

Illinois State Museum

School Program

Changes: Dynamic Illinois Environments



**Exploring *Changes*:
Evolution, Geology, and
Ecology
Grades 9-12**

Developed with support from a Learning Opportunities Grant from the Institute of Museum and Library Services

Dear Educator:

Thank you for reserving the *Exploring Changes: Evolution, Geology, and Ecology* program for your students. This packet is designed to help you prepare your group for the program and make the most of your field trip time at the Museum. For your convenience we've included:

General background materials for your use;
Pre and post trip activities;
Suggested books and Web sites; and
State Learning Standards for this program.

We are eager for your feedback on this packet, especially what is useful and what is not. Please feel free to contact Nina Walthall, Associate Curator of Education, at walthall@museum.state.il.us with comments or suggestions.

Sincerely,

ISM Education Section

Changes: Dynamic Illinois Environments

Exploring *Changes:* Evolution, Geology, and Ecology Grades 9-12

Preparing for Your Visit

Getting Here

The Illinois State Museum is located on the corner of Spring and Edwards Streets in the Capitol Complex. Routes into Springfield and to the Museum are well marked. Buses may unload and load directly in front of the Museum on Edwards Street westbound. Bus parking is available at the State of Illinois Visitor Center Parking Area. When you arrive at the Museum, please register your group at the Front Desk in the Lobby.

Visit Guidelines

Please bring one adult for every ten students. Backpacks, food, beverages, gum, and candy are not allowed in the building. Adult chaperones are required to be with students in the Museum Store and *A Place for Discovery*.

Accessibility

The Museum is accessible to visitors with special needs. Wheelchairs are available at the Front Desk. Please let us know if you have a student with special needs.

Food Service

Food service and vending machines are not available at the Museum. There is a picnic area at the State of Illinois Visitor's Center, one block away. There are a number of fast-food restaurants within one mile of the Museum.

Photographs

Visitors are welcome to take photographs in all areas of the Museum except the Art Gallery (depending on the exhibition).

Program Introduction

Exploring Changes: Evolution, Geology, and Ecology is designed to use the various displays within the Illinois State Museum to illustrate how evolution, geology, and ecology have impacted Illinois's environmental history over the last 500 million years. Students will examine dioramas within *Changes* for evidence relating to evolution, geology, and ecology. In particular, students will attempt to learn how concepts from the three disciplines worked to create the diverse ecosystems depicted within *Changes*.

This program includes two activities. Your class may do one or both activities:

Guided Program: Depending upon the needs of your group, you can choose a 45 minute or 1 hour program. The 45 minute program has a shorter introduction and is most appropriate for advanced students who have already studied evolution, geology, and ecology. The 1 hour program has a longer introduction and is best suited for students who have not studied this material or need a review. Both versions include student group work within the exhibit.

Independent Activity: An unguided activity in the *Changes* exhibit, where students explore the concepts of evolution, geology, and ecology. The Museum will provide activity sheets, clipboards, and pencils for your group.

After taking part in *Exploring Changes: Evolution, Geology, and Ecology*, students should be able to:

Define evolution using examples from the *Changes* exhibit.

Define geology using examples from the *Changes* exhibit.

Define ecology using examples from the *Changes* exhibit.

Explain how evolution, geology, and ecology interrelate to bring about change over time.

Evaluate a *Changes* diorama for evidence of evolution, geology, and ecology.

Exploring Changes: Evolution, Geology, and Ecology can serve as either an introductory lesson or as a summative review for your students.

IL State Goals for Learning

Exploring Changes: Evolution, Geology, and Ecology addresses the following Illinois State Goals for Learning:

State Goals, Early High School

- **4.A.4a** Apply listening skills as individuals and members of a group in a variety of settings (e.g. lectures, discussions, conversations, team projects, presentations, interviews).
- **11.A.4a** Formulate hypotheses referencing prior research and knowledge.
- **11.A.4c** Collect, organize and analyze data accurately and precisely.
- **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms.
- **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry.
- **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms.
- **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics).
- **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth.
- **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.
- **13.A.4c** Describe how scientific knowledge, explanations and technological designs may change with new information over time

- **17.B.4a** Explain the dynamic interactions within and among the Earth’s physical systems including variation, productivity and constructive and destructive processes

State Goals, Late High School

- **4.A.5.b** Use techniques for analysis, synthesis, and evaluation of oral messages.
- **11.A.4a** Formulate hypotheses referencing prior research and knowledge.
- **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy).
- **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction.
- **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions).
- **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories
- **17.C.5b** Describe the impact of human migrations and increased urbanization on ecosystems.

Educator’s Background Information

One of the central themes of the *Changes* exhibit is that Illinois’ environments have changed over time, and those changes have been the result of a variety of forces – geological, evolutionary, and ecological – which are often interrelated. The scientists of the Illinois State Museum are very interested in these changes and study them in what is called the Museum’s Landscape History Program. Much of the science on which the *Changes* exhibit is based comes from their work. This program provides an opportunity for your students to look closely at the science behind the *Changes* exhibit, and how the scientific disciplines of evolutionary biology, geology, and ecology are related.

Simply defined, **evolution** is change over time. Biological evolution concerns changes in living things during the history of life on earth. It explains that living things share common ancestors. Over time, evolutionary change gives rise to new species. Fundamentally, all evolution occurs at the genetic level. If an allele for a trait is favored by an organism’s environment, then that allele will be selected rather than an allele that is somehow less fit for an environment. As environments change, so too do the frequency of alleles for various traits. Nature selects those organisms that best fit into an environment, hence the term “natural selection.” Changes in metabolism, pigmentation, and visual acuity are three of the millions of traits that have become refined over millions of years of evolution at the cellular level. Macroevolution is also readily observable, especially in the *Changes* exhibit. Macroevolution refers to observable changes in organisms as they divergently evolve into different species. Although they share a common ancestor, bivalves such as oysters and clams are sufficiently different that they can no longer interbreed. This is an example of macroevolution.

Geology plays an important role in evolution. Catastrophic events, such as volcanic eruptions, can cause drastic terrain and climate changes that can have an impact on the survival of organisms. Processes that occur more slowly, such as plate tectonics and continental drift, have an equally important impact on the survival of various organisms. As is readily apparent in *Changes*, Illinois’ position in the world has changed dramatically over time. Five hundred million years ago, where the *Changes* exhibit storyline begins, Illinois was underwater and below the equator, resulting in an ecosystem that appeared far different than any found in Illinois today. Throughout time, geologic forces have continued to create an Illinois of diverse landforms and distinct ecosystems.

Ecology refers to the interactions between organisms and their environments. As organisms have evolved to adapt to their changing surroundings, other organisms have had to adapt as well. Whole

ecosystems have developed, based upon the delicate balance of living and nonliving things within an environment. Changes brought about by humans have severely disrupted many of these environments in Illinois and throughout the world. However, geological forces have also caused similar disruptions throughout Illinois' past.

Before Your Visit

Because students will be working in groups, to save during your field trip it is recommended that students know their group assignment before arrival at the Museum. They will be given two worksheets to complete during the program. So that you can review them before your trip, the worksheets are provided in this packet. **The Museum will provide these for your students during the program.**

After Your Visit

Here are some activities that you can do with your students after the *Exploring Changes: Evolution, Geology, and Ecology* program:

- Review concepts related to evolution, geology, and ecology presented at the Museum and discuss student questions.
- Have students give brief presentations reviewing evidence found in the various *Changes* dioramas
- Have students create a time line of Illinois environmental history featuring major plant and animal species at different points in time., along with critical aspects of Illinois geology and climate.
- Have students create a PowerPoint or similar presentation of the plants or animals found in their display.
- Have students write essays on how evolution, geology, and ecology are interrelated, using evidence found in their dioramas.
 - Have students conduct additional research on the time period featured in their diorama. They could then design their own diorama featuring additional plants or animals found in their research.

Resources

Most high school-level texts serve as excellent introductory resources for the fields of evolution, geology, and ecology. The following Web sites and books can provide additional resources for you and your students:

Ecology

Harvard University and the Missouri Botanical Garden. Compendium of ecology-related Web sites.
<http://pbil.univ-lyon1.fr/Ecology/Ecology-WWW.html>

Evolution

National Center for Science Education. This is a great teacher resource on evolution.
<http://www.natcentersci.org>

National Science Teacher Association. List of evolution books and resources.
http://science.nsta.org/enewsletter/2003-11/books_high.htm

University of California - Berkeley Museum of Paleontology. This is a comprehensive resource on evolution and paleontology. <http://www.ucmp.berkeley.edu>

Illinois Ecosystems

Illinois Department of Natural Resources. Information on Illinois ecosystems. <http://dnr.state.il.us/orep/inrin/ecosys/ecosyspg.htm>

Illinois State Museum, MuseumLink-Illinois. Contains Illinois-specific information about forests and prairies. <http://www.museum.state.il.us/muslink>

Illinois State Museum, Of Time and the River. Web module for secondary classrooms that looks at 12,000 years of human impact on the Illinois River. <http://www.oftimeandtheriver.org/>

Illinois Natural History Survey. Information about Illinois plants, animals, and ecosystems. <http://www.inhs.uiuc.edu>

General

EnviroLink Network. Links to geology and ecology-related Web sites. Particularly geared for students. <http://envirolink.org/enviroed/students.html>

National Science Teachers Association. Science-related links. <http://www.scilinks.org/>

Geology

The Illinois State Geological Survey. Information about Illinois geology. <http://www.isgs.uiuc.edu>

Schubert, Christopher J. 1986. *A View of the Past: An Introduction to Illinois Geology*. Illinois State Museum. Springfield, IL. 181 pp. ISBN 0897921046.

Wiggers, Raymond. 1997. *Geology Underfoot in Illinois*. Mountain Press Publishing Company. Missoula, MT. 304 pp. ISBN 087842346X.

Student Name _____

1. What is evolution?

2. What is geology?

3. What is ecology?

4. Find examples or evidence of these sciences in the Introductory Exhibit:

Evolutionary Biology	Geology	Ecology
1.	1.	1.
2.	2.	2.
3.	3.	3.

5. Tallgrass prairie **geology** notes:

6. Tallgrass prairie **ecology** notes:

7. Tallgrass prairie **evolution** notes:

Exploring *Changes*: Evolution, Geology, and Ecology Group Activity

Student Name _____

Diorama/Exhibit Name _____

Look closely at your diorama. What do you see?

What can you tell about the diorama's **geology** ?

What time period is depicted?	
Where is Illinois located on Earth?	
Describe the habitat - land, water, or wetland?	
Can you see soil? If so, what is it like?	
Describe the terrain (hilly, flat, etc.)	
What's the climate? (Av. temp, frost free days, etc.)	

What can you tell about the diorama's **animals**? Chose one animal to study.

Animal Chosen:	
Could your animal live only in this ecosystem? Where else could it live?	
Use the <i>Changes Field Notes</i> to learn more about your animal's diet. This may give evidence about why your animal lives here.	
Are there any large groups of animals (like mammals, birds, etc.) that have not yet evolved ?	
Does your animal have any special adaptations to live here?	

What can you tell about the diorama's **plants**? Chose one plant to study.

Plant Chosen:	
Could your plant live only in this ecosystem? Where else could it live?	
Use the <i>Changes Field Notes</i> to learn more about your plant. This could give evidence about why your plant lives here.	
Does your plant have any special adaptations to live here?	

What can you tell about **evolution** in this diorama?

How much diversity of life is there in the diorama?	
Using the <i>Changes Field Notes</i> and any other evidence in the exhibit, can you give an example of a plant and animal co-evolving?	
What can you infer about the effects of evolution on the organisms exhibited in the diorama? What forces may have caused these animals and plants to evolve, become extinct, or move to different locations? Think about both natural and human factors.	
What living or non-living things from your exhibit still exist, at least in some form, in Illinois today?	
What living or non-living things from your exhibit no longer exist? Why did these changes take place?	

When you go back to class, you will use this data to recreate Illinois' environmental history. Is there any other data from your diorama that you need to record?

