discover™ EARTH

HANDS-ON SCIENCE ACTIVITIES

Activity 4

I Belong to Earth

For use with participants
ages 5 to 7, 8 to 9, 10 to 13, and teens

NSF

SPACE SCIENCE INSTITUTE

LUNAR AND PLANETARY INSTITUTE

National Girls Collaborative Project

ALA American Library Association

Contents

Discover Earth Themes and Overview of Activities

The *Discover Earth* activities focus on Earth science topics close to home – such as local weather and the plants, animals, crops, and environmental features particular to your region – as well as a global view of our changing planet. Through hands-on investigations and discussions, young audiences discover that Earth's global environment changes – and is changed by – the local environment. The activities explore three key messages relating to this overall theme: A. We belong to Earth; B. Each region is unique; and C. Your home is changing. These messages all relate to the overall theme: Earth's global environment changes – and is changed by – the local environment. The activities were developed with guidelines set forth by the National Science Education Standards and American Association for the Advancement of Science (AAAS) benchmarks, and they were designed for audiences in the following four age ranges: 5 to 7, 8 to 9, 10 to 13, and teens.

Overall Theme

Earth's global environment changes – and is changed by – the local environment.

A. We Belong to Earth

We belong to a complex system of interacting water, ice, air, and life.

Community Activities

The community contributes to two exhibits: In *Century of Change Display*, the community gathers and compares photos and/or illustrations of the local areas taken a century and more ago with more contemporary photos of the same areas. In *Weather Wall*, children track the local weather over a period of two months or more, plotting weather data on a kid-friendly sticker chart.

Icebreaker Activities

Children ages 5 and up are introduced to Earth's major characteristics (or parts or systems) -- water, ice, air, and life – through the brief icebreaker activities *Catch!...the World's Ocean, Ice-y Experience, Share the Air,* and *Web of Life.*

Discover Earth through Reading

I Belong to Earth can serve either as part of a kick-off celebration or as an outreach program to area schools. Children and teens discover Earth science questions and answers using the library's resources and participate in reading games — customized for ages 5 to 9, 10 to 13, and teens — that combine book lists and reading logs into take-home adventures! After this activity, the reading

games continue to connect patrons with the *Discover Earth* activities and resources. Participants advance by reading, engaging in suggested at-home activities, attending *Discover Earth* library programs, or investigating Earth and the environment through a variety of citizen science programs. Completed game boards may be submitted to the library for display, and if desired, entry into promotional drawings. Participants earn a decal upon completion.

B. Each Region Is Unique

Changes to distant oceans, air moving freely around our globe, and all living things have an influence on our regional environment, now and in the past and future.

Weather Explorations

Children ages 5 to 7 explore various aspects of weather through a series of stations featuring games, crafts, and weather observations in *Weather: The Many Faces of Mother Nature*. Children ages 8 to 9 and 10 to 13 undertake more advanced investigations of rain, wind, clouds, and weather instruments and consider how locally collected weather data relate to the broader Earth systems of water, ice, air, and life in *Weather Stations*.

Regional Explorations

In *Climate Tour*, children ages 10 to 13 celebrate their region of the United States by creating a regionally-inspired postcard and recipe. Finally, they use a set of *What if…* cards about their region to reconsider their postcards and recipes in light of future climate change. In *Polar Bears or Penguins?*, children ages 10 to 13 use a fast-action matching game to demonstrate how each of Earth's polar regions is distinct and special.

C. Your Home Is Changing

Earth's water, ice, air, and life will continue to interact over long-term scales, shaping the particular features of that place we each call home.

Environmental Stewardship

In teams, children ages 11 to 13 build an understanding of how human actions impact global change by playing a board game, *Polar Bears Go with the Floes*, in which chance and choice determine the fate of a lone polar bear on an ice floe. Teens, ages 14 to 18, engage their communities in science through art in *Earth: Artistically Balanced*. The teens first interact with a climate scientist to unravel, on a very basic level, the complexities of Earth's climate system, and then they create a three-dimensional artistic representation of Earth's climate. The art may be created on a large scale and displayed at the library or made on a smaller scale to take home.

How to Use These Activities in Your Programs

You may design your own program of one or more of these flexible activities, or you may choose to build the story of Earth and its changing environment through the complete series of activities! Background information and facilitator resources are provided to help you prepare to lead the activities. Encourage further exploration with the books, websites, and videos listed in the *Facilitator's Resources* packet. Programming ideas for all ages, infant to adult, are also provided.

Reading games, geared toward different age levels, support this module and connect the activities and resources. The games combine the traditional reading log and book list into a board game, where participants advance by reading, engaging in suggested at-home activities, attending library programs, or investigating Earth and the environment through a variety of citizen science programs. These games are introduced in Activity 4: *I Belong to Earth*. The game boards may be customized with your institutions' address, and if desired, an additional step in the instructions for winning prizes. Matching decals may be printed and awarded as prizes. *Read Me* bookmarks are available as a way for children to read, review, and recommend titles to others. These materials (shown below), including the supporting book lists, are available free for educational use at www.lpi.usra.edu/explore/discoverEarth.

Correlations to National Standards

National Science Education Standards

Grades K-4
Earth and Space Science - Content Standard D
Properties of earth materials

- Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide many of the resources that humans use.

Science in Personal and Social Perspectives - Content Standard F
Types of Resources

- Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials, such as air, water, and soil; some are produced from basic resources, such as food, fuel, and building materials; and some resources are nonmaterial, such as quiet places, beauty, security, and safety.
- The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.

Changes in Environments

- Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.
- Some environmental changes occur slowly, and others occur rapidly. Students should understand the different consequences of changing environments in small increments over long periods as compared with changing environments in large increments over short periods.

Grades 5-8
Earth and Space Science - Content Standard D
Structure of the Earth System

- Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then

compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

- Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers, with each having a different chemical composition and texture.
- Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
- Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.
- Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

Earth's History

- The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.
- Fossils provide important evidence of how life and environmental conditions have changed.

American Association for the Advancement of Science Literacy Maps

Flow of Matter in Ecosystems
Systems
Weather and Climate
Conservation of Matter

Activity Procedure

Overview

Children and teens are introduced to avenues for exploring the Earth through resources and events at the local library in *I Belong to Earth*, which can serve either as part of a kick-off celebration or as an outreach program to area schools. Children discover Earth science questions and answers through story time or reading and group conversations to discuss concepts and overcome vocabulary challenges. Teens join a book discussion group. Finally, they hear about ways to continue their explorations by participating in a reading game — customized for ages 5 to 9, 10 to 13, and teens — that combines a book list and reading log into a take-home adventure! Additional *Discover Earth* events can also be advertised. Allow one hour for the activity, and plan to conduct the reading program over the course of about two months.

Ideally, one of the icebreaker activities, *Catch!...the World's Oceans, Ice-y Experiences, Share the Air*, or *Web of Life* is conducted immediately preceding this activity.

What's the Point?

- We belong to a complex system of interacting water, ice, air, and life.
- Children are engaged in daily reading to improve their literacy skills.
- Information about Earth and the environment can be gathered from a variety of sources, including books, the Internet, and multimedia.

Materials

Facility Needs

- ☐ Optional: Writing space viewable by the entire group, such as white board or poster paper and markers, or a black board and chalk
- ☐ An area large enough for the children to be able to be comfortably seated
- ☐ Optional: staff support and materials (available at www.lpi.usra.edu/explore /discoverEarth) for conducting a reading program
  - ☐ *Read Me* bookmarks
  - ☐ *Discover Earth* reading game boards, printed double-sided and preferably in color:
    - _ *Weather Watcher*, for ages 5 to 9, on 11" x 17" paper

- *Discover Earth's Special Places in the Continental U.S.*, for ages 10 to 13, on 11" x 17" paper
- *Thoughtful Steward of the Earth*, for teens (and adults), on 8.5" x 11" paper

- ☐ *Discover Earth* (editable) book lists
- ☐ Stickers, depicting fun shapes, pictures, or statements of praise, purchased from a craft supply store
- ☐ Optional: *Discover Earth* reading game badges, professionally printed by a custom sticker retailer

For the Group

- ☐ Books about Earth, such as (refer to the resource lists for other suggestions):

WHAT'S SO SPECIAL ABOUT PLANET EARTH?
Robert E. Wells, Albert Whitman & Company, 2009, ISBN: 0807588156
By examining the other planets in our solar system, Wells sets the stage for enumerating Earth's unique features, including its atmosphere, water, and life. The book concludes with family-friendly tips for taking care of our home planet. Readers age 4-8 may enjoy the cartoon illustrations and conversational text.

NATURE IN THE NEIGHBORHOOD
Gordon Morrison, Houghton Mifflin Books for Children, 2004, ISBN: 0618352155
Morrison reveals the diversity and abundance of life that can be found in your very own backyard. Readers, ages 6-10, explore landscapes, seasons, plants and animals through unique facts, engaging text, and beautiful illustrations.

PLANET EARTH
Kathryn Senior, Franklin Watts, 2000, ISBN: 0531164454
This introduction to Earth explores land, oceans, the atmosphere, and animals that inhabit the different climate regions around the globe. Special split pages and colorful illustrations will engage children ages 9-12.

EARTH: THE OPERATOR'S MANUAL
Richard Alley, W. W. Norton & Company, 2011, ISBN 0393081095
Teens may enjoy reading this book, a companion guide to the PBS series of the same title. Stories and scientific facts explore our use of energy over the centuries, including the current practices that contribute to climate change and new energy sources available now.

- ☐ Optional: 1 *Earth lithograph* (NASA educational product number LG-2009-09-567-HQ, www.nasa.gov/pdf/145731main_Earth.Lithograph.h.pdf), preferably printed double-sided and in color

For the Facilitator

- ☐ *Facilitator's Resources* packet (available at www.lpi.usra.edu/explore /discoverEarth), which includes:
  - ☐ Background information
  - ☐ *Be a Science Guide!*
  - ☐ Resource lists
  - ☐ Shopping list

Preparation

- Read the *Discover Earth* reading game boards and rules.
- Develop and implement an advertising plan to attract participation in the *Discover Earth* reading games for ages 5 to 9 and 10 to 13. Advertise the start and end dates (when the reading games must be completed) of the reading program.
  - If possible, identify partners in the community to contribute prizes for those children and teens who participate in and / or complete the reading game. Partners might also be interested in covering the costs of printing the full-color game boards.
  - If possible, use the *I Belong to Earth* activity as a kick-off or as an outreach program to area schools.
  - Invite library staff and volunteers to help facilitate the games. Encourage them to distribute the reading game boards. Outline the reading game board rules for ages 5 to 9 and 10 to 13:
    - For ages 5 to 9, award a fun sticker, preferably depicting shapes, pictures, or statements of praise, for each row (across, up and down, or diagonally) completed.
    - For ages 10 to 13, initial each circular space that a child completes. The children check off the rectangles themselves that they complete at home.
    - For teens, initial each circular space that a teen completes. Teens check off the rectangles themselves that they complete at home.
    - Provide these decals to children and teens who complete all spaces on their reading game boards.
  - Include a campaign to use the *Read Me* bookmarks as a way for children to read, review, and recommend titles to others. Request that library staff

and volunteers distribute *Read Me* bookmarks to young patrons to include when the item is returned. Have them leave the bookmarks in any item that is returned to library and re-shelved. Tell the community to be on the lookout for these slips as they browse the stacks!
    - Advertise the *I Belong to Earth* activity separately to ages 5 to 9 and 10 to 13, and keep the ages separate, if possible. If mixed ages might attend the program, plan to separate into two groups guided by two or more facilitators.
- If desired, use Adobe Reader to customize the *Discover Earth* reading game board PDF files for your institution. (Adobe Reader can be downloaded for free from http://get.adobe.com/reader/.)You may choose to include your library's name and contact information in the editable field of the PDF (below the *STAR_Net* partner logos). If you are providing prizes as an incentive, add an additional step to the instructions of each game board that describes how participants may earn prizes.
- Print (or have professionally printed) high-resolution copies of the *Discover Earth* reading game boards, double-sided and preferably in color on 11" x 17" paper. To ensure that the game boards print properly (with both sides of the board oriented "up"), please try the following printer settings. If you use a professional printer, emphasize that the game boards are to be double-sided with "up" along the same long edge.
    - Landscape orientation
    - 11x17 paper
    - Double-sided
- If desired, customize the editable *Discover Earth* book lists to highlight your institution's resources.
- Print copies of the *Discover Earth* reading lists and *Read Me* bookmarks to make available to program attendees as well as other library patrons.
- If desired, have decals printed at a retailer that provides custom stickers, such as www.stickergiant.com.
- Review the *Facilitator's Resources* packet.
- Display several books about Earth in a place where the children can look through them before and after the activity.

Activity

For ages 5 to 9 and 10 to 13

1. **Invite the children to share what they know about the Earth.** Keep track of their ideas on poster paper. It is not important to correct the children's ideas, rather this activity should encourage them to explore and learn more.

- When you are outside, what is different from day to day? What changes do you notice through the year? What changes do you notice in your neighborhood? Have new buildings been built? New parks? *Accept all answers. The children may mention changing weather or seasons; life cycles of creatures, such as butterflies; or urban development projects in their neighborhoods*.
- How do these changes affect what you do? *Accept all answers. The children may note that they choose what to wear based on the weather and season. Outdoor play and sports depend on weather, and certain sports occur in only certain season(s).*
- What fun activities do you enjoy doing outdoors? Do you do these activities during recess, after school, on weekends, on vacation? Do you go by yourself or with friends or family? *Accept all answers.*
- What kinds of jobs involve working outside? How do adults doing those kinds of jobs interact with Earth? *Accept all answers, but prompt them to think of some examples, if necessary: Farmers must understand, the soil, water, weather, and how things grow. Meteorologists on TV tell us about the weather, which especially relates to water and air. Miners must know about types of minerals or rocks and where to find them.*

2. **Introduce the idea that the Earth is complex, and it is helpful to think of it in terms of its different major characteristics or parts.** Show the large picture of Earth to the children to get the conversation started. Explain that astronauts traveling to the Moon took pictures of our planet from space, and these pictures show us some of Earth's most important characteristics (or parts). These characteristics are what make our planet such a special place to live (and different in many ways from other planets and moons in our solar system!).
   - What major characteristics or parts of Earth can you name? *Water, ice, air, and life.*

Facilitator's Note: Scientists recognize five different Earth characteristics or parts, and they refer to them as "systems" or "spheres." Some of the children may be familiar with these and their technical names:

Hydrosphere
Cryosphere
Atmosphere
Biosphere
Geosphere (lithosphere may be considered a component)

(Scientists sometimes also refine this list to a more detailed level and include even more systems or spheres.)

Water, ice, air, and life interact on long time scales with yet another important feature of our planet: the very rock beneath our feet. Earthquakes, volcanos, erosion and sedimentation all play a significant role in the story of our planet. Their story is beyond the scope of the relatively short term changes that children may observe through this *Discover Earth* module. For activities about the role of rocks and land on our planet and others in the solar system, see the additional *Explore!* program modules. For example, see the *Explore! Mars: Inside and Out* at www.lpi.usra.edu/explore/mars.

- Do you find any of these characteristics in your neighborhood? *Yes, all of them!*
- Where do you find water? Do we have a lot or a little water here? *If necessary, prompt the children to name local water features and think of the forms of precipitation that fall in your area. Have the children think about whether the conditions are typically dry, "not too dry" (moderate), or humid.*
- Where do you find air? How would you describe our air? *Everywhere! Accept all opinions about the local air quality, such as thin, thick, clear, smoggy, smelly, good, etc.*
- What wild animals live nearby?
- Do grassland, forest, desert, scrub, tundra, or wetland plants usually grow wild here?
- What types of land are nearby? *If necessary, prompt the children to describe the mountains, canyons, beaches, or plains that characterize the region.*

Add that Earth's different characteristics or parts interact with each other — for example, life takes in air and water to survive and water condenses from water vapor in the air to form clouds, and ultimately, rain — so scientists call each of them a "system." All of the different characteristics or systems — water, ice, air, and life — change each other and make each other "work" to shape our familiar world.

3. **Ask the children what questions they have about the different features of Earth.** If this activity is being used as an introduction to one of the other *Discover Earth* activities, add the specific questions introduced there to this discussion.

4. **Investigate their questions through reading!** For ages 5 to 7, the facilitator or an older child may read one or more selections aloud. Have children ages 8 to 13 explore the selection of books independently or in small groups.

5. **Optional: If the children have questions about the vocabulary they are reading, have them begin a "vocabulary wall" — a place where they can write the**

words. Can others in the group help with the definition? Invite them to search for the meaning of the word, and have them share their findings with the group.

Facilitator's Note: If desired, make an evolving conversation — and decorate the room — by following the American Geological Institute's brief instructions for creating a "Science Word Wall" (www.k5geosource.org/2activities/2lit/pg4.html). Children ages 5 to 7 may enjoy linking the new vocabulary words they are learning to the familiar alphabet, which is posted along the walls.

For teens

6. **Discuss what the teens know about Earth and its climate and, collectively, determine a few topics or questions the group would like to explore.**

7. **Read a nonfiction book such as** EARTH: THE OPERATOR'S MANUAL **as a starting point.** Meet periodically to discuss the readings, generate more questions, and identify library resources that are appropriate for discovering the answers.

For ages 5 to 9, 10 to 13, and teens

8. **Describe how the children and teens can further explore the Earth through the *Discover Earth* reading game.**

9. **Outline the guidelines for advancement: Participants advance by reading, engaging in suggested at-home activities, attending library programs, or investigating questions about Earth and the environment.** Completed game boards may be submitted to the library for display, and if desired, entry into promotional drawings. Participants earn a certificate of completion.

Conclusion

Invite the children and teens to check out books and videos and continue to discover our Earth! Remind them of ways to get involved:

- Direct them to use the recommended reading list to move through spaces on the *Discover Earth* reading game.
- Explain that they may wish to recommend one or more items to others. Provide them with *Read Me* bookmarks to include when the item is returned. Instruct them to note their initials and describe what they like about the book. Tell them that other children will be on the lookout for their recommendations!

- Invite them to attend another *Discover Earth* activity — and gain a space on their reading games! Give them the time and date of the next program.

Contact Information

Your questions and comments about the *Discover Earth: Hands-on Science Activities* are welcome!

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STAR_Net Project Overview

The *STAR Library Education Network* project (*STAR_Net* for short) is part of a national initiative to support libraries that are already providing informal STEM learning, or want to provide it. The *STAR_Net* project has a number of components, including:

- Two traveling exhibits for libraries: *Discover Earth: A Century of Change,* and *Discover Tech: Engineers Make a World of Difference*.
- An Education Program, which includes developing exemplary hands-on activities for libraries, as well as conducting training (both online and in-person) for library staff.
- An Outreach Program that helps libraries to develop STEM programming and find local partners for collaborations on programming.
- An online Community of Practice (CoP) (http://community.discoverexhibits.org) for librarians (both hosts and non-hosts of the exhibits) and STEM professionals who want to support STEM programming in public libraries.

The National Science Foundation (NSF) provided funding the *STAR_Net* project. *STAR_Net* is led by the National Center for Interactive Learning (NCIL) at the Space Science Institute. Dr. Paul Dusenbery is the project director. STAR stands for “Science-Technology Activities and Resources.” In addition to NCIL staff, the project team includes:

- The American Library Association (ALA), which is managing the exhibit tours and helping to raise awareness among librarians of the many opportunities for providing STEM programming

- The Lunar and Planetary Institute (LPI), which is leading the Education Program component. For some years, LPI has led the *Explore* program for libraries, which has been at the forefront of developing STEM programming and training for librarians.
- The National Girls Collaborative Project (NGCP), which is leading the project's Outreach Program. As a project partner, this NSF-funded project is helping libraries across the country partner with a variety of organizations to provide STEM programming.
- NCIL's Kate Haley Goldman and staff from Evaluation and Research Associates are conducting evaluations of the project's components. The project also includes a research component that explores how public libraries can serve as STEM learning centers in rural, under-served communities. The evaluation and research results will be shared with the informal science education community.

The activity described in this packet was developed for libraries to use in support of the *Discover Earth* traveling exhibit, though it may be implemented independently.

Online Community

Librarians, scientists, engineers, educators, museum staff, and others are invited to join the *STAR_Net* online community! The website fosters collaboration among professionals who want to provide or support Science, Technology, Engineering, and Mathematics (STEM) learning experiences in libraries. The *STAR_Net* project team hopes you find the following activity useful. Please join the online community (http://community.discoverexhibits.org) and share your experiences implementing it with your colleagues.

For more information about the *STAR_Net* project, please contact:

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Appreciation is extended to the librarians who field tested the materials in their children's, youth, and teen programs.

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