Wildlife & Water HABITATS

4-H VOLUNTEER GUIDE

WILDLIFE & WATER HABITATS

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INTRODUCTION

Welcome to the *Wildlife and Water Habitats Volunteer Guide*, the supplement to a curriculum that teaches middle school-age children about the Gem State's multifarious habitats. This guide offers many ideas to help you as a 4-H volunteer, teacher, or parent, including suggestions for group lessons, extra information on techniques, and broader context for the activities.

Because it is intended as a companion to the *4-H Youth Curriculum*, you should read the latter as well. In it, its authors, Marcie Galbreath-Rawls and Jim Ekins, integrate a storyline with activity-based, hands-on, and place-based assignments about Idaho's habitats (land and water) that should appeal to young teens. Furthermore, its methodology is tried-and-true. Based on other wildlife activity-based programs that both authors have used extensively, including IDAH$_2$O, section 2 (water resources and habitat), its organization flows in bite-sized lessons, a pace age-appropriate for a youth audience.

Additional influences for both publications include the Micron STEM Education Research Initiative's (University of Idaho Extension) (https://www.uidaho.edu/academics/stem/signature-area/micron/reports) findings, on which the authors used to base the overall structure of the curriculum and volunteer guide; and the organizational structure in Water Quality Matters! 4-H Water Project—Unit 3 (Pennsylvania State University, College of Agricultural Sciences) (https://extension.psu.edu/programs/4-h/opportunities/projects/environmental-science/aquatic-environments-and-water), which the authors used to adapt the overall flow.

Educators can tailor the pacing, scope, and sequence to their needs, though the authors intend the *Youth Curriculum* as a three-year-long program to be implemented by 4-H Natural Resources or 4-H Science clubs. In addition, the authors intend the *Youth Curriculum* to be used in formal and nonformal (e.g., out-of-school programs) curricular settings.

The first section focuses on wildlife habitat and learning about complex systems. Youth learn to look at different types of habitats and the variety of animals that might inhabit them; to research the availability and quality of nearby food sources and shelter; to describe a habitat in specific terms; and to make a model of a habitat. The second section focuses on water habitat and learning about watershed processes. Investigative activities include habitat assessments, physical/chemical water-quality assessments, and biological stream and pond assessments. Youth will learn about streams and lakes from a whole-watershed perspective: watershed functions, water quantity and wise water use, water-quality criteria measurement, and stream and pond structure.

Lesson Structure

Each lesson follows a standard structure. The lessons start with a story about two fictional characters, Emily and Logan. (The names chosen were the second most common male and female Idaho birth names in 2007, the year our fictitious characters were born. When we wrote this, the characters would have been about 12 years old, the approximate age this was written for). Their story develops throughout the entire program (both Wildlife and Water Habitats) to introduce each successive lesson and its essential questions, to keep youth reader interest, and to weave together the concepts. For each lesson, five parts follow every narrative opening:

- Learning Objectives
- Materials
- Procedure (condensed instructions of exactly how to proceed)
- Let's Do It! (a description of the activity's steps—what to actually do, related to the Procedure section)
- Reflection (adheres to a "Do-Reflect-Apply" framework, an experiential learning approach)

Experiential Learning

What is experiential learning? It is, in its simplest form, learning from experience. True experiential learning also includes reflection, which can happen in a variety of ways (e.g., individual reflective journaling, small or large group discussion).

There are several ways to approach experiential learning. With this curriculum, we use *Do, Reflect, Apply*. This is a simple, yet effective way for youth to become totally immersed in an activity. It stimulates metacognition (thinking about thinking), which takes learning beyond the surface level to a deeper understanding of concepts.

DO — The experience. This is the *Let's Do It!* Section. You can "Do" something big or small individually or in a group. The idea here is to begin the experience and, thus, begin the learning.

REFLECT — The contemplative sharing. This is part 1 of a "Reflection" section. Youth talk about their learning experience. This can be done individually or as a group, via oral and/or written language. This is a free-thought process: sharing any and all experiences. As the volunteer leader, you can ask open-ended questions to begin. For example:

What activity did you do?

What did you learn?

Where did you do the activity?

How did you feel during . . . ?

What was easiest, and why?

What was most difficult, and why?

What would you change the next time you did that or a similar activity?

Then, facilitate youth's ability to process the learning (or to continue a "Reflect") by using the information presented in the reflection prompts; by asking youth to relate the learning experience to previous ones; or by providing them with opportunities to apply the knowledge (see below).

APPLY — The real-world application. This is part 2 of a "Reflection" section. This is where youth generalize their learning, then apply it to their everyday lives. Here, youth (with the help of volunteer leaders and parents) find points where the activity applies to the real world. Youth can also reflect on academic and life skills they learned during the activity, which may benefit them in the future.

During this part, encourage youth to reflect on their own agency. How will they act differently (in the future) after completing this activity?

A Word about Outdoor Classrooms

Wildlife and Water Habitats is a STEM curriculum with the majority of the sections intended for in-the-field participation. Therefore, we need to discuss outdoor classrooms and safety considerations.

Wildlife

Teachers, parents, and 4-H leaders are encouraged to use the natural places within and surrounding their communities as outdoor classrooms (see Figure 1). Being immersed in nature is the best way to learn many of the STEM skills and content in

Figure 1. Outdoor classroom example. *Photo Credit: Marcie Galbreath-Rawls.*

this curriculum. Research shows that spending time in nature improves youth's engagement and academic performance, while it also decreases the incidence of behavioral disorders and acting out. It is best that youth conduct field portions of this curriculum in geographical areas with which they are familiar, or that they have explored virtually (e.g., using Google Earth), so that they can more comfortably and safely comprehend or build a basic understanding of topography and its potential dangers (caves, waterways, wildlife; etc.) and to remove the novelty of being in a new environment. Consult professionals from agencies such as the US Fish and Wildlife Service, Idaho Master Gardener Program, Bureau of Land Management, and others who can educate youth, teachers, and volunteers on potential flora and fauna dangers in the natural spaces you and your participants choose to study. With this kind of proper preparation, nature becomes an excellent and safer classroom.

Water

We encourage teachers and 4-H leaders to take their youth and youth clubs to a stream or pond to explore its structure and habitats, physical and chemical attributes, and, of course, aquatic macroinvertebrates. Waterways are the best place to learn about watersheds, especially the habits and adaptations of the organisms that populate them.

Youth will benefit from the opportunity to investigate freely. Research shows that classroom experiences in conjunction with field experiences enhance youth learning. However, it is best to conduct a field experience after youth have gained some knowledge of what an aquatic macroinvertebrate is and what adaptations to their environment they've developed. Teachers or leaders should also plan at least one final lesson after the field experience to reinforce and to revisit what youth experienced in the field. We offer some basic safety tips below, but please be aware that streams have higher flows during the spring season, which may make them unsafe outdoor classroom settings, especially for young children. In these cases, plan on having youth conduct their collecting activities during the late summer or fall.

Safety Tips for Macroinvertebrate Sampling

Kids and water are a natural combination. To ensure the two mix well, consider the following guidelines before going to the stream site:

- If possible, allot one adult supervisor per six youth participants.
- If you choose to split up into groups, maintain a reliable line of communication among groups at all times (e.g., stay within hearing distance).
- Be aware of medical considerations; make sure you have ready access to first aid supplies.
- Know which youth are allergic to bee stings and how to handle a reaction. Know the causes and early warning signs of hypothermia and heat exhaustion.

When choosing a stream site, be aware of these safety precautions:

- Avoid steep, slippery banks.
- Be mindful of any holes, vertical banks, and other hazards. These can be especially difficult to see when the banks are heavily vegetated.
- Scout the area for dangerous trash such as broken glass, rusted wire, or metal scraps.
- Scout the area for poison ivy, poison oak, and stinging nettle.
- Note any moving water flows. They can be deceptively dangerous. Don't let youth enter water that is moving very fast!

- Know where the water depth increases suddenly or significantly. Don't let youth enter water that covers their knees!
- Keep updated on the weather forecast in your chosen area. Never visit a stream during a lightning storm and beware of sudden storms that could produce flash floods.

Many of the above safety tips apply to the Wildlife Habitat activities as well. Additionally, please consider the following:

- Always carry plenty of water when working in the field.
- Protect yourself from the elements. Use sunscreen and wear proper clothing and footwear.
- Carry a first aid kit.
- Carry a cell phone and/or walkie-talkie.
- Work in pairs or groups. Never conduct field work alone.

Presentation and Portfolio Requirements

The *Youth Curriculum* allows for a presentation component at the end of each year (section 2, chapter 7). Please follow the requirements described therein.

In addition to the presentation, we expect youth to develop one of the following record types as part of their field investigations:

- Design Portfolio
- Engineering Notebook
- Field Journal

The exact "look" or content style of their portfolio, notebook, or journal, is less important than the completeness to which each youth participant faithfully documents her/his learning experiences as s/he progresses through the program. These are commonly used project documentation types (see Figure 2). Advise participants to do what feels right

Research Tool Option 1: **Design Portfolio**

A person with a more **artistic bent** might develop a design portfolio, heavy on labeled drawings, sketches with written descriptions, and other images with some context. There are many ways to create a design portfolio, including using a 3-ring binder, plain paper (no lines) drawing journal, or hardcover composition notebook. Whatever you choose, it will need to have enough pages to complete this three-year curriculum. Make sure you create a label for your portfolio—include your name, 4-H club or other affiliation, title: *Wildlife and Water Habitats Curriculum Design Portfolio*, and any other identifying information.

Research Tool Option 2: **Engineering Notebook**

A person with a more **mathematical mind** might develop an engineering notebook with formulas, graphs, tables, and scale drawings, again with notations and context included. Like the portfolio, there are many ways to create an engineering notebook. You can use a hardcover or softcover graph paper notebook, 3-ring binder, plain (drawing) or lined (writing) journal, or hardcover composition notebook. Whatever you choose, it will need to have enough pages to complete this three-year curriculum. Make sure you create a label for your notebook that includes your name, 4-H club or other affiliation, title: *Wildlife and Water Habitats Curriculum Engineering Notebook*, and any other identifying information.

Research Tool Option 3: **Field Journal**

A person who **likes to write narrative descriptions** might develop a field journal with written reflections about her/his experiences, but also include sketches, drawings, and mathematical formulas. There are many ways to create a field journal, including using a plain (no lines) drawing journal, hardcover or softcover graph paper notebook, 3-ring binder, or journal you create from scratch (described at the beginning of this *Procedure* section) using cardstock (or other equally thick paper) for the cover and plain paper for the inside. Whatever you choose, it will need to have enough pages to complete this three-year curriculum. Make sure you create a label for your journal that includes your name, 4-H club or other affiliation, title: *Wildlife and Water Habitats Curriculum Field Journal*, and any other identifying information.

for them; the goal is to capture all that they do for this project in an easily accessible and organized format.

Remind participants that the research tool they'll create will house and show all their work, including drafts of their maps and any and all of their reflections as they work through each assignment.

In addition to their portfolio/notebook/journal, each youth will also develop and keep a regular 4-H Record Book.

Figure 2. Portfolio/Notebook/Journal example. *Photo Credit: Marcie Galbreath-Rawls.*

How Youth (and Adults) Learn

Having a basic understanding of how youth learn can help leaders/volunteers guide them to become more independent learners, which can foster the development of other beneficial qualities and abilities. Among these are confidence, skill acquisition, understanding, experience, and reflection. These dimensions are woven throughout the *Youth Curriculum*. We designed it to build upon each youth's emerging knowledge, providing lessons that, when completed in order, scaffold the learning process—activities become increasingly more complex, with early activities supporting the learning of concepts in later activities. Professional teachers call this "scaffolding."

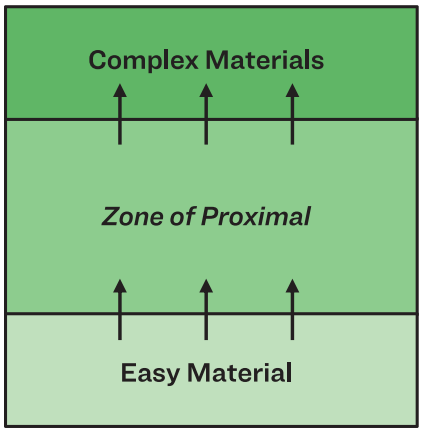

Figure 3. Adapted from Vygotsky, ZPD. Illustrated by Marcie Galbreath-Rawls.

Our curriculum design falls within the *Zone of Proximal Development* (ZPD; developed by Lev Vygotsky). Learning begins in the *Easy Material* phase (see Figure 3). This term refers to material that can be learned without help. Learners then proceed to the *ZPD* where they learn with less help. As learners move through the *ZPD*, they acquire progressively more complex knowledge, ultimately advancing into the *Complex Material* phase (see Figure 3). Because this stage involves material that cannot be learned from current knowledge, youth need to obtain the help of those more knowledgeable. Because this is the way humans learn, the ZPD-based design of our curriculum enables youth to work through the *Youth Curriculum* with minimal support from leaders/volunteers.

Learning Theories

Learning theories attempt to explain how youth take in, process, and maintain knowledge. A general understanding of the main learning theories educators rely on today provides a foundation for guiding youth through the *Youth Curriculum*. It will allow you to meet the participants where they are and to support them as they acquire new knowledge.

There are three main learning theories: Behaviorism, Cognitivism, and Constructivism.

Behaviorism (Skinner, Bandura) is a learning theory that focuses on observable behaviors. Behaviorists believe learning happens mostly because of environmental factors, thus discounting the primacy of mental processes. This approach to learning employs the use of rewards and punishments.

Cognitivism (Piaget, Bloom, Bruner) is a learning theory that emphasizes the learning process. Cognitivists are more interested in a learner's mental processing rather than s/he's observable behaviors when acquiring new knowledge. Youth are thus more engaged participants or learners—not "empty vessels."

Constructivism (Piaget, Papert) is a learning theory that focuses on the construction of knowledge from experience. Youth actively participate in the learning process, building new knowledge from existing studies and personal experiences. Learning is individual and subjective.

***Authors' Note**: Because we expect youth to complete about six to seven activities per year, we recommend completing the chapters in the following order: chapters 1 and 4 (from sections 1 and 2) in year one; chapters 2 and 5 (sections 1 and 2) in year two; and chapters 3 and 6 (sections 1 and 2) in year three. Chapter 7 in section 2 applies to all three years and thus can be completed in year one and improved twice annually thereafter. There is flexibility in the design of the* Youth Curriculum*; while it is more convenient to complete the chapters in the order suggested, it is not entirely necessary to do so. However, it is essential for youth to complete each activity in order within each chapter. Because of our use of scaffolding (see ZPD above) within each individual chapter, we suggest youth complete the activities within a chapter in order, no matter the chapter they are working on.*

Summary of Chapters and Activities

Section 1: Wildlife Habitat

Chapter 1: What Is a Habitat?		
Activity Title	**Content**	**Overview of Activity**
Habitat Diversity	Habitat assessment and construction of scientific arguments.	Create a field journal. For your first entry, define habitat based on newly gained knowledge.
Who Lives There?	Develop critical thinking through understanding and observation of interdependence in ecosystems.	Hike a local natural area. Identify and record various habitats, including subsistence cause and effect.
Habitat Modeling	STEM concepts, including modeling, design, and measurement.	Create a 3-D model based on information collected in *Who Lives There?* activity.
Pieces of the Whole	Biodiversity: understanding ecosystems, including resources needed and their availability.	Understanding ecosystems at the microlevel by taking a minihike (about 12 inches) and recording observations.
Taking a Different View	Understanding interdependent relationships in ecosystems.	Identify animals present in a local county/community; then, by imagining you are each animal, explain how it sees (imagine looking through its eyes) the area via a drawing.

Chapter 2: Human Impacts, Yesterday and Today		
Activity Title	**Content**	**Overview of Activity**
People and the Environment	Appreciating the connection between human activity/impacts and Earth's systems.	Create a storyboard based on research you've conducted using multiple resources.
Science in Action	Environmental issues in relation to human activity.	Design a study method appropriate for a selected environmental issue, then conduct a small-scale research project. Share your findings.

Chapter 3: Soil Science		
Activity Title	**Content**	**Overview of Activity**
Erosion: Where and Why?	Understanding topography and the documentation of natural forces.	Hike a local area, explaining and documenting various forms of erosion.
Changes, Big and Small	Use of reliable data to construct scientific explanations.	Construct an experiment to measure various types of erosion.
Soil at Work	Natural processes—soil as a filtration device.	Run different types of "dirty" water through different types of soil. Record your data.

Section 2: Water Habitat

Chapter 4: Watersheds		
Activity Title	**Content**	**Overview of Activity**
What Is the Water Cycle?	The water cycle—how water moves around the Earth.	Draw the water cycle; using water-cycle vocabulary.
Exploring Your Watershed	Comprehending the definition of *watershed*.	Draw a rough map of a watershed, applying appropriate terminology, map symbols, and place names.
Functions of Watersheds	Watershed functions and the beneficial uses of water.	Draw a large, more sophisticated map of a watershed, applying appropriate terminology, map symbols, and place names.

Chapter 5: Water Quantity and Quality		
Activity Title	**Content**	**Overview of Activity**
How Do We Use Water?	Household water-use study, inside and outside.	Household water-use calculations, using a variety of measurement techniques.
What Is Water Quality?	Water-quality impacts on beneficial uses of water.	Physical/chemical water-quality assessment, using IDAH$_2$O protocols.
What Is Water Pollution?	Local or regional water-quality-issue research.	Write a well-researched report on a local or regional water-quality issue and how it was solved.

Chapter 6: Water Walk		
Activity Title	**Content**	**Overview of Activity**
Water Habitats: An Overview	Exploring and modeling an aquatic habitat.	Identify and describe a stream or pond by monitoring the site, identifying various habitats, and making a diorama that models the site's spatial and geographic features.
Stream Habitats (Habitat Option 1) *If you are studying a pond, skip to Pond/Lake Habitats, below.*	Exploring and quantifying your stream-monitoring site.	Stream-habitat assessment, using IDAH$_2$O protocols.
Pond/Lake Habitats (Habitat Option 2) *If you are studying a stream, skip to Stream Habitats, above.*	Exploring and quantifying your pond-monitoring site.	Pond-habitat assessment, using IDAH$_2$O protocols.
Extra Considerations for Urban Stream and Pond/Lake Habitats (Relates to Habitat Options 1 and 2)		
Aquatic Macroinvertebrates Tell a Story	Collect and identify aquatic macroinvertebrates from your stream- or pond-monitoring site.	Biological (water invertebrates) assessment, using IDAH$_2$O protocols.

Chapter 7: Presentations and Community Engagement		
Activity Title	**Content**	**Overview of Activity**
Project Presentation and Portfolio/Notebook/Journal Development	Presentation and public-speaking skills, project documentation skills (e.g., field notes).	Present your project at a fair or other suitable venue.

Appendix 2: Advanced Activities		
Activity Title	**Content**	**Overview of Activity**
Watershed Precipitation Volume	Geometry and other math skills.	After chapter 2, calculate the total precipitation of your watershed.
Preserving Aquatic Macroinvertebrates	Aquatic macroinvertebrate (soft-bodied) larvae/nymph preservation and identification skills.	Collect and preserve aquatic macroinvertebrates for presentation and study.
Crayfish Population Data Collection	Advanced field-data collection skills, including crayfish-specific identification skills.	After completing chapter 3, collect detailed population data about crayfish in your pond or stream site.
Trash Cleanup and/or Streambank/Lakeshore Restoration Plan	Volunteer management and public engagement.	Organize a volunteer trash cleanup or streambank-planting event.

SECTION 1: WILDLIFE HABITAT

What is a habitat? Habitat is often defined as an organism's natural environment, or a natural place where an organism lives and grows. This section will provide youth with many opportunities to look at habitats from various perspectives. As participants work through each activity, they will gain a deeper, general understanding of ecosystems and habitats and a specific understanding of local natural spaces. They will learn how to identify various habitats, who lives in the natural (and human-made) spaces within and surrounding their communities, humans' impact on the natural world, and specifics about soil and erosion.

Activities in this section will give youth the knowledge necessary to complete the research project and all other presentations. You can extend their learning of science concepts by completing an *Activity Extension* offered at the end of a few of the lessons. Adults should always guide/supervise youth when they work in the field, as well as when they meet professionals in the community—a key component in some activities.

Chapter 1: What Is a Habitat?

Chapter 1 contains five activities related to the broader concept of habitat. The first activity introduces youth to habitat diversity. The second explores who lives in the local area. The third pulls in engineering skills through 3-D modeling. The fourth gives youth a microview of the natural world. The fifth provides youth the opportunity to examine the natural world through the eyes of the animals that live there, taking a macro look at their environment.

Chapter 2: Human Impacts, Yesterday and Today

Chapter 2 contains two activities related to human impacts on the environment. Both of these activities are research-based and will take longer for youth to complete, so it's okay to spread them out over multiple weeks. The first activity introduces participants to conducting research. This activity connects history and ecology, specific to the area they live in. The second activity teaches them about the scientific method and gives them more comprehensive research knowledge and experience. The following activities in this chapter merit a few specific notes.

Activity 6

Note: Conduct an *optional* summative (concluding) assessment for the *People and the Environment* activity. Instruct members/participants to share their storyboards orally, during which other members/participants will evaluate them based on a prepared rubric.

Activity 7

Provided below is an overview of the scientific method and research types. Please read through this information so you can guide club members/youth in comprehending the scientific method and choosing the appropriate research method for their projects.

The Scientific Method: A process that guides experimentation. Scientists use the scientific method to steer their inquiries or experiments, but they don't always exactly follow its steps. Youth can do the same! Whether strictly adhering to its approach or modifying it to fit an experiment, ultimately the goal is the same: to identify the cause-and-effect relationship. What it involves is asking questions, making a hypothesis, and gathering and analyzing information to see if a logical answer arises. Below are the steps of the scientific method:

- Ask a question/make an observation
- Do research
- Construct a hypothesis

- Experiment
- Ask, “is the procedure working?”
- If yes, analyze the data, accept or reject your hypothesis, and report the findings
- If no, troubleshoot/adjust your procedure and run the experiment again until the answer is yes

There are multiple ways scientists and researchers examine phenomena (observable facts, circumstances, or occurrences). *Quantitative* methods involve the use of numerical data to measure and define something—for example, the number of pieces in a package of gum. *Qualitative* methods do not involve the use of numbers. Instead, they rely on text to explain/describe the characteristics of something (a phenomenon), without measurement—for example, a description of the softness of a teddy bear. You can also combine quantitative and qualitative methods. This is known as a *mixed methods* approach. Researchers using mixed methods collect both quantitative (numbers) and qualitative (text) data. The qualitative data supports the quantitative data.

Quantitative Data Collection: Surveys (usually with numerical choices—for example, a scale from 1–5 or 1–7) are often used when collecting quantitative data. Researchers and scientists also use polls, computations, and other calculations-based data.

Qualitative Data Collection: Interviews are a popular form of qualitative data collection. You can also make notes of your observations, keep a more formal journal of your research/science project, or capture your data on video and/or audio recordings or via questionnaires or surveys (make sure you pose open-ended questions, not ones that rely on numerical choices).

An example of a *mixed methods* approach may involve collecting numerical data about the pH levels and temperature of several different bodies of water, then writing down observations of those same bodies of water (their color, clarity, the types of plants and animals in or around them, etc.).

Data collected are then analyzed. There are several ways you can do this. Often, scientists and researchers use software programs (such as SPSS or NVivo) to analyze data.

Quantitative researchers often begin data analysis by identifying measurement scales (e.g., nominal, ordinal, ratio) for comparison to their numbers (variables). They also often use statistical software, such as SPSS, to conduct quantitative data analyses. Excel is popular as well. It is easier to use and works well for less complicated analyses. Its statistical analysis capabilities and “data analysis toolpak” are particularly convenient because they help create tables and charts useful for examining data and reporting your findings.

Qualitative researchers work with different data and procedures. They may hand code data before using a program such as NVivo. Hand coding involves going through interview transcripts, or other qualitative (text) data, and looking for commonalities in the words/text. You might start with codes based on your research question or hypothesis or use the commonalities you discover. Once you have established some codes, look again for commonalities that create themes. Group the data by these themes. The questions you’re asking or the problem you’re trying to solve will guide how you analyze your qualitative data.

Chapter 3: Soil Science

Chapter 3 contains three activities related to soil science. The first activity takes youth into the field to explore erosion. The second brings the exploration of erosion back into the classroom with youth controlling the “natural forces.” The third gives them the opportunity to understand soil as nature’s filtration device.

SECTION 2: WATER HABITAT

What does the concept of "water quality" mean, anyway? Can you define what water quality is? This section focuses on the topic of watersheds. Watersheds are geographic areas where precipitation falls, is stored, is used by a variety of human and natural systems, and then runs through to another watershed or to the ocean. Watershed science includes water quantity, water quality, and how it is measured. This section will teach you how to understand what a watershed is, how much water you use, and then how to measure water-quality parameters in your local waterway, whether it's a stream, lake, pond, river, or even a channel. You will also learn the different water-quality standards that apply to Idaho's streams and lakes, as well as some of the state's water-quality problems and the solutions people have developed to make our water cleaner. The final learning activity involves the use of aquatic insects to help determine the relative health of a stream or lake.

You will work with youth to continually build their stream/lake monitoring plan. You can always add more details and information to the basic set of questions you considered in the second activity (Basic Watershed Mapping). You will build the plan as you go through each subsequent activity, including, where will you go to do regular monitoring? (Select a small, wade-able stream to start out with.) How much time do you have, what safety notes are relevant (see the IDAH$_2$O Master Water Stewards Handbook, page 4, for some safety tips), will you use waders (do you have an understanding of how to safely use them), and what other protective clothing should you wear? (Summer clothing, which protects you from the intense sun and heat, will differ from spring and fall clothing, which is designed to protect you from cold, wet conditions.) Other considerations involve the season, elevation, and water temperature. Midsummer through early fall is generally the safest time to monitor streams. Winter and spring stream monitoring is only allowed if you can safely approach the stream. High water is extremely dangerous, as is cold water. Indeed, the combination of high and cold water is exponentially dangerous; both can be present in winter and well into spring, and even into early summer in some places.

Chapter 4: Watersheds

Chapter 4 contains three activities related to the broad concept of watersheds. The first exercise introduces youth to the concept of a water cycle. The second involves locating the watershed boundaries in which the participant lives, and then learning how to draw a map showing the parts of that watershed. The third deepens a member's understanding of the many functions of a watershed by building on the above-mentioned second exercise. Youth redraw their watershed map on a half-poster board, this time adding physical features, watershed functions, and all the elements a map must have to be called a map.

Chapter 5: Water Quantity and Quality

Chapter 5 contains three activities related to water quantity and water quality. The first activity has two parts, indoor water use and outdoor water use. These activities take somewhat longer to complete, so it's okay to spread these out across multiple weeks. The outdoor water-use section might not apply to a participant's situation. For instance, s/he might live in an apartment, or may not have a lawn. It's also okay to skip this portion if it does not apply. The second activity involves real-world water-quality monitoring. It is based on the IDAH$_2$O Master Water Stewards citizen science Physical/Chemical stream/lake assessment protocol. An important part of this activity is establishing a monitoring plan. Participants will continue to use additional stream/lake assessments under this plan in subsequent chapters, so it's good for them to take the time to think through their monitoring plan at this stage. The final exercise is the only one in the *Youth Curriculum* that requires a written report. Each participant will write a well-researched report on a water-quality issue in her/his area.

Chapter 6: Water Walk

Chapter 6 focuses on aquatic habitats and the creatures that inhabit them. The first activity involves building a 3-D model of a stream or pond, like a pop-up book, or a diorama in a small box. For the second activity, youth choose between assessing the habitat of either a stream or a lake/pond. Have them choose the one whose logistics are the most manageable. If they are monitoring an urbanized area, there are some additional things to consider, beyond additional safety precautions. Activity 4 is for people monitoring in an urban area and can be skipped if they are working in a more rural area. Activity 5 includes two parts: catching and identifying the aquatic macroinvertebrates ("bugs") that live in a chosen water body and then doing a biological assessment. The first part is a sort of warm-up activity to learn the basics of identifying macroinvertebrates. Just catch some "bugs" and carry them home in a 6-quart plastic container (or equivalent) to learn how to identify them in a more comfortable environment. Once participants feel more confident about their ability to identify them, they can begin the second part of the activity: going to the water body and completing the biological assessment, using the same protocol as IDAH$_2$O Master Water Stewards.

Before they go out to collect data on a chosen water body, there are a few safety rules you need them to know and follow:

A Few Safety Rules: Overall, always consider your well-being as your priority.

- Always conduct monitoring with a "buddy" or team member. Never approach streams alone.
- Always let someone know where you are going and how long you will be gone.
- Use caution when entering a stream, making sure that you can get out, that the current is not too strong, and that the bottom will support you safely.
- Do not attempt to enter water if the stream flow is too high. As a general rule, above your knees is probably too high.
- Always conduct monitoring during daylight hours.
- Wear waders or river shoes (old tennis shoes) to avoid cutting your feet on submerged glass, metal, or sharp rocks.
- Be aware of possible dangers, such as poisonous plants, unstable banks, wildlife, stinging insects, and livestock.
- Dress appropriately for the weather. Know how to recognize the signs and symptoms of both heat exhaustion and hypothermia and know how to treat them. Most importantly, know how to prevent them.
- Wash up thoroughly with hot water and soap when you get home.

If you are monitoring in areas with potential contamination, such as mine wastes or harmful cyanobacteria (blue-green algae) blooms, you may want to participate in additional safety training before getting into the stream.

Chapter 7: Presentations and Community Engagement

Chapter 7 brings everything you've done during the year together for a public presentation. Following the guidelines within the chapter, and other relevant 4-H presentation guidelines, it's time for you to get some public recognition for your hard work. Your presentation will contain what you have done and learned in both the Wildlife and Water Habitats sections.

SECTION 3: APPENDICES

Appendix 1: Detailed Instructions for Activities

This engaging but lengthy 4-H program requires learning a lot of new knowledge, understanding natural resources science principles, and developing new observation skills. To enhance readability, each chapter provides basic background information, then detailed instructions for some of the activities (activities 14, 15, 18–20) are provided in appendix 1.

Appendix 2: Advanced Activities

Appendix 2 provides additional, optional, advanced activities to really challenge any science-minded youth participant.

Appendix 3: Data Sheets and Things to Print

Appendix 3 is the clearinghouse for all the data sheets and other printed materials that are associated with any of the activities.

Appendix 4: Glossary

Appendix 4 is a robust glossary providing definitions for the scientific terms appearing within this curriculum.

We hope that you enjoy this journey into wildlife and water habitats as much as we enjoy teaching about these subjects. Thanks for your support of 4-H youth and for learning along with them.

– *Marcie Galbreath-Rawls, Ph.D., and Jim Ekins, Ph.D.*