

# Project WILD and Aquatic WILD Guides

## Correlations to the 2018 Virginia Science Standards of Learning *and Science Guidelines*

The Project WILD Curriculum K-12 and Aquatic WILD Guides support the 2018 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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# 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 – 6<sup>th</sup> 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**

<b>Kindergarten</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
K.6	The student will investigate and understand that there are differences between living organisms and nonliving objects. Key ideas include a) all things can be classified as living or nonliving; and b) living organisms have certain characteristics that distinguish them from nonliving objects.	<ul style="list-style-type: none"> <li>• <i>My Kingdom for a Shelter</i></li> <li>• <i>Insect Inspection</i></li> <li>• <i>Ants on a Twig</i></li> </ul>	
K.7	The student will investigate and understand that plants and animals have basic needs and life processes. Key ideas include a) living things need adequate food, water, shelter, air, and space to survive; b) plants and animals have life cycles; and c) offspring of plants and animals are similar but not identical to their parents or to one another.	<ul style="list-style-type: none"> <li>• <i>My Kingdom for a Shelter</i></li> <li>• <i>What's That Habitat</i></li> <li>• <i>Ants on a Twig</i></li> <li>• <i>Seed Need</i> 🍃</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Are You Me?</i></li> <li>• <i>Water Safari</i></li> </ul>
K.9	The student will investigate and understand that there are patterns in nature. Key patterns include a) daily weather; b) seasonal changes; and c) day and night.	<ul style="list-style-type: none"> <li>• <i>Seed Need</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Are You Me?</i></li> <li>• <i>Water Plant Art</i></li> </ul>
K.10	The student will investigate and understand that change occurs over time. Key ideas include a) natural and human-made things change over time; b) living and nonliving things change over time; c) changes can be observed and measured; and d) changes may be fast or slow.	<ul style="list-style-type: none"> <li>• <i>Color Crazy</i></li> <li>• <i>What's That Habitat?</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Aqua Words</i></li> <li>• <i>Are You Me?</i> 🍃</li> </ul>
K.11	The student will investigate and understand that humans use resources. Key ideas include a) some materials and objects can be used over and over again; b) materials can be recycled; and c) choices we make impact the air, water, land and living things.	<ul style="list-style-type: none"> <li>• <i>What You Wear is What They Were</i></li> </ul>	

<b>First Grade</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
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 a) plants need nutrients, air, water, light, and a place to grow; b) structures of plants perform specific functions; and c) plants can be classified based on a variety of characteristics.	<ul style="list-style-type: none"> <li>• <i>Busy Bees, Busy Blooms</i> 🍃</li> <li>• <i>Seed Need</i> 🍃</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Water Plant Art</i> 🍃</li> </ul>
1.5	The student will investigate and understand that animals, including humans, have basic life needs that allow them to survive. Key ideas include a) animals need air, food, water, shelter, and space (habitat); b) animals have different physical characteristics that perform specific functions; and c) animals can be classified based on a variety of characteristics..	<ul style="list-style-type: none"> <li>• <i>Color Crazy</i> 🍃</li> <li>• <i>My Kingdom for a Shelter</i> 🍃</li> <li>• <i>Insect Inspection</i> 🍃</li> <li>• <i>What's That Habitat</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fashion A Fish</i></li> </ul>
1.7	The student will investigate and understand that there are weather and seasonal changes. Key ideas include a) changes in temperature, light, and precipitation occur over time; b) there are relationships between daily weather and the season; and c) changes in temperature, light, and precipitation affect plants and animals, including humans.	<ul style="list-style-type: none"> <li>• <i>What You Wear is What They Were</i> 🍃</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

1.8	<p>The student will investigate and understand that natural resources can be used responsibly. Key ideas include</p> <ul style="list-style-type: none"> <li>a) most natural resources are limited;</li> <li>b) human actions can affect the availability of natural resources; and</li> <li>c) reducing, reusing, and recycling are ways to conserve natural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• What You Wear is What They Were 🍃</li> </ul>	
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<b>Second Grade</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
2.4	<p>The student will investigate and understand that plants and animals undergo a series of orderly changes as they grow and develop. Key ideas include</p> <ul style="list-style-type: none"> <li>a) animals have life cycles; and</li> <li>b) plants have life cycles.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Limiting Factors: How Many Bears? (Procedure II)</i> 🍃</li> <li>• <i>Surprise Terrarium</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Are You Me?</i></li> </ul>
2.5	<p>The student will investigate and understand that living things are part of a system. Key ideas include</p> <ul style="list-style-type: none"> <li>a) plants and animals are interdependent with their living and nonliving surroundings;</li> <li>b) an animal's habitat provides all of its basic needs; and</li> <li>c) habitats change over time due to many influences.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>My Kingdom for a Shelter</i> 🍃</li> <li>• <i>Busy Bees, Busy Blooms</i></li> <li>• <i>What's That Habitat</i> 🍃</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Water Safari</i></li> </ul>
2.7	<p>The student will investigate and understand that weather patterns and seasonal changes affect plants, animals, and their surroundings. Key ideas include</p> <ul style="list-style-type: none"> <li>a) weather and seasonal changes affect the growth and behavior of living things;</li> <li>b) wind and weather can change the land; and</li> <li>c) changes can happen quickly or slowly over time.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>What Bear Goes Where</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Silt: A Dirty Word</i></li> </ul>
2.8	<p>The student will investigate and understand that plants are important natural resources. Key ideas include</p> <ul style="list-style-type: none"> <li>a) the availability of plant products affects the development of a geographic area;</li> <li>b) plants provide oxygen, homes, and food for many animals; and</li> <li>c) plants can help reduce the impact of wind and water.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>My Kingdom for a Shelter</i> 🍃</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Water Plant Art</i></li> </ul>

<b>Third Grade</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
3.4	<p>The student will investigate and understand that adaptations allow organisms to satisfy life needs and respond to the environment. Key ideas include</p> <ul style="list-style-type: none"> <li>a) populations may adapt over time;</li> <li>b) adaptations may be behavioral or physical; and</li> <li>c) fossils provide evidence about the types of organisms that lived long ago as well as the nature of their environments.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Adaptation Artistry</i> 🍃</li> <li>• <i>Tracks</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Designing a Habitat</i> 🍃</li> <li>• <i>Marsh Munchers</i></li> <li>• <i>Fashion A Fish</i></li> <li>• <i>Sockeye Scents</i></li> <li>• <i>Gone Fishing</i></li> </ul>
3.5	<p>The student will investigate and understand that aquatic and terrestrial ecosystems support a diversity of organisms. Key ideas include</p> <ul style="list-style-type: none"> <li>a) ecosystems are made of living and nonliving components of the environment; and</li> <li>b) relationships exist among organisms in an ecosystem.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Thicket Game</i> 🍃</li> <li>• <i>Owl Pellets</i> 🍃</li> <li>• <i>Quick Frozen Critters</i></li> <li>• <i>Which Niche?</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Marsh Munchers</i> 🍃</li> <li>• <i>Fishy Who's Who</i></li> <li>• <i>Edge of Home</i></li> </ul>
3.6	<p>The student will investigate and understand that soil is important in ecosystems. Key ideas include</p> <ul style="list-style-type: none"> <li>a) soil, with its different components, is important to organisms; and</li> <li>b) soil provides support and nutrients necessary for plant growth.</li> </ul>		<ul style="list-style-type: none"> <li>• <i>Silt a Dirty Word</i></li> </ul>
3.7	<p>The student will investigate and understand that there is a water cycle and water is important to life on Earth. Key ideas include</p> <ul style="list-style-type: none"> <li>a) there are many reservoirs of water on Earth;</li> <li>b) the energy from the sun drives the water cycle; and</li> <li>c) the water cycle involves specific processes.</li> </ul>		<ul style="list-style-type: none"> <li>• <i>Aqua Words</i></li> <li>• <i>Got Water?</i></li> <li>• <i>Water Wings</i> 🍃</li> <li>• <i>Alice in Waterland</i> 🍃</li> </ul>
3.8	<p>The student will investigate and understand that natural events and humans influence ecosystems. Key ideas include</p>	<ul style="list-style-type: none"> <li>• <i>Environmental Barometer</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Silt is a Dirty Word</i></li> <li>• <i>Water Works</i> 🍃</li> </ul>

<ul style="list-style-type: none"> <li>a) human activity affects the quality of air, water, and habitats;</li> <li>b) water is limited and needs to be conserved;</li> <li>c) fire, flood, disease, and erosion affect ecosystems; and</li> <li>d) soil is a natural resource and should be conserved.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Habitat Circles</i></li> <li>• <i>Urban Nature Search</i></li> </ul>	
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Fourth Grade		Project WILD K-12 Guide	Aquatic WILD Guide
4.2	<p>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</p> <ul style="list-style-type: none"> <li>a) the survival of plants and animals depends on photosynthesis;</li> <li>b) plants and animals have different structures and processes for obtaining energy; and</li> <li>c) plants and animals have different structures and processes for creating offspring.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Trophic Transfer</i> </li> <li>• <i>Busy Bees, Busy Blooms</i> </li> <li>• <i>Seed Need</i></li> <li>• <i>Quick Frozen Critters</i></li> <li>• <i>Keeping Cool</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Sockeye Scents</i></li> <li>• <i>Turtle Hurdles</i></li> </ul>
4.3	<p>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</p> <ul style="list-style-type: none"> <li>a) interrelationships exist in populations, communities, and ecosystems;</li> <li>b) food webs show the flow of energy within an ecosystem;</li> <li>c) changes in an organism's niche and habitat may occur at various stages in its life cycle; and</li> <li>d) classification can be used to identify organisms.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Which Niche?</i> </li> <li>• <i>Interview A Spider</i></li> <li>• <i>Monarch Marathon</i></li> <li>• <i>Adaptation Artistry</i></li> <li>• <i>Keeping Cool</i></li> <li>• <i>Career Critters</i> </li> </ul>	<ul style="list-style-type: none"> <li>• <i>Edge of Home</i></li> <li>• <i>Designing a Habitat</i></li> <li>• <i>Fashion a Fish</i></li> <li>• <i>Got Water?</i></li> </ul>
4.8	<p>The student will investigate and understand that Virginia has important natural resources. Key resources include</p> <ul style="list-style-type: none"> <li>a) watersheds and water;</li> <li>b) plants and animals;</li> <li>c) minerals, rocks, and ores; and</li> <li>d) forests, soil, and land.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>What's Wild</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fishy Who's Who</i></li> <li>• <i>Water Plant Art</i></li> <li>• <i>Blue Ribbon Niche</i></li> <li>• <i>Silt – A Dirty Word</i> </li> </ul>

Fifth Grade		Project WILD K-12 Guide	Aquatic WILD Guide
5.2	<p>The student will investigate and understand that energy can take many forms. Key ideas include</p> <ul style="list-style-type: none"> <li>a) energy is the ability to do work or to cause change;</li> <li>b) there are many different forms of energy;</li> <li>c) energy can be transformed; and</li> <li>d) energy is conserved.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Trophic Transfer</i></li> </ul>	
5.9	<p>The student will investigate and understand that the conservation of energy resources is important. Key ideas include</p> <ul style="list-style-type: none"> <li>a) some sources of energy are considered renewable and others are not;</li> <li>b) individuals and communities have means of conserving both energy and matter; and</li> <li>c) advances in technology improve the ability to transfer and transform energy.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Trophic Transfer</i></li> <li>• <i>Lights Out</i> </li> <li>• <i>Sustainability: Then, Now, Later</i> </li> </ul>	

Sixth Grade		Project WILD K-12 Guide	Aquatic WILD Guide
6.6	<p>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</p> <ul style="list-style-type: none"> <li>a) water is referred to as the universal solvent;</li> <li>b) water has specific properties;</li> <li>c) thermal energy has a role in phase changes;</li> <li>d) water has a role in weathering;</li> <li>e) large bodies of water moderate climate; and</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Raindrops and Ranges</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Water Works</i></li> </ul>

	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 a) a watershed is composed of the land that drains into a body of water; b) Virginia is composed of multiple watershed systems which have specific features; c) the Chesapeake Bay is an estuary that has many important functions; and d) natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system.		<ul style="list-style-type: none"> <li>• Watershed</li> <li>• Water Wings</li> <li>• Watered Down History</li> <li>• Net Gain, Net Effect</li> <li>• Facts and Falsehoods</li> </ul>
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 a) natural resources are important to protect and maintain; b) renewable and nonrenewable resources can be managed; c) major health and safety issues are associated with air and water quality; d) major health and safety issues are related to different forms of energy; e) preventive measures can protect land-use and reduce environmental hazards; and f) there are cost/benefit tradeoffs in conservation policies.	<ul style="list-style-type: none"> <li>• <i>Lights Out</i></li> <li>• <i>Wildlife and the Environment : Community Survey</i></li> <li>• <i>Bat Blitz</i></li> <li>• <i>The Power of Planning</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Alice in Waterland</i></li> <li>• <i>What's In The Air?</i></li> <li>• <i>Urban Waterway Checkup</i></li> <li>• <i>Water Works</i></li> </ul>

	<b>Life Science</b>	<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
LS.5	The student will investigate and understand that biotic and abiotic factors affect an ecosystem. Key ideas include a) matter moves through ecosystems via the carbon, water, and nitrogen cycles; b) energy flow is represented by food webs and energy pyramids; and c) relationships exist among producers, consumers, and decomposers.	<ul style="list-style-type: none"> <li>• <i>Eco-Enrichers</i></li> <li>• <i>Trophic Transfer</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Micro Odyssey</i></li> </ul>
LS.6	The student will investigate and understand that populations in a biological community interact and are interdependent. Key ideas include a) relationships exist between predators and prey and these relationships are modeled in food webs; b) the availability and use of resources may lead to competition and cooperation; c) symbiotic relationships support the survival of different species; and d) the niche of each organism supports survival.	<ul style="list-style-type: none"> <li>• <i>Good Buddies</i></li> <li>• <i>Water Mileage</i></li> <li>• <i>Which Niche?</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Blue Ribbon Niche</i></li> <li>• <i>Gone Fishing</i></li> </ul>
LS.7	The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include a) biotic and abiotic factors define land, marine, and freshwater ecosystems; and b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem.	<ul style="list-style-type: none"> <li>• <i>Water Mileage</i></li> <li>• <i>Adaptation Artistry</i></li> <li>• <i>Muskox Maneuvers</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where have all the Salmon Gone?</i></li> </ul>
LS.8	The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time. Key ideas include a) organisms respond to daily, seasonal, and long-term changes; b) changes in the environment may increase or decrease population size; and c) large-scale changes such as eutrophication, climate changes, and catastrophic disturbances affect ecosystems.	<ul style="list-style-type: none"> <li>• <i>Phenology at Play</i></li> <li>• <i>Raindrops and Ranges</i></li> <li>• <i>Time Lapse</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Pond Succession</i></li> </ul>

LS.9	The student will investigate and understand that relationships exist between ecosystem dynamics and human activity. Key ideas include a) changes in habitat can disturb populations; b) disruptions in ecosystems can change species competition; and c) variations in biotic and abiotic factors can change ecosystems.	<ul style="list-style-type: none"> <li>Habitat Circles</li> <li>Ecosystem Architects</li> <li>Changing the Land</li> <li>Migration Barriers</li> </ul>	<ul style="list-style-type: none"> <li><i>To Dam or Not to Dam</i></li> <li><i>Dam Design</i></li> </ul>
LS.10	The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key ideas include a) DNA has a role in making proteins that determine organism traits; b) the role of meiosis is to transfer traits to the next generation; and c) Punnett squares are mathematical models used to predict the probability of traits in offspring.	<ul style="list-style-type: none"> <li><i>Bottleneck Genes</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Eat and Glow</i></li> </ul>
LS.11	The student will investigate and understand that populations of organisms can change over time. Key ideas include a) mutation, adaptation, natural selection, and extinction change populations; b) the fossil record, genetic information, and anatomical comparisons provide evidence for evolution; and c) environmental factors and genetic variation, influence survivability and diversity of organisms.	<ul style="list-style-type: none"> <li><i>Here Today, Gone Tomorrow</i></li> <li><i>Bottleneck Genes</i></li> <li><i>Back from the Brink</i></li> </ul>	

Physical Science		Project WILD K-12 Guide	Aquatic WILD Guide
PS.5	The student will investigate and understand that energy is conserved. Key ideas include a) energy can be stored in different ways; b) energy is transferred and transformed; and c) energy can be transformed to meet societal needs.	<ul style="list-style-type: none"> <li><i>Light's Out</i></li> <li><i>The Power of Planning</i></li> </ul>	

Earth Science		Project WILD K-12 Guide	Aquatic WILD Guide
ES.6	The student will investigate and understand that resource use is complex. Key ideas include a) global resource use has environmental liabilities and benefits; b) availability, renewal rates, and economic effects are considerations when using resources; c) use of Virginia resources has an effect on the environment and the economy; and d) all energy sources have environmental and economic effects.	<ul style="list-style-type: none"> <li><i>The Power of Planning</i></li> <li><i>To Zone or Not to Zone</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Living Research: Aquatic Heroes &amp; Heroines</i></li> <li><i>Dragonfly Pond</i></li> <li><i>To Dam or Not to Dam</i></li> <li><i>Net Gain Net Effect</i></li> <li><i>Sea Turtle International</i></li> <li><i>Plastic Voyages</i></li> </ul>
ES.8	The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include a) water influences geologic processes including soil development and karst topography; b) the nature of materials in the subsurface affect the water table and future availability of fresh water; c) weather and human usage affect freshwater resources, including water locations, quality, and supply; and d) stream processes and dynamics affect the major watershed systems in Virginia, including the Chesapeake Bay and its tributaries.	<ul style="list-style-type: none"> <li><i>Rainfall and Ranges</i></li> </ul>	<ul style="list-style-type: none"> <li><i>Watershed</i></li> <li><i>Where Does Water Run?</i></li> </ul>
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 a) chemical, biological, and physical changes affect the oceans; b) environmental and geologic occurrences affect ocean dynamics;		<ul style="list-style-type: none"> <li><i>Conservation messaging</i></li> <li><i>Plastic Voyages</i></li> </ul>

<ul style="list-style-type: none"> <li>c) unevenly distributed heat in the oceans drives much of Earth's weather;</li> <li>d) features of the sea floor reflect tectonic and other geological processes; and</li> <li>e) human actions, including economic and public policy issues, affect oceans and the coastal zone including the Chesapeake Bay.</li> </ul>		<ul style="list-style-type: none"> <li>• <i>Sea Turtles international</i></li> </ul>
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<b>Biological Science</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
BIO.5 The student will investigate and understand that there are common mechanisms for inheritance. Key ideas include <ul style="list-style-type: none"> <li>a) DNA has structure and is the foundation for protein synthesis;</li> <li>b) the structural model of DNA has developed over time;</li> <li>c) the variety of traits in an organism are the result of the expression of various combinations of alleles;</li> <li>d) meiosis has a role in genetic variation between generations; and</li> <li>e) synthetic biology has biological and ethical implications.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Bottleneck Genes</i></li> </ul>		
BIO.7 The student will investigate and understand that populations change through time. Key ideas include <ul style="list-style-type: none"> <li>a) evidence is found in fossil records and through DNA analysis;</li> <li>b) genetic variation, reproductive strategies, and environmental pressures affect the survival of populations;</li> <li>c) natural selection is a mechanism that leads to adaptations and may lead to the emergence of new species; and</li> <li>d) biological evolution has scientific evidence and explanations.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Back from the Brink</i> 🟢</li> <li>• <i>Bottleneck Genes</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Eat and Glow (indirect)</i></li> </ul>	
BIO.8 The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include <ul style="list-style-type: none"> <li>a) interactions within and among populations include carrying capacities, limiting factors, and growth curves;</li> <li>b) nutrients cycle with energy flow through ecosystems;</li> <li>c) ecosystems have succession patterns; and</li> <li>d) natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Turkey Tallies</i> 🟢</li> <li>• <i>Carrying Capacity</i></li> <li>• <i>Checks and Balances</i></li> <li>• <i>Changing the Land</i></li> <li>• <i>Environmental Barometer</i></li> <li>• <i>Phenology at Play</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where Have All The Salmon Gone</i></li> <li>• <i>Watershed</i></li> <li>• <i>The Glass Menagerie</i></li> </ul>	

<b>Environmental Science Guidelines</b>		<b>Project WILD K-12 Guide</b>	<b>Aquatic WILD Guide</b>
ENV.2 The student will investigate and understand that matter has fundamental properties and interactions. Key content includes <ul style="list-style-type: none"> <li>a) all things are made up of atoms and elements;</li> <li>b) atoms and elements can interact in different ways and can be expressed as different types of chemical reactions;</li> <li>c) chemical processes involve energy</li> <li>d) the law of conservation of energy and matter applies to all closed systems;</li> <li>e) water has unique properties and characteristics which plays a critical role in the environment; and</li> <li>f) the distribution and movement of water across the Earth affects the biosphere, hydrosphere, lithosphere, and atmosphere.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Raindrops and Range</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where Does Water Run</i></li> <li>• <i>What's in the Water</i></li> <li>• <i>Watershed</i></li> <li>• <i>How Wet is Our Planet</i></li> </ul>	
ENV.3 The student will investigate and understand how matter flows in the fundamental processes of Earth systems. Key content includes <ul style="list-style-type: none"> <li>a) the movement of atoms and elements through the biosphere, lithosphere, hydrosphere, and atmosphere as biogeochemical processes to include the carbon, oxygen, nitrogen, and water cycles;</li> <li>b) the atmosphere, lithosphere, and hydrosphere each have processes through which matter flows; and</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fire Ecologies</i></li> <li>• <i>Eco-Enrichers</i> 🟢</li> </ul>	<ul style="list-style-type: none"> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Water Works</i></li> <li>• <i>Where Does Water Run?</i></li> </ul>	

	c) interrelationships exist among the atmosphere, geosphere, anthrosphere, and the hydrosphere.		
ENV.4	The student will investigate and understand that major ongoing processes and systems leads to the formation and change of the Earth's surface. Key content includes a) water, living things, and rock processes impact the shape of landforms; b) physical processes such as erosion and the rock cycle lead to the formation of distinctive landforms; c) plate tectonic theory explains Earth's internal and external geologic processes; and d) both natural and manmade events may alter the Earth's land surface.	<ul style="list-style-type: none"> <li>• <i>Ecosystem Architects</i> </li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where Have All the Salmon Gone</i></li> <li>• <i>Watersheds</i></li> <li>• <i>To Dam or Not to Dam</i></li> <li>• <i>Where Does Water Run?</i></li> </ul>
ENV.5	The student will investigate and understand that the Earth is one interconnected system through which energy and matter flow. Key content includes a) Earth's terrestrial and aquatic biomes have distinct characteristics and components; b) an ecosystem is composed of both biotic and abiotic factors; c) energy and matter flow within an ecosystem; d) the movement of energy through the living world to include food webs, food chains, trophic levels; and e) biotic and abiotic factors may limit population growth in a given area (carrying capacity).	<ul style="list-style-type: none"> <li>• <i>Environmental Barometer</i></li> <li>• <i>Deer Dilemma</i></li> <li>• <i>Carrying Capacity</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Blue Ribbon Niche</i></li> <li>• <i>Eat and Glow</i></li> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Water Canaries</i></li> </ul>
ENV.6	The student will describe that stability and change impact both populations and ecosystems. Key content includes a) the Earth in a state of dynamic equilibrium; b) interactions exist between individuals and populations (i.e. commensalism, mutualism, parasitism, predation, and competition); c) factors such as birth, death, and migration rates determine growth rates in populations; d) genetic diversity and population size both play roles in the conservation of a species; e) natural processes such as succession, evolution, and extinction occur as a result of change in the environment; f) factors such as the introduction of an invasive species, loss of biodiversity, and catastrophic events influence patterns of ecological succession; g) changes in the hydrosphere, atmosphere, geosphere, or anthrosphere impact the biosphere; and h) biodiversity may lead to co-evolution in ecosystems.	<ul style="list-style-type: none"> <li>• <i>Bottleneck Genes</i></li> <li>• <i>Good Buddies</i></li> <li>• <i>Which Niche?</i></li> <li>• <i>Ecosystem Architects</i> </li> <li>• <i>Birds of Prey</i></li> <li>• <i>World Travelers</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Migration Headache</i></li> <li>• <i>To Dam or Not to Dam</i></li> <li>• <i>Where have all the Salmon Gone?</i></li> <li>• <i>Eat and Glow</i></li> </ul>
ENV.7	The student will investigate and understand that Earth's resources are finite. Key content includes a) certain resources are nonrenewable because they are replenished at timescales of thousands to millions of years; b) environmental and commercial benefits and drawbacks of different energy sources to include fossil fuels, biomass, wind, solar, geothermal, hydroelectric, and nuclear power.	<ul style="list-style-type: none"> <li>• <i>The Power of Planning</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>To Dam or Not to Dam</i></li> <li>• <i>Dam Design</i> </li> </ul>
ENV.8	The student will investigate and understand that Earth's resources should be conserved. Key content includes a) the trend in human consumption of energy will affect future availability of nonrenewable resources; b) the effects of natural and human-caused activities may either contribute to or challenge an ecologically sustainable environment; c) individuals can alter their own behavior to reduce their environmental impact; and	<ul style="list-style-type: none"> <li>• <i>Deer Crossing</i></li> <li>• <i>Food Footprint</i></li> <li>• <i>Sustainability: Then, Now Late</i></li> <li>• <i>The Power of Planning</i></li> <li>• <i>To Zone or Not to Zone</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Migration Headache</i></li> <li>• <i>What's in the Water?</i></li> <li>• <i>Net Gain, Net Effect</i></li> <li>• <i>Plastic Voyages</i></li> <li>• <i>Conservation Messaging</i></li> <li>• <i>Dragonfly Pond</i></li> </ul>

<p>d) availability of energy will affect society and human activities, such as transportation, agricultural systems, and manufacturing.</p>	<ul style="list-style-type: none"> <li>• <i>Wildlife and the Environment: Community Survey</i></li> </ul>	
<p>ENV.9 The student will investigate and understand how human actions impact the environment. Key content includes</p> <ol style="list-style-type: none"> <li>advantages and disadvantages of balancing short term interests with long term welfare of society;</li> <li>individual activities and decisions can have an impact on the environment;</li> <li>people affect their environment through the use of natural resources to include how agriculture, forestry, ranching, mining, urbanization, transportation, and commercial fishing impact the land, water, air, and organisms; and</li> <li>the allocation of state and federal lands impacts environmental decisions.</li> </ol>	<ul style="list-style-type: none"> <li>• <i>Pay to Play</i></li> <li>• <i>Turkey Tallies</i></li> <li>• <i>Carrying Capacity</i></li> <li>• <i>Checks and Balances</i></li> <li>• <i>Changing the Land</i></li> <li>• <i>Habitat Heroes</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fishable Waters</i></li> <li>• <i>Migration Headaches</i></li> <li>• <i>Where have all the Salmon Gone?</i></li> <li>• <i>Watered Down History</i></li> <li>• <i>Net Gain, Net Effect</i></li> <li>• <i>Conservation Messaging</i></li> <li>• <i>Living Research</i></li> <li>• <i>What's in the Air?</i></li> <li>• <i>Urban Waterway Cleanup</i></li> <li>• <i>Dragonfly Pond</i></li> </ul>
<p>ENV.10 The student will investigate and understand that pollution and waste management affect an ecosystem. Key content includes</p> <ol style="list-style-type: none"> <li>pollution and resource depletion have potential environmental implications at the local and global levels. These include air and water pollution, solid waste disposal, waste water disposal, depletion of the stratospheric ozone, global warming, and land uses;</li> <li>bioaccumulation and biomagnification directly affect organisms in a food chain or web;</li> <li>there are multiple ways to address pest management resulting in varied impacts on the environment; and</li> <li>different methods are used for remediation of land, air, and water pollution.</li> </ol>	<ul style="list-style-type: none"> <li>• <i>A Dire Diet</i></li> <li>• <i>Lights Out</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>What's in the Air</i></li> <li>• <i>What's in the Water</i></li> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Ecosystem Architects</i></li> <li>• <i>No Water Off a Ducks Back</i></li> </ul>
<p>ENV.11 The student will investigate and understand that global climate change is occurring. Key content includes</p> <ol style="list-style-type: none"> <li>scientific evidence such as changes in average global temperature, greenhouse gases, quantities of arctic and land ice, ocean temperature, ocean acidification, and sea level rise are indicators of climate change;</li> <li>there exists a relationship between global climate change and the frequency or magnitude of extreme weather events;</li> <li>sea level rise is currently affecting coastal areas of Virginia and will lead to the destruction of current habitats; and</li> <li>consequences of climate change will affect the biosphere on many levels including species migration and extinction, disease spread, and ecosystem health (e.g. bleaching corals and dying forests).</li> </ol>	<ul style="list-style-type: none"> <li>• <i>Phenology at Play</i></li> <li>• <i>Raindrops and Ranges</i></li> <li>• <i>Bottleneck Genes</i></li> <li>• <i>Birds of Prey</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Watershed</i></li> <li>• <i>Water We Eating?</i></li> <li>•</li> </ul>
<p>ENV.12 The student will investigate and understand that their actions as an environmentally literate citizen will play a role in environmental policies. Key content includes</p> <ol style="list-style-type: none"> <li>consumer choices in Virginia impact jobs, resources, pollution, and waste here and around the world;</li> <li>environmental justice is the study of the impact of environmental policy including resource allocation, pollution regulations, and waste disposal across all communities;</li> <li>political, legal, social, and economic decisions may affect global and local ecosystems;</li> <li>the media impacts public opinion and public policy;</li> <li>individuals and interest groups influence public policy;</li> </ol>	<ul style="list-style-type: none"> <li>• <i>Wildlife and the Environment: Community Survey</i></li> <li>• <i>To Zone or Not to Zone</i></li> <li>• <i>Wild Bill's Fate</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Sea Turtle International</i></li> <li>• <i>A Whale of an Issue</i></li> <li>• <i>Facts and Falsehoods</i></li> </ul>

<p>f) environmental decisions should include a cost-benefit analysis and may lead to trade-offs in conservation policy; and</p> <p>g) different methods are used by local, state, national, and international governments and organizations with varying results to protect the environment.</p>		
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Ecology Guidelines		Project WILD K-12 Guide	Aquatic WILD Guide
<p>Ec.2 The student will investigate and understand that Life History Theory allows for the prediction of an organisms development and behaviors. Key concepts include</p> <p>a) an organisms life history includes patterns of growth, development and reproduction; and</p> <p>b) patterns of life history (K-selection, r-selection)</p>	<ul style="list-style-type: none"> <li>• <i>Turkey Tallies</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fishy Who's Who</i></li> <li>• <i>Eat and Glow</i></li> </ul>	
<p>Ec.4 The student will investigate and understand that plants have evolved a variety of adaptations to survive, grow, and reproduce in the wide range of environmental conditions on Earth. Key environmental conditions include:</p> <p>a) quantities of reactants for photosynthesis;</p> <p>b) temperature;</p> <p>c) nutrient availability; and</p> <p>d) predators.</p>		<ul style="list-style-type: none"> <li>• <i>Micro-Odyssey</i></li> <li>• <i>Designing a Habitat</i></li> <li>• <i>Aquatic Roots</i></li> </ul>	
<p>Ec.5 The students will investigate and understand that animals have evolved a variety of adaptations to survive, grow, and reproduce in the diversity of environments existing on earth. Adaptations include:</p> <p>a) body size;</p> <p>b) acquiring and digesting food;</p> <p>c) oxygen absorption;</p> <p>d) maintaining temperature and water balance; and</p> <p>e) variations to light and temperature.</p>	<ul style="list-style-type: none"> <li>• <i>Adaptation Artistry</i></li> <li>• <i>A Home Away from Home</i></li> <li>• <i>Raindrops and Ranges</i></li> <li>• <i>Water Mileage</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fashion a Fish</i></li> <li>• <i>Eat and Glow</i></li> <li>•</li> </ul>	
<p>Ec.6 The student will investigate that different factors influence population density, dispersion, and demographics and use models as predictors of population growth. Key concepts include</p> <p>a) basic structure of ecological populations includes population distribution and population abundance;</p> <p>b) factors that regulate population growth include intraspecific competition in population growth and population density;</p> <p>c) limits to population growth include limiting factors, population density, and carrying capacity;</p> <p>d) population growth can be described as geometric or exponential;</p> <p>e) models are used to predict population growth; and</p> <p>f) the impact of rapid growth of human population is a source of environmental problems.</p>	<ul style="list-style-type: none"> <li>• <i>Turkey Tallies</i></li> <li>• <i>Carrying Capacity</i></li> <li>• <i>Checks and Balances</i></li> <li>• <i>Changing the Land</i></li> <li>• <i>Environmental Barometer</i></li> <li>• <i>Phenology at Play</i></li> <li>• <i>Dropping in on Deer</i></li> <li>• <i>Oh Deer!</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where Have All The Salmon Gone</i></li> <li>• <i>Watershed</i></li> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Hooks and Ladders</i></li> <li>• <i>Turtle Hurdles</i></li> </ul>	
<p>Ec.7 The student will investigate and understand that intraspecific interactions and natural selection have an impact on a population. Key ideas include</p> <p>a) there is intraspecific and interspecific competition;</p> <p>b) predation includes cryptic coloration, aposematic, Batesian mimicry, Mullerian mimicry herbivory; and</p> <p>c) organisms have symbiotic relationships.</p>	<ul style="list-style-type: none"> <li>• <i>Good Buddies</i></li> </ul>		
<p>Ec.8 The student will explore and analyze community structures and interactions. Key concepts include</p> <p>a) species interactions (e.g. predation, parasitism, mutualism, commensalism, and competition) and adaptations have evolved in response to interspecific selective pressures;</p>	<ul style="list-style-type: none"> <li>• <i>Bottleneck Genes</i></li> <li>• <i>Good Buddies</i></li> <li>• <i>Which Niche?</i></li> <li>• <i>Ecosystem Architects</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Migration Headache</i></li> <li>• <i>To Dam or Not to Dam</i></li> </ul>	

	<ul style="list-style-type: none"> <li>b) ecological niches and resource partitioning impact interactions;</li> <li>c) dominant, keystone, foundation, and endangered species have roles in ecosystems and communities, locally and globally;</li> <li>d) species diversity relates to the stability of ecosystems and communities; and</li> <li>e) ecological succession changes communities over time and may have an impact of disturbance on community composition.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Birds of Prey</i></li> <li>• <i>World Travelers</i></li> <li>• <i>Here today, Gone Tomorrow</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Where have all the Salmon Gone?</i></li> <li>• <i>Eat and Glow</i></li> <li>• <i>Water Canaries</i></li> </ul>
Ec.9	<p>The student will understand the that energy flow through an ecosystem. Key concepts include</p> <ul style="list-style-type: none"> <li>a) food chains, webs and pyramids model energy flow in ecosystems;</li> <li>b) primary productivity is important in ecosystems;</li> <li>c) efficiency of energy use is important;</li> <li>d) thermodynamic principles apply in an ecological system; and</li> <li>e) the stability of an ecosystem is related to the biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Back from the Brink</i></li> <li>• <i>Ecosystem Architects</i></li> <li>• <i>Fire Ecologies</i></li> <li>• <i>Bat Blitz</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Water Canaries</i></li> <li>• <i>Aquatic Roots</i></li> <li>• <i>Fishable Waters</i></li> <li>• <i>The Glass Menagerie</i></li> </ul>
Ec.10	<p>The student will investigate and understand that dead organic matter is crucial to the internal cycling of nutrients in an ecosystem. Key concepts include</p> <ul style="list-style-type: none"> <li>a) climate impacts the type of decomposers in an ecosystem; and</li> <li>b) rate of decomposition varies by organism and climate.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Eco-Enrichers</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>The Glass Menagerie</i></li> </ul>
Ec.11	<p>The student will investigate and understand the effect of human influence on an ecosystem. Key concepts include</p> <ul style="list-style-type: none"> <li>a) Humans influence the pattern of natural changes such as primary/secondary succession and desertification;</li> </ul>	<ul style="list-style-type: none"> <li>• <i>A Dire Diet</i></li> <li>• <i>Checks and Balances</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>To Dam or Not to Dam</i></li> <li>• <i>Dam Design</i></li> <li>• <i>Where Have All the Salmon Gone?</i></li> </ul>
Ec.12	<p>The student will analyze how biotic and abiotic factors interact to affect the distribution of species and the diversity of life on Earth. Key concepts include</p> <ul style="list-style-type: none"> <li>a) the biotic and abiotic components that define various biomes and aquatic life zones;</li> <li>b) global climate patterns and biogeography impact diversity;</li> <li>c) different factors lead to the species richness of an ecosystem and the importance of biodiversity; and</li> <li>d) natural selection has a role in organismal adaptations that are specific to their habitats.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Environmental Barometer</i></li> <li>• <i>Deer Dilemma</i></li> <li>• <i>Carrying Capacity</i></li> <li>• <i>Ecosystem Architects</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Blue Ribbon Niche</i></li> <li>• <i>Eat and Glow</i></li> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Water Canaries</i></li> </ul>
Ec.13	<p>The student will assess the impact of human activities on the natural world, and research how ecological theory can address current issues facing our society, both locally and globally. Key issues include</p> <ul style="list-style-type: none"> <li>a) major primary and secondary pollutants;</li> <li>b) sustainable and non-sustainable use of resources, including soil, timber, fish and wild game, mineral resources, and nonrenewable energy;</li> <li>c) natural and anthropogenic climate change;</li> <li>d) habitat fragmentation and habitat loss on biodiversity in relation to island biogeography, and apply island biogeography theory to the design of parks and nature preserves; and</li> <li>e) the ecological impact of agriculture (historical and modern) in the environment and its implications for feeding the world's population.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>The Power of Planning</i></li> <li>• <i>To Zone or Not to Zone</i></li> <li>• <i>Wildlife and the Environment: Community Survey</i></li> <li>• <i>Career Critters</i></li> <li>• <i>Bottleneck Genes</i></li> <li>• <i>Deer Dilemma</i></li> <li>• <i>A Dire Diet</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>What's in the Water?</i></li> <li>• <i>Fishable Waters</i></li> <li>• <i>Net Gain, Net Effect</i></li> <li>• <i>Sea Turtle International</i></li> <li>• <i>A Whale of an Issue</i></li> <li>• <i>Facts and Falsehoods</i></li> <li>• <i>Something's Fishy Here!</i></li> </ul>

Oceanography Guidelines	Project WILD K-12 Guide	Aquatic WILD Guide
<p>Ocean.2 The student will investigate and understand that the Earth has one big ocean with many features. Key concepts include</p> <ol style="list-style-type: none"> <li>a majority of the Earth's surface is covered with saltwater that includes a variety of ocean basins, seas, bays, and gulfs; and</li> <li>ocean seawater contains a constant proportion of dissolved salts and has unique inter-related physical and chemical properties.</li> </ol>		<ul style="list-style-type: none"> <li>• <i>Got Water?</i></li> </ul>
<p>Ocean.7 The student will investigate and understand that the ocean has a role in biogeochemical cycles that affect the atmosphere, seawater, and seafloor features. Key concepts include</p> <ol style="list-style-type: none"> <li>important biogeochemical cycles include the carbon cycle, nitrogen cycle, oxygen cycle, phosphorus cycle, and the water cycle;</li> <li>biogeochemical cycles always seek a state of equilibrium; and</li> <li>human activities affect biogeochemical cycles and their steady state.</li> </ol>		<ul style="list-style-type: none"> <li>• <i>The Glass Menagerie</i></li> </ul>
<p>Ocean.10 The student will investigate and understand that populations in ecosystems vary with changes in physical properties and geographic locations of the ocean. Key concepts include</p> <ol style="list-style-type: none"> <li>optical properties of light in water, water temperature, and water pressure affect marine autotrophic populations and their ecosystems; and</li> <li>changes in surface water temperatures vary with latitude and ocean currents creating ecological zones.</li> </ol>		<ul style="list-style-type: none"> <li>• <i>Eat and Glow</i></li> </ul>
<p>Ocean.11 The student will investigate and understand how energy flows in an ecosystem through complex food webs. Key concepts include</p> <ol style="list-style-type: none"> <li>interrelationships of biotic and abiotic factors explain the transfer of matter and energy within ecosystems;</li> <li>mixing of geothermal fluids with seawater supports a vast microbial ecosystem in deep ocean regions; and</li> <li>most primary producers derive energy from photosynthesis; and</li> <li>models of energy flow in an ecosystem are created to make predictions of the health of ecosystems.</li> </ol>	<ul style="list-style-type: none"> <li>• <i>Environmental Barometer</i></li> <li>• <i>Deer Dilemma</i></li> <li>• <i>Carrying Capacity</i></li> <li>• <i>Ecosystem Architects</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Blue Ribbon Niche</i></li> <li>• <i>Eat and Glow</i></li> <li>• <i>The Glass Menagerie</i></li> <li>• <i>Water Canaries</i></li> <li>• <i>Aquatic Roots</i></li> <li>• <i>Fishable Waters</i></li> </ul>
<p>Ocean.12 The student will investigate and understand that marine organisms have unique morphological features that allow them to be successful in specific ecosystems. Key concepts include</p> <ol style="list-style-type: none"> <li>the diversity of phyla is greater in the ocean than on land from unicellular microbes to the largest animal on Earth;</li> <li>the process of natural selection and biological evolution has led to speciation and biodiversity in ocean ecosystems;</li> <li>morphological adaptations, development, and life cycle allow organisms to survive in specific oceanic ecosystems; and</li> <li>organisms that experience drastic changes in their habitat have highly specific adaptations for surviving in extreme ecosystems.</li> </ol>		<ul style="list-style-type: none"> <li>• <i>Fashion a Fish</i></li> </ul>
<p>Ocean.13 The student will investigate and understand that the Chesapeake Bay and the ocean are of important social and economic value to Virginia. Key concepts include</p> <ol style="list-style-type: none"> <li>maritime boundaries determine resource ownership and can change due to a variety of factors;</li> <li>commercial and recreational fishing in Virginia is impacted by natural and human causal factors;</li> <li>state and federal agencies and non-profit organizations advocate and invest in protecting and expanding environmental habitats; and</li> <li>Virginia coastal zone management involves protecting and restoring coastal resources.</li> </ol>	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Fishable Waters</i></li> <li>• <i>Where Have All the Salmon Gone?</i></li> <li>• <i>Edge of Home</i></li> <li>• <i>Water We Eating?</i></li> <li>• <i>Net Gain, Net Effect</i></li> <li>• <i>A Whale of an Issue</i></li> <li>• <i>Sea Turtles International</i></li> </ul>