**Pedosphere Learning Progression**

**Grades K-2: GLOBE Protocols Aligned with NASA Resources and NGSS Standards**

**NGSS Progression of Learning**: Soils are one of the Earth System’s essential natural resources, yet they are often taken for granted. In these activities, K2 students will learn about the characteristics of the soil and how they interact with one another to support the Biosphere. Through participating in a series of GLOBE and NASA learning activities and protocols, interacting with the characters in the Elementary GLOBE Storybooks, students have the opportunity to engage in authentic science learning experiences with the Pedosphere.

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| **Performance Expectations Suppo**rt**:**   * **K-LS1-1, K-ESS2-2** Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. * K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live. * 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. | | |
| **Science Practices:**   * Asking Questions and Defining Problems: Ask questions based on observations to find more information about the natural and/or designed worlds(s). * **Developing and Using Models:** Use a model to represent relationships in the natural world. * **Analyzing and Interpreting Data**: Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. * **Engaging in Argument from Evidence**: Construct an argument with evidence to support a claim. * **Obtaining, Evaluating, and Communicating Information**: Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. | Disciplinary Core Idea:  **LS1.C: Organization for Matter and Energy Flow in Organisms:** All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow  **ESS2.E: Biogeology:** Plants and animals can change their environment.  **ESS3.A: Natural Resources:** Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.  **ESS3.C: Human Impacts on Earth Systems:** Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.  PS1.A: Matter can be described and classified by its observable properties. | **Crosscutting Concepts:**   * **Patterns**: Patterns in the natural and human designed world can be observed and used as evidence. * **Cause and Effect:** Events have causes that generate observable patterns. * **Systems and System Models:** Systems in the natural and designed world have parts that work together. * Energy and Matter:Objects may break into smaller pieces and be put together into larger pieces, or change shapes. |
| **GLOBE Application** | | |
| Pedosphere Protocols: [E-Training](https://www.globe.gov/get-trained/protocol-etraining/etraining-modules/16867724/12276)   * Protocols begin for grades 3-5 * [Soil Protocols Introduction](https://www.globe.gov/documents/352961/8de1fc2a-dc4e-41c5-a5d9-985865b0d67f)   Data Investigation Sheets:   * Data sheets associated with protocols begin for grades 3-5. Available through [Soil Protocols Introduction](https://www.globe.gov/documents/352961/8de1fc2a-dc4e-41c5-a5d9-985865b0d67f)   Elementary GLOBE Storybooks:   * [It’s All About Earth](https://www.globe.gov/documents/348830/350113/ElementaryGLOBE_EarthSystems_en.pdf) * [The Scoop on Soils](https://www.globe.gov/documents/348830/35487706/Soil+Book_FINAL2017.pdf/6b84e020-6215-41a5-82c7-dd9155efcdbf) | **GLOBE Learning Activities:** (Learning activities can be used to develop concepts associated with the NGSS Performance Expectations.)   * [Soil and My Backyard](https://www.globe.gov/documents/352961/5c5f7bfe-f98f-4aec-b554-539809a98725) (2-PS1-1) * [Soil Treasure Hunt](https://www.globe.gov/documents/348830/351088/ElementaryGLOBE_SoilActivity2_en.pdf/af7f6b29-6fdb-4b08-a9ba-d6f9ea5bcbe5) (2-PS1-) * [We All Need Soil!](https://www.globe.gov/documents/348830/351088/ElementaryGLOBE_SoilActivity3_en.pdf/3041408c-15e9-4274-a27a-63368afd320c) (K-LS1-1, K-ESS2-2) * [From Mud Pies to Bricks](https://www.globe.gov/documents/352961/a542e33d-e06e-4baf-9b83-dd84df9bae9e) (2-PS1-1, K-LS1-A, K-ESS2-2, K-ESS3-1) * [Earth System Play](https://www.globe.gov/documents/348830/350113/ElementaryGLOBE_EarthSystemsActivity3_en.pdf) (K-PS2-1) * [Why do We Study Soil?](https://www.globe.gov/documents/352961/2392e756-b89f-48ed-90ce-5f1440ab2d75) (K-ESS3-1, 2-PS1-1) * [Getting to Know the Soil](https://www.globe.gov/documents/348830/351088/ElementaryGLOBE_SoilActivity1_en.pdf/97fdde91-e41a-4f31-9116-cbb049c6e743) (2-PS1-1) * [We All Need Soil](https://www.globe.gov/documents/348830/351088/ElementaryGLOBE_SoilActivity3_en.pdf/3041408c-15e9-4274-a27a-63368afd320c) (K-LS1-1, K-ESS2-2, K-ESS3-1, 2-PS1-1) | Guiding Question(s):   1. What is soil? What is it made of? 2. How does Earth’s surface change from place to place? 3. Why is soil important? 4. What role does soil play in our big Earth? |
| **NASA Resources** | | |
| **Extension Learning Activities:**  [**Earth Systems Connections:** Compost Bucket](https://www.americangeosciences.org/sites/default/files/education-nasatriad-CompostBucketk-2.pdf)  [**Earth Systems Connections**: Hold On Tight, K2](https://www.americangeosciences.org/sites/default/files/education-nasatriad-HoldonTightK-2.pdf)  [**Earth Systems Connections:** Playground Pounding](https://www.americangeosciences.org/sites/default/files/education-nasatriad-PlaygroundPoundingK-4.pdf)  [**ESSEA K-4 Climate: Land:** The Dirt on Dirt and Climate](https://esseacourses.strategies.org/dirt_climate.pdf)  [**NASA Moon Munchies:**  Natural Resources on Earth](https://www.nasa.gov/pdf/326862main_Moon_Munchies_Lesson_1.pdf) | **My NASA Data Visualization Tool:**   * [Earth System Data Explorer](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;globalMin=0;globalMax=750.4146;xCATID=06ECF098DFA28B37C38B9EA28DCB9B88;xDSID=soil_moisture;varid=soilw-id-70637cbe91;imageSize=auto;over=xy;compute=Nonetoken;tlo=01-Jan-2018%2000:00;thi=01-Jan-20) * [Tutorials](https://mynasadata.larc.nasa.gov/basic-page/tutorials)   My NASA Data **Science Variable Suggestions:**  **Soil Moisture:** [Monthly Mean Soil Moisture (millimeters)](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;globalMin=0;globalMax=750.4146;xCATID=06ECF098DFA28B37C38B9EA28DCB9B88;xDSID=soil_moisture;varid=soilw-id-70637cbe91;imageSize=auto;over=xy;compute=Nonetoken;tlo=01-Jan-2018%2000:00;thi=01-Jan-20)  **Soil Temperature:**   * [Daytime Skin Temperature (degrees Celsius)](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=0A456C6EE1BEE5AC8A2D7BD0386C1A1F;xDSID=skinTemp;varid=SurfSkinTemp_A-id-4c24211c9a;imageSize=auto;over=xy;compute=Nonetoken;tlo=01-Sep-2002%2000:00;thi=01-Sep-2002%2000:00;catid=0A456C6EE1) * [Nighttime Skin Temperature (degrees Celsius)](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=0A456C6EE1BEE5AC8A2D7BD0386C1A1F;xDSID=skinTemp;varid=SurfSkinTemp_D-id-4c24211c9a;imageSize=auto;over=xy;compute=Nonetoken;tlo=01-Sep-2002%2000:00;thi=01-Sep-2002%2000:00;catid=0A456C6EE1)   **Land Cover Classification:**   * [Surface Scene Type/](about:blank)[Soil Characterization](https://mynasadata-las.larc.nasa.gov/EarthSystemLAS/UI.vm#panelHeaderHidden=false;differences=false;autoContour=false;xCATID=A0DB27025C92201EE0CF405A32D63119;xDSID=soil_char;varid=SCENE_TYPE-id-5a5ba6b6a6;imageSize=auto;over=x;compute=Nonetoken;tlo=01-Feb-2006%2000:00;thi=01-Feb-2006%2000:00;catid=A0DB27025C9220) | **My NASA Data Lessons/Activities:**  *Not supported at this grade level band.*  **Multimedia Links:**   * [NASA's Earth Minute: Dishing the Dirt](https://www.youtube.com/watch?v=hgsIFyITvJE&feature=youtu.be) * [NASA eClips Our World: What is Soil?](https://nasaeclips.arc.nasa.gov/video/ourworld/our-world-what-is-soil) |

*Prepared by NASA Langley Research Center Science Directorate, Science Education Team (2019) DRAFT - NOT FOR DISSEMINATION*