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| **Teacher:****“Pride Inside”** | Willy Herrera |
| **Date:** | November 25, 2013  |
| **Content:** | **Environmental Science**  |
| **Unit:** | Ecology |
| **Topic:** | Keystone Species |
| **Core Learning Goal(s)****or VSC Standard(s)** | **MSDE Standards:*****Skills and Processes:*****1.5.2** The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.**1.5.6** The student will read a technical selection and interpret it appropriately.***Content:*****3.5.2** The student will analyze the interrelationships and interdependence among different organisms and explain how these relationships contribute to the stability of the ecosystem.**6.2.2** The student will explain why interrelationships and interdependencies of organisms contribute to the dynamics of ecosystems. **Common Core State Standards:****RST.9-10.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in specific scientific or technical context relevant to grades 9-10 texts and topics.**WHST.9.10.4** Provide clear and coherent writing in which the development organization, and style are appropriate to task, purpose, and audience. |
| **Objective:** | At the end of the lesson students will be able to understand ecological importance of keystone species by describing how the ecology of New England changed in the disappearance of the beavers. |
| **Accommodations and Modifications:** |

|  |  |
| --- | --- |
| **STUDENT INITIAL** | **ACCOMODATIONS/MODIFICATIONS** |
| **Presentation Accommodations** | **Response Accommodations** | **Timing and Scheduling Accommodations** | **Setting Accommodations** | **Supplementary Aids** |
| 1. C.N.(P4/6)
 |  **(1-P)** Notes, Outlines, (1-F) Human reader or audio recording for verbatim reading of the entire test | **(2-J)** Calculation Devices (2-L) Visual Organizers **(2-M)** Graphic Organizers(2-A) Scribe | **(3-A)** Extended time **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students(4-B) Reduce distraction to other students | **(4H) Preferential seating (1Q) Repetition of directions (1P) Provide student with copy of student/teacher notes****(2C) Chunking of texts****(5C) Classroom instruction consult(1F) Have students repeat and/or paraphrase information(1H) Monitor independent work (3H) Frequent eye contact/proximity control****(3R) Strategies to initiate and sustain attention** |
| 1. A.J (P4/6)
 | **(1-G)**Human Reader for verbatim reading of selected sections of the test**(1-P)** Notes, Outlines, | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students(4-B) Reduce distractions to other students | **(1E) Frequent and/or immediate feedback****(1H) Monitor independent work (1Q) Repetition of direction (5C) Classroom instruction consult** |
| 1. J.R (P 4/6)
 | **(1-G)**Human Reader for verbatim reading of selected sections of the test**(1-P)** Notes, Outlines,  |  **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students(4-B) Reduce distractions to other students |  |
| 1. S.M. (P4/6)
 |  | **(2-J)** Calculation Devices | **(3-A)** Extended time **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students | **(1Q) Repetition of directions (1E) Frequent and/or immediate feedback (5K) Psychologist consult (1H) Monitor independent work (2B) Break down assignments into smaller units (3R) Strategies to initiate and sustain attention (5C) Classroom instruction consult** |
| 1. K.H. (P8)
 | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(2A) Classroom instruction consult****(5C) Classroom instruction consult** |
| 1. A.J. (P8)
 | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students(4-B) Reduce distractions to other students | **(1A) Allow use of highlighters during instructions and assignments****(1Q) Repetition of directions****(1D) Check for understanding (5C) Classroom instruction consult** |
| 1. T.R. (P 8)
 | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students |  |
| 1. K.R. (P8)
 | **(1-P)** Notes, Outlines, (1-F) Human reader or audio recording for verbatim reading of the entire test | **2-J)** Calculation Devices **(2-M)** Graphic Organizers (2-L) Visual Organizer | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(3J) Home-school communication system****(3G) Encourage/reinforce appropriate behavior in academic and non-academic settings (!D) Check for understanding****(1O) Provide proofreading checklist****(1J) Peer tutoring/paired work arrangement****93R) Strategies to initiate and sustain attention****(2A) Altered/modified assignments****(5C) Classroom instruction consult**  |

 |
| **Warm-Up** | * Students will be asked to identify the given species as a keystone species, invasive species, or endangered species.
 | Level(s) of Bloom’s taxonomy: | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Engagement** | * Students will be given a short PowerPoint presentation about Ecology and History. Students will be asked to take note of the Definition of Keystone species.
* The PowerPoint presentation is to help students understand the effect the ecological change has on history.

  |  | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Exploration**  | * Students will be asked to read the passages/reading from the book “Water: A Natural History” by Alice Outwater.
* Students will be asked to respond to the text-based questions after reading.
 | Level(s) of Bloom’s taxonomy:  | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Explanation** | Students will be asked to explain how the disappearance of the beaver changed the ecology of New England.  | Level(s) of Bloom’s taxonomy:  | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Extension** | **EXTENDING THE CONCEPT ONE STEP FURTHER:**Students will be asked to read the article about the Chesapeake Bay. In this reading, students will be asked to identify a keystone species in the Chesapeake Bay. | Level(s) of Bloom’s taxonomy:  | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Evaluation** | **CHECKING FOR UNDERSTANDING:** Students will be asked to choose one from the following options:**OPTION A:** Compose an essay explaining how the disappearance of the beaver because of the fur trade increased European settlement in America.**OPTION B:** Write a speech as a member of the Abenaki tribe convincing your tribe not to take part in the fur trade.**OPTION C:** Write a journal as young settler in New England describing the change in land and animal that you see in your settlement. | Level(s) of Bloom’s taxonomy: | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Homework** | Students will be given a list of situations illustrating various ecological relationships. Students will Identify the relationship described in each situation. | Level(s) of Bloom’s taxonomy: | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **Summary** | **PART A:** What are the different types of ecological relationships?**PART B:** Ask students to identify the ecological relationships described by the following statements.1. This is a symbiotic relationship between organisms where both are helped.2. Relationship between organisms where one organism is helped, while the other is harmed. 3. This is a symbiotic relationship between organisms where one organism is helped, while the other it is associated with is basically unaffected. 4. The roots of a mistletoe plant absorb nutrients from living oak trees, causing some damage to the tissues of the trees. 5. Protozoans living in the intestine of a termite secrete enzymes that digest cellulose, providing digestive end products of value to both organisms.  | Level(s) of Bloom’s taxonomy: | I KnowledgeII ComprehensionIII ApplicationIV AnalysisV SynthesisVI Evaluation |
| **References/Credits:** | <http://education.nationalgeographic.com/activity/ecological-relationships/?ar_a=1><http://www.rossignols.net/mrsr/biology/ecology/ecological_relationships.pdf><http://www.ekcsk12.org/faculty/jbuckley/leclass/ecologywssymbioticrelationships.pdf>http://www.nsta.org/publications/interactive/galapagos/activities/pdf/btales.pdf |
| **Reflections:**  | * What went well and why?
* What didn’t go well and why?
 |
| ***Areas for Improvement:*** |  |
| ***NOTES:*** |  |

**NAME:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_DATE: November 25, 2013

**WARM UP:** Keystone, Invasive, and Endangered species.

Directions: Identify the following organisms as keystone species (KS), invasive species (IS) or endangered species (ES):

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1. MENHADEN are filter feeders that consume plankton and in turn are food for striped bass and other important fish, as well as marine mammals and sea birds

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. Purple loosestrife (*Lythrum salicaria*) is a non-native plant that threatens significant portions of Maryland's marsh, swamp, and coastal habitats. By crowding out native wetland species, purple loosestrife can reduce biodiversity, eliminate food sources for marsh animals and change water flow patterns.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3. Zebra mussels, *Dreissena polymorpha*, are tiny bivalve mollusks that inhabit fresh to brackish or even estuarine waters. Zebra mussels are native to Eastern Europe, and it is believed that the planktonic larvae were transported in cargo-ship ballast water to the Great Lakes Region in the mid-to-late 1980’s where they have become an invincible problem to industry and the native species of the area.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_4. Its proper name - Phragmites - makes it sound like a crawling creature, or a disease. But phragmites, also known as common reed, is a large, coarse, perennial grass often found in wetlands. Although scattered clumps of phragmites provides cover for small mammals and birds, it usually forms large, dense stands that provide little value for wildlife. Phragmites reduces the diversity of plant and wildlife species.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_5. The Indiana bat is found only in the Eastern United States (east of Oklahoma). The major cause of the decline is human interference and damage, both to hibernation caves as habitat, and to bat food sources.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_6. The mountain chorus frog is Threatened in Maryland because its natural breeding places – wooded seasonal pools and springs – are often disturbed by human activities. Much of this natural wetland habitat has been degraded or destroyed.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_7. The Baltimore checkerspot is named for George Calvert, the first Lord Baltimore, because its orange and black colors match those on his heraldic shield. In 1973, the Baltimore checkerspot was named the official insect of Maryland. While the Baltimore checkerspot was once common in the region, the species has experienced significant declines in recent years. Currently, it has a state conservation rank of S2, meaning that it is imperiled in Maryland because it is very rare.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_8. The world's rarest fish doesn't live at the bottom of the ocean or in some remote pool in the Amazon Jungle. It lives in a clear, cool creek in Harford County, Maryland, just a few miles from where 1-95 crosses the Susquehanna River. The fish is the Maryland Darter, *Etheostoma sellare*, named for the only state in which it has ever been found. Scientists suspect that the scarcity of the Maryland Darter is due to its extremely specialized habitat requirements.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_9. The sea otter lives in the Pacific Northwest. These mammals feed on sea urchins, controlling their population. If the otters didn't eat the urchins, the urchins would eat up the habitat's kelp. Kelp, or giant seaweed, is a major source of food and shelter for the ecosystem. Some species of crabs, snails, and geese depend on kelp for food. Many types of fish use the huge kelp forests to hide from predators. Without sea otters to control the urchin population, the entire ecosystem would collapse.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_10. When beavers build dams the wetlands spread out behind them, providing home and food for dozens of species, from migrating ducks to moose, from fish to frogs to great blue herons.

Sources: 1. <http://www.dnr.state.md.us/wildlife/Plants_Wildlife/rte/rtemddarter.asp>

 2. <http://www.cbf.org/about-the-bay/more-than-just-the-bay/creatures-of-the-chesapeake/atlantic-menhaden>

3. <http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1#page=2>

4. <http://www.nature.com/scitable/knowledge/library/keystone-species-15786127>

Keystone Species

<http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1#page=2>

A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether.

All species in an ecosystem, or habitat, rely on each other. The contributions of a keystone species are large compared to the species' prevalence in the habitat. A small number of keystone species can have a huge impact on the environment.

A keystone species is often, but not always, a predator. A few predators can control the distribution and population of large numbers of prey species. A single mountain lion near the Mackenzie Mountains in Canada, for example, can roam an area of hundreds of kilometers. The deer, rabbits, and bird species in the ecosystem are at least partly controlled by the presence of the mountain lion. Their feeding behavior, or where they choose to make their nests and burrows, are largely a reaction to the mountain lion's activity. Scavenger species, such as vultures, are also controlled by the activity of the mountain lion.

A keystone species' disappearance would start a domino effect. Other species in the habitat would also disappear and become extinct. The keystone species' disappearance could affect other species that rely on it for survival. For example, the population of deer or rabbits would explode without the presence of a predator. The ecosystem cannot support an unlimited number of animals, and the deer soon compete with each other for food and water resources. Their population usually declines without a predator such as a mountain lion.

Without the keystone species, new plants or animals could also come into the habitat and push out the native species. Some species of hummingbirds are keystone species in the Sonoran Desert of North America. Hummingbirds pollinate many varieties of native cactus and other plants. In areas of the Sonoran Desert with few hummingbirds, invasive species such as buffelgrass have taken over the ecosystem.

The theory that the balance of ecosystems can rely on one keystone species was first established in 1969 by American zoology professor Robert T. Paine. Paine's research showed that removing one species, the *Pisaster ochraceus* sea star, from a tidal plain on Tatoosh Island in the U.S. state of Washington, had a huge effect on the surrounding ecosystem. The sea stars are a major predator for mussels on Tatoosh Island. With the sea stars gone, mussels took over the area and crowded out other species. In this ecosystem, the sea star was the keystone species.

The sea otter is another example of a keystone species in the Pacific Northwest. These mammals feed on sea urchins, controlling their population. If the otters didn't eat the urchins, the urchins would eat up the habitat's kelp. Kelp, or giant seaweed, is a major source of food and shelter for the ecosystem. Some species of crabs, snails, and geese depend on kelp for food. Many types of fish use the huge kelp forests to hide from predators. Without sea otters to control the urchin population, the entire ecosystem would collapse.

Herbivores can also be keystone species. In African savannas such as the Serengeti plains in Tanzania, elephants are a keystone species. Elephants eat small trees, such as acacia, that grow on the savanna. Even if an acacia tree grows to a height of several feet, elephants are able to knock over the tree and uproot it. This feeding behavior keeps the savanna a grassland and not a forest or woodland. With elephants to control the tree population, grasses thrive and sustain grazing animals such as antelopes, wildebeests, and zebras. Smaller animals such as mice and shrews are able to burrow in the warm, dry soil of a savanna. Predators such as lions and hyenas depend on the savanna for prey. Elephants are the keystone species that maintain the entire savanna ecosystem.

In addition to keystone species, there are other categories of species that are crucial to their ecosystems' survival.

**Foundation Species**

Foundation species play a major role in creating or maintaining a habitat that supports other species. Corals are one example of a foundation species in many islands in the South Pacific Ocean. Corals produce the reef structures on which countless other organisms, including human beings, live.

**Umbrella Species**

An umbrella species is a large animal or other organism on which many other species depend. Umbrella species are very similar to keystone species, but umbrella species are usually migratory and need a large habitat.

Protection of umbrella species is thought to automatically protect a host of other species. Tigers are an example of an umbrella species. Efforts to save wild tigers in forests in the Indian state of Rajasthan also accomplish the goal of saving other species there, such as leopards, boars, hares, antelopes, and monkeys.

**Indicator Species**

An indicator species is a plant or animal that is very sensitive to environmental changes in its ecosystem. This means it is affected almost immediately by damage to the ecosystem and can give early warning that a habitat is suffering. Damage from external influences such as water pollution, air pollution, or climate change first appear in indicator species.

In the United States, the Environmental Protection Agency (EPA) studies the population and health of fish in the Chesapeake Bay to evaluate the quality of water in the ecosystem. The EPA uses the fish as indicator species of the bay.

**DIRECTIONS:** Complete the table below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | DEFINITION | IMPORTANCE | EXAMPLE/S |
| Keystone Species |  |  |  |
| Foundation Species |  |  |  |
| Umbrella Species |  |  |  |
| Indicator Species |  |  |  |

**NAME:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_DATE: November 25, 2013

## The Chesapeake's Unsung Hero

SOURCE: <http://www.cbf.org/about-the-bay/more-than-just-the-bay/creatures-of-the-chesapeake/atlantic-menhaden>

They've been called "the most important fish in the sea."

Small, silvery, and packed with nutritional value, menhaden are filter feeders that consume plankton and in turn are food for striped bass and other important fish, as well as marine mammals and sea birds. They are in effect a critical link in the marine food web. **But in 32 of the past 54 years (through 2008), menhaden were overfished, and they are now at their lowest level on record.**

Many people have never even heard of this boney, oily, unappetizing fish (also known as bunker or pogy). But without this little unsung hero the Bay's ecosystem would likely collapse. The Bay's other valuable fish like striped bass (rockfish), bluefish, and summer flounder rely heavily on menhaden for nutrition as do sea turtles, osprey, and other fish-eating marine mammals and seabirds.

Further, the Chesapeake Bay is the most important nursery area for Atlantic menhaden. From spring through fall, juveniles as well as adults would be found throughout the entire Bay when the population was healthy.

### Why Are they Disappearing?



For hundreds of years, menhaden have been a vital part of our natural and national history. American Indians used menhaden as fertilizer for corn; the early settlers processed them for lamp oil. Then, in the late 19th century, the menhaden population began to collapse.

In the past century, all but one state gradually banned the large scale fishing of this important fish; today, only Virginia allows industrial menhaden fishing. Approximately 80,000 tons of menhaden are removed from the Virginia part of the Bay each year in this fishery.

Taking too many young fish both greatly diminishes the spawning potential of the population and reduces their availability to predators. The declining number of menhaden in the Chesapeake Bay has been a concern for many years and has been linked to the chronic disease problem facing Chesapeake striped bass.

By 2006, the annual industrial catch in the Chesapeake was capped. Then in May 2010, the Atlantic States Marine Fisheries Commission (ASMFC) received an alarming scientific report on the status of Atlantic menhaden—confirmation that the species had been systematically overfished for 32 of the previous 54 years. The population was reported to be at its lowest level on record. The analysis was peer reviewed by independent scientists and remains the best available science on Atlantic menhaden.

### What's Being Done?

The fact that this critically important fish's population is at its lowest point on record is a startling wake-up call. So in November of 2011, the Atlantic States Marine Fisheries Commission (ASMFC) decided in an [historic vote](http://www.cbf.org/page.aspx?pid=2978) to set new standards for how it manages menhaden.

After thousands of letters and e-mails (including 1,036 from CBF advocates) as well as comments at public ASMFC hearings urging the implementation of these new standards (see sidebar), ASMFC voted to adopt new threshold and target fishing rates to allow the menhaden population to increase to a point where it can support a fishery and fulfill its vital ecological role.

This vote was the most significant management action ever taken for Atlantic menhaden and shows just how important this fish is to the marine ecosystem and to other valuable fisheries. In December, ASMFC met again and adopted new fishing guidelines, such as catch quotas, that reduce the coast-wide menhaden catch by 20 percent.



QUESTIONS:

1. Write a short description of Menhaden. (This may include they food, predator, habitat, or physical characteristics)

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1. What makes Menhaden “the most important fish in the sea’?

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1. What happened to the population of Menhaden in the past 54 years? What caused this problem?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_4. What do you think will happen to other organisms in the Bay if this problem will continue?

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5.What was done to save the Menhaden?

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Read the passage, then answer the questions following the reading

Reading 1

*At the onset of the fur trade, ten good beavers— adult, winter-prime northern hides that were stretched and cured— bought the Indians one gun. One good beaver bought, variously, half a pound of powder, four pounds of shot, a hatchet, eight jack-knives, half a pound of beads, a good coat, or a pound of tobacco. “The beaver does everything perfectly well,” an Indian trapper told a Jesuit priest in 1657. “It makes kettles, hatchets, swords, knives, bread. In short, it makes everything. The English have no sense— they give us two knives for one beaver skin.”* Outwater, Alice (2008-08-06). Water: A Natural History (Kindle Locations 139-143). Basic Books. Kindle Edition.

Question 1: What did the Native Americans think of the European’s ability as traders?

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Question 2: What was the most advanced item the beaver pelt would buy?

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Reading 2

*It is estimated that as many as two hundred million beavers once lived in the continental United States,….. Beavers are a keystone species, for where beavers build dams the wetlands spread out behind them, providing home and food for dozens of species, from migrating ducks to moose, from fish to frogs to great blue herons.* Outwater, Alice (2008-08-06). Water: A Natural History (Kindle Locations 304-306). Basic Books. Kindle Edition.

Question 1: How many beavers once lived in the United States?

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Question 2: What is a keystone species?

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Reading 3

*But it was when the old dams collapsed for want of maintenance that they conferred their greatest benefit on colonial settlers. Behind them was many years’ accumulation of leaves, bark, rotten wood, and rain-washed silt; in addition, their ponds had killed acres of trees which had once stood on the banks of pre-beaver streams. When the pond disappeared with the breaching of its dam, the rich black soil was suddenly exposed to the sun and rapidly became covered with grass that grew “as high as a man’s shoulders.” Not only did this provide forage for moose and deer— as long as those animals remained to browse there— but it became ideal mowing ground when settlers arrived with their cattle.* Cronon, William (2011-04-01). Changes in the Land: Indians, Colonists, and the Ecology of New England (Kindle Locations 1869-1875). Farrar, Straus and Giroux. Kindle Edition.

Question1: When the pond drained what made the soil that was exposed so rich and fertile?

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Question 2: When the pond drained what animals came to use the land?

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Reading 4

*What made Indian and European subsistence cycles seem so different from one another had less to do with their use of plants than their use of animals. Domesticated grazing mammals— and the tool which they made possible, the plow— were arguably the single most distinguishing characteristic of European agricultural practices. The Indians’ relationships to the deer, moose, and beaver they hunted were far different from those of the Europeans to the pigs, cows, sheep, and horses they owned. Where Indians had contented themselves with burning the woods and concentrating their hunting in the fall and winter months, the English sought a much more total and year-round control over their animals’ lives.* Cronon, William (2011-04-01). Changes in the Land: Indians, Colonists, and the Ecology of New England (Kindle Locations 2249-2253). Farrar, Straus and Giroux. Kindle Edition.

Question 1: What was the difference between the way Native Americans related to animals and the way Europeans related to their animals?

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Question 2: What was the difference in the way Native Americans used the land, and the way Europeans used the land?

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Reading 5

*Regions which had once supported Indian populations considerably larger than those of the early English settlements came to seem inadequate less because of human crowding than because of animal crowding*. Cronon, William (2011-04-01). Changes in the Land: Indians, Colonists, and the Ecology of New England (Kindle Locations 2485-2487). Farrar, Straus and Giroux. Kindle Edition.

Question 1: What crowded out the Native American populations – settlers or animals?

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