

## Earth Systems Understandings

Prepared for all by Ohio teachers

EARTH SYSTEMS UNDERSTANDINGS by number and bullet

<b>Activity</b>	<b>Grades</b>	
<b>Great Lakes Overview</b>		
How big is a crowd?	6-10	1.2, 1.3; 2.1, 2.2, 2.3, 2.4, 2.5, 7.4
How well do you know the GL?	6-10	1.2, 2.5, 3.1, 3.2; 4.4
Where should I relocate in the GL region?	6-10	1.2; 3.2, 3.3, 7.1, 7.5
200 Years of Change	4-8	1.1, 1.2, 1.3; 2.1, 2.2, 3.3, 3.6
Ojibway-Early Immigrants to the Great Lakes Region	4-8	1.1, 1.2
Great Lakes, Great Careers	4-8	7.1, 7.2, 7.4, 7.5
<b>Life in the Water</b>		
Don't Stop for Hitchhikers!	4-8	2.5, 4.1, 4.7
Where Have all the Lake Trout Gone?	6-10	2.1, 2.5, 3.1, 3.3, 3.6
Who can harvest a walleye?	6-10	2.1, 2.4, 2.5, 3.2, 4.2, 4.3
What are the characteristics of some GL fish?	6-10	3.1, 3.2
<b>Habitats</b>		
What is the ecological role of an estuary?	6-10	2.1, 2.2, 2.5, 3.1, 3.2, 4.1, 4.2, 4.3
Seeing Purple: A Population Explosion	4-8	2.2, 2.5, 3.1, 3.2, 4.1, 7.2
Hydropoly: A Decision-Making Game	4-8	1.3, 2.1, 2.2, 2.4, 2.5, 7.5
Wetland in a Pan	4-8	1.2, 2.5, 4.1, 4.4, 4.6
<b>Climate &amp; Weather</b>		
How do the Great Lakes Modify the Growing Season	6-10	4.1, 4.2, 4.4
Snowmaking- Great Lakes Style	6-10	2.4, 3.6, 4.2, 4.4
How does the temperature of the GL change over time?	6-10	3.1, 3.2, 3.3, 4.1, 4.2, 4.3
Great Lakes Triangle set of 3 activities.	6-10	1.1, 1.2, 3.1, 3.2, 3.3, 4.1, 4.2, 4.4, 7.1
What happens to heat energy reaching the Great Lakes?	6-10	3.2, 4.1, 4.2, 4.3, 4.4
<b>Hydrology</b>		
Your Great Lake	4-8	2.4, 2.5, 3.6, 4.1
More than Just a Lake	4-8	4.1,

How does stratification affect water quality?	6-10	3.2,3.3,3.6,4.1,4.2,4.3,4.4,4.7
Making Great (Lakes) Connections	4-8	4.1,
Water Quantity	4-8	2.1,2.21
<b>Coastal Processes</b>		
How did rocks and rivers shape the Great Lakes?	6-10	4.1,4.2,4.4,4.6,5.1
What evidence of glaciation exists in the GL?	6-10	4.1, 4.4, 4.6, 5.1, 5.2
How fast can a shoreline change? How much land is lost?	6-10	2.2, 2.3, 2.5, 3.2, 3.3, 3.4, 4.1, 4.2, 4.4, 4.6, 5.1
Indoor Dunes	4-10	3.2, 4.1, 4.4, 4.6, 4.7, 5.1
<b>Issues</b>		
Rival for Survival	4-8	1.3, 2.1, 2.2, 2.4, 4.7
Beach Mysteries	4-10	1.2, 1.3, 2.1, 4.7, 7.2
Exotic Puzzle - Title: What are the Characteristics of the Great Lakes Exotic Species?	6-8	2.2, 2.4, 3.6, 4.7
Invader Species of the Great Lakes (From GLEP)	4-8	1.3, 2.2, 2.4, 3.6, 4.7
Where do the toxins go [internal, external]	6-10	2.1, 2.4, 2.5, 3.2, 3.3, 3.6, 4.4, 4.7, 7.2
Is the globe warming? Is there evidence in the Great Lakes region?	6-10	3.2, 3.3, 4.1, 5.1
Which Fish Can We Eat?	6-10	2.4, 2.5, 3.3, 3.6, 4.4, 4.7, 7.5
Whose Water?	6-10	1.3, 2.1, 2.2, 2.4, 2.5, 5.1, 7.5

## **Framework for Earth Systems Education**

### **Understanding #1: Earth is unique, a planet of rare beauty and great value.**

- a. The beauty and value of Earth are expressed by and for people through literature and the arts.
- b. Human's appreciation of planet Earth is enhanced by a better understanding of its subsystems.
- c. Humans manifest their appreciation through their responsible behavior and stewardship of its subsystems.

### **Understanding #2: Human activities, collective and individual, conscious and inadvertent, affect planet Earth.**

- a. Earth is vulnerable, and its resources are limited and susceptible to overuse or misuse.
- b. Continued population growth accelerates the depletion of natural resources and destruction of the environment, including other species.
- c. When considering the use of natural resources, humans first need to rethink their lifestyles, then reduce consumption, then reuse and recycle.
- d. By-products of industrialization pollute the air, land, and water, and the effects may be global as well as near the source.
- e. The better we understand Earth, the better we can manage our resources and reduce our impact on the environment worldwide.

### **Understanding #3: The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.**

- a. Biologists, chemists, and physicists, as well as scientists from the Earth and space science disciplines, use a variety of methods in their study of Earth systems.
- b. Direct observation, simple tools, and modern technology are used to create, test and modify models and theories that represent, explain, and predict changes in the Earth system.
- c. Historical, descriptive, and empirical studies are important methods of learning about Earth and space.
- d. Scientific study may lead to technological advances.
- e. Regardless of sophistication, technology cannot be expected to solve all of our problems.
- f. The use of technology may have benefits as well as unintended side effects.

### **Understanding #4: The Earth system is composed of interacting subsystems of water, rock, ice, air, and life.**

- a. The subsystems are continuously changing through natural processes and cycles.
- b. Forces, motions and energy transformations drive the interactions within and between the subsystems.
- c. The Sun is the major external source of energy that drives most system and subsystem interactions at or near the Earth's surface.
- d. Each component of the Earth system has characteristic properties, structure, and composition that may be changed by interactions of subsystems.
- e. Plate tectonics is a theory that explains how internal forces and energy cause continual changes within Earth and on its surface. Weathering, erosion, and deposition continuously reshape the surface of the Earth.
- f. The presence of life affects the characteristics of other systems.

### **Understanding #5: Planet Earth is more than 4 billion years old and its subsystems are continually evolving.**

- a. Earth's cycles and natural processes take place over time intervals ranging from fractions of seconds to billions of years.
- b. Materials making up planet Earth have been recycled many times.
- c. Fossils provide the evidence that life has evolved interactively with Earth through geologic time.
- d. Evolution is a theory that explains how life has changed through time.

### **Understanding #6: Earth is a small subsystem of a solar system within the vast and ancient universe.**

- a. All material in the universe, including living organisms, appears to be composed of the same elements and to behave according to the same physical principles.
- b. All bodies in space, including Earth, are influenced by forces acting throughout the Solar System and the universe.
- c. Eight planets, including Earth, revolve around the sun in nearly circular orbits.
- d. Earth is a small planet, third from the Sun in a unique system of planets in the Milky Way galaxy.
- e. The position and motions of Earth with respect to the Sun and Moon determine seasons, climates, and tidal changes.
- f. The rotation of Earth on its axis determines day and night.

**Understanding #7: There are many people with careers that involve study of Earth's origin, processes, and evolution.**

- a. Teachers, scientists, and technicians who study Earth are employed by businesses, industries, government agencies, public and private institutions, and as independent contractors.
- b. Careers in the sciences that study Earth may include sample and data collection in the field and analyses and experiments in the laboratory.
- c. Scientists from many cultures throughout the world cooperate and collaborate using oral, written, and electronic means of communication.
- d. Some scientists and technicians who study Earth use their specialized understanding to locate resources or predict changes in Earth systems.
- e. Many people pursue avocations related to planet Earth processes and materials.

<http://earthsy.../framework.html> [revised 8/06]