THE HALL of biodiversity

A Teacher's Guide

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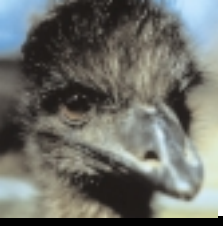
FOR FURTHER INFORMATION AND ACTIVITIES, VISIT OUR WEBSITE AT WWW.AMNH.ORG/RESOURCES/BIODIVERSITY

AMERICAN MUSEUM OF NATURAL HISTORY



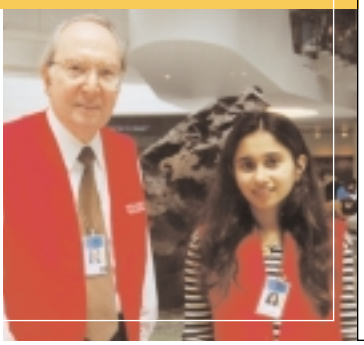
key concepts and orientation

come prepared !

The Hall of Biodiversity is very busy and noise levels can be high. It is a large space with a lot of through traffic. It can be a challenging environment in which to introduce new topics and skills to your students. Familiarize your class with the content of the Hall and give them an opportunity to practice any necessary new skills before they visit. Or choose another nearby location to speak with your class.

As an informal learning environment, the Museum offers many opportunities for self-directed learning. During the visit, your students will be exposed to, and inspired by, wonderful artifacts and specimens presented in a range of media. Build flexibility into your planning to allow students to follow their own interests. Give yourself time to observe their behavior.

Most mornings between 10 a.m. and noon, red-vested Museum volunteers are stationed in the Hall. Some volunteers are free-floating; others are located at a hands-on cart containing objects made from endangered species and confiscated by the U.S. Fish and Wildlife Service. All volunteers are happy to provide information and answer questions. Several flashlights are available for use in the Rain Forest Diorama.



The Hall of Biodiversity, which opened in the spring of 1998, addresses the variety and interdependence of all living things. It celebrates the beauty, diversity, and abundance of life on Earth while warning of the threats posed by human activity. The Hall is organized around four questions:

- What is biodiversity?
- Why is biodiversity important?
- What are the threats to biodiversity?
- What can be done to protect biodiversity?

Information and responses to these questions are embedded throughout the Hall in text, videos, and interactives. Red text indicates threats. See the "How to Read the Labels" page for a schematic of how these questions are addressed.

Class visits may focus on the entire hall or one of the following:

- ecosystems/habitats
- human effects on the environment
- evolution

(These three topics, which specifically address performance standards and curriculum requirements, are covered in more detail in the Background section of this guide.)

No matter how you tour the Hall, we recommend that you begin with the eight-minute **Introductory Video (8)**, *Life in the Balance*. A continuous loop, it provides an overview of the main concepts of biodiversity featured in the Hall.

The **Spectrum of Life Wall (1)** highlights the wealth and diversity of life on Earth. Along the wall and overhead are displayed 1,500 specimens and models—ranging from microorganisms to large terrestrial and aquatic organisms, including bacteria, plants, fish, mammals, and insects—presented in the form of a **cladogram**, a graphic chart that reconstructs the evolutionary history of a group of organisms. This cladogram shows the 28 living groups that make up all life on Earth.

The **Crisis Zone (5)**: Embedded in the floor in front of the Spectrum of Life Wall is a time line of the five previous major **extinction events**—periods of unusually high levels of extinction—with fossils from these periods. Two columns flanking the time line provide an overview of the causes of the present, or sixth extinction, an event different from previous extinctions because it is caused by human activity. A display case nearby contains examples of and information about endangered and extinct animals.

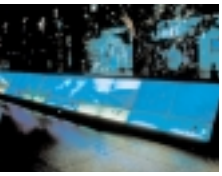
A multiscreen **Habitat Video Wall (2)** provides a global tour of nine **ecosystems**, communities of interacting organisms and their physical environments. Each 90-second video is superimposed with warnings about threats to each ecosystem. Texts and maps show distributions.

The **Rain Forest Diorama (6)**, representing a section of the Dzanga Ndoki rain forest from the Dzanga-Sangha Forest Preserve in the Central African Republic, features more than 160 flora and fauna **species**. The rain forest is shown in progressive states of disturbance. An interpretative railing provides details in text and graphics. Through video interviews, local people, government officials, and World Wildlife Fund representatives tell their stories about the forest.

In text, graphics, and on video, the **Transformation of the Biosphere Wall (7)** presents dramatic case studies of changes to the **biosphere**—all living things on Earth and their habitats. Case studies on the **Solutions Wall (3)** suggest possible remedies to the biodiversity crisis. Between these two walls, 10 computer kiosks offer access to Web sites, a bibliography, names of conservation organizations, and a searchable archive of the Hall's quarterly **BioBulletin (4)**—a video magazine.

the hall of biodiversity

1. Spectrum of Life Wall



2. Habitat Video Wall

3. Solutions Wall

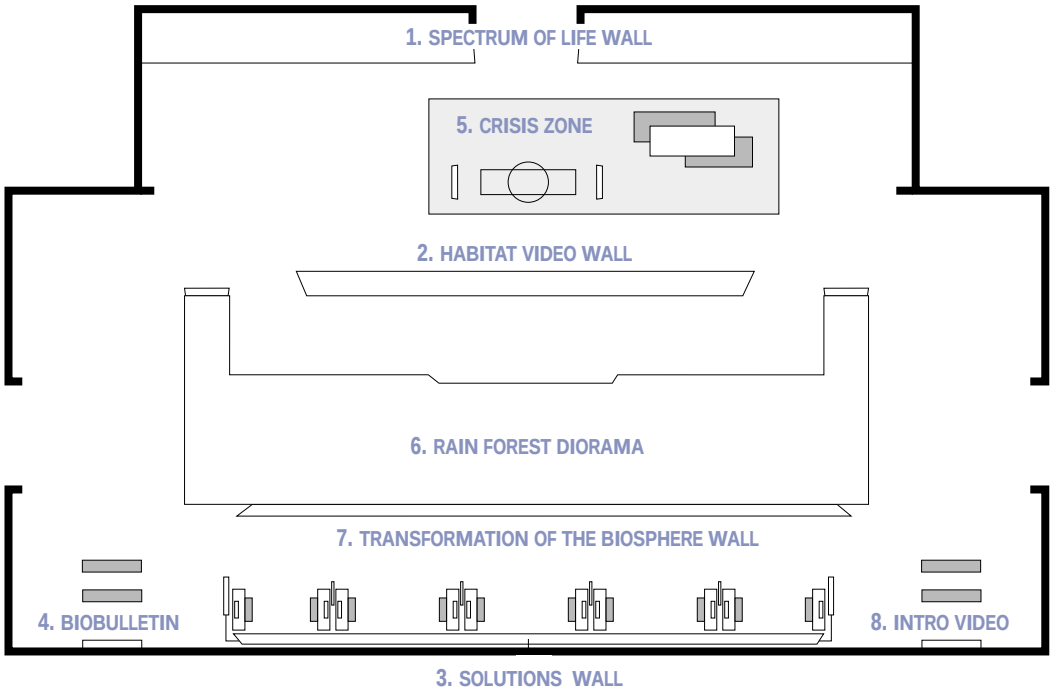
4. BioBulletin

5. Crisis Zone

6. Rain Forest Diorama

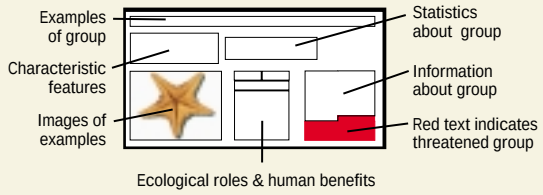
7. Transformation of the Biosphere Wall

8. Introductory Video

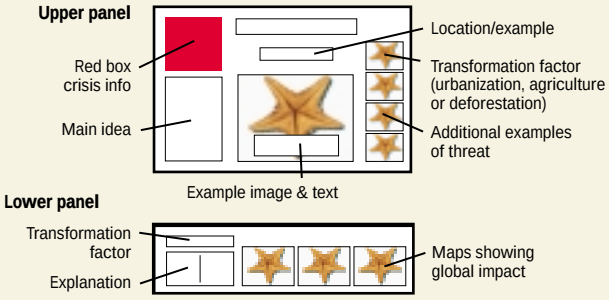


how to read the labels

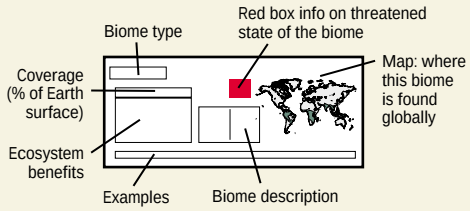
Spectrum of Life Wall



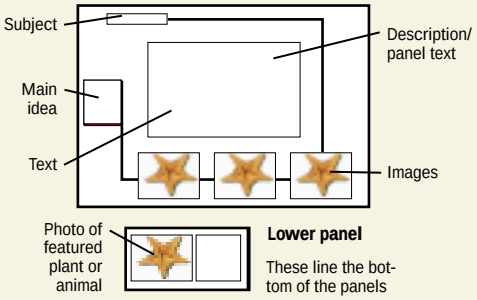
Transformation of the Biosphere Wall



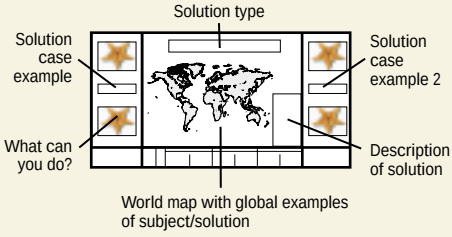
Habitat Video Wall



Rain Forest Diorama



Solutions Wall



BACKGROUND

In this section of the guide we describe ways to integrate the different areas of the Hall into the following aspects of the science curriculum:

- ecosystems/habitats
- human effects on the environment
- evolution

Spectrum of Life Wall

Ecosystems/Habitats Text panels describe the value and benefits provided by ecosystems to humans—such as the production of oxygen through photosynthesis, or the purification of water.

Evolution Most of the 200 scientists working at the Museum carry out research in **systematics**, the area of biology that describes living and extinct species, some already discovered and some formerly unknown to science. These **systematists** study the diversity of species by arranging organisms into groups that share an evolutionary history and classifying species according to characters, or distinctive features. Systematists display this information in a branching diagram called a cladogram. The organisms in each group, or **clade**, that branches off the cladogram share characters inherited from a common ancestor. Each of the 28 groups represented on the Spectrum of Life Wall makes up one clade. Combined, these 28 clades constitute a giant cladogram that contains all life on Earth: almost 1.75 million species have already been described, but there are millions more. Estimates range from 5-100 million.

The complete cladogram is shown on the text panel in front of the interactive computer stations. Use these stations to identify specimens on the wall. Text panels provide information about and examples of species within each clade—including the characteristic features used to define them—and, in some cases, the threats they face.

Crisis Zone

Human Effects on the Environment Human activity is now causing the sixth known mass extinction in our planet's history. The expansion of agriculture and industry, particularly in the last 400 years, has resulted in a loss of habitat, pollution, overexploitation by hunting and fishing, and the introduction of **non-native species**—species from other ecosystems—on large scales and in many parts of the globe. A display case contains animals that are either extinct or under serious threat because of human activity.

Evolution Extinction is as much a part of the evolutionary cycle as the origin and diversification of new species. Scientists estimate that more than 99% of all species that have existed at some time on Earth are now extinct.

Evidence of five previous periods of global mass extinctions is found in the **fossil record**—the form, variety and distribution of all fossils in time and space. The display case in the floor identifies these events.

Habitat Video Wall

Ecosystems/Habitats Examples of nine different ecosystems are shown on video screens. Their global distribution is displayed on maps. Panels provide the following information on each ecosystem:

- detailed description
- benefits provided to humans
- percentage of the Earth's surface covered
- global distribution

before your visit

Key words
Review the vocabulary in bold throughout this guide (as appropriate to the ages and levels of students)

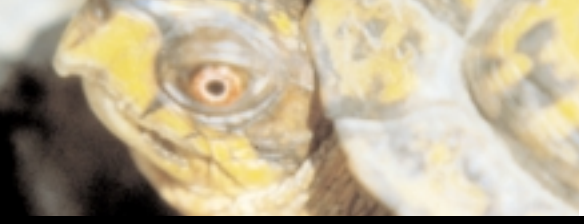
Classification
Familiarize students with dichotomous keys. See:
www.amnh.org/resources/biodiversity

Ecosystems/Habitats (Web-of-Life game)

1. On index cards, copy the names of organisms from the Rain Forest Diorama (see insert sheet).
2. Ask students to sit in a large circle and take one card each.
3. Toss a ball of string to one student who reads aloud the name of the item on his or her card. Keeping a tight hold of the string, the student throws the ball of string to another student.
4. The second student reads out the item on his or her card and tries to explain how it might relate to the item on the previous card. Anyone in the group can offer suggestions and discuss the relationship. (Use photographs with younger students).
5. Keeping a tight hold on the string, the second student tosses the ball to a third student who repeats the process, then throws the string to another student.
6. Repeat until the ball of string is used up. The web created by the string illustrates the complex ecology of a tropical rain forest. Ask students to predict what happens to the web if certain items are removed, or become extinct. How might people affect some of these relationships?

Human impacts on the environment:

1. As a class activity, make an inventory of objects in the classroom.
2. List the natural materials used in each object. (Use photographs with younger students.) Where do they come from, and how easy are they to replace?
3. What does this tell you about our use of the natural world and our dependence on biodiversity? How might this differ for people in other countries?
4. To illustrate the concept of extinction, choose a product, such as wood, and invite students to come up with alternative materials for all objects made of wood or wood-related materials.



Human Effects on the Environment Specific threats to each ecosystem are described in red beside the distribution map and superimposed on video screens.

Rain Forest Diorama

Ecosystems/Habitats Visitors can observe the interaction of species within this diverse ecosystem as well as their interactions within **microhabitats**, such as a stream, a tree branch, or a dungheap. Disturbances caused by natural forces such as running water and elephants are evident. The text provides information about tropical forest ecology.

Human Effects on the Environment Foreign timber and mining concessions drain natural resources from the region, while local people clear land for agriculture and use the forest for other basic needs. The government of the Central African Republic established the Dzanga-Ndoki National Park and the Dzanga-Sangha Dense Forest Reserve to protect this ecosystem. The national park is protected from human impacts, while the forest reserve allows limited extraction of the local flora and fauna. Dzanga-Sangha is an example of a conservation effort designed to conserve biodiversity by enlisting local people as partners in the management of a protected area.

Evolution In tropical rain forests the interaction of **abiotic**, or non-living, elements such as heat, light, and water, results in the highest terrestrial rates of species diversity. This re-creation of the Dzanga-Sangha rain forest in the Central African Republic shows the rich biodiversity present in this ecosystem. Field guides on the rail identify the hundreds of species that live there.

Transformation of the Biosphere Wall

Human Effects on the Environment This wall examines the root causes of biodiversity loss—population growth and overconsumption. Panel text, graphics, and video presentations provide detailed information as well as showing global impacts.

Solutions Wall

Human Effects on the Environment Case studies on this wall provide examples of conservation in action. Attempts to solve complex ecological problems are described, and suggestions of ways that visitors themselves can make a difference are offered.

BioBulletin

On the other end of the wall from the Introductory Video, a BioBulletin offers magazine-format commentaries about biodiversity-related issues. It includes profiles of scientists and their research, and stories of threats to biodiversity as well as efforts to protect and conserve it. Produced on a regular basis, the BioBulletins keep the content of the Hall up-to-date.

while you're at the museum

Encourage students to record information in words and drawings.

Spectrum of Life Wall:

Ask students to work with a partner. Allocate one clade, or animal or plant evolutionary group, from the Wall (see insert for list) to each pair of students, who should:

- choose three specimens from their clade. Draw these in close detail. Include labels to describe features and colors. Why are these specimens in the same clade? Use the computer interactives to find and record further information on the specimens and the clade.
- closely study the labels in front of the clade. Make notes and drawings on areas of interest for further research back in the classroom.

Younger students may choose favorite specimens, make drawings, then look for their specimens on the computer interactives.

Older students may focus on one area of the panel text, e.g. human benefits, rather than on individual clades (see "How to Read the Labels" for details of how the text is organized).

Rain Forest Diorama:

Ask students to sit, closely observe, and listen to the diorama. Draw their attention to the three different levels of the rain forest:

- forest floor
- understory (area at eye level)
- canopy (sit back on the benches and look up)

Ask questions that encourage students to focus on the interactions they see in each layer (remind them of the Web-of-Life game) and to record their observations in drawings and writing.

To help them focus closely, younger students may bring flashlights, or create observational tools (such as binoculars) before their visit.

Older students may use panel text or the field guides to make more detailed notes.

Entire Hall

Before your visit, ask older students to choose an environmental topic that interests them, e.g., oceans, forests, pollution, endangered species. At the Museum, invite students to use the resources of the Hall to gather information for further research and writing back in the classroom.

back in the classroom

Follow up with a directed class discussion based around the four organizing questions of the Hall:

- What is biodiversity?
- Why is biodiversity important?
- What are the threats to biodiversity?
- What can be done to protect biodiversity?

Students may raise other areas of interest for discussion.

Create definitions for a class glossary of new terms learned before and during the visit. For younger students, include illustrations. Older students may annotate with examples, maps, and graphics.

Spectrum of Life Wall

Ask students, in their pairs, to continue researching their clade using available resources including books and the Internet. Topics for study might include: endangered species, values and benefits to humans, and ecosystems/habitats.

A **cladogram** is a diagrammatic representation of evolutionary relationships. Using the information—written and graphic—collected from the Spectrum of Life Wall, students can create a cladogram in the classroom that reflects their research.

Older students may carry out independent research on the history of classification systems. What are the limitations and advantages of different systems? How do people classify nature in other cultures?

Rain Forest Diorama

Use the information collected to create food webs. Make a mural or small-scale diorama that illustrates the layered structure of the rain forest. Younger students may focus on animals and plants, and on basic interactions. Older students may focus on the range and complexity of microhabitats within each layer.

Invite students to prepare class presentations based on their research into specific environmental issues, focusing on the United States. A presentation may be in the form of a debate, show-and-tell, drama, a video, or a Web site. Encourage students to consider multiple perspectives—social, cultural, ecological, economic, political, and historical—and the issue of sustainability.

Links to New York State Standards:

The activities in this guide fulfill the following standards:

- Life Sciences
- Scientific Communication
- Scientific Tools and Technologies
- Scientific Thinking
- Scientific Connections and Applications

Further information on standards and additional activities may be found on the Web site at: **www.amnh.org/resources/biodiversity**

connections to other exhibits in the museum

- **Ecosystems/Habitats** The Museum's world-renowned dioramas show a wide range of ecosystems. Compare and contrast mammal and bird habitats and adaptations by studying the dioramas in:
  - Akeley Hall of African Mammals
  - North American Mammals
  - Small Mammals
  - North American Birds
  - Birds of the World

  Compare different ecosystems:
  - Rain Forest Diorama in the Hall of Biodiversity, Olympic Rain Forest Diorama, Giant Cactus Forest, and Forest Floor Diorama in the Hall of North American Forests
  - Rain Forest Diorama in the Hall of Biodiversity with local ecosystems and microhabitats in New York State Environment Hall
  - North American Bird Hall with Reptiles and Amphibians Hall
- **Evolution** Discover the birth of life on Earth in the Hall of the Universe. In the Hall of Planet Earth, find evidence of a recently discovered ecosystem—**hydrothermal vents**, sulfur chimneys on the ocean floor. The Fourth Floor Halls tell the history of vertebrate evolution using cladograms. Make connections with our own evolutionary history in the Hall of Human Biology and Evolution.
- **Human Effects on the Environment** Both the New York State Environment Hall and the Reptiles and Amphibians Hall highlight habitat loss due to human activity. Study the development of irrigation in the River Valley area of the Hall of African Peoples to see how people use their environment. Compare to the New York State Environment Hall.

  Find information about many endangered species and habitats on exhibit throughout the Museum at: **www.amnh.org/nationalcenter/Endangered/**

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