# Project WILD and Aquatic WILD Guides

## Correlations to the current Virginia Science Standards of Learning *and Science Guidelines and Correlation to Math Skills*

The Project WILD Curriculum K-12 and Aquatic WILD Guides support the 2018/2025 Virginia Standards of Learning objectives for Science by providing background content for teachers and activities that help teach science standards using creative instructional methods. The following correlations to WILD activities match the Science Standard as they are written; extensions, adaptations or secondary objectives are not included. Some of the listed activities build on the student's knowledge and further the understanding of a concept but do not correlate directly. Other activities will support the standards in math and language arts and have an indirect link to Virginia's Science Standards at the suggested grade level. Reviewing the activities in the Project WILD guide along with the Topic, Subject, and Skills indexes found in the appendices will create a comprehensive correlation to Virginia's subject area Standards of Learning.

Activities in the guides have been field tested for Lower Elementary, Upper Elementary, Middle School and/or High School. As a result, some activities are listed for multiple grade levels. Teachers should communicate with teachers in other grades to prevent the same activity being used repeatedly to teach a related standard. Many activities have extensions that will expand the use of the activity across grade levels. Many activities can easily be adapted by educators to suit your grade level.

Within Virginia's Science SOLs, the first objective or ".1" standard touches on Scientific and Engineering Practices. These skills should be a part of all science lessons and can be found incorporated into all of the Project WILD activities. Activities in both guides include ***STEM, Career Connections*** and ***Field Investigations*** information. Those marked with a green leaf support the **Scientific and Engineering Practices** in the Curriculum Framework**.** Teachers are referred to the *Skills Index* in the back of their Project WILD Activity Guides for activities that would assist in teaching any given skill.

Many activities in Project WILD and Aquatic WILD reinforce skills included in the ***Profile of a Virginia Graduate***: Communication, Collaboration, Critical Thinking, Creative Thinking and Civic Responsibility.

The Virginia Department of Wildlife Resources is the state sponsor for Project WILD. The Department provides professional development for formal and community educators. From awareness to action, this hands-on approach to learning engages students in investigating the world around them, connecting them to conservation careers, and participating in solid STEM activities.

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2026

# Science Standards of Learning Themes and Project WILD Activities Grades K-6

**The Nature of Science**

*"Science is not a mere accumulation of facts; instead, it is a discipline with common practices for understanding the natural world."* The 2018 Virginia Science Standards of Learning uses themes in grades K – 6th grade to help build on the understanding of the natural world around them. The correlation below shows which Project WILD activities will help the teacher build on the theme for that grade level. Additional activities will also support the themes but were not listed because the connection to the objectives for that grade level were not as strong.

Denotes that this activity also supports a **Scientific and Engineering Practice** in the Framework

***Kindergarten – Using my senses to understand my world.***

*"In science, kindergarten students use their senses to make observations of the characteristics and interactions of objects in their world. Students study the characteristics of water and the basic needs of living things. They also study the relationship between the sun and Earth through shadows and weather. They determine how their actions can change the motion of objects and learn how they can make a difference in their world."*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Growing Up WILD Guide |
|---|---|---|
| My Kingdom for a Shelter | Are You Me? | Less is More |
| Insect Inspection | Water Safari | Looking at Leaves |
| Ants on a Twig | | Wildlife is Everywhere |
| Seed Need | | Hiding in Plain Sight |
| Color Crazy | | |
| What's That Habitat? | | |
| What You Wear is What They Were | | |

***Grade One - How I interact with my world.***

*In first-grade science, students become aware of factors that affect their daily lives. Students continue to learn about the basic needs of all living things and that living things respond to factors in their environment, including weather and the change of season. They continue the examination of matter by observing physical properties and how materials interact with light.*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Growing Up WILD Guide |
|---|---|---|
| Busy Bees, Busy Blooms | Water Plant Art | Lunch For a Bear |
| Seed Need | Fashion A Fish | Who Lives in a Tree |
| Color Crazy | Aqua Words | Seed Need |
| Insect Inspection | | Show Me the Energy! |
| What's That Habitat | | In A Grasshopper's World |
| My Kingdom for a Shelter | | |

**Grade Two – *Change occurs all around us***

*"Science in second grade builds on the previous understandings of forces, water, weather, and plants and animals, and students explore these concepts through the lens of change. They examine how water changes phase, how visible and invisible forces change motion, how plants and animals change through their life cycles, and how weather changes the Earth. Students also examine how change occurs over a short or long period of time".*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Growing Up WILD Guide |
|---|---|---|
| Limiting Factors: How Many Bears? | Are you Me? | Grow As We Go |
| Surprise Terrarium | Silt: A Dirty Word | Aqua Charades |
| Busy Bees, Busy Blooms | Water Plant Art | Field Study Fun |
| What's That Habitat? | | |

**Grade Three - *Interactions in our world***

*"The focus of science in third grade is interactions in our world. Students continue their study of forces and matter by learning about simple machines and by examining the interactions of materials in water. They also look at how plants and animals, including humans, are constantly interacting with the living and nonliving aspects of the environment. This includes how*

*adaptations satisfy the life needs of plants and animals and the importance of water, soil, and the sun in the survival of plants and animals".*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Flying WILD Guide |
|---|---|---|
| Tracks | Marsh Munchers | Bird Behavior Scavenger Hunt |
| Adaptation Artistry | Fashion A Fish | The Fine Art of Nesting |
| Thicket Game | Designing a Habitat | The Great Migration Challenge |
| Owl Pellets | Edge of Home | |
| Quick Frozen Critters | Got Water | |
| Which Niche? | Water Wings | |
| Urban Nature Search | Silt: A Dirty Word | |

**Grade Four – *Our place in the solar system***

*"Our solar system is a grand place, and in fourth-grade science, students learn where we fit in this solar system. Starting with the solar system, and then moving to the planet Earth, the Commonwealth of Virginia, and finally their specific ecosystems, students examine how features of plants and animals support life. They also explore how living things interact with both living and nonliving components in their ecosystems".*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Flying WILD Guide |
|---|---|---|
| Trophic Transfer | Got Water? | Hidden Hazards |
| Busy Bees, Busy Blooms | Fashion a Fish | |
| Seed Need | Water Plant Art | |
| Which Niche? | Blue Ribbon Niche | |
| Interview A Spider | | |
| Keeping Cool | | |

**Grade Five - *Transforming matter and energy***

*"Grade five science takes a deeper dive into foundational concepts in physical science as students begin to make connections between energy and matter. Students explore how energy is transformed, and learn about electricity, sound, and light. They also learn about the composition of matter and explore how energy can change phases of matter. They apply an understanding of force, matter, and energy when they explore how the Earth's surface changes".*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Flying WILD Guide |
|---|---|---|
| Tropic Transfer | | Avian Acoustics: Sound Off |
| Lights Out | | |

**Grade Six - *Our world; our responsibility.***

"*In sixth grade, students are transitioning from elementary to middle school. The science standards support that transition as students examine more abstract concepts, providing a foundation in the disciplines of science. They explore the characteristics of their world, from the Earth's placement in the solar system to the interactions of water, energy, air, and ecosystems on the Earth. As students more closely examine the use of resources, they also consider how their actions and choices affect future habitability on Earth".*

**The following Project WILD activities support this theme:**

| Project WILD Guide | Aquatic WILD Guide | Flying WILD Guide |
|---|---|---|
| Lights Out | Water Works | Bird Action |
| Wildlife and the Environment | Watershed | Council Consensus |
| Bat Blitz | Water Wings | |
| | Watered Down History | |
| | Net Gain Net Effect | |

**Project WILD and Aquatic WILD CORRELATION TO VIRGINIA'S SCIENCE STANDARDS OF LEARNING**

| Kindergarten | | Project WILD K-12 Guide | Aquatic WILD Guide |
|---|---|---|---|
| K.6 | The student will investigate and understand that there are differences between living organisms and nonliving objects. Key ideas include<br>a) all things can be classified as living or nonliving; and<br>b) living organisms have certain characteristics that distinguish them from nonliving objects. | • *My Kingdom for a Shelter*<br>• *Insect Inspection*<br>• *Ants on a Twig* | |
| K.7 | The student will investigate and understand that plants and animals have basic needs and life processes. Key ideas include<br>a) living things need adequate food, water, shelter, air, and space to survive;<br>b) plants and animals have life cycles; and<br>c) offspring of plants and animals are similar but not identical to their parents or to one another. | • *My Kingdom for a Shelter*<br>• *What's That Habitat*<br>• *Ants on a Twig*<br>• *Seed Need* | • *Are You Me?*<br>• *Water Safari* |
| K.9 | The student will investigate and understand that there are patterns in nature. Key patterns include<br>a) daily weather;<br>b) seasonal changes; and<br>c) day and night. | • *Seed Need* | • *Are You Me?*<br>• *Water Plant Art* |
| K.10 | The student will investigate and understand that change occurs over time. Key ideas include<br>a) natural and human-made things change over time;<br>b) living and nonliving things change over time;<br>c) changes can be observed and measured; and<br>d) changes may be fast or slow. | • *Color Crazy*<br>• *What's That Habitat?* | • *Aqua Words*<br>• *Are You Me?* |
| K.11 | The student will investigate and understand that humans use resources. Key ideas include<br>a) some materials and objects can be used over and over again;<br>b) materials can be recycled; and<br>c) choices we make impact the air, water, land and living things. | • *What You Wear is What They Were* | |

| First Grade | | Project WILD K-12 Guide | Aquatic WILD Guide |
|---|---|---|---|
| 1.4 | The student will investigate and understand that plants have basic life needs and functional parts that allow them to survive. Key ideas include<br>a) plants need nutrients, air, water, light, and a place to grow;<br>b) structures of plants perform specific functions; and<br>c) plants can be classified based on a variety of characteristics. | • *Busy Bees, Busy Blooms*<br>• *Seed Need* | • *Water Plant Art* |
| 1.5 | The student will investigate and understand that animals, including humans, have basic life needs that allow them to survive. Key ideas include<br>a) animals need air, food, water, shelter, and space (habitat);<br>b) animals have different physical characteristics that perform specific functions; and<br>c) animals can be classified based on a variety of characteristics.. | • *Color Crazy*<br>• *My Kingdom for a Shelter*<br>• *Insect Inspection*<br>• What's That Habitat | • *Fashion A Fish* |
| 1.7 | The student will investigate and understand that there are weather and seasonal changes. Key ideas include<br>a) changes in temperature, light, and precipitation occur over time;<br>b) there are relationships between daily weather and the season; and<br>c) changes in temperature, light, and precipitation affect plants and animals, including humans. | • What You Wear is What They Were | • |

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| 1.8 | The student will investigate and understand that natural resources can be used responsibly. Key ideas include<br>a) most natural resources are limited;<br>b) human actions can affect the availability of natural resources; and<br>c) reducing, reusing, and recycling are ways to conserve natural resources. | • What You Wear is What They Were | |

| ***Second Grade*** | | **Project WILD K-12 Guide** | **Aquatic WILD Guide** |
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| 2.4 | The student will investigate and understand that plants and animals undergo a series of orderly changes as they grow and develop. Key ideas include<br>a) animals have life cycles; and<br>*b)* plants have life cycles. | • *Limiting Factors: How Many Bears? (Procedure II)*<br>• *Surprise Terrarium* | • *Are You Me?* |
| 2.5 | The student will investigate and understand that living things are part of a system. Key ideas include<br>a) plants and animals are interdependent with their living and nonliving surroundings;<br>b) an animal's habitat provides all of its basic needs; and<br>c) habitats change over time due to many influences. | • *My Kingdom for a Shelter*<br>• *Busy Bees, Busy Blooms*<br>• *What's That Habitat* | • *Water Safari* |
| 2.7 | The student will investigate and understand that weather patterns and seasonal changes affect plants, animals, and their surroundings. Key ideas include<br>a) weather and seasonal changes affect the growth and behavior of living things;<br>b) wind and weather can change the land; and<br>c) changes can happen quickly or slowly over time. | • *What Bear Goes Where* | • *Silt: A Dirty Word* |
| 2.8 | The student will investigate and understand that plants are important natural resources. Key ideas include<br>a) the availability of plant products affects the development of a geographic area;<br>b) plants provide oxygen, homes, and food for many animals; and<br>c) plants can help reduce the impact of wind and water. | • *My Kingdom for a Shelter* | • *Water Plant Art* |

| **Third Grade** | | **Project WILD K-12 Guide** | **Aquatic WILD Guide** |
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| 3.4 | The student will investigate and understand that adaptations allow organisms to satisfy life needs and respond to the environment. Key ideas include<br>a) populations may adapt over time;<br>b) adaptations may be behavioral or physical; and<br>c) fossils provide evidence about the types of organisms that lived long ago as well as the nature of their environments. | • *Adaptation Artistry*<br>• *Tracks* | • *Designing a Habitat*<br>• *Marsh Munchers*<br>• *Fashion A Fish*<br>• *Sockeye Scents*<br>• *Gone Fishing* |
| 3.5 | The student will investigate and understand that aquatic and terrestrial ecosystems support a diversity of organisms. Key ideas include<br>a) ecosystems are made of living and nonliving components of the environment; and<br>b) relationships exist among organisms in an ecosystem. | • *Thicket Game*<br>• *Owl Pellets*<br>• *Quick Frozen Critters*<br>• *Which Niche?* | • *Marsh Munchers*<br>• *Fishy Who's Who*<br>• *Edge of Home* |
| 3.6 | The student will investigate and understand that soil is important in ecosystems. Key ideas include<br>a) soil, with its different components, is important to organisms; and<br>b) soil provides support and nutrients necessary for plant growth. | | • *Silt a Dirty Word* |
| 3.7 | The student will investigate and understand that there is a water cycle and water is important to life on Earth. Key ideas include<br>a) there are many reservoirs of water on Earth;<br>b) the energy from the sun drives the water cycle; and<br>c) the water cycle involves specific processes. | | • *Aqua Words*<br>• *Got Water?*<br>• *Water Wings*<br>• *Alice in Waterland* |
| 3.8 | The student will investigate and understand that natural events and humans influence ecosystems. Key ideas include | • *Environmental Barometer* | • *Silt is a Dirty Word*<br>• *Water Works* |

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| | a) human activity affects the quality of air, water, and habitats;<br>b) water is limited and needs to be conserved;<br>c) fire, flood, disease, and erosion affect ecosystems; and<br>d) soil is a natural resource and should be conserved. | • *Habitat Circles*<br>• *Urban Nature Search* | |

| Fourth Grade | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| 4.2 | The student will investigate and understand that plants and animals have structures that distinguish them from one another and play vital roles in their ability to survive. Key ideas include<br>a) the survival of plants and animals depends on photosynthesis;<br>b) plants and animals have different structures and processes for obtaining energy; and<br>c) plants and animals have different structures and processes for creating offspring. | • *Trophic Transfer*<br>• *Busy Bees, Busy Blooms*<br>• *Seed Need*<br>• *Quick Frozen Critters*<br>• *Keeping Cool* | • *Sockeye Scents*<br>• *Turtle Hurdles* |
| 4.3 | The student will investigate and understand that organisms, including humans, interact with one another and with the nonliving components in the ecosystem. Key ideas include<br>a) interrelationships exist in populations, communities, and ecosystems;<br>b) food webs show the flow of energy within an ecosystem;<br>c) changes in an organism's niche and habitat may occur at various stages in its life cycle; and<br>d) classification can be used to identify organisms. | • *Which Niche?*<br>• *Interview A Spider*<br>• *Monarch Marathon*<br>• *Adaptation Artistry*<br>• *Keeping Cool*<br>• *Career Critters* | • *Edge of Home*<br>• *Designing a Habitat*<br>• *Fashion a Fish*<br>• Got Water? |
| 4.8 | The student will investigate and understand that Virginia has important natural resources. Key resources include<br>a) watersheds and water;<br>b) plants and animals;<br>c) minerals, rocks, and ores; and<br>d) forests, soil, and land. | • *What's Wild* | • *Fishy Who's Who*<br>• *Water Plant Art*<br>• *Blue Ribbon Niche*<br>• *Silt – A Dirty Word* |

| Fifth Grade | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| 5.2 | The student will investigate and understand that energy can take many forms. Key ideas include<br>a) energy is the ability to do work or to cause change;<br>b) there are many different forms of energy;<br>c) energy can be transformed; and<br>d) energy is conserved. | • *Trophic Transfer* | |
| 5.9 | The student will investigate and understand that the conservation of energy resources is important. Key ideas include<br>a) some sources of energy are considered renewable and others are not;<br>b) individuals and communities have means of conserving both energy and matter; and<br>c) advances in technology improve the ability to transfer and transform energy. | • *Trophic Transfer*<br>• *Lights Out*<br>• Sustainability: Then, Now, Later | |

| Sixth Grade | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| 6.6 | The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include<br>a) water is referred to as the universal solvent;<br>b) water has specific properties;<br>c) thermal energy has a role in phase changes;<br>d) water has a role in weathering;<br>e) large bodies of water moderate climate; and | • Raindrops and Ranges | • Water Works |

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| | f) water is important for agriculture, power generation, and public health. | | |
| 6.8 | The student will investigate and understand that land and water have roles in watershed systems. Key ideas include<br>a) a watershed is composed of the land that drains into a body of water;<br>b) Virginia is composed of multiple watershed systems which have specific features;<br>c) the Chesapeake Bay is an estuary that has many important functions; and<br>d) natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system. | | • Watershed<br>• Water Wings<br>• Watered Down History<br>• Net Gain, Net Effect<br>• Facts and Falsehoods |
| 6.9 | The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment. Key ideas include<br>a) natural resources are important to protect and maintain;<br>b) renewable and nonrenewable resources can be managed;<br>c) major health and safety issues are associated with air and water quality;<br>d) major health and safety issues are related to different forms of energy;<br>e) preventive measures can protect land-use and reduce environmental hazards; and<br>f) there are cost/benefit tradeoffs in conservation policies. | • *Lights Out*<br>• *Wildlife and the Environment : Community Survey*<br>• *Bat Blitz*<br>• *The Power of Planning* | • *Alice in Waterland*<br>• *What's In The Air?*<br>• *Urban Waterway Checkup*<br>• *Water Works* |

| Life Science | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| LS.5 | The student will investigate and understand that biotic and abiotic factors affect an ecosystem. Key ideas include<br>a) matter moves through ecosystems via the carbon, water, and nitrogen cycles;<br>b) energy flow is represented by food webs and energy pyramids; and<br>c) relationships exist among producers, consumers, and decomposers. | • *Eco-Enrichers*<br>• *Trophic Transfer* | • *Micro Odyssey* |
| LS.6 | The student will investigate and understand that populations in a biological community interact and are interdependent. Key ideas include<br>a) relationships exist between predators and prey and these relationships are modeled in food webs;<br>b) the availability and use of resources may lead to competition and cooperation;<br>c) symbiotic relationships support the survival of different species; and<br>d) the niche of each organism supports survival. | • *Good Buddies*<br>• Water Mileage<br>• Which Niche? | • *Blue Ribbon Niche*<br>• *Gone Fishing* |
| LS.7 | The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include<br>a) biotic and abiotic factors define land, marine, and freshwater ecosystems; and<br>b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem. | • Water Mileage<br>• Adaptation Artistry<br>• Muskox Maneuvers | • *Where have all the Salmon Gone?* |
| LS.8 | The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time. Key ideas include<br>a) organisms respond to daily, seasonal, and long-term changes;<br>b) changes in the environment may increase or decrease population size; and<br>c) large-scale changes such as eutrophication, climate changes, and catastrophic disturbances affect ecosystems. | • *Phenology at Play*<br>• *Raindrops and Ranges*<br>• *Time Lapse* | • *Pond Succession* |

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| LS.9 | The student will investigate and understand that relationships exist between ecosystem dynamics and human activity. Key ideas include<br>a) changes in habitat can disturb populations;<br>b) disruptions in ecosystems can change species competition; and<br>c) variations in biotic and abiotic factors can change ecosystems. | • Habitat Circles<br>• Ecosystem Architects<br>• Changing the Land<br>• Migration Barriers | • *To Dam or Not to Dam*<br>• *Dam Design* |
| LS.10 | The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key ideas include<br>a) DNA has a role in making proteins that determine organism traits;<br>b) the role of meiosis is to transfer traits to the next generation; and<br>c) Punnett squares are mathematical models used to predict the probability of traits in offspring. | • *Bottleneck Genes* | • *Eat and Glow* |
| LS.11 | The student will investigate and understand that populations of organisms can change over time. Key ideas include<br>a) mutation, adaptation, natural selection, and extinction change populations;<br>b) the fossil record, genetic information, and anatomical comparisons provide evidence for evolution; and<br>c) environmental factors and genetic variation, influence survivability and diversity of organisms. | • *Here Today, Gone Tomorrow*<br>• *Bottleneck Genes*<br>• *Back from the Brink* | |

| Physical Science | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| PS.5 | The student will investigate and understand that energy is conserved. Key ideas include<br>a) energy can be stored in different ways;<br>b) energy is transferred and transformed; and<br>c) energy can be transformed to meet societal needs. | • *Light's Out*<br>• *The Power of Planning* | |

| Earth Science | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| ES.6 | The student will investigate and understand that resource use is complex. Key ideas include<br>a) global resource use has environmental liabilities and benefits;<br>b) availability, renewal rates, and economic effects are considerations when using resources;<br>c) use of Virginia resources has an effect on the environment and the economy; and<br>d) all energy sources have environmental and economic effects. | • *The Power of Planning*<br>• *To Zone or Not to Zone* | • *Living Research: Aquatic Heroes & Heroines*<br>• *Dragonfly Pond*<br>• *To Dam or Not to Dam*<br>• *Net Gain Net Effect*<br>• *Sea Turtle International*<br>• *Plastic Voyages* |
| ES.8 | The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include<br>a) water influences geologic processes including soil development and karst topography;<br>b) the nature of materials in the subsurface affect the water table and future availability of fresh water;<br>c) weather and human usage affect freshwater resources, including water locations, quality, and supply; and<br>d) stream processes and dynamics affect the major watershed systems in Virginia, including the Chesapeake Bay and its tributaries. | • *Rainfall and Ranges* | • *Watershed*<br>• *Where Does Water Run?* |
| ES.10 | The student will investigate and understand that oceans are complex, dynamic systems and are subject to long- and short-term variations. Key ideas include<br>a) chemical, biological, and physical changes affect the oceans;<br>b) environmental and geologic occurrences affect ocean dynamics; | | • *Conservation messaging*<br>• *Plastic Voyages* |

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| c) unevenly distributed heat in the oceans drives much of Earth's weather;<br>d) features of the sea floor reflect tectonic and other geological processes; and<br>e) human actions, including economic and public policy issues, affect oceans and the coastal zone including the Chesapeake Bay. | | • *Sea Turtles international* |

| Biological Science | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| BIO.5 | The student will investigate and understand that there are common mechanisms for inheritance. Key ideas include<br>a) DNA has structure and is the foundation for protein synthesis;<br>b) the structural model of DNA has developed over time;<br>c) the variety of traits in an organism are the result of the expression of various combinations of alleles;<br>d) meiosis has a role in genetic variation between generations; and<br>e) synthetic biology has biological and ethical implications. | • *Bottleneck Genes* | |
| BIO.7 | The student will investigate and understand that populations change through time. Key ideas include<br>a) evidence is found in fossil records and through DNA analysis;<br>b) genetic variation, reproductive strategies, and environmental pressures affect the survival of populations;<br>c) natural selection is a mechanism that leads to adaptations and may lead to the emergence of new species; and<br>d) biological evolution has scientific evidence and explanations. | • *Back from the Brink*<br>• *Bottleneck Genes* | • *Eat and Glow (indirect)* |
| BIO.8 | The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include<br>a) interactions within and among populations include carrying capacities, limiting factors, and growth curves;<br>b) nutrients cycle with energy flow through ecosystems;<br>c) ecosystems have succession patterns; and<br>d) natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia. | • *Turkey Tallies*<br>• *Carrying Capacity*<br>• *Checks and Balances*<br>• *Changing the Land*<br>• *Environmental Barometer*<br>• *Phenology at Play* | • *Where Have All The Salmon Gone*<br>• *Watershed*<br>• *The Glass Menagerie* |

| Environmental Science Guidelines | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| ENV.2 | The student will investigate and understand that matter and energy move within and among Earth's systems.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how Earth is a system composed of interacting components.<br>b) Explain the importance of the properties and characteristics of water in supporting life processes and Earth systems.<br>c) Develop and use a model to explain how biogeochemical processes support life and demonstrate the conservation of matter and energy.<br>d) Develop and use a model of Earth's energy budget to predict how fluctuations and changes in the budget might affect Earth's ability to sustain life. | • *Raindrops and Range*<br>• *Fire Ecologies*<br>• *Eco-Enrichers* | • *Where Does Water Run*<br>• *What's in the Water*<br>• *Watershed*<br>• *How Wet is Our Planet*<br>• *The Glass Menagerie*<br>• *Water Works* |
| ENV.3 | The student will investigate and understand that processes and systems lead to changes on Earth's surface.<br>Demonstration of the essential knowledge and practices includes:<br>a) Plan and conduct an investigation on the effect of processes on Earth's surface.<br>b) Develop and use a model to explain how processes of the rock cycle change Earth's surface.<br>c) Make, support, and evaluate a claim about how natural processes and human activities have changed Earth's surface. | • *Ecosystem Architects* | • *Where Have All the Salmon Gone*<br>• *Watersheds*<br>• *To Dam or Not to Dam*<br>• *Where Does Water Run?* |

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| ENV.4 | The student will investigate and understand that ecosystems are in a state of dynamic equilibrium that is affected by complex biotic and abiotic interactions.<br>Demonstration of the essential knowledge and practices includes:<br>a) Compare biotic and abiotic factors in terrestrial and aquatic ecosystems.<br>b) Describe the ecological role that an organism plays in supporting the overall sustainability of the ecosystem.<br>c) Make, support, and evaluate a claim about the ecological roles of different categories of species in maintaining or disrupting ecosystem equilibrium.<br>d) Predict the effect caused by the introduction of an invasive species on the equilibrium of an ecosystem.<br>e) Develop and use models to predict the effects of energy and matter transfer in ecosystems.<br>f) Make, support, and evaluate a claim about how energy and matter is conserved in ecosystems.<br>g) Make, support, and evaluate a claim about how environmental pressures may lead to shifts in ecosystem equilibrium.<br>h) Explain how ecosystems change over time through succession and how this affects ecosystem dynamics.<br>i) Predict the effect of natural processes and human activities on Virginia's biodiversity and ecosystem equilibrium. | • *Environmental Barometer*<br>• *Deer Dilemma*<br>• *Carrying Capacity*<br>• *Bottleneck Genes*<br>• *Good Buddies*<br>• *Which Niche?*<br>• *Ecosystem Architects*<br>• *Birds of Prey*<br>• *World Travelers* | • *Blue Ribbon Niche*<br>• *Eat and Glow*<br>• *The Glass Menagerie*<br>• *Water Canaries*<br>• *Migration Headache*<br>• *To Dam or Not to Dam*<br>• *Where have all the Salmon Gone?* |
| ENV.5 | The student will investigate and understand that changes in population affect biodiversity and ecosystem success.<br>Demonstration of the essential knowledge and practices includes:<br>a) Analyze and interpret population growth curves to identify changes in population size.<br>b) Make, support, and evaluate a claim about the relationship among limiting factors, population size, and carrying capacity.<br>c) Make, support, and evaluate a claim about the importance of genetic variation on the biodiversity of an ecosystem.<br>d) Develop and use a model to explain how species diversity is affected by environmental pressures.<br>e) Explain how human population growth changed over time as a result of various factors and predict the effect of continued growth on the environment. | • *Birds of Prey*<br>• *Oh Deer*<br>• *Bottleneck Genes* | • |
| ENV.6 | The student will investigate and understand that Earth's resources are finite and should be conserved.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how sustainable and unsustainable natural resources affect organisms.<br>b) Compare geologic and chemical processes that are responsible for filtering, cycling, and storing Earth's freshwater resources.<br>c) Debate advantages and disadvantages of a sustainable practice in a community, in a home, and as an individual.<br>d) Make, support, and evaluate a claim about how human activities affect Earth's resources.<br>e) Compare environmental effects related to the various energy sources in Virginia. | • *The Power of Planning*<br>• *Deer Crossing*<br>• *Food Footprint*<br>• *Sustainability: Then, Now Late*<br>• *To Zone or Not to Zone*<br>• *Wildlife and the Environment: Community Survey*<br>• *Pay to Play*<br>• *Turkey Tallies*<br>• *Carrying Capacity*<br>• *Checks and Balances*<br>• *Changing the Land*<br>• *Habitat Heroes* | • *Fishable Waters*<br>• *Where have all the Salmon Gone?*<br>• *Watered Down History*<br>• *Net Gain, Net Effect*<br>• *Conservation Messaging*<br>• *Living Research*<br>• *Urban Waterway Cleanup*<br>• *Dragonfly Pond*<br>• *Migration Headache*<br>• *Conservation Messaging*<br>• *Dragonfly Pond*<br>• *To Dam or Not to Dam*<br>• *Dam Design* |

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| ENV.7 | The student will investigate and understand that pollutants have physical, chemical, and biological consequences at the local, regional, and global level.<br>Demonstration of the essential knowledge and practices includes:<br>a) Use data to identify a land, water, or atmospheric pollutant in the local community and determine possible sources and effects on the environment.<br>b) Debate advantages and disadvantages of solutions to safely reduce, eliminate, or remediate a land, water, or atmospheric pollutant.<br>c) Compare the benefits and limitations of remediation methods used with land, water, and atmospheric pollutants.<br>d) Research a clean-up plan for a designated Environmental Protection Agency Superfund site. | • *The Power of Planning*<br>• *Lights Out* | • *What's in the Water?*<br>• *What's in the Air?*<br>• *Plastic Voyages*<br>• *Dragonfly Pond*<br>• *The Glass Menagerie*<br>• *Ecosystem Architects*<br>• *No Water Off a Ducks Back*<br>• *To Dam or Not to Dam*<br>• *Dam Design* |
| ENV.8 | The student will investigate and understand that natural events and human activities affect global climate change.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how human activities affect global climate change.<br>b) Compare the effects of natural events and human activities on global climate change.<br>c) Develop and use a model to explain how changes in global temperature affect a specific ecosystem.<br>d) Make, support, and evaluate a claim about how climate change affects Virginia communities.<br>e) Research ways to mitigate greenhouse gas emissions and propose solutions to reduce emissions in the school, home, and community. | • *Phenology at Play*<br>• *Raindrops and Ranges* | • |
| ENV.9 | The student will investigate and understand that individual and collective actions influence environmental sustainability and policy at local, national, and global levels.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how consumer, corporation, and government choices can affect the environment.<br>b) Compare the priorities of multiple stakeholders involved in an environmental issue that affects global and/or local ecosystem health.<br>c) Debate advantages and disadvantages of possible solutions to an environmental problem.<br>d) Research solutions that reduce effects of human activities on natural systems and propose solutions for school, home, and community to reduce these effects.<br>e) Explain the roles individuals and communities as well as local, national, and global policies play in mitigating the negative effects of human activities on the climate. | • *The Power of Planning*<br>• *Wildlife and the Environment: Community Survey*<br>• *To Zone or Not to Zone*<br>• *Wild Bill's Fate* | • *Sea Turtle International*<br>• *A Whale of an Issue*<br>• *Facts and Falsehoods*<br>• *To Dam or Not to Dam*<br>• *Dam Design* |

| Ecology Guidelines | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| EC.2 | The student will investigate and understand that biotic and abiotic factors affect the distribution of species and the diversity of life on Earth.<br>Demonstration of the essential knowledge and practices includes:<br>a) Compare the biotic and abiotic characteristics of Earth's principal terrestrial and aquatic biomes.<br>b) Make, support, and evaluate a claim about how characteristics of biomes affect biodiversity.<br>c) Plan and conduct a biosurvey to assess the health and condition of a circumscribed natural area.<br>d) Research a natural or anthropogenic threat, the issues that are causing the threat, and describe potential remediation strategies. | • *Environmental Barometer*<br>• *Deer Dilemma*<br>• *Carrying Capacity*<br>• *Ecosystem Architects* | • *Blue Ribbon Niche*<br>• *Eat and Glow*<br>• *The Glass Menagerie*<br>• *Water Canaries* |

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| | e) Make, support, and evaluate a claim about how the level of biodiversity influences ecosystem resilience and sustainability.<br>f) Research ways legislation and/or global agreements provide biodiversity protections.<br>g) Compare benefits and limitations of methods used to increase resilience and sustainability in a local ecosystem. | | |
| EC.3 | The student will investigate and understand that energy is transferred through ecosystems.<br>Demonstration of the essential knowledge and practices includes:<br>a) Explain how the laws of thermodynamics govern energy transfers through ecosystems.<br>b) Explain how changes in ecosystem factors affect energy transfer and ecological efficiency in a local ecosystem.<br>c) Make, support, and evaluate a claim about how strategies organisms use to acquire energy lead to biodiversity within ecosystems.<br>d) Make, support, and evaluate a claim about how nutrient cycling by decomposers affects energy transfer in ecosystems. | • *Back from the Brink*<br>• *Ecosystem Architects*<br>• *Fire Ecologies*<br>• *Bat Blitz* | • *Water Canaries*<br>• *Aquatic Roots*<br>• *Fishable Waters*<br>• *The Glass Menagerie* |
| EC.4 | The student will investigate and understand that matter flows through ecosystems.<br>Demonstration of the essential knowledge and practices includes:<br>a) Develop and use a model to explain the cycling of matter in ecosystems through biogeochemical cycles (carbon, nitrogen, water, and phosphorus).<br>b) Develop and use a model to explain how the movement of one nutrient affects an ecosystem.<br>c) Analyze and interpret data to predict how changes in the availability of resources will affect species' success in ecosystems.<br>d) Make, support, and evaluate a claim about how a disruption in a biogeochemical cycle affects an ecosystem.<br>e) Make, support, and evaluate a claim about how changes in resource availability affect the biodiversity of an ecosystem. | • *Raindrops and Range*<br>• *Fire Ecologies*<br>• *Eco-Enrichers* | • *Watershed*<br>• *How Wet is Our Planet*<br>• *The Glass Menagerie* |
| EC.5 | The student will investigate and understand that growth within populations is influenced by biotic and abiotic factors.<br>Demonstration of the essential knowledge and practices includes:<br>a) Explain how population growth and resource availability affect population dispersion.<br>b) Analyze data to determine the relationship between population density and resource availability.<br>c) Analyze data (age structure, r/K strategy, and survivorship curves) to evaluate the viability of a population.<br>d) Analyze a local ecosystem and categorize limiting factors<br>e) Analyze population growth curves to determine growth trends, identify limiting factors, and make predictions about future population behavior. | • *Turkey Tallies*<br>• *Carrying Capacity*<br>• *Checks and Balances*<br>• *Changing the Land*<br>• *Environmental Barometer*<br>• *Phenology at Play*<br>• *Dropping in on Deer*<br>• *Oh Deer!* | • *Where Have All The Salmon Gone*<br>• *Watershed*<br>• *The Glass Menagerie*<br>• *Hooks and Ladders*<br>• *Turtle Hurdles* |
| EC.6 | The student will investigate and understand that driving forces of ecological relationships support biodiversity.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how natural selection leads to adaptations in species and increases ecosystem biodiversity.<br>b) Describe the behavioral and physiological adaptations that plants and animals have developed to allow them to survive in diverse ecosystems.<br>c) Make, support, and evaluate a claim about the roles of adaptive and non-adaptive forces in speciation and biodiversity.<br>d) Research a real-world example of an organism's adaptation to an evolving environment.<br>e) Make, support, and evaluate a claim about how species interactions and adaptations are a response to selective pressures. | • *Adaptation Artistry*<br>• *A Home Away from Home*<br>• *Raindrops and Ranges*<br>• *Water Mileage*<br>• *Bottleneck Genes*<br>• *Good Buddies*<br>• *Which Niche?*<br>• *Ecosystem Architects*<br>• *Birds of Prey*<br>• *World Travelers*<br>• *Here today, Gone Tomorrow* | • *Micro-Odyssey*<br>• *Designing a Habitat*<br>• *Aquatic Roots*<br>• *Fashion a Fish*<br>• *Eat and Glow*<br>• *Migration Headache*<br>• *To Dam or Not to Dam*<br>• *Where have all the Salmon Gone?*<br>• *Water Canaries* |

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| | f) Research real-world structural and behavioral adaptations used by predators and prey for survival.<br>g) Make, support, and evaluate a claim about how ecological niches and resource partitioning affect interactions within communities.<br>h) Explain the role predation plays in population size within an ecosystem and differentiate forms of predation. | | |
| EC.7 | The student will investigate and understand that natural and anthropogenic events affect ecosystems.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about the ecological evolution of an ecosystem that is currently experiencing disruption.<br>b) Develop and use a model to explain ecological succession for a local ecosystem and predict the effect of natural and anthropogenic events on natural succession processes.<br>c) Make, support, and evaluate a claim about the effect of an invasive species on the stability of a local ecosystem.<br>d) Make, support, and evaluate a claim about how natural and anthropogenic events affect ecosystem resilience. | • *Eco-Enrichers*<br>• *A Dire Diet*<br>• *Checks and Balances*<br>• *The Power of Planning*<br>• *To Zone or Not to Zone*<br>• *Wildlife and the Environment: Community Survey*<br>• *Career Critters*<br>• *Bottleneck Genes*<br>• *Deer Dilemma*<br>• *A Dire Diet* | • *The Glass Menagerie*<br>• *To Dam or Not to Dam*<br>• *Dam Design*<br>• *Where Have All the Salmon Gone?*<br>• *What's in the Water?*<br>• *Fishable Waters*<br>• *Net Gain, Net Effect*<br>• *Sea Turtle International*<br>• *A Whale of an Issue*<br>• *Facts and Falsehoods*<br>• *Something's Fishy Here!*<br>• *Plastic Voyages* |

| Oceanography Guidelines | | Project WILD K-12 Guide | Aquatic WILD Guide |
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| OC.2 | The student will investigate and understand that ocean ecosystems support a great diversity of life.<br>Demonstration of the essential knowledge and practices includes:<br>a) Explain how biotic and abiotic factors affect biodiversity within marine ecosystems.<br>b) Make, support, and evaluate a claim about factors that promote and control the locations of primary productivity and its effect on ocean ecosystems.<br>c) Identify characteristics of major groups (kingdom, phylum, and class) of marine organisms.<br>d) Make, support, and evaluate a claim about how unique morphological features of marine organisms help them survive and thrive in their respective marine niches.<br>e) Explain the benefit of daily vertical migration for zooplankton and its effects on ocean ecosystems.<br>f) Develop and use a model to predict the transfer of energy within ocean ecosystems and predict the effects of natural and anthropogenic events on ecosystem health.<br>g) Compare the relative roles of chemosynthesis and photosynthesis in biological productivity of ocean ecosystems.<br>h) Debate advantages and disadvantages of a solution to a natural or anthropogenic threat to a marine organism. | • *Environmental Barometer*<br>• *Deer Dilemma*<br>• *Carrying Capacity*<br>• *Ecosystem Architects* | • *Blue Ribbon Niche*<br>• *Eat and Glow*<br>• *The Glass Menagerie*<br>• *Water Canaries*<br>• *Aquatic Roots*<br>• *Fishable Waters* |
| OC.3 | The student will investigate and understand that the properties of seawater enable distinct biological and physical characteristics within the ocean and ecosystems.<br>Demonstration of the essential knowledge and practices includes:<br>a) Explain how the properties of seawater (pH, dissolved oxygen, turbidity, density, and salinity) affect biodiversity in ocean ecosystems. | | • *The Glass Menagerie* |

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| | b) Plan and conduct an investigation to determine how salinity affects density of water.<br>c) Make, support, and evaluate a claim about the relationship between the density and depth of seawater.<br>d) Explain how the relationships among temperature, density, depth, and salinity can be used to predict effects on ocean currents.<br>e) Explain how the properties of the thermocline, halocline, and pycnocline create distinct ecosystems.<br>f) Describe the variation of the transmission of light through zones of the ocean and determine biological adaptations that allow organisms to survive within each zone.<br>g) Analyze data to understand the relationship among dissolved gases, temperature, and pressure with increasing depth and effects on marine life.<br>h) Develop and use a model to explain thermohaline circulation and the effect on ecosystems.<br>i) Plan and conduct an investigation that demonstrates the ocean's capacity to serve as a buffer and predict the effects of changing pH levels on marine ecosystems. | | |
| OC.7 | The student will investigate and understand that the ocean is of important social and economic value globally and in Virginia.<br>Demonstration of the essential knowledge and practices includes:<br>a) Make, support, and evaluate a claim about how the extraction of physical and biological resources from the ocean affects marine ecosystems.<br>b) Compare global consumerism to our national and local trends and explain these effects on Virginia, local coastal, and offshore environments.<br>c) Make, support, and evaluate a claim about the benefits and drawbacks of various uses of the ocean.<br>d) Research local and global issues, policies, and laws that promote responsible stewardship of the oceans.<br>e) Debate advantages and disadvantages of the law of the sea.<br>f) Design, evaluate, and refine a solution for reducing the effects of a natural event or a human activity on Virginia's ocean systems, shorelines, local communities, and on ecosystem biodiversity.<br>g) Make, support, and evaluate a claim about how continued coastal population growth in Virginia affects sustainability. | | • *Fishable Waters*<br>• *Where Have All the Salmon Gone?*<br>• *Edge of Home*<br>• *Water We Eating?*<br>• *Net Gain, Net Effect*<br>• *A Whale of an Issue*<br>• *Sea Turtles International* |

# Project WILD and Mathematics Skills

Many of the Project WILD Activities will assist in teaching mathematical skills found in the Virginia Standards of Learning objectives. See the Skills section in the back of the Project WILD guides for more information.

## *Graphing*

***Project WILD K-12 Guide***
Graphananimal (grades K-4)
Oh Deer (grades 5-8)
World Travelers (grades 5-8)
Limiting Factors: How Many Bears? (grades 5-8)
Birds of Prey (grades 9-12)
Bat Blitz (grades 5-8)
Phenology at Play (grades 7-12)

***Project WILD Aquatic Guide***
What's in the Water? (grades 5-8)
Where Have All the Salmon Gone? (grades 5-8)
Eat and Glow (grades 7-10)

## *Computation and Estimation*

***Project WILD K-12 Guide***
Checks and Balances (grades 5-8)
Food Footprint (grades 5-8)
No Water Off a Duck's Back (grades 5-8)
Water Mileage (grades 6-8)
Dropping in on Deer (grades 9-12)
Tropic Transfer (grades 5-8)

***Project WILD Aquatic Guide***
Puddle Wonders (grades 5-8)
Alice in Waterland (grades 5-8)
Water's Going On? (grades 5-8)
How Wet Is Our Planet? (grades 5-8)

## *Measurement*

***Project WILD K-12 Guide***
Dropping In On Deer (grades 9-12)

***Project WILD Aquatic Guide***
Puddle Wonders (grades 5-8)
Whale of a Tail (grades 5-8)
Watershed (grades 5-8)
How Wet Is Our Planet? (grades 5-8)
Where Does Water Run? (grades 5-8)

## *Percentages*

***Project WILD K-12 Guide***
Food Footprint (grades 5-8)
Limiting Factors: How Many Bears? (grades 5-8)
Bat Blitz (grades 5-8)

***Project WILD Aquatic Guide***
How Wet Is Our Planet? (grades 5-8)

## *Geometry*

***Project WILD Aquatic Guide***
Puddle Wonders? (grades 5-8)
Where Does Water Run? (grades 5-8)

## *Data Collection*

***Project WILD K-12 Guide***
World Travelers (grades 5-8)
Bat Blitz (grades 5-8)
Keeping Cool (grades 3-5)

***Project WILD Aquatic Guide***
Net Gain, Net Effect (grades 5-8)
Water's Going On? (grades 5-8)
What's in the Air? (grades 5-8)
Eat and Glow (grades 7-10)

## *Exponential Growth Curves*

***Project WILD K-12 Guide***
Turkey Tallies (grades 9-12)