

## actionbioscience.org lesson

To accompany the article by H. Bruce Rinker:

**Conservation from the Treetops: The Emerging Science of Canopy Ecology** (Oct. 2000)

<http://www.actionbioscience.org/environment/rinker.html>

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### **Forest Canopies: View from the Top** (August 2002)

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Educator's section: p. 1-2
Student handout 1: p. 3
Student handout 2: p. 4

#### **Grades & Levels:**

- **Handout 1:** high school (general - advanced/AP)
- **Handout 2:** undergraduate (year 1-2)

#### **Time Recommendations:**

- **Handout 1:** 1-2 class periods for article review and 2 weeks for projects
- **Handout 2:** • 1-2 class periods for article review
  - up to 2 weeks for Part A of student handout
  - Part B of student handout can take one or more semesters to complete

#### **NSES (USA) Content Standards, 9-12:**

- NSES 1.1. Unifying Concepts & Processes: systems, order & organization
- NSES 1.4. Unifying Concepts & Processes: evolution and equilibrium
- NSES 4.4. Life Science: interdependence of organisms
- NSES 4.5. Life Science: matter, energy & organization in living systems
- NSES 5.1. Earth & Space Science: energy in the earth system
- NSES 7.3. Science in Personal & Social Perspectives: natural resources

#### **Learning Objectives:** Students will...

- explore the ecological characteristics of canopy ecology, especially forest canopies
- consider the various social, economic, and environmental issues in canopy conservation
- examine the impact of human activities that destroy forest canopies
- discuss ways to reduce negative impacts on canopy ecosystems

#### **Key Words Include:**

canopies, cover (in a habitat), deforestation, environmental degradation, predator, prey, species diversity, species extinction, tropical/temperate forests, wildlife habitat

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### **Preparation**

#### **Article Discussion:**

Distribute copies of the article by H. Bruce Rinker or ask students to download it from

<http://www.actionbioscience.org/environment/rinker.html>. Have students read the article on their own. Several approaches are possible for using the Article Discussion questions on page 2:

- Pose the content questions for whole class discussion. Assign the extension questions as class work or homework assignment.
- Ask students to form small groups for discussion. Provide copies of the questions to each group. The smaller groups can report the results of their discussions to the entire class.

- Have students complete the content questions on their own, perhaps as a short-answer writing assignment. They could then discuss their answers to the more complex questions in a group.

### Student Handout 1:

- **Part A:** Short essays that expand on the information in the article, which can be completed as homework.
- **Part B:** Projects that require investigation to be done individually or in teams of two or more.

### Student Handout 2:

- **Part A:** Short-term projects that require individual or team research.
- **Part B:** The Canopy Walkway Project should be undertaken by the whole class. Teams can work on different aspects of the project. You may want the class to present its feasibility study and designs to college administration or town council for consideration.

### Other Resources:

- National Geographic Video: Try to obtain a copy of *Heroes of the High Frontier* through the library. The video is also available for purchase on the National Geographic web site. After viewing, have students discuss the importance of forest canopies and the things we all can do to minimize deforestation and conserve forest canopies.
- The following reference was used in the research of this lesson:  
Lowman, M.D., and N.M. Nadkani, editors. *Forest Canopies*. Academic Press. 1995.
- Refer students to the "Useful Links" section in the *Educator Resources* section. These links provide information about canopy ecology for their activities and provide a source for research information.

## For Educators: Article Discussion

About the article by H. Bruce Rinker:

“Conservation from the Treetops: The Emerging Science of Canopy Ecology”

<http://www.actionbioscience.org/environment/rinker.html>

### Content Questions:

1. What is a canopy?
2. Why should we care about canopies?
3. According to the author, what are the 3 major points we have learned from canopy research?
4. How does deforestation affect the conservation of forest canopies?
5. How do people benefit by maintaining healthy forest canopies?
6. What are the methods used by biologists (or other interested people) to get into a forest canopy?
7. What are the rates of extinction for species in the 1970s, 1980s, and estimated for the 21<sup>st</sup> century?

### Extension Questions:

1. What did the lesson of Rapa Nui, or Easter Island, tell us about canopy conservation?
2. Why do you think canopies have been called "highways in the trees"?
3. Imagine "the implications [of extinction rates of 100 species or more per day] for the tapestry of life upon which we depend," stated by the author. Why should we protect canopy species?
4. What are the differences and similarities between "canopies" in a forest, in an orchard, or in the grassy cover of a backyard lawn?
5. Why do you think that forest canopies in tropical countries are particularly interesting to canopy ecologists?
6. Why are public aerial walkways a good education tool? Where would you build one in your community?

# Forest Canopies: View from the Top

## Student Handout 1

### PART A. ESSAYS ON THE ARTICLE

Write an essay on one of the following:

- Why is canopy ecology considered one of the few last frontiers in ecological research?
- If you were to spend a whole year in the canopy of a forest near your house or school, what do you think you would see up there as the seasons changed?
- Bruce Rinker's article points out that, in the year 2000, there were approximately 100 forest canopy walkways/platforms worldwide. Summarize what you discover on a web site that describes one of these walkways.

### PART B. PROJECTS

#### Tour Assistant

You volunteer at your local botanical garden. Every day, busloads of school children visit the garden. The Canopy Ecology Director asks you to prepare a pamphlet for them about canopy research that:

- explains the variety of methods used to study forest canopies; include illustrations
- lists advantages and disadvantages of the different methods
- describes methods most commonly used today and why

#### Observing a Canopy

- You will need a clipboard, pencils, and a camera for this project. Choose an outdoor wooded area and observe it for some time (half an hour to several days). Make sure you don't make any noise while you observe. Record your observations on your clipboard. Take pictures of animals that show up. Create a scrapbook of your pictures and observations. You will need to refer to wildlife books to help you name some of the animals in your pictures.

#### Forest Sketchbook

There are three major layers in a forest: forest floor, understory, and canopy. Research a wooded area in your community. If there is no such area nearby, conduct your research on the Internet.

- Make sketches of plants that you find within each layer of the forest. If possible, paste dried leaves into your sketchbook (use gloves to pick leaves to avoid contact with toxic plants such as poison ivy).
- For each sketch or leaf, make notes about the height of the plant, density of the species, and its location in the forest layers.
- Using naturalist guides and Internet searches, identify as many of the plants as you can.

#### Easter Island

Prepare an illustrated brochure or web page for a travel agency that undertakes archaeological tours. Include the following information about Easter Island:

- its geographical location, topography, and climate
- the cultural history of the island
- a summary of the ecological disaster that happened there and how it affected the population

# Forest Canopies: View from the Top

## Student Handout 2

### PART A. PROJECTS

#### Canopy Ecology in the Curriculum

If you were a high school biology teacher, how would you go about teaching canopy ecology? Prepare a curriculum unit that outlines the topics that you think should be taught at that level. You should contact a local high school biology teacher to review the school board's biology curriculum and discuss how your unit can be applied to the curriculum.

#### Field Guide to Epiphytes

Sunlight is key to many plants. In tropical and subtropical forests, one way for plants to grow in the sunlight is to start their growth near or in the canopy. Create an illustrated field guide to epiphytes for visitors to these forests. Include:

- an introduction that explains epiphytes in general terms
- an explanation of their ecological role in forests
- sketches or pictures of at least a dozen epiphyte species from around the world
- notes for each species that describe where they can be found, how they obtain water and nutrients, and how they disperse

#### Easter Island

Prepare an illustrated brochure or web page, suitable for a travel agency that undertakes archaeological tours. Include the following information about Easter Island:

- its geographical location, topography, and climate
- its natural resources
- the cultural history of the island
- a summary of the ecological disaster that happened there and how it affected the islanders

### PART B. CANOPY WALKWAY FEASIBILITY STUDY

Conduct a feasibility study of building a canopy aerial walkway and/or platform(s) on your campus or in a wooded area in your community. Assign different tasks to team members for the study. Here are some considerations for team research:

- Identify and describe a suitable, safe, and accessible outdoor area for the project
- Research the methods used to study forest canopies and describe advantages and disadvantages of the different methods
- Create architectural drafts of possible walkway structures based on the above
- Estimate the costs for the proposed structures
- Address human safety concerns and site maintenance
- Consult with a canopy ecologist on campus or biologists at a botanical garden about the project
- Consult with landscape architects about design, safety, and costs
- Describe the benefits of the project to the campus and to the general public

Teams should research canopy walkways on the Internet and in the campus library and conduct interviews with experts in order to support findings and conclusions. After project completion, consider creating a bound report of the study to present to campus administration or community council. The walkway project may become a reality!