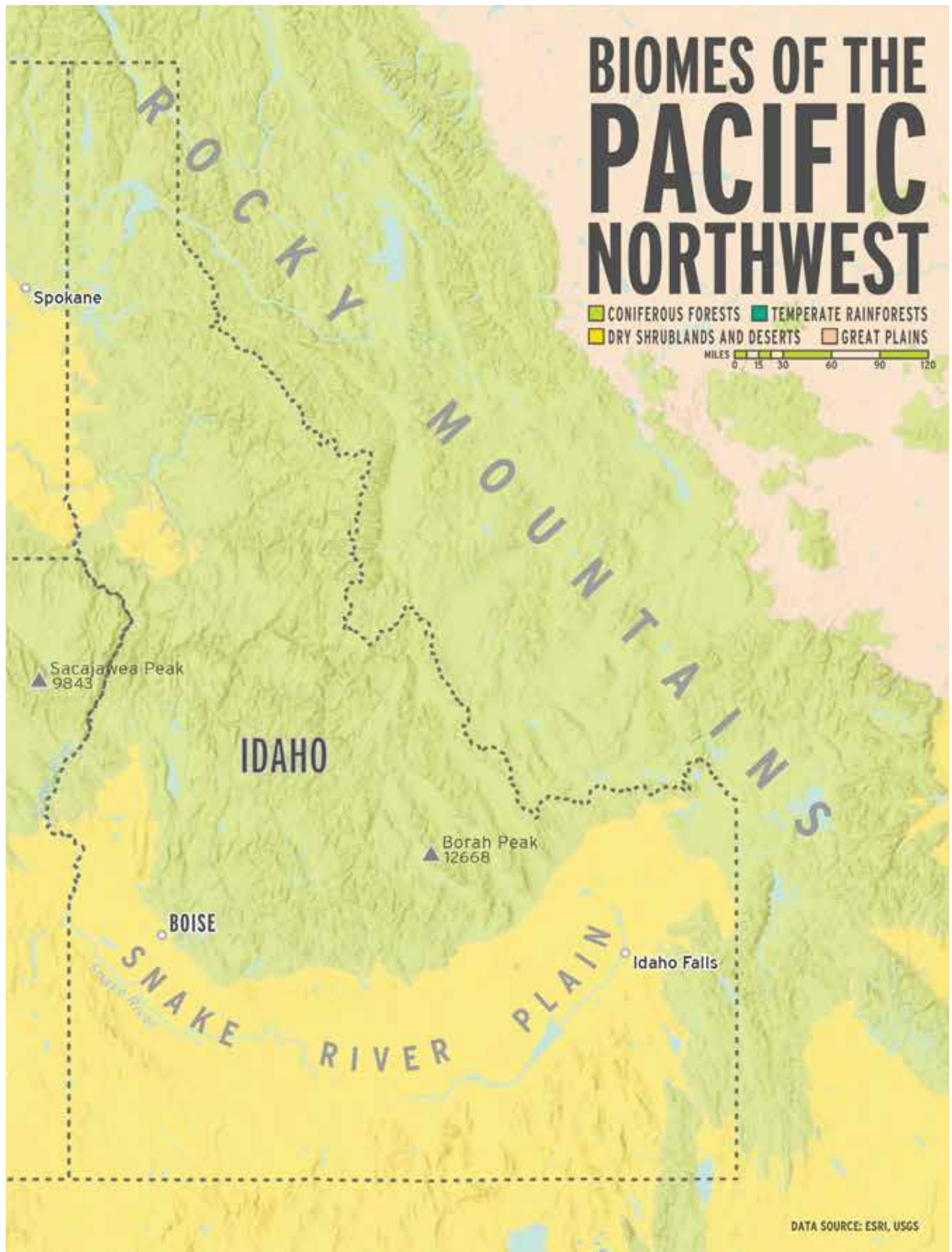


3. Dry Shrublands and Deserts

QUICK QUIZ

Which biome do you live in? Use the map on the next page!







CONIFEROUS FORESTS

A **conifer** is a tree that has cones. You've probably seen woody pine cones like those from the Douglas-fir or Ponderosa Pine, but did you know that all conifers make two different kinds of cones? The large woody ones are female. They produce seeds (like pine nuts from the grocery store!). The male cones are smaller and produce pollen. In the spring, at the height of pollen season, a single male cone can produce over 30,000 grains of pollen! Don't worry though, pollen from pine trees doesn't influence allergies like pollen from grasses and ragweed.

Almost all conifers are **evergreen**, which means they don't lose their leaves in the winter. But some, like the Western Larch, are famous for their annual displays of color as their needles die off in autumn. Depending on which part of the Pacific Northwest you're in, Coniferous Forests are dominated by Douglas-fir, Ponderosa Pine, Western Red Cedar, Western Larch, Engelmann Spruce, or Subalpine Fir.

Coniferous Forests are found throughout the Pacific Northwest, especially in mountainous regions where it's not too dry and not too rainy.



Western Red Cedar forest

QUICK QUIZ

Which of the following trees is evergreen?



A. Western Larch



B. Subalpine Fir



C. Black Hawthorn



D. Black
Cottonwood

Answer on page 140!

1. Make a list of the evergreen trees near you.

2. What **deciduous** trees (trees that lose their leaves) are nearby?

MAKE A COLLECTION OF PACIFIC NORTHWEST CONES

Even if you don't live in the Coniferous Forest biome, you can still find conifers in most neighborhoods in the Pacific Northwest. Conifer cones come in all different shapes and sizes. Most have papery or woody scales. Some really weird ones, like the cones from junipers, are covered in hard bluish-purple flesh and look more like berries. Some trees that aren't conifers produce seed pods that look a bit like cones too. The Alder, for example, makes a cone-like structure called a catkin. Look for cones, catkins, and other seed pods on the ground around large trees. Try organizing your collection using a cardboard egg carton! Label each cone or seed pod by writing its name on the edge of each dimple. You can even use the lid to hold really big cones like those from Sugar Pines.





Alder catkin



Douglas-fir cone



Ponderosa Pine cone



Sugar Pine cone



TEMPERATE RAINFORESTS

I bet you've heard of rainforests before. But did you know that the Pacific Northwest is home to some of the only **temperate** rainforests in the world? The word temperate means mild or moderate and refers to the cooler climate zones between the tropics (around the **equator**) and the polar zones. Most rainforests exist in areas with a tropical climate, which is what makes our temperate rainforests so special!

As you might have guessed, Temperate Rainforests are very wet places. But not all their water comes from rain. In our southernmost rainforests, rain contributes around 70 inches of water each year, but fog contributes another 30 to 40 inches! As moist air from the Pacific Ocean moves onto land, it condenses and forms rain and fog—the lifeblood of all rainforests.

All that moisture means that plants in our temperate rainforests have to like it wet! Plants like mosses, ferns, and Oxalis wood sorrels blanket the forest floor, while Douglas-fir, Western Red Cedar, Sitka Spruce, and Western Hemlock dominate the canopy. In between, Big-leaf Maples, Red Alders, Pacific Madrone, and Pacific Rhododendron are common, and fungi sprout from every surface. These rich forests are home to nearly 300 species of birds and over 70 species of mammals.

MAKE A COLLECTION OF PRESSED LEAVES

Leaves can be pressed and dried to preserve their beauty or to turn into your very own art project.

- Start by collecting neat leaves, either fresh from trees in the summer or from the ground in the fall.
- Place your leaves between two sheets of heavy construction paper. Thick paper helps absorb moisture from the leaves as they dry.
- Now place your leaf sandwich between the pages of a big book. Then add some more big books on top of it, for good measure.
- Place your stack of leaf-filled books in a warm, dry place for four to ten days (depending on the leaf thickness).

That's it! You've now got a lovely preserved leaf! Leaves preserved by using this method should retain their color for many years. But be careful, they're brittle!





DRY SHRUBLANDS AND DESERTS

Between the Pacific Northwest's mountain ranges lay vast regions of deserts and dry shrublands. The Cascade Range acts like a barrier for clouds that are heavy with water, so by the time they reach the Columbia Plateau and Great Basin, they're as dry as a bone. Parts of Central Washington, Central and Southeastern Oregon, and Southern Idaho receive only 5 or 6 inches of precipitation (rain and snow, combined!) each year. But just because these habitats are dry, it doesn't mean they aren't bursting with life!

In areas where it's slightly wetter, Big Sagebrush dominates the landscape. This plant is a keystone species for our dry shrubland habitats, which are aptly called sagebrush steppe habitats. The Big Sagebrush provides shade for other plants to grow and shelter for animals that are **endemic** to the sagebrush steppe, such as the Greater Sage-Grouse, Brewer's Sparrow, Pygmy Rabbit, and Pronghorn.



Greater Sage-Grouse

DID YOU KNOW?

The sagebrush steppe is also home to one of the world's largest migratory events? Every summer, migrating bands of Mormon Crickets travel through the sagebrush steppe looking for food. Each swarm of flightless hungry insects can contain millions of individuals that can quickly devour crops. They also become a hazard for drivers because the endless supply of roadkilled insects can make highways dangerously slick with cricket guts. Gross!



Mormon Cricket



Thousands of Mormon Crickets crossing a road

QUICK QUESTION

In the sentence, "The Big Sagebrush provides shade for other plants to grow and shelter for animals that are endemic to the sagebrush steppe," what do you think the word endemic means?

- A. Widespread and diseased
- B. Native and restricted to a certain area
- C. Finished and not continuing
- D. Dedicated and committed to a cause

Answer on page 140!



THEN VS. NOW

GEOLOGIC HISTORY

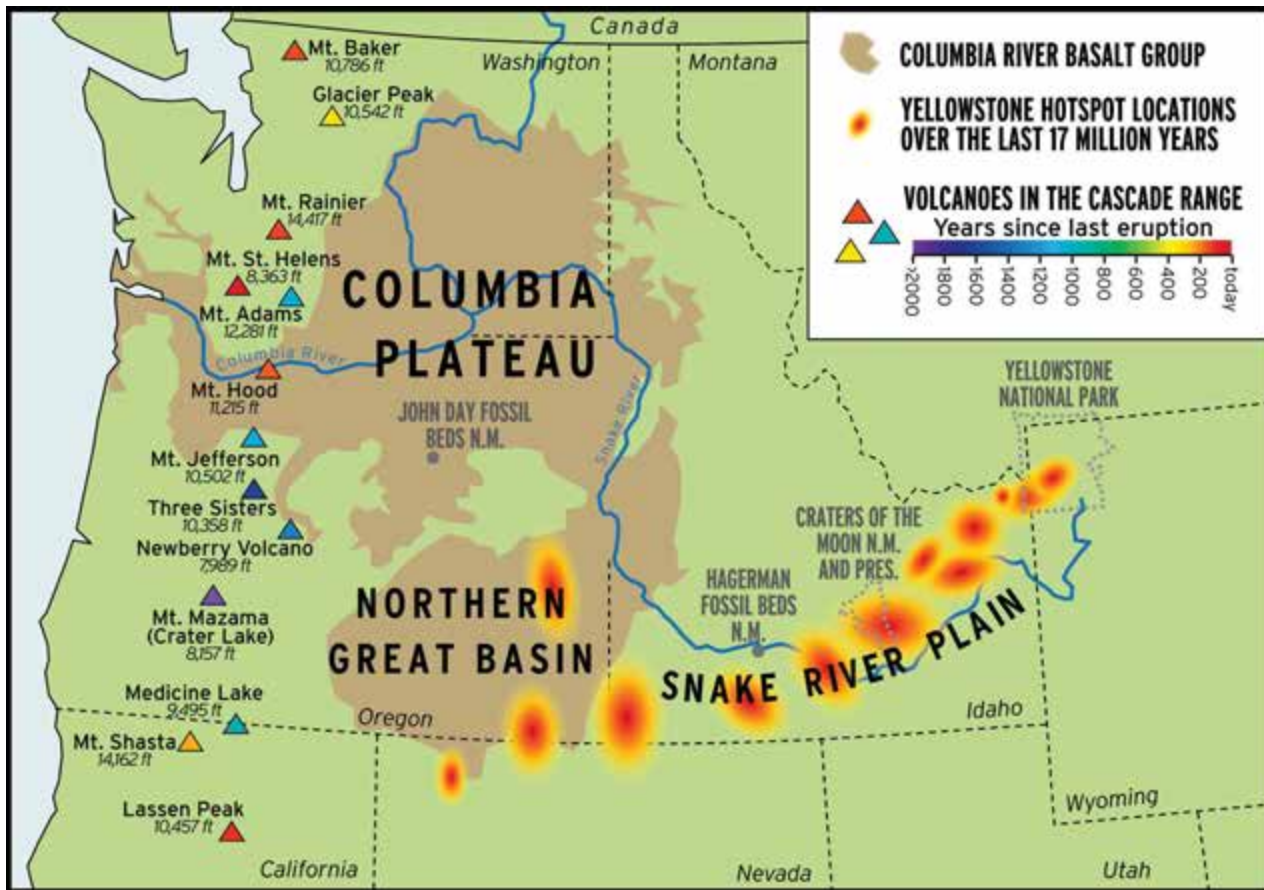
The landscape of the Pacific Northwest has been shaped by catastrophic natural forces. The Columbia Plateau and Northern Great Basin were completely flooded with lava between 17 and 14 million years ago. The lava flowed and cooled repeatedly until, in some places, it became more than a mile thick! The resulting rock formations are called basalts, and they blanket an area of the Pacific Northwest that spans more than 81,000 square miles—that's larger than the entire state of Washington!

The Columbia River Basalts were formed by volcanic activity surrounding the Yellowstone Hotspot. But you might be wondering, how could the Yellowstone Hotspot, which is all the way over in Wyoming, cause the massive lava floods here in the Pacific Northwest? Well, because of the movement of Earth's tectonic plates, the Yellowstone Hotspot was actually beneath Oregon 17 million years ago. Over time, the North American tectonic plate has slowly



Mount St. Helens before and after it erupted in 1980.

moved to the southwest, and the land above the hotspot has suffered cataclysmic volcanic events as a result. The trail of destruction left behind by this movement created the Snake River Plain and some of Idaho's most famous geologic features, like the Craters of the Moon National Monument.



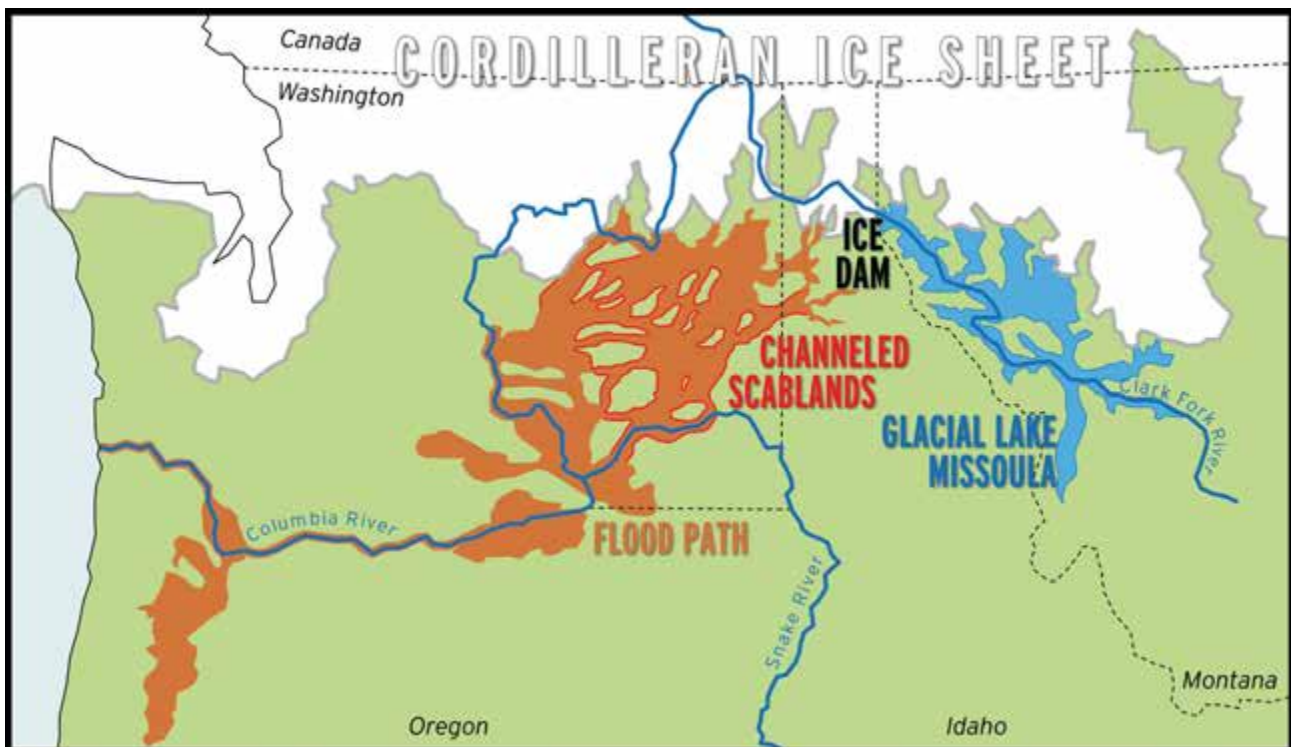
QUICK QUESTION

If you live in the valleys and foothills surrounding the Cascade Mountain Range, you're probably familiar with some of the Pacific Northwest's most prominent volcanoes. The Cascade Range is home to dozens of volcanoes, most of which have erupted at least once in the last 2,000 years. Which volcano is closest to where you live? When was the last time it erupted?

THEN VS. NOW

GEOLOGIC HISTORY

More recently a massive **glacier** called the Cordilleran Ice Sheet covered western North America from Alaska to Montana. Between 18,000 and 12,000 years ago, the southern edge of this ice sheet in Idaho's panhandle occasionally created an ice dam that blocked water from escaping the Clark Fork River Valley. This created a huge lake in western Montana called Glacial Lake Missoula. Whenever too much water built up behind the dam, it would burst, sending a wave of ice, water, boulders, and debris flooding through the Columbia Plateau. These cataclysmic floods occurred at least 40 times and **eroded** massive channels in the basalt, creating a region in eastern Washington now known as the channeled scablands. Just like waves on a beach, or a river flowing over sand, we can see gigantic ripples in the earth that were left behind by these incredible floods.





QUICK QUESTION

Even though the gigantic Cordilleran Ice Sheet is gone, there are still smaller glaciers in the Pacific Northwest. Where do you think you might be able to find some of the last of the Pacific Northwest's glaciers?



THEN VS. NOW

HUMAN HISTORY

THE FIRST NATIVE AMERICANS

Humans first arrived in North America when they crossed an ancient land bridge that used to connect Alaska and Siberia. That makes the Pacific Northwest, including Alaska and British Columbia, the very first places to have human inhabitants on this continent. In Washington, Oregon, and Idaho, specifically, evidence indicates that humans have lived here for between 10,000 and 15,000 years. Along the Columbia River, some excellent fishing locations have been continuously inhabited for over 10,000 years—the longest of any location in North America.



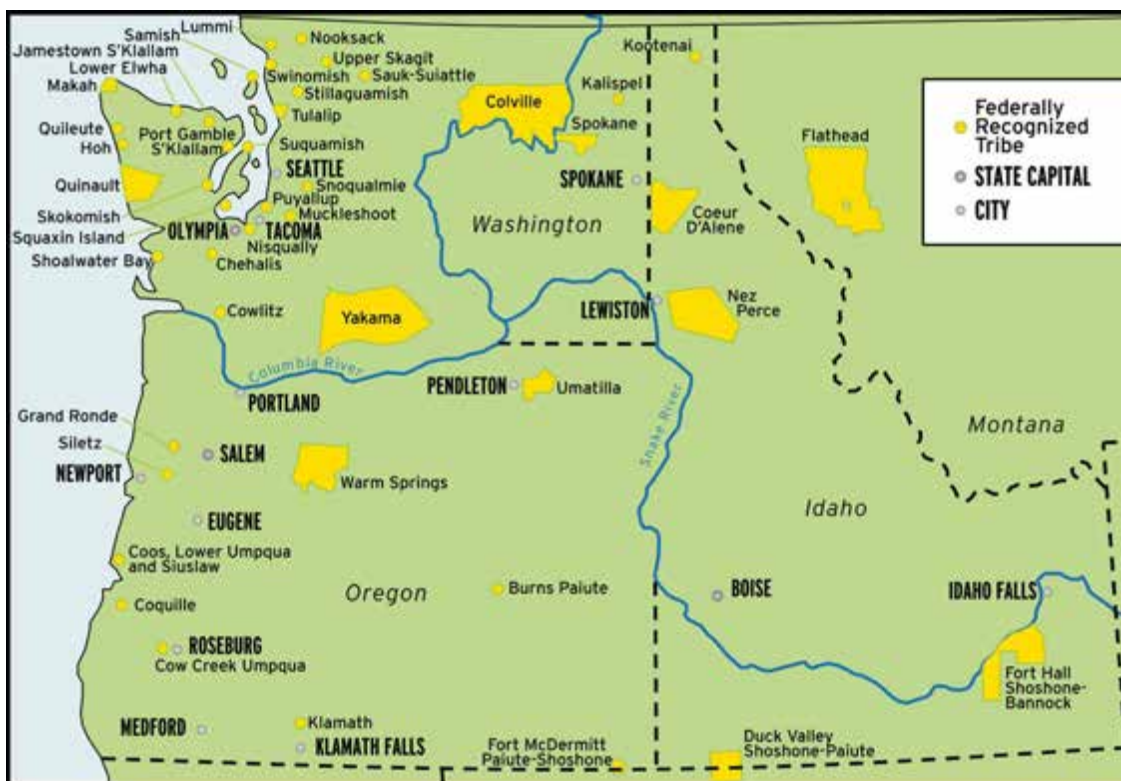
Dipnet fishing for salmon at Kettle Falls today, in 1941, and in the 1800s.

THE FIRST EUROPEAN EXPLORERS

The west coast of the Americas was visited by a variety of Europeans, including the Spanish, British, Russians, and French. In 1804, after the French sold the land west of the Mississippi River to the United States (known as the Louisiana Purchase), the US ordered Meriwether Lewis and William Clark to lead an expedition to explore the Pacific Northwest. Their journey took them along the Clearwater, Snake, and Columbia Rivers, where many of their camps are designated historic sites today.

NATIVE AMERICANS IN THE PACIFIC NORTHWEST TODAY

After more than 10,000 years of human habitation, it's no wonder that the cultures, languages, and histories of modern Native peoples are so diverse. There are over 50 distinct languages spoken by modern Native peoples in the Pacific Northwest today and over 40 different sovereign nations (governments, tribes, and groups of tribes that are independent from the United States government) still present in Washington, Oregon, and Idaho.



QUICK QUESTION

Wherever you live in the Pacific Northwest, the land around you was once inhabited by Native Americans, and many still continue their traditions and customs nearby. What tribes are in your area?

STATE SYMBOLS

Another good way to get to know the region is by learning your state's official symbols. From the state bird and flower, which you might know already, to lesser-known categories, such as state amphibian, gemstone, or **fossil**, these iconic plants, animals, and materials are usually selected because they have a long history with the state. Of course, not every state has symbols for the same categories—some states even have a state soil!—and not all of the state's symbols are listed here. Still, they are a good way to learn about your state and its wildlife.

QUICK QUIZ

Most state symbols represent animals, plants, rocks, or fossils that are naturally found in (**native**) our area. But only two of these state symbols are unique to the Pacific Northwest and found nowhere else in the world. When a plant or animal can only be found in one small part of the world, we say that they are endemic to that region. Can you name two state symbols that are endemic to the Pacific Northwest?

1. _____ 2. _____

Answers on page 140!

WASHINGTON



Willow Goldfinch

Bird



Pacific Rhododendron

Flower



Petrified Wood

Gem



Western Hemlock

Tree



Pacific Chorus Frog

Amphibian



Olympic Marmot

Endemic Mammal



Orca

Marine Mammal



Steelhead Trout

Fish



Apple

Fruit



Green Darner Dragonfly

Insect



Walla Walla Sweet Onion

Vegetable



Columbian Mammoth

Fossil

STATE SYMBOLS

OREGON



Western Meadowlark

Bird



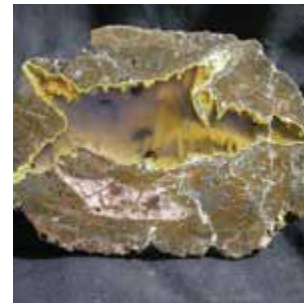
Oregon Grape

Flower



Oregon Sunstone

Gemstone



Thunderegg

Rock



Dawn Redwood

Fossil



Douglas-fir

Tree



Chinook Salmon

Fish



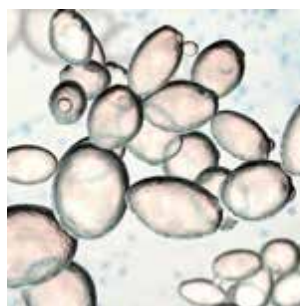
American Beaver

Animal



Oregon Swallowtail Butterfly

Insect



Brewer's Yeast

Microbe



Pacific Golden Chanterelle

Mushroom

IDAHO



Mountain Bluebird
Bird



Syringa (Mock Orange)
Flower



Idaho Giant Salamander
Amphibian



Hagerman Horse
Fossil



Cutthroat Trout
Fish



Huckleberry
Fruit



Star Garnet
Gem



Appaloosa
Horse



Monarch Butterfly
Insect



Western White Pine
Tree



Potato
Vegetable



GET TO KNOW THE SEASONS & THE WEATHER

The seasons of the year are like the hours on a clock: winter is the night, spring is the morning, summer is the afternoon, and fall is twilight. If you pay attention to this seasonal clock, and the animals and plants found during each season, you'll be studying **phenology**. Phenology is the study of the cycles of the seasons and the natural world over time. By studying the phenology of your area—when certain birds arrive in spring, or when huckleberries are first ripe in summer, or when the first frost comes—you'll learn a lot about the natural world around you and what to expect next.

IT DEPENDS ON WHERE YOU LIVE

Phenology is very different across the Pacific Northwest. The Pacific Ocean prevents coastal areas from ever getting too hot or too cold and creates a lot of clouds. The Cascade Mountains are like a giant barrier preventing those clouds and their moisture from reaching the eastern parts of Oregon, Washington, and Idaho. This means that weather and temperatures can be very different on a single day, depending on whether you are on the west or east side of the Cascades. For example, in the last week of October in 2019, the coastal city of Brookings, Oregon, experienced several days above 70°F (up to 86°F) while Pocatello, Idaho, experienced its coldest October ever (with a record low of -6°F!).

LET'S STUDY PHENOLOGY!

START OUT BY MAKING SOME PREDICTIONS

Before you start observing, see what you already know. Make some predictions about when you expect to see the wildlife around you. You might not have seen all of these animals or plants before. If not, that's OK, but make predictions about those you recognize.

LEARN A NEW TERM: F.O.T.Y.

Birders are famous for making many careful observations about when and where they see certain species of birds. Many birders keep F.O.T.Y. records noting the **First Of The Year** sighting for migratory species. Try keeping your own F.O.T.Y. records for your favorite migratory birds! Or explore the F.O.T.Y. sightings on eBird for your county by visiting eBird.org/explore. Search for your county, change the time period from "All Years" to "Current Year," and then select "First Seen."

LET'S MAKE SOME OBSERVATIONS!

When we study phenology, we keep records of what times of the year certain plants and animals are seen doing certain things. When does a flower bloom? When do leaves change color? When do sparrows lay their eggs? Some naturalists keep a small notepad with them to write down certain events. Some gardeners take detailed notes and compare their gardens to what is available at farmer's markets. But anyone can take a picture with a smartphone to create a record of the exact date and time of flowers blooming, etc.



Bohemian Waxwing migration

RECORD YOUR ACTIVITIES,

DISCOVERIES & FINDS HERE

Did you find a neat feather, leaf, rock, or other natural object? Record your discovery by writing down your observations below and making a sketch to the right!

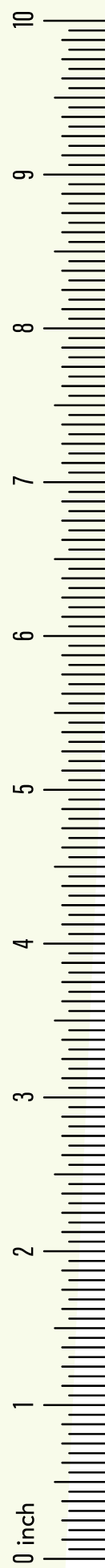
Date _____

Location _____

Weather & Temperature

Observations

[illegible]



RECOMMENDED READING

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

Eisner, Thomas. *For Love of Insects.* Cambridge, Mass: Belknap Press of Harvard University Press, 2003.

Lynch, Dan R. *Fossils for Kids: An Introduction to Paleontology.* Cambridge, Minnesota: Adventure Publications, 2020.

Lynch, Dan R. *Rock Collecting for Kids: An Introduction to Geology.* Cambridge, Minnesota: Adventure Publications, 2018.

ADVANCED GUIDES TO EXPAND YOUR KNOWLEDGE

Bradley, Richard A. *Common Spiders of North America.* University of California Press, 2012.

Elbroch, Mark, and Casey McFarland. *Mammal Tracks & Sign: A Guide to North American Species.* 2nd ed. Rowman & Littlefield, 2019.

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McCune, Bruce, and Linda Geiser. *Macrolichens of the Pacific Northwest.* 2nd ed. Oregon State University Press, 2009.

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Trudell, Steve, and Joe Ammirati. *Mushrooms of the Pacific Northwest.* Timber Press, 2009.

GLOSSARY

Biome A community of animals and plants that live in a specific kind of climate and environment.

Chalcedony A banded form of quartz that is popular as a collectible.

Chemical element One of the 92 naturally occurring chemicals, such as oxygen, carbon, etc., that make up all matter on Earth.

Commodities Farm products that are sold worldwide.

Conifer A tree that produces seeds by cones; most conifers, but not all, are evergreen.

Decomposer An organism that breaks down (decomposes) the dead tissues of other organisms.

Dormant A sleep-like state when a plant or animal is not active.

Endemic An organism that is unique to a certain area (usually fairly small) and found nowhere else on Earth.

Eroded Material, especially rock or soil, that has worn away due to water and wind over time.

Equator The midpoint on the earth's surface between the North and South Poles; the days and nights are always equal in length, and the latitude measurement is 0.

Evergreen A tree that doesn't lose its leaves and stays green all winter.

Extinct When a species no longer exists on Earth.

Fluorescent A material that glows, or emits light, when it absorbs energy like light (especially ultraviolet light).

Fossil A once-living organism whose dead body has been replaced with rock (mineralized) over time.

GLOSSARY

Genus name Because there are so many different plants and animals and other lifeforms, scientists give every organism one name, usually derived from Latin/Greek. This scientific name has two parts: a genus, which is like an organism's last name, and which it shares with others, and its species name, which is like its first name.

So if you want to talk to a scientist about the American Robin, *Turdus migratorius* is the name that scientists would recognize all around the world. (And really, that's its real scientific name).

Geode A round rock that contains an empty space inside it often with crystals inside; when broken in half, geodes are popular collectibles.

Glaciers Huge rivers of ice that once covered much of the country creating much of the topography we see (or don't!) today.

Intertidal The part of the beach that's underwater during high tide but exposed during low tide.

Introduced An animal or plant that was brought to an area (example: cows in the US).

Living Fossil An organism that appears remarkably similar to its fossilized, prehistoric ancestors.

Mineral A chemical combination of two or more elements; individual elements (like copper and gold) are considered minerals as well.

Mohs Hardness Scale The relative scale of mineral hardness, from the softest, talc (1), to the hardest, diamond (10).

Mutualistic A relationship between two organisms where each one gets something of value/or benefit.

Mycelium The underground, root-like network of tiny, thread-like tissues that makes up most of a fungus's body.

Native An animal, plant or organism found naturally in an area.

Non-native An animal, plant, or organism not naturally found in an area; **note:** not all non-native animals are invasive.

Orion (constellation) A group of stars named for a hunter in ancient Greek mythology.

Parasite An animal or organism that feeds on or otherwise depends on another animal, plant or organism.

Phenology The study of the seasons and other natural cycles over time.

Predators Animals that eat other animals.

Rock A combination of two or more minerals.

Species name See genus.

Symbiosis When two different organisms interact; sometimes, this interaction is beneficial for both (known as mutualism). At other times, one organism thrives at the expense of another (known as parasitism).

Temperate An environment where there are long periods (summer!) where the weather is warm.

Toxic Poisonous

Translucent Something (often a mineral) that allows light to pass through it.

QUICK QUIZ ANSWERS

Page 5: Boise, Idaho; Salem, Oregon; Olympia, Washington

Page 11: B. Subalpine Fir

Page 17: B. Native and restricted to a certain area

Page 24: Olympic Marmot, Idaho Giant Salamander

Page 43: Huckleberries and Chanterelles are not included because they can't be grown, they can only be harvested from the wild

Page 49: Opal and obsidian

Page 77: Washington endemic mammal: Olympic Marmot
Washington marine mammal: Orca
Washington fossil: Columbian Mammoth
Oregon animal: Beaver
Idaho fossil: Hagerman Horse
Idaho horse: Appaloosa

Page 79: 1. Two; 2. Animals with webbed toes live near water.
The Beaver has webbed toes.

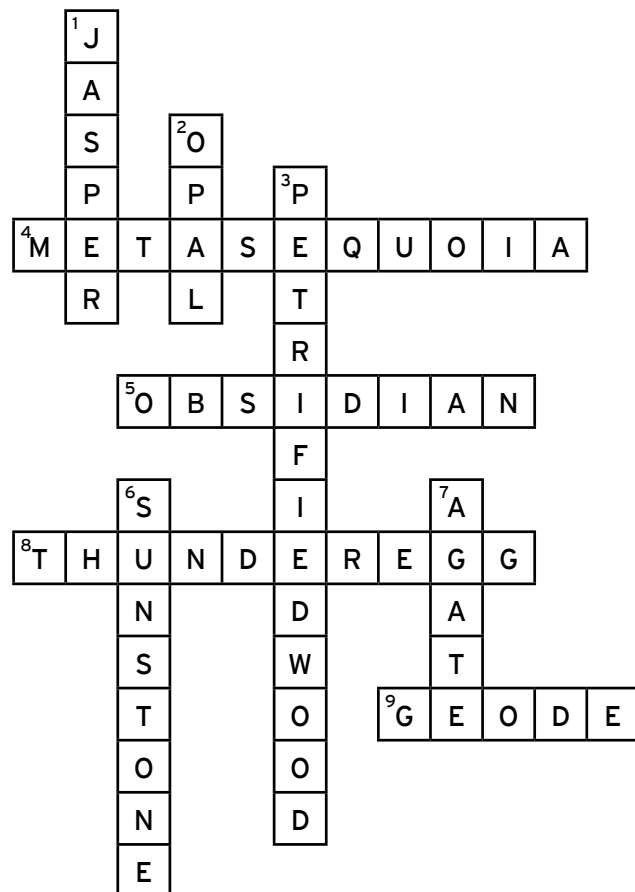
Page 93: Idaho: Monarch Butterfly (Lepidoptera)
Oregon: Oregon Swallowtail (Lepidoptera)
Washington: Green Darner (Odonata)

Page 98: 1. Flower Scarab; 2. Hoverfly; 3. Bumblebee

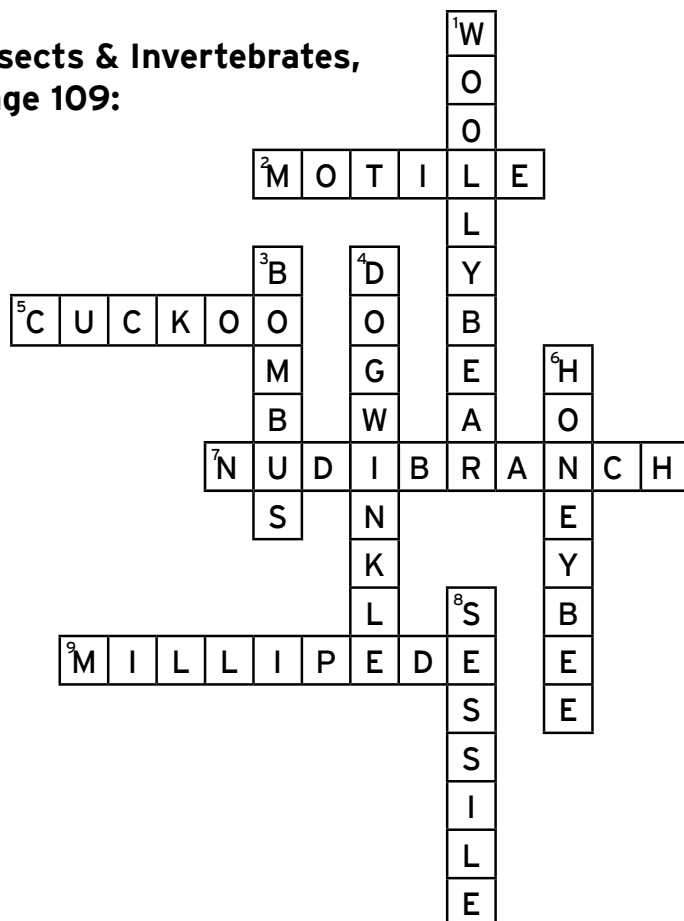
Page 119: Oregon state mushroom: Pacific Golden Chanterelle
Oregon state microbe: Brewer's Yeast

CROSSWORD ANSWERS

Geology & Gemstones, page 55:



Insects & Invertebrates, page 109:



ABOUT THE AUTHOR



Dr. Robert Niese is a lifelong nature nut and has been collecting and identifying plants, animals, fungi, rocks, and fossils ever since he was a child exploring California's diverse habitats. As an undergraduate at the University of Puget Sound in Tacoma, Washington, his hobbies became invaluable skills when he was hired by the Slater Museum of Natural History to write and implement science curricula for hundreds of elementary school classrooms throughout western Washington. In 2013, Robert took his enthusiasm and expertise for Pacific Northwest flora and fauna to Montana where he received his Ph.D. in comparative vertebrate anatomy and, in his free time, wrote nature journal entries for his blog, Northwest Naturalist, which has thousands of followers. Today, Robert continues to teach college students about mammals, plants, birds, and bones throughout the Pacific Northwest.

ACKNOWLEDGMENTS

To all the naturalists who came before me, to those who took the time to connect me to nature, and to those who never stopped encouraging my curiosity.

DEDICATION

For curious kids and adults everywhere.

PHOTO CREDITS

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Front and back cover images used under license from Shutterstock. Front cover and title page: Birdiegal: bird; **Bob Pelletier:** butterfly; **next143:** binoculars; **Steve Mann:** ruler; **tab62:** flowers; **Vitaly Korovin:** magnifying glass; **Vitaly Zorkin:** pencil
Back cover: **Svetlana Foote:** Inchworm

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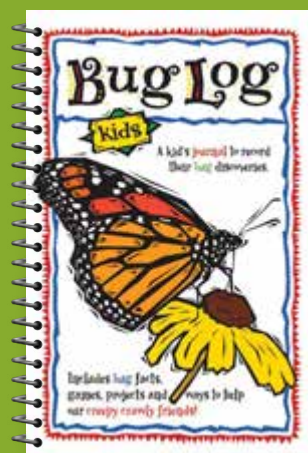
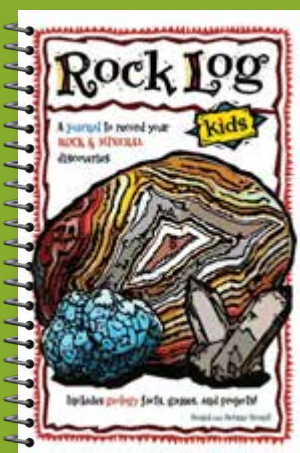
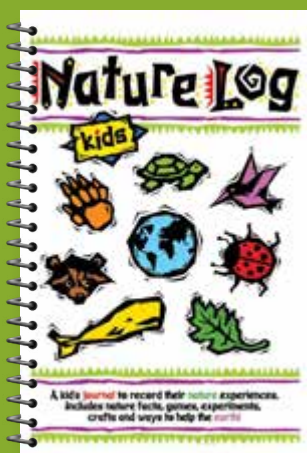
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Edited by Brett Ortler

Cover and book design by Fallon Venable

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Published by Adventure Publications

An imprint of AdventureKEEN

310 Garfield Street South

Cambridge, Minnesota 55008

(800) 678-7006

www.adventurepublications.net

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Printed in the United States of America

ISBN: 978-1-64755-171-1

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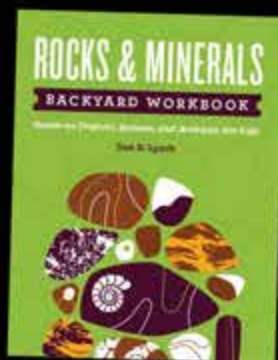
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