**Biosphere Learning Progression-Grades 3-5: GLOBE Protocols Aligned with NASA and NGSS**

**NGSS Disciplinary Core Ideas Content Progression**: In grades 3-5 students investigate how particular organisms can only survive in particular environments. They discover that populations of organisms live in a variety of habitats and that changes in those habitats affect the organisms living there. When the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. Through a series of learning activities, GLOBE protocols and NASA classroom resources, teachers can bring authentic science data collection into their classrooms as students explore the world in which they live.

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| **NGSS Performance Expectations:**3-LS4-1 Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. 3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there change. 5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.  |
| **NGSS Science Practices:****Planning and Carrying Out Investigations**:Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation or phenomenon. **Analyzing and Interpreting Data:** Analyze and interpret data to make sense of phenomena using logical reasoning. **Constructing Explanations and Designing Solutions:**Use evidence (e.g., observations, patterns) to construct explanation. **Engaging in Argument from Evidence**:Construct an argument with evidence. Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.  | **NGSS Disciplinary Core Idea:****ESS3.C Human impacts on Earth systems:** Human activities in agriculture, industry and everyday life have had major effects on the land, vegetation, streams, ocean, air and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments. **LS2.C Ecosystem Dynamics, Functioning, and Resilience:** When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. **LS4.A Evidence of Common Ancestry and Diversity:** Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environment.**LS4.C Adaptation**: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. **LS4.D Biodiversity and Humans:** Populations live in a variety of habitats, and change in those habitats affects the organisms living there.  | **NGSS Crosscutting Concepts:****Cause and Effect:** Cause and effect relationships are routinely identified andused to explain change. **Scale, Proportion, and Quantity:**Observable phenomena exist from very short to very long time periods.**Systems and System Models:** A system can be described in terms of itscomponents and their interactions.  |
| **GLOBE Application** |
| **GLOBE Protocols:** * [**Green-up**](https://www.globe.gov/documents/355050/ac287b49-8559-4f98-b9e5-a1421f5ae336)
* [**Green-Down**](https://www.globe.gov/documents/355050/849d4a1a-96dd-4965-ab36-0ae77a447cd9)
* [**Ruby-Throated Hummingbirds**](https://www.globe.gov/documents/355050/5b71b051-92a9-40a5-b4a1-a14de00d604b)
* [**Air Temperature**](https://www.globe.gov/documents/348614/93d4bb3c-79e3-4255-9fc8-537fc4f870dc)

**GLOBE Elementary Storybook:***The* [***Mystery of the Missing Hummingbirds***](https://www.globe.gov/web/elementary-globe/overview/seasons)(In this story, the GLOBE Kids wonder why hummingbirds have stopped visiting their school. They learn about the needs of thehummingbirds, the seasonal changes where they live, and the environment where thehummingbirds spend the winter. 1. [**All Year Long Learning Activity**](https://www.globe.gov/documents/348830/350902/ElementaryGLOBE_SeasonsActivity1_en.pdf/3d244465-cd67-44d5-a49c-586e258b2e48): Students make observational drawings in nature and compare the results throughout the year.
2. [**Honing In On Hummingbirds Learning Activity**](https://www.globe.gov/documents/348830/350902/ElementaryGLOBE_SeasonsActivity3_en.pdf/ab35f0d1-413b-4838-aed5-825c5005e1f2): Students research hummingbirds and the factors associated with their migration from one habitat to another at different times of the year.
 | **GLOBE Learning Activities:** * [**Getting to Know Your Terrestrial Biomes**](https://www.globe.gov/documents/10157/2596335/Seasons-Biomes_Get-2-Know-Your-TerrBiome-10-27-10.pdf)**:** Students become familiar with the Terrestrial Biome Classifications
* [**How to Make a Climograph from Your Local Weather Data**:](https://www.globe.gov/documents/10157/2596335/Seasons-Biomes_ClimographActivity-10-28-2010.pdf) Students will assemble, analyze and graph the long-term air temperature and precipitation data for their general area.
* [**First Look at Phenology**](https://www.globe.gov/documents/355050/fa49c394-2f14-410e-abb8-6d73d329df64): To develop an understanding of the patterns, similarities, and differences among plants at the same location
* [**A Sneak Preview of Budburst**](https://www.globe.gov/documents/355050/5fa93edf-852a-43f0-8ef9-44300e5a2fc6): To develop an understanding of the relationship between budburst and the environment.
* [**Operation Ruby Throat**](https://www.globe.gov/documents/356823/2538681/earth_prot_rthbird.pdf): To observe seasonal migration patterns, feeding habits, and nesting behavior of Ruby-throated Hummingbirds in North and Central America.
* [**Diagraming the Study Site for Others**](https://www.globe.gov/documents/356823/5ddffaf3-edbe-43ea-a742-44a68e18d1ee)**:** To develop the best possible representation of the study site as a system, identifying key components and interconnections.
* [**What can We Learn About Our Seasons**](https://www.globe.gov/documents/356823/3fedb06a-a17d-40db-a506-4fbe373be983)**?** Students observe and record seasonal changes in their local study site. They establish that these phenomena follow annual cycles and conclude the activity by creating displays that illustrate the repeating pattern associated with the appearance and disappearance of seasonal markers.
 |  **Guiding Questions:** 1. Based on fossil evidence, how have the types of organisms living in your area changed over time?
2. What types of changes affect organisms living in an area?
3. What types of solutions can we develop to reduce the changes that are occurring to the habitats in our community?
4. How can our community use science to help us conserve our natural resources and protect our environment?
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| **NASA Resources** |
| **NASA Extension Resources:*** [Global Biome Descriptions](https://www.globe.gov/documents/355050/589a4250-9980-4b29-899c-68f9ba561dfb)
* [EO Kids: (Infra) Red Light, Green Light](https://earthobservatory.nasa.gov/blogs/eokids/infrared-light-green-light/)
* [NASA Climate Change: How do we know?](https://climate.nasa.gov/evidence/)
* [NASA Mission: Biomes](https://earthobservatory.nasa.gov/experiments/biome)
 | **My NASA Data Earth System Data Explorer**: * [**Monthly Vegetation Index**](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=C2440DB71EEA11F37B4B4BAE13BE3D75;xDSID=vegetation;varid=NDVI_average-id-6f895e6efa;imageSize=auto;over=xy;compute=Nonetoken;tlo=15-Jan-2001%2000:00;thi=15-Jan-2001%2000:00;catid=C2440DB71E)
* [**Monthly Surface Air Temperature**](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=EA87EC370E27DABCDB17E1A8C0CA1CBC;xDSID=atmos_temp;varid=tsa_tovs;imageSize=auto;over=xy;compute=Nonetoken;tlo=15-Jan-1994%2000:00;thi=15-Jan-1994%2000:00;catid=EA87EC370E27DABCDB17E1A8C0CA)
* [**Monthly Precipitation**](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=917C7CEA2EE5654B6013BA0809005D77;xDSID=Precip;varid=precipitation-id-32889af644;imageSize=auto;over=xy;compute=Nonetoken;tlo=01-Jan-1979%2000:00;thi=01-Jan-1979%2000:00;catid=917C7CEA2EE56)
* [**Land Cover Classification**](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=522CAFC767FDD374F6BBDF2889B43326;xDSID=land_cover_classification;varid=SCENE_TYPE-id-5a5ba6b6a6;imageSize=auto;over=x;compute=Nonetoken;tlo=01-Feb-2006%2000:00;thi=01-Feb-2006%2000:00;cati)
 | **NASA Lessons/Activities:*** [Observing Earth’s Seasonal Changes](https://mynasadata.larc.nasa.gov/lesson-plans/observing-earths-seasonal-changes)
* Data Literacy Cube: Beginner-Using Seasonal Vegetation mapped Images
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