

BIG RIVER ECOSYSTEM:

A Question of Net Worth



PURPOSE

To explore biodiversity at the ecosystem level.

KERA CONNECTIONS to Life Science

Core Content: Structure and Function in Living Systems

Academic Expectations: 2.2 Patterns, 2.3 Systems, 2.4 Models & Scale

Process Skills: Observation, Modeling

OBJECTIVES

Students should be able to:

1. identify five “big river” organisms
2. construct a diagram showing interactions between living and nonliving parts of an ecosystem
3. discuss factors that affect the level of biodiversity in their river basin.

VOCABULARY

Teachers may wish to discuss the following terms:
aquatic, commercial, ecosystem, water cycle and watershed.

aFIELD NOTEBOOK

Ideas for Teachers

- A. Develop a concept map for the water cycle. Include these items in the concept map: clouds, groundwater, apple tree, stream, precipitation, condensation, evaporation, harvest mouse, snowflakes, sun and humans. What other cycles are needed to maintain an ecosystem?
- B. Biospheres, containing algae, brine shrimp and water, are often shown in advertisements. Analyze how the biosphere is self-maintaining. Have students create a complete ecosystem in a jar. Are producers, consumers and scavengers present? How do the biosphere and terrarium compare to the earth?
- C. Adopt a pen-pal classroom in another Kentucky big river basin. Geographical, biological and cultural differences between watersheds can be explored through student letters, E-mail or the Internet. In which watershed do all Kentuckians live?
- D. Encourage students to develop a “watershed address.” For example, Jane Fish, 6 South Benson Creek, Kentucky River, Atlantic Ocean 00960. Jane lives 6 miles from the headwaters of South Benson Creek. This small stream drains into Benson Creek, then the Kentucky River, the Ohio River, the Mississippi River and approximately 960 miles later into the Gulf of Mexico.
- E. Discuss the difference between political boundaries and ecological boundaries. Which big rivers form the political boundaries for Kentucky? How do the big river ecosystems extend beyond

Program 2

ANSWERS TO aFIELD NOTES

1. In a hot and hostile environment, the evaporated water cannot be incorporated into living cells (as we know them).
2. An extremely cold environment, or frozen desert, does not allow cells to utilize water.
3. Answers will vary but should display logical flow of water and allow for recirculation in a loop.
4. Arteries and veins.
5. A pumping heart.
6. Diagram A shows many different types of ecosystems in close proximity.
7. Add a watering hole, plant a miniature forest, create a meadow of wildflowers. Most importantly, break up a monoculture of grass.
8. Lake, pond, stream, wetland, ocean, puddle, estuary, glacier, iceberg.
- 9 - 13. Answers will vary. The river continuum usually looks like this: cavestream→spring→headwater creek→stream→river→big river.
14. \$148.50
15. Clean water, shelter, prey, predators, symbionts and nutrients (as well as the processes that maintain these) are needed in the fish’s ecosystem. If the fish disappear, so does the commercial angler’s income.

The Spider God

As told around the Blackfoot's campfire, the Spider God watches over the earth from his star web. He often climbs down the Milky Way to visit the land.

Spider Sniffing

Make the unbelievers convert, when you follow your nose to find spiders in the dark. Place a flashlight on the end of your nose. Jokingly explain that the heat from the flashlight intensifies the spider's scent. Look down the light beam toward the ground. Reflection off the spider's compound eyes will create a sparkle. By zeroing-in on the glow, you should find yourself nose-to-nose with a spider in its lair. Fisher spiders may be spotted along the big river's shoreline.

Making Connections

How is a spider web like an ecosystem?

If sport hunting stopped, how would you control the deer population?



Send individual or class responses to:

Kentucky Afield for Kids
#1 Game Farm Road
Frankfort, KY 40601

E-mail: ntheiss@mail.state.ky.us

Kentucky's boundaries? Name cities (outside the state) that affect Kentucky's big river ecosystems.

- F. **THE BUCK BASS STOPS HERE** - Why are prices listed per pound rather than per fish? If the average buffalofish weighs 5 lbs., how many fish did Peter catch? What expenses cut into the commercial angler's profit? Investigate gross and net profits as advanced economic concepts.
- G. Construct a simple food chain with organisms described in "The River's Riches." One possible solution is: plankton → burrowing mayfly → smallmouth buffalo → black-crowned night heron. Use *The Big River Ecosystem* poster for classification exercises, constructing a food web and discussing life cycles. How do people benefit from the river's food web?

Tasks for Students

1. Develop a checklist of fish found in your big river basin. Why would the checklist be slightly different for each big river basin?
2. Write a story about a fish that swims from the headwaters of a big river to its mouth. What obstacles does the fish encounter?
3. Nominate a segment of a nearby river as a "Wild and Scenic River." Determine criteria for the designation and explain why your river is special.
4. Monitor the water quality of your river through RAMP - the River Assessment Monitoring Project administered by the Division of Water, 18 Reilly Road, Frankfort, KY 40601. (502) 564-3410

WILD THINGS FOR TEACHERS

Encourage your students to enter this year's Louisville Courier-Journal Poster and Essay Contest. The 1997 theme is "Water: Clear into the 21st Century." Tabloids are available free from your county's Natural Resources Conservation District.

RECOMMENDED RESOURCES

- * Big River Ecosystem Poster and Teacher's Guide, provided free from the KDFWR. Use this poster to identify organisms commonly found in Kentucky's big rivers.
- * Hermes, Kimberly. "Paddlefish Project - Modern Technology, Ancient Fish" *Kentucky Afield - The Magazine*. Sept./Oct. 1996, pp. 10-12.
- * Garland, J.B. "The Green River Region" *Kentucky Afield - The Magazine*. Mar./Apr. 1997, pp. 12-19.

ADDITIONAL ACTIVITIES

- * Project WILD activities "Everybody Needs A Home" "Forest in a Jar" and "Birds of Prey"
- * Project WILD Aquatic activities "Where Does Water Run Off After School?" "The Edge of Home" "Watered Down History" and "Net Gain, Net Effect"
- * "Kentucky's Unusual Fish" *Kentucky Afield for Kids*, May 1996.

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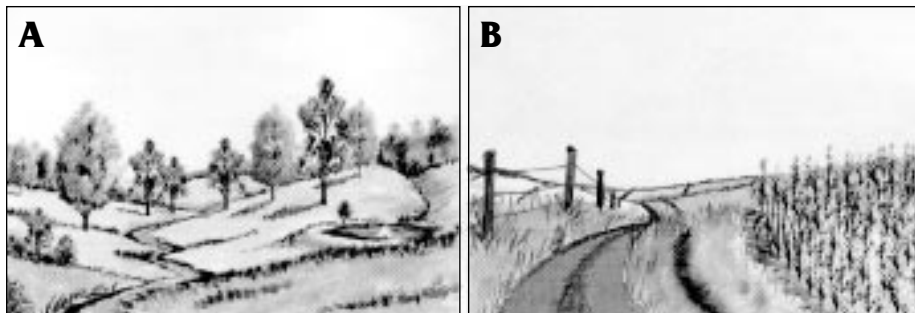
WATER, WATER EVERYWHERE

Why is the Earth the most biodiverse planet in our solar system? The answer is water. The distance between the sun and the Earth allows water to change states from solid to liquid to gas. Liquid water travels around the globe carrying nutrients to microorganisms, fungi, plants and animals. Raindrops, **rivulets**, streams, rivers and oceans help circulate the water through different habitats.

WHAT IS AN ECOSYSTEM?

An ecosystem describes the interactions between living and nonliving things in a defined area over time. An ecosystem may be as small as a fallen log or as large as the earth itself. More important than size, the ecosystem tells a story about how energy and nutrients move from one organism to another. It also allows biologists to study how organisms behave, grow and adapt to the conditions around them. An ecosystem provides an organizational unit for studying wildlife. The number of different self-sustaining ecosystems in an area, or **ecosystem diversity**, is a measure of biological diversity.

6. Which area has the most *ecosystem diversity*? _____



7. How can you increase *ecosystem diversity* on school grounds? _____

SPRING + STREAM + RIVER = BIG RIVER

The Big River is one example of an **aquatic** ecosystem. Many smaller bodies of water have combined to create the big river. The big river mixes nutrients and pollution flushed down these feeder streams. The collection of water in the big river provides habitat for cottonwood trees, blue catfish, osprey and softshell turtles. The volume of water and its contents vary over distance and time. Since the river and its tributaries crisscross through several landscapes, the potential for biodiversity is high.



aFIELD NOTES

October 1, 1997

1. Why doesn't life exist on Mercury?

2. Why is life unlikely on Pluto?

3. Draw a model of the water cycle.

If the Earth's water is compared to blood flowing through our bodies,

4. What body parts do rivers represent?

5. What role does the water cycle play?

8. Name 3 examples of aquatic ecosystems.

9. Name the creek nearest to your school.

Trace the water in this creek as it travels downstream to enter a big river.

10. Into which smaller bodies of water does it travel?

11. In which big river basin do you live?

Using a state highway map,

12. Name a city upstream that affects the river's water quality.

13. Name a city downstream that depends on your actions for clean water.

WE BUY FISH!

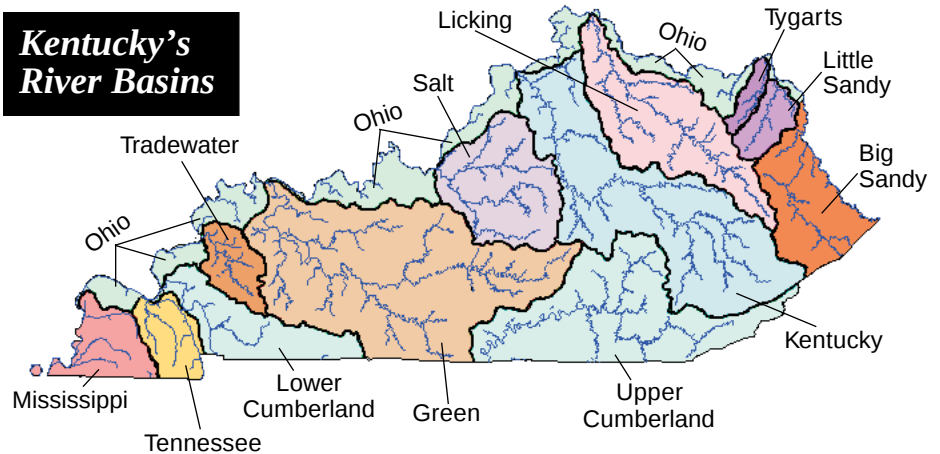
Catfish	50¢ per pound
Buffalofish	25¢ per pound
Paddlefish	40¢ per pound
Paddlefish eggs	\$70.00 per pound

14. How much money can Peter net for today's catch of 90 lbs. of paddlefish, ½ lb. of paddlefish eggs, 70 lbs. of buffalofish and 120 lbs. of catfish?

WEB OF WATER

A big river is defined by a channel with permanently-flowing water. From bank to bank, the big river measures more than 200 feet wide and occupies an U-shaped floodplain. Millions of gallons of water, shed from a large land area, move down the river. The drainage area, referred to as a **watershed** or a **river basin**, contains the big river and its **tributaries**. Kentucky is divided into thirteen big river basins.

Kentucky's River Basins



Watersheds connect the terrestrial environment with the aquatic environment. The landscape, type of rocks and human activity in an area have an impact on the big river via its watershed. Rivers are heavily affected by the conditions on land surrounding feeder streams. Sometimes big rivers magnify the problems upstream by flooding after heavy rains. At other times, big rivers dilute pollutants directly dumped into the water.

THE BUCK BASS STOPS HERE

The big river is a national treasure. People use the big river for transportation, drinking water, hydropower, waste treatment, irrigation and recreation. About 450 **commercial** anglers make their living by catching fish in Kentucky's big rivers. The big river is big business - commercial fishing alone adds more than \$5 million per year to our common wealth. The river's riches were recognized by the founding fathers of many big cities. Protecting the big river means protecting biodiversity and our grandchildren's economic and environmental health.



15. Why should the commercial angler care about biodiversity?

THE RIVER'S RICHES

BLACK-CROWNED NIGHT HERON

Nycticorax nycticorax

Description: nocturnal, short-necked bird, 25" long

*black crown, back and bill, gray wings, yellowish legs

Food: small fish, amphibians and reptiles

Reproduction: 3 - 5 blue-green eggs

*stick nest in reedbed or tall tree

*colonies of herons often nest together

Ecological Role: predators prevent prey from overpopulating

*eliminate sick and old prey animals

Status: listed "endangered" on state list

*low breeding numbers



BURROWING MAYFLY

Ephemera simulans

Description: naiad larvae have 3 tail filaments

*naiads live up to 4 years

*adult flies, 1" long, emerge to mate & die within 48 hours

Food: naiads eat microscopic green plants; adults do not eat

Reproduction: eggs sink in shallow water to river bottom

*adults emerge May to August and swarm toward lights

Ecological Role: adults eaten by swallows and fish

*larvae provide food for dragonfly naiads and fish

*water quality indicator

Status: improving with water quality & less use of pesticides

*related *Litobranchia recurvata* listed as special concern in KY



PLANKTON

Euglena *Desmidium*

Stauroneis *Copepods*

Description: variety of microorganisms

Food: like plants, many do photosynthesis

*some engulf and eat other microbes

Reproduction: most simply divide in two

Ecological Role: producers at beginning of the food chain

*sensitive to erosion and silt

*can cause fish kills by using oxygen

Status: steady



SMOOTH SOFTSHELL TURTLE

Trionyx muticus

Description: olive pancake-like shell, tubular snout

*rarely leaves water, basks on mud flats

Food: fish, frogs, crayfish, insects, snails and worms

Reproduction: 18 - 22 round white eggs

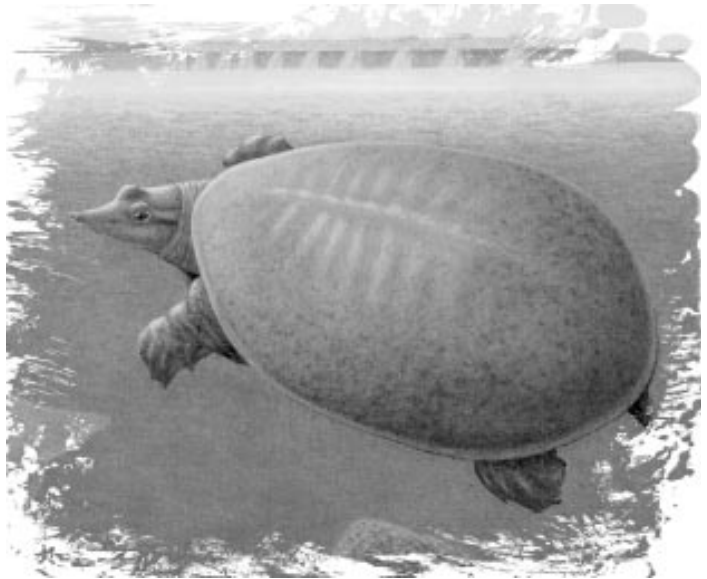
*nest in sandbar or sunny bank

*young hatch in 65 - 77 days

Ecological Role: skunks, raccoons and crows feed on eggs

*young eaten by large fish, herons, snakes

Status: steady



SMALLMOUTH BUFFALO

Ictiobus bubalus

Description: also called roach-back, blue pancake

*slate-gray color in common lengths of 20 inches

*in 1890's, fish market specimens weighed
25 pounds

*today's average is 5 pounds

Food: insect larvae, snails & algae
on river bottom

Reproduction: late summer
spawner; eggs deposited on
mud bottom

*reach maturity in 3 years

Ecological Role: middle position
in food chain

*sold by commercial anglers

Status: steady



WASHBOARD MUSSEL

Megaloniaias gigantea

Description: weigh up to 4 pounds

*measure up to 12 inches long

*live more than 60 years

Food: bacteria, algae and zooplankton

Reproduction: glochidia larvae are parasites of many fish

*within four weeks juveniles are free-living

Ecological Role: act as "living filters" to clean water

*food for animals like the drum, otter and heron

*indicators of environmental health

Status: decline due to habitat loss and pollution

