



# Literature and the Diversity of Life

## Materials:

### Activity One:

- ☆ "Book Lice" from a *Joyful Noise: Poems for Two Voices* by Paul Fleischman (Harper Row, 1988) or other poems about nature.

### Activity Two:

- ☆ Book-making materials such as paper, crayons and ribbon.

### Activity Three:

- ☆ "October Has the Heart" (poem), "The Innocent Fox" or "The Star Thrower" (essays) by Loren Eiseley from *The Star Thrower*, (Harcourt Brace Jovanovich, 1978) or other books and essays describing the natural environment.

### Activity Five:

- ☆ *The Diversity of Life* by E. O. Wilson (Harvard University Press, 1992) or other books that emphasize ecological principles.

## Objectives

1. Students will understand literature can teach about biological diversity.
2. Students gain an understanding of the interdependence between science and literature.
3. Students will be exposed to examples of biological diversity through literature, learn to relate and learn how to apply ideas about biological diversity in the books to science.

## Activity One: The Literature Connection

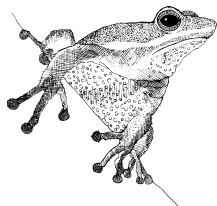
### PROCEDURE:

1. Pose questions to students about how literature and science (environmental science) are interconnected. As a springboard for discussion, students should discuss stories, books and poems they have read that contain scientific facts or have a science-based story line. Share stories with the class, including what students liked or disliked about them.
2. List the pros and cons of combining literature and science (some pros will be found on the background information page at the end of the lesson). Cons might include the fear that some literature is not scientifically accurate (fiction) or the inclusion of anthropomorphism (attributing human characteristics to animals, plants or inanimate objects)

3. Share the literature categories given in the background information in this lesson with students. Brainstorm and list books students have read or heard about that fall into each category. Ask students to justify why it might be important to categorize scientific literature and why it is sometimes difficult to do so.
4. Read a nature poem such as "Book Lice" from *Joyful Noise* by Paul Fleischmann. This poem is from a collection for two voices. It is written so that one person or group reads phrases on the left side of the page while the phrases on the right side are read by the other group or person. Center phrases are read simultaneously. Afterwards, discuss the following questions:
  - What scientific information did you find in this poem?
  - Could anything in this poem form the basis for experimental science research? Explain your answer.
  - Does this poem illustrate biodiversity?
5. Compose a poem showcasing facts about biological diversity in general or biodiversity within a specific habitat or ecosystem (in a rotten log, under a rock or

## Rationale

Utilizing basic reading, writing and thinking skills, explore nature through various forms of literature.



on a mountainside).

**PROCEDURE:**

**Activity Two:  
Be an Author**

1. Author and illustrate a book based on biological diversity in Arkansas for use by students in a lower grade. Afterwards, place the books in a classroom library or book fair.
2. Cover and contents:
  - Make your own book using blank art paper or other heavy paper for pages. Card board or foam board covered with contact paper for the covers and ribbon for binding. You may order bound, blank books and erasable crayons from Treetop Publishing, Box 085567, Racine, WS 53408-5567, (414-884-0501).
  - Create a title, author and dedication page.
  - Create WOW page! This can feature a surprise nature pop-up, a flap to lift or paper animal. Be creative!
  - Include illustrations.
  - Investigate a local library for examples, ideas and writing techniques.
  - Use drawings rather than computer graphics. Hand drawings make a book more personal.
  - Place the book in outline form prior to writing. This may simplify the writing process (list the events in order as 1, 2, 3 or I, II, III, etc.). Use a rough draft before creating the final book.
  - Use classmates as editors

and arrange meetings between the writers and audience to gather information, suggestions for the book.

- Write the story, divide it by pages and create artwork for each page.
- Have a book party for the audience when the books are finished.

**PROCEDURE:**

**Activity Three:  
Dissecting a Literary Piece**

1. Read *October Has the Heart*, a short poem by Loren Eiseley about the coming of winter for scientific information.
2. Identify the biodiversity concepts in *October Has the Heart*:
  - Variety of organisms.
  - Habitats.
  - Living and non-living things change over time.
  - Organisms have different types of locomotion (movement).
  - Organisms have different activity periods.
  - Organisms have different means of communication.
4. Dissect the scientific information listed in books, poems and essays relating to plants and animals, as well as the biological diversity of ecosystems. Conduct one or more of the following biodiversity activities that fit a favorite book or story:
  - Capture a jar of fireflies and read by their light. Release them afterwards. Are there any

other organisms you can use in similar ways? (glowworms or the larvae of fireflies). Identify the purpose of the firefly's light (communication).

Count the number of flashes that the fireflies make and the various patterns they use (each species has its own number and pattern).

- Spend an evening looking for spiders. Point a flashlight outward from your forehead and aim it where you might expect a spider to be found (ex., base of a tree, around a rock or the edge of the house). When the light hits the spider's eyes, they will glow emerald green. How many places and how many different spiders can you locate?
- Describe different methods of animal locomotion (movement) on slips of paper and drop them into a jar. Have each student pick a slip and the movement listed. Ask the other students to guess which animal is being depicted (ex., crickets crawl, spiders run, dragonflies dart, butterflies drift, and frogs hop).
- Brainstorm and list animals that are nocturnal (active at night) and those that are diurnal (active during the day). Talk about adaptations (structures, chemical processes and behaviors) these animals exhibit that help them fit

- their activity period.
- Take a field trip to a small pond or stream that is surrounded by a field or meadow. Discuss how the combination of the pond and its surrounding meadow increases biodiversity of nearby life forms.
- Count the spots on the backs of ladybug beetles. Chart the diversity of the group you are studying.
- Locate as many different kinds of spider webs you can find and try to identify the spider from the web pattern. Capture a web by placing black construction paper gently against one side of it (without the spider!) while spraying the other side lightly with hair spray until the web sticks to the paper. Make your own class web with string and see if you can feel vibrations like the spider can when something bumps its web. Test different web materials.
- Talk about metamorphosis in insects. Compare and contrast the differences between cricket metamorphosis (incomplete) and the metamorphosis of butterflies (complete). Identify how some organisms don't undergo metamorphosis but still change over time through a variety of processes (aging, ecosystem succession).
- Use colored pipe cleaners and tissue paper to make a variety of butterflies.

- Hatch a moth, butterfly or frog in the classroom. Keep a daily journal of student observations.

### **Activity Four:** ***You Read, We All Read***

#### **PROCEDURE:**

1. Assign students a nature book on Arkansas to read and report back to the class on its contents, including:
  - Title and author.
  - Why student choose this book?
  - Synopsis: summarize the reading (grading criteria for this summary will include interest, clarity, originality, logical order, completeness and accuracy of information) and its contribution to understanding biodiversity in Arkansas.
  - Comparison: compare the book's topic with other materials you have read that addresses the same subject.
  - Conclusion: discuss the scientific, aesthetic and emotional value of this book. Did the book change or reconfirm knowledge about biodiversity in Arkansas? What new ideas did it present to the student? Give a quotation from the book that describes biodiversity in Arkansas and explain its significance to the class.
  - Future: identify major changes that have occurred or new information that has come to

light since this book was written (this question will require outside research by the student on Arkansas sources). List predictions for the future of biodiversity and nature in Arkansas based on what you have learned or inferred from reading this book.

#### **PROCEDURE:**

### **Activity Five:** ***The Diversity of Life:***

1. Read *The Diversity of Life* by E. O. Wilson (or the teacher may read selected portions to students) and utilize the questions found at the end of the lesson for a question and answer session with students (note: question numbers correspond to chapter numbers in the book). There is no key to the questions since answers and opinions by students should be highly variable. Many of the questions are on general biodiversity topics and could be used without this particular book or directed specifically towards Arkansas.
2. Have students answer the questions individually, with partners or in groups. Questions should be justified by students with a variety of opinions present.

***Correlation to  
National Science Standards***  
Unifying Concepts and Processes;  
Life Science

***Correlation to  
Arkansas Frameworks***  
Science ; Social Studies: 1.1.12.,  
1.1.14., 2.1.7., 3.1.13.

## ***Questions for the Diversity of Life*** **by E.O. Wilson**

### **Question #1:**

- A. E.O. Wilson feels that biodiversity is the key to maintenance of the world. How does this premise fit with your own beliefs about biodiversity?
- B. Does biodiversity in the world equal stability? Justify your answer.
- C. Describe why the Amazon River region a good area to use as a background for studying Wilson's theory?

### **Question #2:**

- A. Relate succession and Krakatau.

### **Question #3:**

- A. Evidence indicates that life recovered to its former level of diversity after each of the five great extinctions. Therefore, why then do humans need to be concerned about today's sixth period of extinction?

### **Question #4:**

- A. From an energy point of view, would it be wise for all terrestrial organisms to be plants?
- B. Cite evidence that the bio-species concept holds true for nature and is not just a tool devised by man to simplify the study of biologically diverse organisms.

### **Question #5:**

- A. Construct and describe a phylogenetic tree for the evolution of man that illustrates both vertical evolution and speciation. Explain why human speciation is a by-product of vertical evolution.
- B. Is there evidence in your tree of intermediate forms? If so, what has happened to them?
- C. Are the humans on your tree moving toward or away from the subspecies concept?
- D. Was the evolution of man sympatric or allopatric speciation?

### **Question #6:**

- A. Discuss the concept of natural selection as an ethically neutral phenomenon that has and is being influenced by man. Indicate the future effects of what such an influence might be and how does individual and/or species selection play any part in your scenario?

### **Question #7:**

- A. Using several examples, illustrate how adaptive radiation and evolutionary convergence are interdependent (note the factors—especially the "balance of nature" factor - that influence these processes) and cite evidence (other than observation) that indicates the processes have actually taken place.



**Question #8:**

- A. Read the last paragraph of page 133 (“the extinction scenario) and comment on the order of the extinctions suggested. Contemplate the future of the Kingdom not mentioned. Describe the effects of the extinctions on the two great unexplored continents specified in the text.
- B. Discuss the meaning of the following statement; “The subjective nature of higher taxonomic categories reflects the chaotic nature of organic evolution.”

**Question #9:**

- A. Discuss the general effects of the removal of a keystone species from an ecosystem. Cover the long and short-term effects and the local and global effects.
- B. List other forces that might cause increased biodiversity in ecosystems?
- C. Rather than concentrating on ecological factors such as keystone species, how does Wilson suggest we begin to study ecosystems?

**Question #10:**

- A. Briefly describe the four great steps that measure evolutionary progress and the six great periods of extinction. Discuss their parallels and any relationships between them as a whole.
- B. Why do rainforest organisms often present bizarre, extremely specialized adaptations suitable only for narrow pieces of the environment when we read that generalists usually out compete specialists?
- C. Why don't conifers, aphids and salamanders follow the latitudinal diversity gradient? Is this related to the ESA theory?
- D. Using illustrations of the beach fly maggot, female coccid scale and the water penny, show how they could be classified erroneously as three different phyla. Finally, describe the traits that place them in phylum Arthropoda, class Insecta.
- E. Why have insects not become dominant in the marine habitat as they have in the terrestrial and fresh water habitats since carboniferous times?

**Question #11:**

- A. Briefly describe two ways to access the balance of diversity of an ecosystem.
- B. Species continue to go extinct even within diverse and presumably stable ecosystems. How can this occur?
- C. Where do chronospecies and metapopulations feature in this?
- D. Describe what is meant by biodiversity at dynamic equilibrium? List factors that affect the diversity of an ecosystem.

**Question #12:**

- A. If centinelan extinctions occur mostly to megafaunal populations most vulnerable to humans, why does it matter to the rest of the environment? Will this pattern of extinction continue into the future? Why or why not?
- B. Describe the two major categories of environmental problems we face today. Which do you think presents the most danger and why?
- C. How are the rainforest and the deep sea rift communities similar?
- D. Which do you feel is in greater danger at this time, the tropical rainforest or the coral reefs? Why?

**Question #13:**

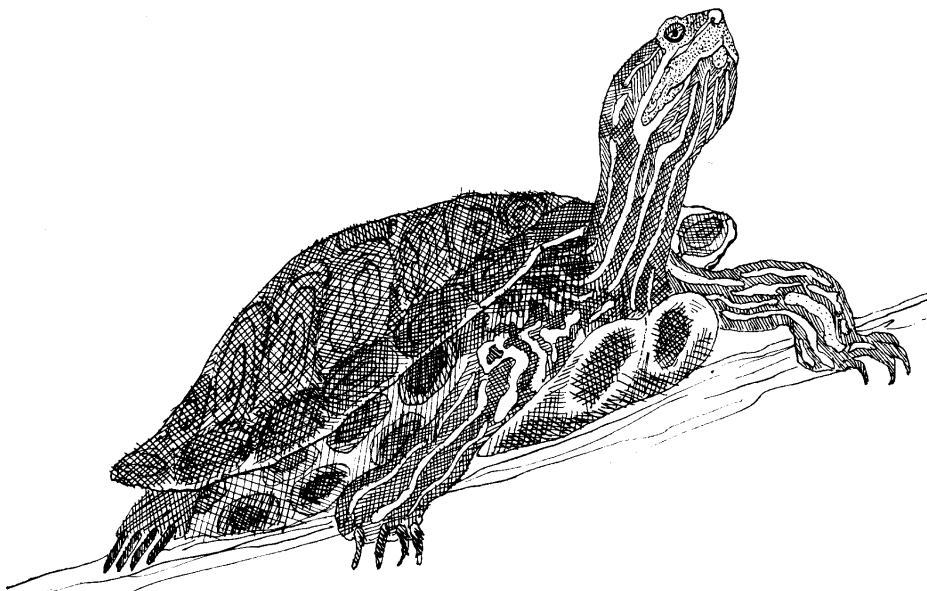
- A. How will the movement of environmental focus from species to ecosystems help?
- B. What does Wilson mean when he states that prejudice and inertia have slowed ecological advances in agriculture and animal husbandry?
- C. Explain the statement; "In a world created by natural selection, homogeneity means vulnerability."
- D. Why is it impossible to measure the worth of biodiversity with a traditional econometric approach?

**Question #14:**

- A. What is the largest problem facing the human race today?
- B. What is the worst past mistake that man has made when dealing with environmental systems?
- C. Compare the need for the human genome project with the need for a biodiversity project as described by Wilson's agenda.
- D. What appears to be the key to getting people to shift to sustainable use of ecosystems and to agree that biodiversity is ethically part of the global concern?

**Question #15:**

- A. Use the unit and chapter titles along with the chapter to discuss the underlying themes and suggestions made by Wilson.
- B. Now that you have covered the book, revisit Question #1 (Part A), and see if your answer would change.



## Teacher Background Information for the Science-Literature Connection

Why integrate seemingly different subjects as science and literature? Science is often abstract while story lines and literary structure can make science facts and concepts more user-friendly. Stories build interest and enable readers to absorb information quickly. A science-literature link helps students to understand how everyday things work, including science. Both science and literature emphasize process skills, problem solving and manipulation of objects and language.

All students should be exposed to a variety of teaching methods and materials while learning to communicate observations and inferences in a variety of ways. Content, language and thinking skills are necessary to experience and communicate discoveries and the results of hands-on science. Literature can help tame the increasing complexity and content of science and focus attention on scientific concepts using language that is appropriate for various learning stages.

Learning is not restricted to isolated subjects, but rather it is about integrating various curriculum areas and building connections among them. For example, science to literature, art to math or social studies to music, students must learn to read simultaneously for information, ideas, insights and entertainment as they develop skills needed for the future. There are books, essays, poetry and short stories for all science topics (life, earth and space, and physical sciences). There are connections among subject areas that lend themselves to whole class, small group or individual activities. Good questions for science teachers to ask themselves about a possible literature selection include the following.

- Are science concepts recognizable and adequately covered?
- Is the story factual? If not, are the science facts discernable from fiction?
- Are science misconceptions present?
- Are illustrations scientifically accurate and are animals, plants and other organisms portrayed in a natural manner?
- Does time passage follow a clear and adequate sequence?
- Does the book project science and/or technology in a positive light while the science content is timely?
- Is the book within the comprehension range and interest level of the students?
- Does the book encourage curiosity and questioning of science?

Categorizing science related literature can help students differentiate between what is real and what is fantasy, while helping develop the vivid imagination that is vital and common to all great scientists. To make literature useful to science teachers and their students (or to put it into perspective for them), it is sometimes helpful to categorize the literature. The following categories are broad and can be made more specific if desired; however, almost all science-based or related literature will fall into one or more of them. These include **imagination** (a blend of fact and fantasy, often requiring input from the student), **relationships** (systems, cycles and processes), **content knowledge** (adds to the student's base of knowledge about a particular topic), and **archetypical images** (superstitions, legends and symbols).

**“Book Lice”**  
***From Joyful Noise: Poems for Two Voices***

by  
**Paul Fleischman**

I was born in a  
fine old edition of Schiller

We're book lice  
who dwell  
in these dusty bookshelves.  
Later I lodged in  
Scott's works-volume 50

We're book lice  
Attached  
despite contrasting pasts.  
One day, while in search of  
a new place to eat

We're book lice  
who chew  
on the bookbinding glue.  
We honeymooned in an  
old guide book on Greece

We're book lice  
fine mates  
despite different tastes.  
So we set up our home  
inside Roget's Thesaurus

We're book lice  
adoring  
despite her loud snoring.  
And there we've resided,  
and there we'll remain,

We're book-loving  
book lice

which I'm certain I read  
in a book some months back  
that opposites  
often are known  
to attract.

While I started life  
In a private eye thriller  
We're book lice  
who dwell  
In these dusty bookshelves.

While I passed my youth  
in an Agatha Christie  
We're book lice  
attached  
despite contrasting pasts.

He fell down seven shelves,  
where we happened to meet  
We're book lice  
who chew  
n the bookbinding glue.

I missed Conan Doyle,  
he pined for his Keats  
We're book lice  
fine mates  
despite different tastes.

Not far from my mysteries,  
close to his Horace  
we're book lice  
adoring  
despite his loud snoring.

He nearby his Shakespeare,  
I near my Spillane  
We're book-loving  
book lice  
plain proof of the fact

that opposites  
often are known  
to attract.

***Partial List of Authors  
for the Science-Literature Connection***

Abbey, Edward	L'Engle, Madeleine
Asimov, Isaac	Leguin, Ursula K.
Attenborough, David	Leopold, Aldo
Audubon, John James	Lewis, Meriwether
Austin, Mary	Lorenz, Konrad
Bartram, William	McPhee, John
Bird, Isabella	Morris, Desmond
Byrd, William	Mowat, Farley
Cahn, Robert	Muir, John
Carr, Archie	Nuttall, Thomas
Carson, Rachel	Oliver, Mary
Catlin, George	Parkman, Francis
Colvin, Verplanck	Plenty-Coups
Conniff, Richard	Powell, John Wesley
Cousteau, Jacque	Roberts, David
Crick, Francis	Roosevelt, Theodore
Dethier, Vince	Sagan, Carl
Dillard, Annie	Schell, Jonathan
Dubos, Rene	Stegner, Wallace
Dutton, Clarence	Storer, John
Ehrlich, Paul and Ann	Teale, Edwin Way
Eiseley, Loren	Thomas, Lewis
Fletcher, Colin	Thoreau, Henry David
Fremont, John	Van Dyke, John
Gerstaecker, Frederic	Wilson, E.O.
Goodall, Jane	
Gould, Stephen J.	
King, Clarence	