

## Great Lakes Wetlands – Climate Change Adaptation Lessons

*A mini-unit to help middle school students understand how climate change affects coastal wetlands in the Great Lakes region.*

### **Purpose:**

The five lessons included in this unit are meant as an introduction to further research and education about how climate change impacts wetlands in Michigan, including Great Lakes coastal wetlands.

Each lesson offers simple instruction, a variety of resources, and focus questions to ensure that teachers can offer students both breadth and depth of content.

*The lessons and resources contained in this unit are by no means exhaustive and Tip of the Mitt Watershed Council envisions this unit as a “living document” that can be added to, improved, and changed as educators utilize the lessons in their classrooms. Comments, suggestions, and identified resources are encouraged.*

### **Lessons:**

Lesson 1: Wetlands in the Great Lakes Region: What are wetlands and how are freshwater coastal wetlands unique?

Lesson 2: Climate Change in the Great Lakes: How does climate change affect the Great Lakes region?

Lesson 3: Coastal Wetland Scenarios: How does climate change affect Great Lakes coastal wetlands?

Lesson 4: Best Management Practices (BMPs): What can humans do to help coastal wetlands “adapt” to changes?

Lesson 5: Taking Action: What stewardship practices help protect and restore coastal wetlands?

### **Next Generation Science Standards:**

In 2010, the National Academy of Sciences, Achieve, the American Association for the Advancement of Science, and the National Science Teachers Association embarked on a two-step process to develop the *Next Generation Science Standards* (NGSS). NGSS are a new set of standards that provide consistent science education through all grades, with an emphasis on engineering and technology.

For an in-depth explanation of the standards referenced in this mini-unit see the Next Generation Science Standards website: <http://www.nextgenscience.org/get-to-know>

### NGSS Cross Cutting Concepts

**Patterns:** Identify patterns in rates of change and other numerical relationships that provide information about natural and human designed systems. Use patterns to identify cause and effect relationships, and use graphs and charts to identify patterns in data.

**Cause and Effect:** Classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. Use cause and effect relationships to predict phenomena in natural or designed systems. Understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

**Stability and Change:** Explain stability and change in natural or designed systems by examining changes over time, and considering forces at different scales, including the atomic scale. Changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be disturbed by either sudden events or gradual changes that accumulate over time.

### NGSS Science and Engineering Practices

**Asking Questions and Defining Problems:** Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. Identify and/or clarify evidence and/or the premise(s) of an argument.

**Obtaining, Evaluating, and Communicating Information:** Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question.

### **Middle School Earth Space Science Standards:**

The Next Generation Science Standards addressed in the mini-unit are Middle School Earth Space Science (MS-ESS) standards. In some lessons, elementary Earth Space Science Standards are addressed.

**MS-ESS2.A: Earth Materials and Systems:** Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources.

**MS-ESS2.C: The Roles of Water in Earth's Surface Processes:** Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.

**MS-ESS2.D: Weather and Climate:** Complex interactions determine local weather patterns and influence climate, including the role of the ocean.

**MS-ESS2.E: Biogeology:** Changes in biodiversity can influence humans' resources and ecosystem services they rely on.

**MS-ESS3.A: Natural Resources:** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

**MS-ESS3.C: Human Impacts on Earth Systems:** Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.

**MS-ESS3.D: Global Climate Change:** Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.