| **Indiana Dunes**  **Education** | National Park Service  U.S. Department of the Interior  **Indiana Dunes National Lakeshore**  **Education Department** | National Park Service Logo |
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**Secrets of Succession**

**Summary:**

Follow the legacy of early dunes’ scientist Henry Chandler Cowles and hike on the beach over foredunes and through forests. By exploring diverse ecosystems, students will discover the forces that shape the dunes and produce this unique succession of plants.

**Objectives:** students will be able to

1. Describe the plant and animal species which characterize each successional stage of the dunes.
2. Name three ways in which plants and animals in the dunes change the environment, allowing other plants and animals to succeed them.
3. Explain the affect of human and natural erosion on the process of succession.
4. Relate the abiotic measurements to trends in biological communities.
5. Define succession, humus, community, disturbance, adaptation, and glacier.



**What to expect on during your trip:**

1. Group arrives at the West Beach unit.
2. A brief introduction is given, and the moderate to strenuous hike begins. Some flexibility is possible to accommodate physical ability. Let rangers know beforehand if your group has any special needs or requirements.
3. Students will be engaged in exploration activities to learn about the special features in the dunes throughout the 1.5 to 2 hour hike

**Setting:**

West Beach is located in Portage, Indiana; Porter County on County Line Road. The Succession Trail is about 1 mile long and includes walking in sand and on flights of stairs. Restrooms and picnic shelters are available at this site. Other hiking trails are available for use in this area if a group wishes to hike on their own before or after the program

**Grade:**

5th – 12th grade.

**Ratio of students to ranger:**

30 or less is ideal; we will try to accommodate larger groups within reason due to staffing levels. Please provide one adult chaperone for every ten students for safety purposes

**Safety Issues:**

Poison ivy, slivers on boardwalks, seasonal heat or cold, safety on stairs and dunes. Some adults and children may have difficulty walking the trails and climbing the dunes. Bring sunscreen, insect repellant and lots of water when hiking any of the park’s trails. Students should dress for the weather and wear shoes suitable for hiking.

**Background Information:**

**Geology:** The first dunes of Indiana were formed approximately 15,000 years ago when the last of the Ice Age glaciers swept down from the north. As the climate warmed, the movement of the glacier was halted, and a glacial deposit called a moraine was formed. This moraine acted as a dike holding back the water of the melting glacier forming what is now Lake Michigan. Waves, wind and plants have all combined to bring sand to the southern and eastern shores of Lake Michigan and begin the dune building process. The process of dune building that began over 15,000 years ago is still continuing today. Through the dynamic process of succession, a variety of biological communities succeed one another on the dunes of West Beach. Each community changes the physical and biological environment making conditions suitable for the next community.

The shoreline of the new lake first stood at 640 feet elevation, but this was only temporary. The increasing influx of meltwater from the ice to the north soon caused the lake to breach its morainic dam near what is now the southwest part of Chicago. As water passed out of the opening in the moraine and down the DesPlaines and Illinois valleys, the level of ancestral Lake Michigan fell. A new, lower lake level was established when the down-cutting of the DesPlaines River was stabilized by a boulder-rich zone with the Valparaiso Moraine. The new lake level, which stabilized at 620 feet was also only temporary. When the boulder field near southwest Chicago was breached, the lake began to lower again until a third level at 605 feet was reached. This resulted because the down cutting of the Illinois River and its tributaries virtually ceased when the river reached bedrock. This third lake level was to be the last stage of ancestral Lake Michigan.

By this time, the glaciers had completely left the Lake Michigan Basin. A new drainage was opened at the Straits of Mackinac, to the north, which was lower than the outlet at Chicago and continues to be the principal drainage of the lake up to the present.

Geologists refer to the three lake levels of ancestral Lake Michigan as the following: 1) Glenwood at 640 feet elevation; 2) Calumet at 620 feet; and 3) Tolleston at 605 feet.

At each of these lake stages, beaches and their accompanying foredunes are preserved. The transition to modern day Lake Michigan was a gradual one involving numerous rises and falls of the lake level. Even today the lake level is not fixed, as can be seen by a two to three foot rise during the past several years. The average level of Lake Michigan over the past 100 years is about 578 feet above sea level.

Succession: Sand dunes start as bare sand, then become dunes with grass helping to hold them in place. Over time, shrubs and trees are able to take root. As more time passes, a full forest, also called a climax forest, is able to grow at the back edge of a dune system. The change in ecosystems that takes place over time is called succession.

During succession, a series of changes occurs in the ecological community that inhabits a region. Succession happens because the activities of living organisms and abiotic factors change the conditions of a region so that it becomes more inhabitable by a different group of organisms. In sand dunes, an example of the changing communities is beach, foredune, interdunal pond, forested back dune. If marram grass takes root on a beach, its roots will begin to trap sand, causing small dunes to form. This then sets the stage for additional plant and animal life to inhabit the dunes. A progression of plant communities is found on the dunes along the south shore of Lake Michigan.

Moving from beach to oak forest in the dunes, the amount of sunlight decreases. This is due to the community plant composition. Near the lake, sun-tolerant cottonwoods and grasses are found. In the oak forest are found shade-tolerant oak, witch hazel, and other broad-leaved trees and shrubs. Sunlight, evaporation, and transpiration decrease from beach to oak forest, while the amount of moisture available to the soil increases. Since there is a greater quantity of organic material in the soil progressing from beach to oak forest, the soil is more capable of holding moisture.

The vegetation controls the amount of sunlight striking the ground. As the plants grow, they create shade, which modifies the light and moisture conditions on the ground. Trees are sometimes observed with unusual bent or twisted growth patterns resulting from their competition for available sunlight.

Dune grasses have adapted ways to reproduce and spread. They may have underground runners and the ability to shoot up new stems to prevent sand burial. Others produce enormous quantities of seeds which travel by wind. In the foredunes, a greater part of the plant is underground. This enables plants to capture and hold sand in place to build dunes.

**Prerequisite Classroom Activities:**

Prior to your visit to Indiana Dunes National Lakeshore, please take a moment to read through the information listed below. We suggest that you do one or more of the described activities with your class in order to prepare them for the lessons and experiences they will have during their field trip. If there is a special topic or area that you want the ranger to cover during the presentation, please contact the park’s scheduling office, and every effort will be made to accommodate your request.

**Activity 1:** Practice data collection with your group to prepare them for their field experience at the park. Use data such as height, shoe size, hair color, eye color, etc. After recording the data, break into small groups to summarize their findings. Each group should present their conclusions orally to the class.

**Activity 2:** Use field guides around the school to become familiar with using them. Research the organisms listed on the **attached student data sheet** and try to determine any special adaptations those organisms might have to help them survive in the five different successional stages of the dunes.

**Activity 3:** Ask each student to dig up and bring into class a plant from his or her yard along with a small amount of the soil from which it came. Make sure to dig up the roots as well as the other plant parts. Study the various parts of the plant and especially notice the roots. Students should describe the soil sample. Discuss how different soil types require different root structures for plants.

**Activity 4:** Study various soil types common to your area. Soil surveys of your county should be available from your local soil conservation service office. These provide detailed soil descriptions, aerial photos and many other types of information. Pay particular attention to information pertaining to soil formation. You may want to allow some freedom to allow the students to find their town or their house on the photos.

**Activity 5:** Students examine a map or atlas of the world and find other areas which have sand dunes. Compare the differences and similarities between these areas and the southern shore of Lake Michigan. Have students work in groups to research a park and present their findings to the class. Beginning in the United States, students can research the differences and similarities between our Indiana dunes with those found at the following national parks:

* Sleeping Bear Dunes National Lakeshore—www.nps.gov/slbe
* Great Sand Dunes National Monument and Preserve—www.nps.gov/grsa
* White Sands National Monument—www.nps.gov/whsa
* Pictured Rocks National Lakeshore—www.nps.gov/piro
* Cape Cod National Seashore—www.nps.gov/caco

**Vocabulary:**

**ABIOTIC –** Non living.

**ADAPTATION –** Change in an organism or its parts that fits it better for the conditions of its environment.

**CLIMAX COMMUNITY** - The final, most mature and stable community (sere) possible under existing environmental conditions.

**COMMUNITY** - A group of plants and animals which thrive and work together in a specific area.

**ECOSYSTEM -** Interacting communities and abiotic components

**GLACIER** - A sheet of moving ice which lasts through the yearly dry period. Continental glaciers, such as the one which produced Lake Michigan, were a mile thick and covered Indiana Dunes 12,000 years ago. When they melted, this formed the shoreline of ancient Lake Chicago (present day Lake Michigan).

**HABITAT –** The place or environment where a plant or animal normally or naturally lives and grows

**MORAINE** - Rock material of variable size deposited in a ridge by retreating glaciers at their sides (lateral moraine – Sleeping Bear Dunes) or front (terminal moraine – Indiana Dunes area).

**PRIMARY SUCCESSION** - The change in vegetation and animal life over time which naturally occurs as one community is replaced by others. Primary succession begins on barren soil.

**SECONDARY SUCCESSION** - The change in vegetation and animal life in a community which occurs after a human disturbance or a major event such as a fire, flooding, or volcanic event. Secondary succession occurs on formerly vegetated areas.

**SERAL STAGE** - A community in a successional series. The entire sequence of communities is known as a sere.

**SUCCESSION** - The changes in vegetation and animal composition over time through which one population or community is replaces by others in the same location. The process produces a sequence in community types from pioneer stages to a mature or climax community, unless the process is interrupted. The process of succession is often interrupted.

**Extension or Follow-up Activity**

Class reflection paper or writing sample:

Ask each student to write a short essay, letter or story about what they learned on their field trip to Indiana Dunes National Lakeshore. Rangers love receiving mail from their students. Send the ranger the packet of essays from your class (or a copy of them), and your ranger will send your class a certificate from the dunes. Send your essays to:

Indiana Dunes National Lakeshore

1100 N. Mineral Springs Road

Porter, IN 46304

Attn: Your ranger’s name or just Education Department

If you are using this essay as a class assignment for a grade, we would like to suggest that each essay contain the following elements. Use the rubric below to score them.

\* The name of the park and the location of their field trip—for example: Douglas Center, Indiana Dunes National Lakeshore

\* Three facts they learned on the field trip about the habitats of the dunes.

\* A brief explanation of why Indiana Dunes is unique and therefore a national park.

\* At least two things the student can do to help take care of his or her national park.

\* Fill in the blank of this statement and provide an explanation:

I would like to learn more about \_\_\_\_\_\_\_\_\_\_ at Indiana Dunes.

\*\*\* For advanced groups, add the following element:

Tell the park rangers if you would like to bring your families and friends to the dunes and if so what would you do here and where would you go.

**Assessment:**

**Grading Scale for Class reflection writing assignment:**

1. **Writing and organization**- ***4 points*** the writing sample is very well written and organized by the elements provided. It has a strong introduction, middle and conclusion. ***3 points*** the writing sample is well written and organized by the elements provided. It includes an introduction, middle and conclusion. ***2 points*** the writing sample is choppy and is not well organized. It lacks an introduction or conclusion. ***1 point***the writing sample is very short and unorganized.
2. **Grammar & Spelling-** ***4 points*** Mistakes in spelling and grammar are minor or non-existent. ***3 points*** Mistakes in spelling and grammar are minimal—about 4-5. ***2 points*** mistakes in spelling and grammar are numerous—5-10. ***1 point*** mistakes in spelling and grammar are more than 10.
3. **Facts and content**- ***4 points*** the writing sample demonstrates the student’s learning on the dunes program and includes three or more facts provided by the park staff. ***3 points*** the writing sample demonstrates the student’s learning and includes only two facts provided by the park staff. ***2 points*** the writing sample does not demonstrate much learning and only includes one fact provided by the park staff.***1 point*** the writing sample does not demonstrate any learning and does not include any facts provided by the park staff.
4. **National Park Service theme** - ***4 points*** the writing sample clearly demonstrates the student’s understanding of the role of the NPS in preserving the dunes by explaining why Indiana Dunes is such a unique treasure.***3 points*** the writing sample mentions the NPS and its role in preserving the Indiana Dunes. ***2 points*** the writing sample mentions the NPS and Indiana Dunes. ***1 point*** the writing sample does not mention anything about the NPS or its role at Indiana Dunes.
5. **Stewardship-** ***4 points*** the writing sample lists three things the student can do to assist in taking care of the Indiana Dunes. ***3 points*** the writing sample lists two things the student can do to assist in taking care of the Indiana Dunes. ***2 points*** the writing sample lists one thing the student can do to assist in taking care of the Indiana Dunes. ***1 point*** the writing sample does not list anything about what the student can do to take care of the Indiana Dunes.