The 10,000 Year Significance of Bison: A Curriculum Sequence on the Past, Present, and Future of Bison

Includes Complete Lessons and Teacher Guides for Science and Language Arts Units, Grades 6th-9th

Authors

Mario Battaglia

John Murray

Photo Credit: Dr. Maria Nieves Zedeño,
Bureau of Applied Research in Anthropology, University of Arizona

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A collaborative project with the Blackfeet Tribal Historic Preservation Office, the Montana Department of Transportation, and the Bureau of Applied Research in Anthropology at the University of Arizona

Authors

Mario Battaglia

John Murray

For Additional Resources Contact

John Murray

Tribal Historic Preservation Office (THPO) *Blackfeet Tribe*

850 Government Square Browning, Montana 59417

Tel: 406.338.7521. Fax: 406.338.7530

Mario Battaglia, M.A.

Email: mbattaglia23@gmail.com

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MONTANA MDT DEPARTMENT OF TRANSPORTATION

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Introduction: A Note to the Teachers

The design of this curriculum is one centered on multivocality, an idea that stresses collaboration and equal input from a variety of project collaborators. A Master's Thesis study assessing the efficacy of the curriculum was conducted by Mario Battaglia (2015) entitled *Presenting a Pluralized Past: Assessing the Efficacy of Multivocal, Bison-Themed Lesson Modules as a Public Education and Outreach Strategy for Archaeology*. The study examined the efficacy of this multivocal model of curriculum design, finding that a targeted, collaborative approach was an effective way to foster student and teacher agency, address cultural sensitivities, and incorporate multiple worldviews. In this light, the bison curriculum is the result of a collaborative process of teachers and students on the Blackfeet reservation, members of the Blackfeet Tribal Historic Preservation Office, and both the Department of Education and the School of Anthropology at the University of Arizona.

The curriculum examines the 10,000 year significance of bison to Native and non-Native peoples primarily within the state of Montana. Each unit—4 science units and 1 language arts unit—examines how bison have played an integral role culturally, politically, socially, and environmentally in the past and how this understanding might be used in the present and into the future.

Each science unit within the curriculum meets the Next Generation Science Standards (NGSS), and lists the disciplinary core ideas and cross cutting concepts. A full explanation and list of the standards can be found at http://www.nextgenscience.org/ under the tabs: *About the Standards* and *Next Generation Science Standards*.

The language arts unit meets common core standards as listed for English Language Arts. These standards can be found at http://www.corestandards.org/ELA-Literacy/ under the *Download the Standards* link.

Science Unit 1 introduces students to bison, presenting the behaviors of bison throughout the year. During this three part lesson sequence, students will learn how bison have adapted to their eco-niche, taking into account environmental, seasonal, and predatory pressures. Students will also gain an understanding about the various bison adaptations and behaviors that have contributed to general species and reproductive success.

Science Unit 2 presents the pre-and-post contact natural and enculturated history of bison. Beginning 10,000 years ago, students learn how bison and humans have interacted through the changing landscape. Students will also discover that the bison ecosystem encompasses a vast spatial and temporal area with a great amount of diversity, change, and fluctuation.

Science Unit 3 has students put on the hat and shoes of an archaeologist for the day. Students learn about the impacts of the mass hunting of bison, getting at this understanding through oral histories, archaeological evidence, and historical written records. Through an analysis of bison bones, students engage with the tangible past, as well as draw conclusions about the complex and intricate hunting strategies and processing techniques that were used by Native peoples.

Science Unit 4 guides students through the trajectory of bison conservation from the initial efforts in the late 1800s into the present era. With bison restoration efforts on the rise, students will examine the past and current strategies of bison conservation and restoration and then be challenged to design their own hypothetical bison conservation area. The unit culminates in the students designing a brochure of their hypothetical bison conservation area.

Finally, in Language Arts Unit 1 students will learn about the high significance of bison to the various Native American tribes within Montana. Specifically, students will gain a broader understanding of the oral tales and stories, music, art, ceremonies, and various rituals involving bison. Students are then tasked with creating an art piece or storybook about a particular story of bison they found interesting or noteworthy. Upon completion, the students will present this storybook or art piece to a lower grade level.

In all, these five units strive to be student-centered, in which students are able to take an active role in their own education. Teachers are certainly welcome to customize the curriculum as they see fit for their classroom contexts. For ease of implementation, a robust teacher guide, film links, and further resources have been provided throughout the five units. Also provided are PowerPoint presentations to help teachers introduce a topic and reinforce the subject through a free and easily accessible YouTube film.

There is a suggested textbook entitled *The Buffalo and the Indians: A Shared Destiny* by Dorothy Hinshaw Patent that, though not required, is recommended. However, alternative readings are available, either included in this curriculum or provided through website links. Beginning Fall 2015, there will also be readings available online written by the author of the curriculum, Mario Battaglia.

I hope you find these lessons on the 10,000 year significance of bison to be engaging, educational, and most of all, fun for both you and your students. Please feel free to email me with suggestions, comments, and general feedback.

Thank you for your interest,

Mario Battaglia

Bison Curriculum Project Author

Bison Curriculum Project

SCIENCE MODULE ON THE SIGNIFICANCE OF BISON

Unit 1: Bison Behaviors and Adaptations

Lesson 1: Have you "Herd" of Bison

Objective: Students will be introduced to bison (also known as buffalo) by watching a documentary about the bison living in Yellowstone National Park. During the film, students will complete a film worksheet.

Students will understand: How bison have adapted to their eco-niche taking into account environmental, seasonal, and predatory pressures. They will also gain an understanding about the various bison adaptations and behaviors that have contributed to general species and reproductive success.

Students will be able to: Do a film analysis to learn about the adaptations and behaviors.

Essential Question(s): How have bison adapted to their eco-niche? What behaviors and adaptations have allowed them to more effectively utilize their habitat and contribute to their overall species success?

Estimated Time Lesson 1: Approximately 1 class period

Handout(s)/Worksheet(s)/Teacher Guide(s)/PowerPoint Presentations:

(1) Worksheet 1: Buffalo Thunderbeast
(2) Introduction to Bison

Prior Knowledge: No prior knowledge is necessary for this module.

Reading(s): No readings are required for Lesson 1

Documentaries/Film Clips: (1) *Buffalo Thunderbeast: Wildlife Documentary*. Optional Films: (1) *Bison: Documentary on the Buffalo of Yellowstone* (2) *Cold Warriors: Wolves and Buffalo* PBS Documentary, (3) *American Buffalo: Spirit of a Nation* PBS Documentary

Key Terms: Bison; Buffalo; Eco-Niche; Environment; Seasonal, Environmental, and Predatory Pressures; Reproductive Success; Herbivore; Evolutionary Behaviors; Adaptations

National Science Standards: MS-LS1 From Molecules to Organism

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors…affect the probability of successful reproduction…

MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary Core Ideas: LS1:B

Crosscutting Concepts: Cause and Effect

Lesson Outline:

Part 1: An Introduction to Bison

1. The teacher will introduce students to bison as a species, its major characteristics, location, habitat, etc. by presenting the provided PowerPoint *An Introduction to Bison*. The PowerPoint is available with this curriculum, the outline of which is provided below. Following the presentation, students will then watch Buffalo Thunderbeast: Wildlife Documentary, available for free online at:
    1. Buffalo Thunderbeast: Wildlife Documentary*: https://www.youtube.com/watch?v=m-ZHFyhBbRg*
2. Students will take notes on the corresponding worksheet provided (**Worksheet 1: Buffalo Thunderbeast**). *Note: The worksheets can be adapted for the optional videos as well.* Some optional videos if *Buffalo Thunderbeast: Wildlife Documentary* is unavailable:
    1. *Bison: Documentary on the Buffalo of Yellowstone* Video Link: https://www.youtube.com/watch?v=WSONdYVo_6Q
    2. *Cold Warriors: Wolves and Buffalo* PBS Documentary: https://www.youtube.com/watch?v=Zj82dImOwdw
    3. *The Great Buffalo Saga:* https://www.youtube.com/watch?v=cCo1crv8EoA
3. If continuation to lesson 2 of this unit is planned, give students **Handout 1: Student Instructions for Group Poster Project** which explains the rest of the lesson module sequence.
4. Time allowing, students can be asked to write about how certain adaptations and behaviors have helped bison survive and thrive.

Teacher's PowerPoint Guide

SLIDES | **NOTES**

Slide 1

Introduction to Bison

PowerPoint 1: Have you "Herd" of Bison?

What is a bison? Where does it live? What does it eat?

What behaviors and adaptations have helped it survive?

Slide 2

Slide 3

Slide 4

But then…

- They were nearly hunted to **extinction.**
- The photo on the left is a pile of bison skulls hunted by early settlers.
- Bison were hunted for their meat, but mostly for their hide that could be used as conveyor belts in industrial factories.

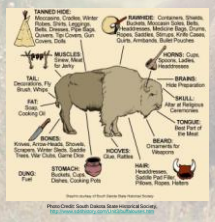
Slide 5

Bison Restoration

- Luckily, before they were fully **exterminated** (hunted to extinction), people began opening vast tracts of land to save the remaining bison.
- One such place is Yellowstone National Park. Do you know where Yellowstone National Park is?

Slide 6

Parts of the Bison That Were Used



For many thousands of years before European settlers came to North America, the bison were hunted by Native Americans for food and tools.

Slide 7

Bison Behaviors and Adaptations

- Bison have adapted to the North American continent over many thousands of years.
- Bison are well adapted to the cold, harsh winters of the North American Plains and the hot, dry summers.
- The story of the American Bison is one of **survival**, a story that still continues today.


Photo Credit: Left: http://commons.wikimedia.org/wiki/File:WR_-_Snow_covered_bison_%3B27705035879%29.jpg Right: http://commons.wikimedia.org/wiki/Commons:Featured_pictures/Animals/Mammals

Slide 8

Male bison will compete for females during "rutting" or mating season in summer.

Photo Credit: http://en.wikipedia.org/wiki/American_Bison

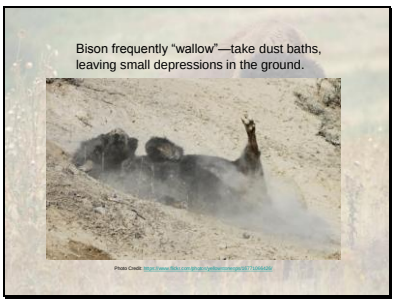
Slide 9

Bison face many predators year round, foremost among them wolves and humans, but also grizzly bears have been known to take down a bison.

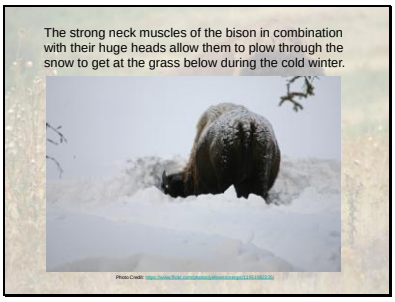
Photo Credit: http://en.wikipedia.org/wiki/American_Bison#mediaviewer/File:Cape_buffalo_back_surrounding_Bison.jpg

Slide 10

Slide 11



Slide 12



Student Name:_____Date: _____

Worksheet 1: Buffalo Thunderbeast

Key Terms:

BISON: Also popularly, but incorrectly, called buffalo, bison are large, shaggy-haired wild animals native to North America.
HERBIVORE: An animal that feeds on plants.
PREDATOR: An animal that naturally hunts or preys upon other animals for food
ADAPTATION: A behavior or a physical change that has happened to an animal species which enables it to better survive in a particular environment.
EVOLUTIONARY BEHAVIORS: Behaviors that promote species survival and reproductive success.
ECO-NICHE: The position of an organism within its environment affecting its survival as a species.
REPRODUCTIVE SUCCESS: The number of offspring an individual produces; also the ability or rate at which an organism successfully passes on its genes to the next generation.

Section 1:

What do you think you will see in this documentary? List TWO concepts or ideas you might expect to see based on the title of the film and the introduction given in class. Write in COMPLETE sentences in the boxes provided below.

AFTER the film, list TWO new things you learned from the film. Try to focus on bison behaviors and adaptations throughout the year, specific to each season.

Concepts or Information You Hope to Learn from the Film	New Information You Learned From the Film
1.	1.
2.	2.

Worksheet 1: Buffalo Thunderbeast *(Page 2)*

Section 2:

Using a complete sentence, what was the central message(s) of the documentary?

_____

_____

_____

_____

Do you think the central message was conveyed effectively? What were some of the strengths and weaknesses of the documentary?

_____

_____

_____

Describe in a complete sentence TWO bison adaptations or behaviors you saw in the film:

1. _____

_____

2._____

_____

What environmental or predatory pressures upon the bison occurred in the film?

_____

_____

_____

The film presented many bison adaptations and behaviors. From the film, name at least ONE bison behavior or adaptation that occurred during each season:

Winter_____

Spring_____

Summer_____

Fall_____

TEACHER GUIDE

Worksheet 1: Buffalo Thunderbeast

Section 1:

What do you think you will see in this documentary? List TWO concepts or ideas you might expect to see based on the title of the film and the introduction given in class. AFTER the film, list TWO new things you learned from the film. Try to focus on bison behaviors and adaptations throughout the year, specific to each season.

Concepts or Information You Hope to Learn	New Information You Learned
1. *These answers could be anything related to bison, including what is a bison, how bison on related to Yellowstone National Park, etc.*	1. *Bison display different seasonal behaviors: **Winter**—split into small groups, males wander off, all move to wooded areas for protection. **Spring**—regrouping of bison, nutritious grass available for the larger herds. **Summer**—breeding season/rutting. **Fall**--prepare for winter*
2. *Specific topics: bison ecosystem: predators, prey, plant foods, environment both past and present. More possible topics: bison seasonality: bison behaviors during each season, bison adaptations to each season, etc.*	2. *Bison display numerous seasonal adaptations: **Winter**—well adapted to cold, thicker fur coats. **Spring—**calves are born with enough time to grow strong before winter, herds begin to coalesce. **Summer**—herds continue to coalesce for protection, mating in late summer. **Fall**—herds disperse into smaller groups to not exhaust one resource patch*

Section 2:

Using a complete sentence, what was the central message(s) of the documentary?

Possible answer: *Though a dominant species on the plains for millennia, bison have had a long, upward battle for survival due to the over-predation and wanton killing largely at the hands of fur traders. Yellowstone National Park is one of the few remaining free-roaming bison landscapes today. This allows bison to live as they once did in a more open and natural eco-niche or habitat experiencing traditional predator-prey relationships and displaying seasonal behaviors and adaptations.*

Do you think the central message was conveyed effectively? What were some of the strengths and weaknesses of the documentary?

Possible topics in answer: *Yes, the central message was conveyed effectively because this documentary was able to provide insight into bison as a species and hints at how bison lived prior to the near extinction of the species. The Yellowstone documentary effectively depicts the bison's year divided by the seasons and showcases bison behaviors and adaptations. The documentary nicely encapsulates the multivariate predator-prey relationships in the park.*

Describe in a complete sentence TWO bison adaptations or behaviors you saw in the film:

1. *The bison behavior to group into lager herds in the spring and summer allow for protection against prey species such as wolves and grizzlies. The herding behavior specifically protects young calves from these prey species.*
2. *Bison became one of the dominant herbivore species in the Great Plains environment or eco-niche by adapting to eat one of the most plentiful food resources in the area: the abundant grasses and sedges of the Plains.*

What environmental or predatory pressures upon the bison occurred in the film?

The bison experienced predation from (1) wolves that were recently reintroduced into the Yellowstone ecosystem, and (2) occasionally from grizzly bears. Both predators were historical and (with the reintroduction of wolves) predator species preying upon the bison. Humans have also had a major impact upon bison as a species both historically through hunting and fur trading as well as contemporaneously with some killing of bison taking place in Yellowstone.

The film presented many bison adaptations and behaviors. From the film, name at least ONE bison behavior or adaptation that occurred during each season:

Possible answers could include:

Winter *1.Find shelter from cold wind in wooded areas, 2.Snow-plow like head removed the snow to get to the grass*

Spring *1.Regroup into larger herds when grass is plentiful. 2. Birthing of calves to give them time to mature*

Summer *1. Rutting/mating in late summer 2. Large herding behavior*

Fall *1. Divide into small groups to not exhaust grass in one area 2. Calves become stronger to prepare for winter*

Handout 1: Student Instructions for Group Poster Project

Part 1: Introduction

(1) After completion of film, you will be divided into groups of 3-4 people AND given one bison trait (behavior or adaptation) from the list provided by the teacher.

(2) Each of you will receive a copy of *Worksheet 2: Bison Behavior and Adaptations*.

(3) After every group member has been given a copy of (a) *Worksheet 2: Bison Behavior and Adaptations*, and (b) has been given a bison behavior or adaptation from the teacher, each of you will get a printed copy of the selected readings from the book *The Buffalo and the Indians* and copies of the two bison fact sheets provided in the lesson module.

(4) HOMEWORK ASSIGNMENT:

a. **Individually** read the handouts and bison fact sheets. As you do, fill out the research worksheet with the appropriate information that corresponds to your group's behavior or adaptation of bison.
b. Find or draw a picture showcasing the behavior or adaptation on a sheet of paper. This image can be used later for the group poster project described below.

Part 2: Class Posters

(1) After completing *Worksheet 2: Bison Behavior and Adaptations*, you will turn in your individual worksheets for teacher approval and suggestions. After approval, you will get your research worksheets returned to you to be used in the group poster project.

(2) You will then group up into your bison trait groups to discuss what you learned about your particular bison behavior or adaptation during your research *(10 minutes).*

(3) After discussing the bison behavior or adaptation, as a group you will design a poster explaining and displaying your behavior or adaptation *(50 minutes).*

POSTERS SHOULD INCLUDE:

--Title of the poster
--Picture(s) or graphics of the behavior or adaptation (use previous drawings)
--Text describing the behavior or adaptation (5-10 sentences)
--Text describing what season(s) the behavior or adaptation occurs during the year
--Text giving argument points for why this trait has contributed to species success
--Any other relevant information the group members feel is important to include

Part 3: Group Poster Presentations

(1) After the posters are finished, a presentation walk will be done in which each group spends 5-10 minutes presenting their poster to the class *(60 minutes/1 class period).*

(2) During the walk, fill out *Worksheet 3: Bison Adaptation and Behavior Matrix.*

Unit 1: Bison Behaviors and Adaptations

Lesson 2: Bison Uncovered

Objective: Students will work in small groups (3-4 members) to research the bison eco-niche, examining a particular trait (behavior or adaptation) contributing to species survival.

Students will understand: How bison have adapted to their eco-niche taking into account environmental, seasonal, and predatory pressures. They will also gain an understanding about the various bison traits that have contributed to reproductive and general species success.

Students will be able to: Research, record, and understand the different adaptations and behaviors contributing to bison species success as well as identify the similarities and differences between the various traits.

Essential Question(s): How have bison adapted to their eco-niche? What traits have allowed them to more effectively utilize their habitat and contribute to their overall species success?

Estimated Time Lesson 2: 1 class period (with an optional 2nd class period)

Handout(s)/Worksheet(s)/Teacher Guide(s):

(1) Handout 1 (If not provided already): Student Instructions for Group Poster Project
(2) Worksheet 2: Research Template (1 per group)
(3) Worksheet 2: Teacher Guide
(4) Bison Factsheet 1 Student Handout (1 per group)
(5) Bison Factsheet 2 Student Handout (1 per group)

Prior Knowledge: No prior knowledge is necessary for this module.

Readings: (1) *The Buffalo and the Indians* (2) Bison Fact Sheets

Documentaries/Film Clips: Optional documentaries to be shown while teacher reviews Worksheet 2: (1) *Cold Warriors: Wolves and Buffalo* PBS Documentary, (2) *American Buffalo: Spirit of a Nation* PBS Documentary, (3) *Bison: Documentary of the Buffalo in Yellowstone*

Key Terms: Bison; Buffalo; Eco-Niche; Environment; Environmental, Seasonal, and Predatory Pressures; Reproductive Success; Herbivore; Evolutionary Behaviors; Adaptations

National Science Standards: MS-LS1 From Molecules to Organism

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors…affect the probability of successful reproduction…

MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary Core Ideas: LS1:B

Crosscutting Concepts: Cause and Effect

Lesson Outline:
Students are divided into small working groups (3-4 members) to be assigned one trait to research. Up to 10 traits have been provided below: 5 Behaviors & 5 Adaptations.

Part 1: Exploring Bison Traits

1. Display on overhead or hand out copies (if you have not already) of the **Handout 1: Student Instructions for Groups Poster Projects** found in Lesson 1 of this Unit. Students will follow the instructions on the handout for the remainder of the poster project.

2. Each group will get copies of the recommended readings to use in their research. *Note: The provided readings listed below plus the Lesson 1 film (Buffalo Thunderbeast: Wildlife Documentary) will give students enough information to complete the assignment. HOWEVER, students are most certainly encouraged to gather more information from other sources (i.e., other books or websites)*
    a. Readings from *The Buffalo and the Indians*, pp. 1-7 (introduction to bison)
    b. Readings from *The Buffalo and the Indians*, pp. 8-13 (seasonal behaviors/adaptations of bison)
    c. Readings from Bison Fact Sheets. Direct students to these two websites if online access is available for students
        i. Fact Sheet #1 available at: http://www.defenders.org/bison/basic-facts
        ii. Fact Sheet #2 available at: http://library.sandiegozoo.org/factsheets/bison/bison.htm#behavior
    d. IF online access is NOT available, adapted printable versions ARE included at the end of the module:

3. Using the list provided below (a. Behaviors or b. Evolutionary Adaptations), groups will be given one trait to research. Each behavior or adaptation has influenced bison species success and survival in some way. Student groups may suggest an alternative behavior or evolutionary adaptation not provided below (*Note: some traits listed could arguably be on both lists, however, it is largely irrelevant for the module sequence*):
    a. Behaviors: (1) herding behavior (2) rutting (mating), (3) dividing into smaller groups and the breaking apart of the large herd, (4) tendency to run if spooked (5) continual movement while in large herds
    b. Evolutionary Adaptations: (1) birthing young at a particular time of the year, (2) grass eating herbivore, (3) calves have the ability to run within a few hours of birth, (4) thick, warm, insulating hide, (5) powerful "plow-like" head with strong neck muscles

4. Students must follow the Research Criteria provided on the example template (**Worksheet 2: Bison Behaviors and Adaptations**) to record their findings. They are as follows:
    a. Describe the specific trait (behavior or adaptation)
    b. Explain its impact on bison survival and provide an explanation as to how this trait has contributed to bison species success

c. Provide pictures or an info-graphic of this characteristic trait and provide a written supplement explaining those picture(s)
d. List the research and data they collected about the trait
e. Students can also use their notes from the video shown in class as part of their sources for research.

5. Students will submit for teacher review their **Worksheet 2: Bison Behavior and Adaptations**. Once teacher-approved, students can begin creating their posters. If students are not done, they can finish it as an in-class homework while the teacher reviews the other worksheets.

Optional Part 2: Additional documentary

1. Optional (50 minutes): If the teacher needs time to review students' **Worksheet 2: Bison Behavior and Adaptations**, a second video/film can be shown at this time for one class period while outlines are reviewed.

Optional videos:

a. **Recommended optional film**: *Cold Warriors: Wolves and Buffalo Nature Documentary*, 53:08 minutes, Worksheet 1: Buffalo Thunderbeast can be used for this documentary as well, available free online at http://www.youtube.com/watch?v=cGfKTnsAjhs
    i. Provides more information about predator/prey relationships
    ii. Supplements and compliments and provides info about bison behavior and adaptations
b. *Bison: Documentary on the Buffalo of Yellowstone*, Worksheet 1: Buffalo Thunderbeast can be used for this documentary, available free online at: https://www.youtube.com/watch?v=WSONdYVo_6Q
c. *Rutting and Mating*, a YouTube video, NO worksheet included, can be found at: http://www.youtube.com/watch?v=9UxUVGIxWXo
d. *American Buffalo: Spirit of a Nation* PBS Documentary, NO worksheet included, can be found at: http://www.pbs.org/wnet/nature/episodes/american-buffalo-spirit-of-a-nation/troubled-herds/2181/

Worksheet 2: Bison Behavior and Adaptations

Group member names: _____

Your Name: _____ Date: _____

1. **Name** and **describe** your group's bison adaptation or behavior. In the description, **explain why** you think it contributes to overall species survival:

_____

_____

_____

_____

_____

_____

2. IMAGE:
On the back of this sheet of paper please draw a picture showing your group's trait: the bison behavior or adaptation. You may choose to find a picture instead and attach it to the worksheet.

Below your drawing or image, write a 3-5 sentence description on the back of this piece of paper describing the behavior or adaptation you drew or found.

3. THE SEASONALITY OF A BISON ADAPTION OR BEHAVIOR:
When do bison use the behavior or adaptation during the year?

	Give a brief summary (1-2 sentences) explaining why the trait occurs in that season:
Summer	
Fall	
Winter	
Spring	

TEACHER GUIDE

Worksheet 2: Bison Behavior and Adaptations

Group member names: _____

Your Name: _____ Date: _____

Possible Adaptations or Behaviors students can use for worksheet. Assign 1 per group:

a. *Behaviors: (1) large group herding behavior, (2) rutting/mating, (3) dividing into smaller groups, (4) tendency to run if spooked (5) continual movement of bison herds*
b. *Evolutionary Adaptations: (1) specific time of the year for birthing young, (2) grass eating herbivores, (3) calves have the ability to run within a few hours of birth, (4) thick insulating bison hide, (5) powerful "snowplow-like" head with strong neck muscles*

1. **Name** and **describe** your group's bison behavior or adaptation. In the description, **explain why** you think it contributes to overall species survival:

NOTE—this assignment utilizes the readings suggested in the Lesson Outline:
(1) Readings from *The Buffalo and the Indians*, pp. 1-7 (introduction to bison)
(2) Readings from *The Buffalo and the Indians*, pp. 8-13 (seasonal movement of bison)
(3) The TWO fact sheet/student print outs provided at the end of this module

Behaviors:

(1) Group herding: This bison behavior in spring and summer involves the grouping (e.g. herding) of bison into much larger herds. This behavior contributes to species survival by protecting against predators which might prey on the young calves. Grouping also helps facilitate mating later in the summer.

(2)Rutting/Mating: This bison behavior occurs in late summer after the males have returned to the herd and beefed up on the spring grasses. The late summer mating or rutting insures timely birthing of calves in spring. The bison cows have already given birth in the spring, so the cycle of mating and birthing can begin again in order to continue species survival.

(3)Dividing into smaller groups: This behavior occurs during the winter months and prevents the bison from exhausting the diminished food resources such as grasses and sedges in one specific area. If the resources in an area were completely exhausted, the bison would be forced to move through the extreme cold and snow. Dividing into smaller groups allows them to stay protected in a smaller area in order to make it through the harsh and resource scarce winter months.

(4)Tendency to run if spooked: This behavior allows the herd to get away fast if predators (such as humans or wolves) are endangering the bison in some way. This is important during any season of the year! This behavioral tendency has been utilized by Native American bison hunters (like the Blackfeet) in the past to get large bison herds to run away from the perceived danger, usually toward a cliff face ("bison jump") or corral. Running away as a group when spooked is a behavioral tendency that insures species success by both getting away from predators while at the same time maintaining some level of protection against the predators. Cows will often stay with the calves up at the front while the bulls remain in the back to fend off the predator(s).

(5)Continual movement of bison herds: Continual movement of bison herds is a behavioral adaptation into their eco-niche, the grassy Great Plains. Continual movement or migration allows the giant herds of the spring and summer to have continual access to food resources, essential for both the growing calves and the bulls getting ready for mating (rutting) later in the summer. Giant herds exhaust the grass resources quickly, so continual movement across the landscape allows bison to get to locations with fresh grass and sedges.

Evolutionary Adaptations:

(1) Specific time of the year for birthing young: Giving birth in the spring allows calves time to grow and prepare before the harsh winter months. The plentiful and nutritious availability of spring and summer grasses gives the calves a good opportunity to survive the winter. This opportunity, along with a more protected environment due to group congregation, helps significantly to continue bison species survival.

(2) Grass eating herbivores: Grasses (and sedges) are the most plentiful plant species in the Great Plains. With such a great abundance of this food source, the bison adaptation to eat such available and easily accessible grasses allowed for the massive herds of bison. Adapting to be specialized on eating these grasses not only helped support such large herds but contributed to general species success.

(3) Calves have the ability to run within a few hours of birth: With predators always looking for a vulnerable young calf, the need to run soon and quickly after birth is vital for bison species survival. Wolves often focus on herds with calves, therefore, bison calves have adapted to be able to run with the herd only hours after birth to escape from predators and increase their protection.

(4) Thick insulating bison hide: Bison live in the Great Plains, an area that gets incredibly cold during the winter. The thick hides help insulate the bison during the winter and keep them warm, a very important trait during the cold winter months! The hide is incredibly thick and an important adaptation for species survival.

(5) Powerful "plow-like" head with strong neck muscles: The massive head and strong neck muscles are perfect for protection against predators and for competition with other males during mating. However, one of the biggest advantages is to" plow" the snow during the winter to be able to get had the scarce grasses below.

2. IMAGE:
On the back of this sheet of paper please draw a picture showing your group's trait: the bison behavior or adaptation.

Below your drawing on the back of this piece of paper, write a 3-5 sentence description describing the behavior or adaptation you drew.

3. THE SEASONALITY OF A BISON ADAPTION OR BEHAVIOR:
When do bison use the behavior or adaptation during the year?

	Give a brief summary (1-2 sentences) explaining why the trait occurs in that season
Summer	Example used: Powerful "snowplow-like" head with strong neck muscles *This adaptation during the summer is very useful both to ward off predators like wolves, but also for the bulls for competition and displays during mating in late summer.*
Fall	NOTE: Some adaptations or behaviors like this one are used year-round, possibly for different things. Students should recognize when this adaptation or behavior is vital (in this case summer for mating and winter for feeding), but the more subtle uses during other seasons might be missed. This module recommends suggestions over graded corrections for this part of the assignment. Possible answer*: As herds split up, protection from predation is still necessary.*
Winter	*During the winter months with snow heavy on the ground, bison can use their strong neck muscles and large heads to "plow" the snow to get at the grass hidden below.*
Spring	Possible answer*: As dispersed herds begin to congregate after the winter and birthing of calves begins, the powerful heads can be used to ward off and protect from wolves and predators.*

HANDOUT: BISON FACT SHEET #1
ADAPTED FROM http://www.defenders.org/bison/basic-facts

Fast Facts:
Height: 6-6.5 feet at the shoulder
Length: 10-12.5 feet
Weight: 900-2,000 lbs. Males are larger than females.
Lifespan: 18-22 years in the wild; over 30 years in captivity.
Mating Season: June-September, peak activity in July-August
Gestation: 270-285 days. Calf is born April-May.
Litter size: 1 calf

© Midori Layzell

Millions of bison once thundered across North America. These massive animals, characterized by their long, shaggy brown coats, have poor eyesight but very good hearing and an excellent sense of smell.

Historically, the American bison played an essential role in shaping the ecology of the Great Plains. They graze heavily on native grasses and disturb the soil with their hooves, allowing many plant and animal species to flourish. Prairie dogs prefer areas grazed by bison where the grass is short so they can keep a lookout for hungry predators, and wolves once relied on bison herds as a major food source. Today, wild bison are making a small comeback in a few scattered places, but they need more room to roam.

Diet

Bison mainly eat grasses and sedges which are both very plentiful foods on the Great Plains which resulted in massive herds of bison. Bison have adapted to eat these grasses because it is so plentiful, especially during the spring and summer months when the grass is more nutritious. This is a very important time because the bulls need the nutritious grasses to bulk up before mating in the late summer and the calves need it to grow strong to prepare for the harsh winter. During the winter when grasses are less plentiful and snow covering the ground, bison have adapted their massive, “snow-plow” like heads and powerful neck muscles to move the snow and get at the sparse winter grasses below.

Population

An estimated 20 to 30 million bison once dominated the North American landscape from the Appalachians to the Rockies, from the Gulf Coast to Alaska. Habitat loss and unregulated shooting reduced the population to just 1,091 by 1889. Today, approximately 500,000 bison live across North America. However, most of these are not pure wild bison, but have been cross-bred with cattle in the past, and are semi-domesticated after being raised as livestock

for many generations on ranches. Fewer than 30,000 wild bison are in conservation herds and fewer than 5,000 are unfenced and disease-free.

Range & Habitat (where they live)

Though bison once roamed across much of North America, today they are “ecologically extinct” as a wild species throughout most of their historic range, except for a few national parks and other small wildlife areas. Yellowstone National Park has the largest population of wild plains bison (about 4,000), and Wood Buffalo National Park has the largest population of wild wood bison (about 10,000). With help from Defenders, two small herds of pure, wild Yellowstone bison were recently reintroduced onto two Indian Reservations.

Some Behaviors and Adaptations

A bison's thick fur offers great protection against the harsh elements of the American plains. Their thick hide helps to insulate them to conserve heat. This winter coat is so thick and well insulated that snow can cover their backs without melting because so little heat escapes! Known for roaming great distances, bison move continuously in order to get at fresh grasses to keep eating. The females, or cows, lead family groups during this continual movement. Bulls, however, remain solitary or in small groups for most of the year, rejoining the group during late spring and summer to prepare for rutting or mating season.

Bison also have a tendency to run if spooked. This behavior allows the herd to escape fast if predators (like wolves or humans) are threatening the bison. This behavioral tendency was utilized by Native American hunters (like the Blackfeet) in the past to get large bison herds to run away from the perceived danger, usually toward a cliff face (“bison jump”) or a corral.

Reproduction

Bulls and cows do not mingle until breeding season which happens in the late summer. This is called “rutting”. Dominant bulls “tend” to cows, paying attention only to the cow and sometimes not even eating for fear the cow will leave! The bull will follow the cow around until the cow chooses to mate. During this period, the bull blocks the cow’s vision so that she may not see other competing bulls, and bellows at males striving for the cow’s attention.

Mating or rutting happens in late summer so that the calves will be born in the spring, giving the calves plenty of time to feed on the nutritious spring and summer grass in order to become big and strong before the arrival of the cold winter. This timing in birth also allows for added protection with larger herds to protect the calves from predators like wolves.

Calves have the ability to run just hours after birth, an important survival adaptation when the herd is continually moving or is targeted by predators like wolves. Indeed, wolves often target vulnerable young calves, therefore, bison calves have adapted to be able to run with the herd only hours after birth to both escape from predators and increase their protection.

HANDOUT: BISON FACT SHEET #2

ADAPTED FROM http://library.sandiegozoo.org/factsheets/bison/bison.htm#behavior

Location (of North American bison)

- Beginning around 5,000 years ago, *Bison* occupied grasslands and parklands of central United States and Canada. There are two types of bison:
    - Wood Bison mainly inhabited western forests of Canada to eastern Alaska.
    - Plains Bison in general occupied territories to the south of the Wood Bison, south across the United States to northern Mexico.
- By around 2,000 years ago *Bison* reached its maximum range. When modern Europeans arrived in North America, an estimated 50 million bison inhabited the continent.
- By 1903, fewer than 2,000 were known to survive in zoos and private collections, plus isolated wild populations in Canada and the United Sates.
- Occur today in geographically isolated populations in parks and preserves.
- Largest free-ranging populations in parks and preserves:
    - In Canada (Mackenzie Sanctuary, Wood Buffalo National Park and Slave River lowlands)
    - In the United States (Yellowstone National Park)

American bison historical distribution. Click on map for current detailed distribution (IUCN). From IUCN *Bison bison* fact sheet.

Habitat (area where they live):

- American Wood Bison occupied parklands and woodlands of Canada and northern U.S.
- American Plains Bison occupied more open grasslands, mainly in the central U.S.

BISON BEHAVIOR:

Activity Cycle

- Active during day, sleep at night. During the day bison herds often are on the move, a behavioral adaptation into their eco-niche, the grassy Great Plains. Continual movement or migration allows the giant herds formed during the spring and summer to have constant access to fresh food resources, essential for both the growing calves and the bulls which are getting ready for mating (rutting) later in the summer. Giant herds exhaust the grasses quickly, so continual movement to get to new locations with fresh grass becomes essential.
- Bison move about 1.9 miles per day, this however varies according to habitats, the presence of biting insects, the amount of grass available, and where the water is located.

- Several times a day in summer, bison will take a dirt bath called wallowing. Bison roll on the ground to put dirt and dust into their hair helping to keep insects off the skin and protect against the heat. Wallowing creates these dusty holes with little to no vegetation.
- Bison will often divide into smaller herds during the winter months. This prevents the bison from exhausting the diminished grasses and sedges in the sparse winters. If the resources in an area were to be completely exhausted, the bison would be forced to move through the extreme cold and snow. Dividing into smaller groups allows them to stay protected and more stationary in order to make it through the harsh and resource scarce winter months.

Territory Size

- Plains Bison are non-territorial and are nomadic (herds that migrate or move)
- Plains bison living in small herds may be non-migratory and stay within a home range.
- When bison are seasonally migratory, they move to warmer, southerly habitats in winter.
- Distances traveled between winter and summer territories may be up to 25 miles in mountainous habitats and up to 149 miles in forest parkland habitats!

Social Groups

General

- Bison are social, forming fluid groups of females with calves, young males up to 2 or 3 and possibly a few older males.
- Breeding males play little role in raising the calf. Normally, they do not mix with cows.
- Males live alone or in small herds for most of the year and regroup in summer to mate.

Hierarchy

- Dominance in males is a linear hierarchy. This means:
    - The top bull dominates over all other members in the group
    - This pattern continues down the bison rank so that subordinate males only rarely challenge the order of more dominate males.
- Bison dominance is strongly associated to the age and weight in bison groups

Territorial Behavior

- Bison are nomadic, may move several miles a day while feeding.
    - Amount of movement influenced by quality of habitat's plants and grasses, presence of biting insects, and amount of water that is available
    - Bison herds moved several miles or more a day in grasslands because they can eat all the grass in an area very quickly. Movement helps to insure they always have fresh grass to munch on.
- In shrub-steppe habitats of Southern Utah, herds remained in one area about 2 days feeding on grasses and wild shrubs before moving on to a new area. They move on to avoid eating all the grass in one area. This migrating behavior happens a lot in spring and summer when there are big herds of bison that need a constant supply of food.

Aggression

- About 5 to 10 percent of a bull's challenges lead to fights, their massive plow-like heads help in this fight for dominance as well as for protection against fierce predators like wolves.

- When bulls threaten they may bellow, stamp their feet, snort, and approach each other with tails held high. These behaviors usually occur during the summer competition for mates.
- When fighting, bulls run together, clash heads, and push upwards with heads held low.
    - Relatively short horns of *bison* allow a bull to slip to the side after head clashing and gore an opponent; such wounds are frequent—OUCH!
- Bulls may approach closely, heads turned sideways, then nod the head up and down until one may attack or submit before an attack; called a "nod threat" Turning the head sideways when two bulls threaten each other indicates submission; then the contest is over and the winner does not attack further.

Communication

Visual Signs

- Broadside (facing sideways) threat posture displays give best view of overall large body size; may intimidate opponents into submission or predators like wolves!

Vocalization

- Bulls may bellow when threatening each other.
    - This sound has been compared to a lion's roar and can be heard up to 3 miles away. WOW!

Locomotion (Movement)

- Gaits include walking, trotting, galloping, bounding.
- Can run up to 60 km/hr (35 mph)
- Known to leap over barbed wire fences; surprising agility for animal its size
- Good swimmers; can swim rivers at least 1 km (.6 mi) wide.
- When spooked by predators like wolves or grizzly bears, bison have a tendency to run in a large herd to try and escape from the threat. The cows and calves will run up in front while the bulls will stay toward the back to try to ward off the threat.

Interspecies Interaction (interaction with people and animals)

- The human burning of grasses with fire plus intense bison grazing may lower numbers of four grass-dependent species of sparrows and Eastern Meadowlarks.
    - After grazing by bison, there are fewer plants, but more species; grazing increases diversity of grassland species, as does a fire.
- Grazing bison keep grasses short, which promotes prairie dog colony survival; prairie dogs don't live in areas with tall grass where they cannot see approaching predators
- Bison are attracted to bare dirt for dusting fur in prairie dog towns.
- Brown-headed cowbirds forage on insects disturbed by grazing bison.
- Sedges and rushes (water loving plants) grow in compacted bison wallows that can hold extra rainfall. Good for promoting diversity in plants on the Great Plains.
- Native Americans living in bison habitats depended on bison for much of their subsistence. Traditionally, they hunted the bison by driving them toward a cliff-face or corral. Much planning and strategy went into these hunts to get the bison to run in the right direction at the right time. Bison are so important, many native songs, rituals, and ceremonies existed and continue to exist recognizing bison’s sacred importance.
- Bison fertilize the grasslands with their dung helping the growth of many plants.

Unit 1: Bison Behaviors and Adaptations

Lesson 3: Bison Presented

Objective: Students will create a poster displaying their particular behavior or adaptation. The posters will explain why the trait has helped bison species survival and success. After completion of the posters, the class will conduct a "presentation walk" moving to each poster and having the representative group briefly explain the trait or adaptation.

Estimated Time Lesson 1: Approximately 2 class periods

Students will understand: How bison have adapted to their eco-niche taking into account environmental, seasonal, and predatory pressures. They will understand the various bison adaptations and behaviors that have contributed to reproductive and general species success.

Essential Question(s): How have bison adapted to their eco-niche? What behaviors and adaptations have allowed them to more effectively utilize their habitat and contribute to their overall species success?

Students will be able to:

(1) Design and create a presentation poster using all the data and analysis from their group research in which they identify seasonal traits of bison.
(2) Compare and contrast the different adaptations and behaviors. By doing so, students can identify the similarities and differences between the adaptive and behavioral strategies as well as see how they all interrelate.

Students Will Need: Poster board, poster design materials (markers, glue, and construction paper), internet for research, and ability to print text and pictures for the posters.

Handout(s)/Worksheet(s)/Teacher Guide(s):

(1) Worksheet 3: Adaptation and Behavior Matrix (1 per student)
(2) Unit 1 Quiz: Bison Species Behavior and Adaptations
(3) *Note:* Teacher Guides are provided

Prior Knowledge: No prior knowledge is necessary for this module.

Readings: No readings for this part of the lesson sequence

Documentaries/Film Clips: No documentaries of films during this part of the module sequence

Key Terms: Bison, Buffalo, Niche, Environment, Environmental and Seasonal Pressures, Predatory Pressures, Reproductive Success, Herbivore, Evolutionary Behaviors, Adaptations

National Science Standards: MS-LS1 From Molecules to Organism

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors…affect the probability of successful reproduction…

MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary Core Ideas: LS1:B

Crosscutting Concepts: Cause and Effect

Lesson Outline:

Part 1 (50-90 minutes): Poster Project

Using their individual research worksheet and notes, the groups must now design an informative poster to be presented to the rest of the class.

1. Students will analyze the data they have collected and compile the information collected from the different group members.
2. Posters must display their bison trait. They must also explain how it has helped bison species success.
3. Poster board or sheets of paper should be provided by school if able. If unable, students can find inexpensive poster-board.

Part 2 (50 minutes): Presentation Walk

2. Upon completion of the posters, students will display their posters for a "presentation walk" in which all students will visit each poster. Each group will present their poster to the other students who will record the presented data on their Matrix sheet (**Worksheet 3: Bison Adaptation and Behavior Matrix**).

Part 3 Closure Activity: Quiz OR Writing Assignment

1. **Worksheet 3: Bison Adaptation and Behavior Matrix** will be used as a reference tool for a 'quiz/review activity' in which they can compare and contrast adaptations and behaviors. This quiz review activity is included at the end of the lesson modules as **Worksheet 4: Lesson Module Completion**
2. As an alternative to the end of the unit assessment quiz, a 1-2 page writing assignment answering the unit's essential questions is another possible option.
    a. Unit 1 Essential Question: How have bison adapted to their eco-niche? What behaviors and adaptations have allowed them to more effectively utilize their habitat and contribute to their overall species success?

Worksheet 3: Bison Adaptation and Behavior Matrix

Student Name:_____Date: _____

Name the adaptation or behavior	In the corresponding box below, provide some information about the adaptation or behavior. Include the season(s) the trait occurs in	How has it contributed to bison species success?

TEACHER GUIDE

Worksheet 3: Bison Adaptation and Behavior Matrix

Note: answers may vary; refer to Worksheet 2 Teacher Guide for additional answers

Name the adaptation or behavior	In the corresponding box below, provide some information about the adaptation or behavior. Include the season(s) the trait occurs in	How has it contributed to bison species success?
Powerful "plow-like" head with strong neck muscles	*The massive head and strong neck muscles are perfect for protection against predators and for competition with other males during mating in summer. However, one of the biggest advantages is to" plow" the snow during the winter to be able to get had the scarce grasses below.*	*Helps to protect bison against predators and helps much needed and scarce food (the grasses and sedges) during the winter*
Rutting/mating	*The bison behavior to mate happens when the males return to the herd in summer to insure timely birthing of calves in spring.*	*The bison cows have now given birth to the calves in spring, so the cycle of birth can begin again with birthing of calves in the spring (the optimal time for fresh grasses and time to gain strength before winter) to continue species survival.*
Grass eating herbivore	*Grasses (and sedges) are the most plentiful plant type in the Great Plains. With such a great abundance of this food source, the bison adaptation to eat such available and easily accessible grasses allowed for massive herds of bison.*	*Adapting to eat these grasses not only helped support such large herds but also for general species survival because this type of food was so easily found and plentiful.*
Tendency to run if spooked	*This behavior during any time of the year allows the herd to get away fast if predators are endangering the bison in some way. Cows will often stay with the calves up at the front while the bulls remain in the back to fend off the predator(s).*	*Running to escape in a group herd when spooked is a behavioral tendency that insures species success by both getting away from predators while maintaining some level of protection against the predators.*
Specific time of the year for birthing young	*Giving birth in the spring allows calves time to grow and prepare before the harsh winter months.*	*The plentiful and nutritious availability of spring and summer grasses gives the calves a good opportunity to survive the winter. This opportunity significantly helps to continue bison species survival.*
Dividing into smaller groups	*This behavior occurs during the winter months and prevents the bison from exhausting the diminished food resources such as grass in one specific area.*	*If the resources in an area were completely exhausted, the bison would be forced to move through the extreme cold and snow. Dividing into smaller groups allows them to remain in the often wooded and protected area through the winter.*
Thick insulating bison hide	*Bison live in the Great Plains, an area that gets incredibly cold during the winter. The thick hides help insulate the bison during the winter and keep them warm.*	*This is very important during the cold and long winter months to retain heat, and thus, retain energy! The hide is incredibly thick and an important adaptation for species survival.*

Student Name:_____Date: _____

Unit 1 Quiz: Bison Species Behavior and Adaptations

Using your Matrix as a reference, please answer the following using complete sentences.

1. Name and describe your group's bison behavior or adaptation:

2. Why does this behavior or adaptation help bison species survival?

3. What environmental or predatory pressures do you think caused bison to acquire this particular behavior or adaptation?

4. Name and describe another group's bison behavior or adaptation:

5. Why does this behavior or adaptation help bison species survival?

6. What environmental or predatory pressures do you think caused bison to acquire this particular behavior or adaptation?

7. Briefly describe the yearly cycle of the bison. List as many behaviors or adaptations as you can and the season they occur in.

Unit 2: Bison Through Time

Lesson 1: Introductory Film

Objective: Students will watch *Facing the Storm: Story of the American Bison* to learn more about the pre-and-post contact natural and enculturated history of the bison. During the film they will complete a worksheet. If unable to attain *Facing the Storm: Story of the American Bison*, an alternative and free YouTube sequence is recommended: (1) *The National Bison Range: Documentary on Buffalo* and then (2) *The Return.*

Estimated Time: 1 class period (60 minutes)

Students Will Understand: That the bison ecosystem encompasses a vast spatial and temporal area with a great amount of diversity, change, and fluctuation. Examples of this include:

- Bison herds once dominated the grassland ecosystems of the United States.
- It has been estimated that with the first human interactions in the Great Plains, estimates of over 40 million *Bison bison*, or American Bison, roamed the land.
- By 1900, a little over 1,000 bison could be found with only a handful of wild bison left in Yellowstone National Park.

Students will be able to: Critically engage with the topic and themes by watching the film and completing the worksheet to prepare themselves for the rest of the Unit 2 sequence.

Essential Question(s): How has the bison eco-niche changed over time? How have humans played a role in impacting the bison eco-niche?

Prior Knowledge: Though not critical for the completion of this module, *Unit 1: Bison Species Behaviors and Adaptations* is recommended prior to this unit sequence.

Students Will Need: No additional materials are needed for Unit 2: Lesson 1.

Handout(s)/Worksheet(s)/Teacher Guide(s):

(1) Worksheet 1: Facing the Storm Film
(2) Worksheet 1 Teacher Guide
(3) (Alternative Film Option) Worksheet 1: The National Bison Range and The Return
(4) (Alternative Film Option) Worksheet 1 Teacher Guide

Readings: No readings are assigned for this part of the lesson sequence.

Key Terms: Ecosystem, Eco-Niche, Holocene, Pre-contact Period, Contact Period, National Park, Human Predation, Population Pressure, Population Density, Great Plains

National Science Standards: MS-LS2 Ecosystems: Interactions, Energy, and Dynamics:

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2: Construct and explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4: Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Disciplinary Core Ideas: LS2A, LS2B, LS2C

Crosscutting Concepts Patterns, Cause and Effect, Stability and Change

Lesson Outline:

Part 1: Film

1. The teacher will introduce the background information by showing students the first part of the following film: *Facing the Storm: Story of the American Bison* Documentary ending at *29:10*. This PBS film must be purchased, and is available inexpensively on iTunes and can be examined for review and purchase online at http://www.pbs.org/independentlens/facing-the-storm/
    a. If the documentary film is unavailable, an alternative and free YouTube film sequence can be used: (1) *The National Bison Range: Documentary on Buffalo* (*15:16*) found at: https://www.youtube.com/watch?v=pjqv5DJnE0E and (2) *The Return* (*16:47*) found at https://www.youtube.com/watch?v=kZ3HtWcXXbE&list=PLYSMxORqGlAkk3NI0Di8x5cLRw-t6wl-B&index=4
    b. While watching *Facing the Storm*, students will fill out **Worksheet 1: Facing the Storm.** If the YouTube film sequence is selected, students will complete **Worksheet 1: The National Bison Range and The Return**.

2. After completion of the ½ hour film segment, students will turn in **Worksheet 1: Facing the Storm** or the alternative film option **Worksheet 1: The National Bison Range and The Return**.

3. The teacher can now lead a brief discussion reviewing the film and the answers on the worksheet for the remainder of the period.

4. *NOTE: If teacher desires, Lesson 2 can be started after completion of the film to expedite the Unit 2 lesson sequence.*

Worksheet 1: Facing the Storm

Name_____ Date_____

Directions: Use the film *Facing the Storm: Story of the American Bison* to answer the questions listed below:

(1) The bison range extended from where to where?

_____
_____
_____
_____

(2) How did Native Americans hunt buffalo at Head-Smashed-In Buffalo Jump?

_____
_____
_____
_____

(3) How many bison (also called buffalo) were left in North America by 1884? Why?

_____
_____
_____
_____

Worksheet 1: Facing the Storm *(Page 2)*

(4) What was the traditional Indian belief of where the buffalo had gone?

_____
_____
_____
_____

(5) What was the name of the group that helped bring bison back from the brink of extinction?

_____
_____
_____
_____

(6) Where was a herd of bison discovered in 1890?

_____
_____
_____
_____

TEACHER GUIDE

Worksheet 1: Facing the Storm

Name_____ Date_____

Directions: Use the film *Facing the Storm: Story of the American Bison* to answer the questions listed below:

(1) The bison range use to extend from where to where?

The bison range use to extend from Mexico to Alaska.

(2) How did Native Americans hunt buffalo at Head Smashed In?

Native Americans would create drive lanes leading to a cliff, such as the one at Head Smashed In, stampeding the bison herd over the cliff.

(3) How many bison (also called buffalo) were left in North America by 1884? Why?

There were less than a thousand bison left in North America by 1884. This was due to extreme overhunting of bison, useless, slaughter, and a pervasive idea that the bison were so plentiful they could never disappear.

(4) What was the traditional Indian belief of where the buffalo had gone?

Native Americans believed the bison had returned back underground from where they believed they had originated.

(5) What was the name of the group that helped bring bison back from the brink of extinction?

The name of the group that helped bring bison back from the brink of extinction was the American Bison Society.

(6) Where was a herd of bison discovered in 1890?

The herd was discovered in Yellowstone National Park. This herd was one of the last remaining bison herds in North America.

Worksheet 1: The National Bison Range and The Return

(Alternative Film Sequence)

Name_____ Date_____

Directions: Use the film *The National Bison Range: Documentary on Buffalo* to answer the questions listed below:

(1) Native American oral history or legends tell of bison coming from where?

_____
_____
_____
_____

(2) What direct impacts led to the decline of bison numbers in North America?

_____
_____
_____
_____

(3) By 1889, bison had been reduced to how many animals AND where were they located?

_____
_____

(4) What other species share the National Bison Range?

_____
_____
_____
_____

Worksheet 1: The National Bison Range and The Return *(Page 2)*

(Alternative Film Sequence)

Directions: Use the film *The Return* to answer the questions listed below:

(5) What do the buffalo (bison) symbolize to Native Peoples?

_____

_____

_____

_____

(6) What is significant (important) about the Yellowstone herd of bison?

_____

_____

_____

_____

(7) How many bison have been killed trying to leave the border of Yellowstone National Park?

_____

_____

(8) What happened to 65 genetically pure Yellowstone bison?

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TEACHER GUIDE
Worksheet 1: The National Bison Range and The Return

Directions: Use the film *The National Bison Range: Documentary on Buffalo* to answer the questions listed below:

(1) Native American oral history or legends tell of bison coming from where?

Native American oral history tells of bison coming from the earth, from underground, to provide for the Native American people.

(2) What impacts led to the decline of bison numbers in North America?

Cattle competed for land and grasses as well as brought disease. Direct impacts on bison came from commercial demand for bison robes and for leather, fur traders, hide hunters, and Native Americans all perused the animals (though Native Americans pursued the animals for food and resources). Railroads provided the means to ship hunters, guns, and ammunition west and brings the hides and meat east. The demand didn't slacken until the bison were almost completely gone.

(3) By 1889, bison had been reduced to how many animals AND where were they located?

By 1889, bison had been reduced to fewer than 100 wild animals, scattered in small herds. Some 900 more were in private herds.

(4) What other species share the National Bison Range?

Numerous other species occupy the Bison Range: pronghorn, coyotes, Columbian ground squirrels, and badgers. It is also home to over 200 species of bird. White tail and mule deer live in the bushier areas. Black bears can be found foraging the berry bushes in the area. Bighorn sheep and elk live at higher elevations in these areas.

Directions: Use the film *The Return* to answer the questions listed below:

(5) What do the buffalo (bison) symbolize to Native Peoples?

Buffalo signifies prosperity, it is a symbol that means life is going to be good and kids would not go hungry. It is an important symbol for you Native Americans are as people.

(6) What is unique about the Yellowstone herd of bison?

The Yellowstone bison are the only continuously wild, genetically pure bison remaining on earth. No cattle gene introgression has occurred. This makes the Yellowstone bison unique and important for bison conservation and restoration.

(7) How many bison have been killed trying to leave the border of Yellowstone National Park?

Over 3,000 bison have been killed trying to leave the border of Yellowstone National Park

(8) What happened to 65 genetically pure Yellowstone bison?

65 genetically pure Yellowstone bison were transported from a quarantine facility in Yellowstone National Park to Fort Peck as Fort Peck's tribal cultural bison herd.

Unit 2: Bison Through Time

Lesson 2: Research for the Bison Ecosystem Timeline Collage

Objective: Students will work individually to research (using the lesson module readings and those listed in the handout accompanying this assignment) one of 3 time periods over the past 10,000 year span of bison history.

Estimated Time: 2-3 classroom hours and 2-3 student homework hours

Students Will Understand: That the bison ecosystem encompasses a vast spatial and temporal area with a great amount of diversity, change, and fluctuation. Examples of this include:

- Bison herds once dominated the grassland ecosystems of the United States.
- It has been estimated that with the first human interactions in the Great Plains, estimates of over 40 million *Bison bison,* or American Bison, roamed the land.
- By 1900, a little over 1,000 bison could be found with only a handful of wild bison left in Yellowstone National Park.

Students will be able to:

1. Research a time period (1 of the 3 provided in the module) and then work as a group to create a visual collage depicting that specific time period in bison history.
2. Utilize research of past climatic conditions, environmental and predatory pressures, human hunting activities, estimated bison populations densities, and any other relevant information to write a 1 page descriptive synopsis about the collage.
3. Create a class timeline (ideally on an easily visible classroom wall) to showcase the changing bison ecosystem through time.

Essential Question(s): How has the bison eco-niche changed over time? How have humans played a role in impacting the bison eco-niche?

Prior Knowledge: Though not critical for the completion of this module, Unit 1 will more fully introduce students to the bison species.

Students Will Need: Paper printouts, craft materials (crayons/colored pencils, markers, glue, construction paper), 8 x 10 collage paper, stack of magazines w/ high density of pictures, and a computer with an internet connection for research and collage material. Access to a computer lab for the students is recommended if possible.

Handout(s)/Worksheet(s)/Teacher Guide(s):
(1) Worksheet 2: Bison Ecosystem Time Period
(2) Worksheet 2: Teacher Guide (There is 1 teacher guide for each time period)
(3) Handout 1: Bison Timeline Summary Reading (1 for each of the 3 time periods)
(4) Handout 2: Research Resources for Students
(5) Bison fact sheet (in case *Unit 1: Bison Species Behaviors and Adaptations* was skipped)

Readings: (1) *The Buffalo and the Indians*, (2) Reading handouts provided by the module: Handout 3: Research Resources for Students and Handout 4: Bison Timeline summary readings with lists of website links for further student research

Key Terms: Ecosystem, Pleistocene, Holocene, Pre-contact Period, Contact Period, National Park, Human Predation, Population Pressure, Population Density, Great Plains

National Science Standards: MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem,

MS-LS2-2: Construct and explanation that predicts patterns of interactions among organisms across multiple ecosystems

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

MS-LS2-4: Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Disciplinary Core Ideas: LS2A, LS2B, LS2C

Crosscutting Concepts Patterns, Cause and Effect, Stability and Change

Lesson Outline:

In Class ASSIGNMENT—Individual Research Activity. This part of the lesson should take approximately 2 class periods *(Note: the research is expected to take only 1 weekend or 1-2 week days to complete. If the teacher feels a second day of research is needed, the second class period is recommended to be spent at the COMPUTER LAB to facilitate student research)*

Part 1: Timeline Activity

1. After the film and overview presented in class, each student will be given a spot on the 10,000 year timeline in one of the three time periods listed below so that there are three evenly numbered (or as close to evenly numbered) groups:
    i. Early-Middle Holocene (10,000 BC to 6,000 BC)
    ii. Middle-Late Holocene (6,000 BC to1500 AD)
    iii. Contact Period (1500 AD to Present)
2. Students are assigned to research bison during the timeframe they have been given.
3. Each student must use **Worksheet 2: Bison Ecosystem Time Period** as a guide for recording the information they are uncovering during their research. (*Note:* **Teacher Guides** *for EACH time period have been provided by the module. These guides can be used both to point students in the right direction and, if desired, assess their work before the students begin creation of their time period collage during part 3 of this module sequence*).

4. Students will be given **Handout 1: Summary Readings of Time Periods** which provides students with a general overview of their time period. Each of the 3 time period readings is included below. Students will find a lot of the information to complete their Worksheet 2 in these readings but they will need to do some outside research using **Handout 2: Research Resources for Students** as well. A **Bison Fact Sheet** has been provided if Unit 1 was skipped for additional information.
5. For further research, students can use **Handout 2: Research Resources for Students** which lists additional online reference materials that can be used.
    a. In **Handout 2: Research Resources for Students** there are recommended readings from the module textbook *The Buffalo and the Indians*. If possible, printouts of the pages listed should be made available AND/OR copies of the book for students to read in class.
6. During their research, students will analyze the pressures and changes in the environment that in some way affected bison ecology, bison populations, and general species success. Students must identify and record on their individual **Worksheet 2: Bison Ecosystem Time Period** the following:
    a. Describe the environment of their time period.
    b. Provide some interesting facts about bison in their time period
    c. List the species putting predatory or competitive pressure on bison
        i. Predation from wolves, bears, and other carnivores)
        ii. The current competition with cattle (bison competing with cattle for grazing land) and the historical "domestication" of some bison.
    d. What climatic conditions are present during their time period:
        i. E.g., cold spell during the transition from Pleistocene to the Holocene also called the Younger Dryas
        ii. E.g., warming trend after the Younger Dryas that saw the extinction of megafauna (large animals like the giant sloth and mammoth)
    e. Human hunting of bison
        i. Native hunting during the pre-contact period
        ii. Human hunting and fur trading post-contact period that brought about the near extermination or extinction of the bison
    f. Give a brief explanatory sentence on how they think bison were important during their particular time period
    g. Students can draw or find 2 images of bison, predators, or the environment that represent their time period. Old magazines can be used as well as images printed online.

NOTE: if students don't have access to internet or printing resources at home, class time should be designated in a computer lab for students to research and collect images.

NOTE: Inform students that the end product will be a timeline collage, in which they will all be grouped up in one of the 3 time periods to collaborate on a collage of words and images depicting what their time period was like for bison.

Worksheet 2: Bison Ecosystem Time Period

Directions: From the information provided in class, the class readings, and the research resources given, complete the worksheet by recording the relevant information specific to your time period. This information will be used later for a class project, so include as much as you can!

Name _____ Date_____

Time Period Name: _____ Time Period Dates_____

Find or Draw **2 images** about bison, the time period, or both, AND bring them to class.

List some characteristics of the bison **environment** in your time period (where did they live, how far did they range, and what other plants/animals were around?):

1. _____
2. _____
3. _____

List some **interesting facts** related to bison during your time period:

1. _____
2. _____
3. _____

What species are placing **predatory** pressures on bison in your time period? What about **competitive** pressures? For example, going after similar foods or competing for land.

1. _____
2. _____
3. _____

What **climatic** (weather) **conditions** were present in your time period? Is the temperature usually cold, warming up, or stable?

1. _____
2. _____
3. _____

Describe the **human interaction with bison** such as hunting practices or rituals involving bison during your time period:

1. _____
2. _____
3. _____

In your opinion, what do you think was the importance of bison for people during your time period? (Use the back of this sheet of paper for your answer)

TEACHER GUIDE
Worksheet 2: Bison Ecosystem Time Period

Directions: From the information provided in class, the class readings, and the research resources given, complete the worksheet by recording the relevant information specific to your time period. This information will be used later for a class project, so include as much as you can!

Name _____ Dates_____

Time Period Name: *Early to Middle Holocene* Time Period Date: *10,000 B.C. to 6,000 B.C.*

Find or Draw **2 images** about bison, the time period, or both, AND bring them to class.

List some characteristics of the bison **environment** in your time period (where did they live, how far did they range, and what other plants/animals were around?):

1. *Bison, or Buffalo as they are also called, once ranged much of the continent, from the east to west coasts, and from Canada's Northwest Territories in the north and Mexico in the south*

2. *The center of population was the great western grasslands known as the Great Plains, where they fed on the abundant grasses. American bison also lived in river valleys, and on prairies and plains.*

3. *Their typical habitat was open or semi-open grasslands, as well as sagebrush, semi-arid (semi-dry) lands and scrublands. Bison also grazed in hilly or mountainous areas where the slopes are not steep. Many other species lived in this changing landscape, from mammoth and sabertooth tiger before going extinct, to deer and mountain goats.*

List some **interesting facts** related to bison during your time period.

Note: answers will vary, possible answers from handout could include:

1. *Bison migrated in large herds across the landscape. Herds were a protective strategy from predators such as wolves but also for mating during the summer. Herds would often disband into smaller groups over the winter months.*

2. *Bison were well adapted to the cold, being able to withstand extremely cold temperatures because their thick insulating hide trapped heat inside.*

3. *The plentiful grasses of the Great Plains, bison's main food source, allowed for numbers to grow into the millions*

What species are placing **predatory** pressures on bison in your time period? What about **competitive** pressures? For example, going after similar foods or competing for land.

1. *Wolves have been a major predator of bison and on occasion grizzlies, both being major predators of bison, especially bison calves.*
2. *Before going extinct, sabertooth tigers likely hunted bison.*
3. *Human predation also began during this time period using bison as a major food source.*

What **climatic** (weather) **conditions** were present in your time period? Is the temperature usually cold, warming up, or stable?

1. *Warming temperatures was prevalent in this time period causing major extinctions at the end of the Pleistocene and the beginning of the Holocene about 10,000 years ago.*
2. *Though certainly affecting particular areas differently at different times, the general trend of a warming climate was distinct. However, much of the northern landscape was still very much glaciated and cold.*
3. *Bison are well adapted to the cold. And, unlike other species, bison were able to adapt to a slowly warming climate.*

Describe the **human interaction with bison** such as hunting practices or rituals involving bison during your time period:

1. *Humans entering into North America began hunting bison as a major food source beginning at the end of the Pleistocene beginning of the Holocene around 10,000 years ago.*
2. *Paleoindians, as they are known, used the throwing board (atlatl) and dart, as well as nets and snares, hunted both large and small game. Large game animals, like bison deer and mountain sheep, were hunted communally using sophisticated hunting blinds (areas where people could remain concealed from the bison until it was too late!), traps, and other hunting methods.*
3. *Much is still unknown about these early people, part of the Clovis culture. It is largely agreed upon that they were big game hunters utilizing large, fluted points to hunt bison, possibly mammoth, and other megafauna. The Clovis culture appears around 11,050 RCYBP (radiocarbon years before present), at the end of the last glacial period, Archaeologists' most precise determinations at present suggest that this radiocarbon age is equal to roughly 13,200 to 12,900 calendar years ago or about 11,200 BC to 10,900 BC. Clovis people are considered to be the ancestors of most of the indigenous cultures of the Americas. Early populations in Montana would be direct descendants of this early Clovis culture.*

In your opinion, what do you think was the importance of bison for people during your time period? (Use the back of this sheet of paper for your answer). *Answers may vary.*

TEACHER GUIDE

Worksheet 2: Bison Ecosystem Time Period

Directions: From the information provided in class, the class readings, and the research resources given, complete the worksheet by recording the relevant information specific to your time period. This information will be used later for a class project, so include as much as you can!

Name _____ Dates_____

Time Period Name: *Middle to Late Holocene* Time Period Date: *6,000 B.C. to A.D. 1500*

Find or Draw **2 images** about bison, the time period, or both, AND bring them to class.

List some characteristics of the bison **environment** in your time period (where were they living, what other plants and animals were around?):

1. *This time period saw increasing human habitation and hunting of bison.*
2. *The Bison range, like in previous periods, continued to span from northern Mexico into Canada, and from the East to West coasts. This range likely increased in the northern climes as temperatures rose and glacial landscapes melted.*
3. *The center of population was the great western grasslands known as the Great Plains, where they fed on the abundant grasses. American bison also lived in river valleys, and on prairies and plains. Their typical habitat was open or semi-open grasslands, as well as sagebrush, semi-arid (semi-dry) lands and scrublands. Bison also grazed in hilly or mountainous areas where the slopes are not steep. Many other species lived in this changing landscape, among them deer and mountain goat.*

List some **interesting facts** related to bison during your time period:

Note: answers will vary, possible answers from handout could include:

1. *Bison have sharp a sense of smell which has enabled them to quickly get the scent of approaching wolves and hunting parties as well as the smoke from raging wildfires*
2. *Bison have good hearing which has helped them avoid predators.*
3. *Bison are very curious animals. The bulls are also relatively fearless, so drawing a bull, or several, away from the herd by piquing their curiosity proved to be an effective strategy for hunting.*

What species are placing **predatory** pressures on bison in your time period? What about **competitive** pressures? For example, going after similar foods or competing for land.

1. *Predators like wolves and grizzlies continued to prey upon bison.*

2. *Human hunting of bison increased significantly during this time period utilizing hunting blinds, traps, corrals, and "jumps"(cliffs in which to drive bison over)*

3. *Bison experienced very little competition with other species in terms of access to food, and were able to spread over much of the plains*

What **climatic** (weather) **conditions** were present in your time period? Is the temperature usually cold, warming up, or stable?

1. *The climate during this time period began to stabilize in comparison to the earlier warming trend replacing glacial conditions prior to 10,000 years ago.*

2. *This period of warmth ended about 5,500 years ago. At that time, the climate was similar to that of today.*

3. *Habitable zones for the bison expanded northwards as glaciers retreated and temperatures began to rise.*

Describe the **human interaction with bison** such as hunting practices or rituals involving bison during your time period:

1. *The most efficient hunting technique was what Crow Indians called "driving buffalo over embankments," which involved enticing and leading buffaloes to the edges of cliffs or bluffs up to seventy feet high, then driving them over the cliff. This hunt involved an entire society: the "chaser" or "runner," who possessed special skills and knowledge, led animals he had found toward the precipice, where other people, hidden behind trees or rock piles, waved blankets and shouted the animals onward to their doom at the base of the cliff.*

2. *By about 2,000 years ago, the bow and arrow replaced the older throwing board and dart, increasing effectiveness of hunting bison.*

3. *During this time period, bison became very important in many Indian rituals, festivals, and symbolism. The buffalo dance is once such festival. The festival traditionally coincided with the return of the buffalo herds, and included a feast and a dance with a number of men wearing buffalo and other animal skins. Since the buffalo, or bison, were so central to society, it was important to assure the return of the herd and an abundance of food and resources. Many parts of the bison (not just the meat) such as the hide, the bones, or tail were utilized by Indian groups for tools and clothing. The bison was indeed very important to many Plains Indian societies.*

In your opinion, what do you think was the importance of bison for people during your time period? (Use the back of this sheet of paper for your answer). *Answers may vary.*

TEACHER GUIDE

Worksheet 2: Bison Ecosystem Time Period

Directions: From the information provided in class, the class readings, and the research resources given, complete the worksheet by recording the relevant information specific to your time period. This information will be used later for a class project, so include as much as you can!

Name _____ Dates_____

Time Period Name: *Contact Period/Late Holocene* Time Period Date: *A.D. 1500 to Present*

Find or Draw **2 images** about bison, the time period, or both, AND bring them to class.

List some characteristics of the bison **environment** in your time period (where were they living, what other plants and animals were around?):

1. *The decline of the bison, or buffalo as it is also often called, is largely a 19th century story. The size of the herds was affected by predation (by humans and wolves mostly), disease, fires, climate, competition from horses and later cattle for grass and land, the fur trade market, and other factors. Fires often swept the grasslands, sometimes maiming and killing bison. Drought was perhaps most significant; severe prior to the fifteenth century, and episodic in the eighteenth, it might have been worst at the very moment when other pressures converged in the early years of the decades from 1840 to 1880.*

2. *Yet no matter the impact from drought, horses, or fires, what doomed the buffalo most were (1) the commodities markets for buffalo tongues, skins, meat, and robes; and (2) the railroads, which provided the means of transporting the materials to rapidly expanding European-American settler populations.*

3. *In 1867 the first of five railroads split the herd in the heart of bison range, a process repeated again and again. At one time bison were able to freely range from northern Mexico into Canada, but with the continued settlement of the Great Plains bison were faced with a quickly shrinking area in which to live. Sportsmen, farmers, and ranchers who wanted the prairies for crops and cattle—all placed new pressure on bison.*

List some **interesting facts** related to bison during your time period:

Note: answers will vary, possible answers from handout could include:

1. *Bison experienced major limitations and restrictions on their range as settlers encroached into their migratory territory.*

2. *The commercial hunt was finished by the fall of 1883. The final shipment of hides took place in 1884. With very few exceptions, bison were gone from the Great Plains completely.*

3. *Today, just over one hundred years later, the bison have returned from the brink of extinction to roam the grasslands again in Yellowstone National Park and beyond.*

What species are placing **predatory** pressures on bison in your time period? What about **competitive** pressures? For example, going after similar foods or competing for land.

1. *Predators like wolves and grizzlies continued to prey upon bison.*

2. *Human hunting of bison increased significantly during this time period.*

3. *Settlers, particularly ranchers, began encroaching on the bison landscape of the Great Plains. Ranchers brining herds of cattle and fencing off the landscape along with increased railroad construction and activity severely crippled the bison range. The numbers of bison were quickly dwindling in the mid to late 1800s.*

What **climatic** (weather) **conditions** were present in your time period? Is the temperature usually cold, warming up, or stable?

1. *The climate had largely stabilized from the warming trend that was present after the last glacial period before 10,000 years ago.*

2. *There was a slightly warmer period from the 10th–14th centuries known as the Medieval Warm Period.*

3. *This was followed by the Little Ice Age, from the 13th or 14th century to the mid-19th century, which was a period of significant cooling, though not everywhere as severe as previous times*

Describe the **human interaction with bison** such as hunting practices or rituals involving bison during your time period:

1. *The acquisition of the horse by native peoples in the early 1700s completely altered the ancient hunting lifeway of Plains Indians. The horse allowed Indian groups, such as the Salish, Kutenai, Blackfeet and Shoshone, to become highly mobile and roam over a large territory. Bison, the principle food source, could now be sought out instead of waiting for the herds to come to them.*

2. *Rather than using the ancient methods of traps and bison "jumps" (driving bison over cliffs), bison were now more often hunted by Indian riders on highly trained horses ("buffalo runners") who charged into the herd to make individual kills.*

3. *European fur traders also began hunting bison at this time for the bison hides. As the demand for bison hides grew, more and more bison were killed for profit.*

In your opinion, what do you think was the importance of bison for people during your time period? (Use the back of this sheet of paper for you answer. *Answers may vary*

Handout 1: Bison Timeline Summary Reading for
Early to Middle Holocene (10,000 B.C. to 6,000 B.C.)

Native American peoples first settled the region we now call Montana at the close of the last Ice Age (Pleistocene), some 13,000 to 11,000 years ago. These first Montanans were hunter-gatherers who evolved into the many individual cultures that today we generically call American Indians. This human migration was facilitated by a land bridge between Asia (Siberia) and North America (Alaska). The thousand-mile land bridge was created when continental glaciers "locked up" huge amounts of ocean water, dropping the sea level by 300 feet or more. But indigenous people may have also arrived in the western hemisphere at other times and at different entry points such as the coast. During this time, the climate was much colder and many animals, like bison, were well adapted to these colder conditions. Saber tooth tigers, grizzlies, and wolves were major predators of bison before human arrival. As humans arrived into the area, however, they began hunting bison as a source of food.

These first pioneers of the North American continent were adept hunters who depended on large Ice Age mammals (extinct types of bison and mammoth) for their food. Plant foods, eggs, and small game were also important to their survival. By 8,000 years ago, Indian groups had adjusted their hunter-gatherer life-ways to meet the requirements of a slowly warming (Holocene) climate. For bison, well adapted to cold climatic conditions, this meant adjusting to slowly warming temperatures. As the climate warmed, the Ice Age mammals like mammoth, saber tooth tiger, and giant sloth went extinct occurring of a long span of time roughly 10,000 years ago at the beginning of the Holocene. Bison, however, managed to thrive with numbers in the millions. In many areas of North America, the climatic conditions were still much colder on average than they are today, and huge glacial ice sheets still covered some of the northern landscape. Bison in these areas were well adapted to the cold, having a thick insulating hide to trap the heat and keep them warm during the cold, icy winter months.

Indian groups using the throwing board (atlatl) and dart, as well as nets and snares, hunted both large and small game. Large game animals, like bison deer and mountain sheep, were hunted communally using sophisticated hunting blinds (areas where people could remain concealed from the bison until it was too late!), traps, and other hunting methods. The size of a hunting-gathering band was likely influenced by the number of people required to operate a successful communal bison hunt—from 70 to 100 persons.

During this time period, bison ranged over much of the continent, from the east to west coasts, and from Canada's Northwest Territories in the north and Mexico in the south. The center of population was the great western grasslands known as the Great Plains, where they fed on the abundant grasses. American bison also lived in river valleys, and on prairies and plains. Their typical habitat was open or semi-open grasslands, as well as sagebrush, semi-arid (semi-dry) lands and scrublands. Bison also grazed in hilly or mountainous areas where the slopes are not steep. Constantly in need of new grassy patches to eat, bison moved in large herds across this landscape.

Handout 1: Bison Timeline Summary Reading for
Middle to Late Holocene (6,000 B.C.- A.D. 1500)

Predators like wolves and grizzlies continued to prey upon bison, but human hunting of bison increased significantly during this time period. To obtain an animal so critical to their survival, Plains Indians developed a number of solitary and group hunting techniques. Sometimes a man clothed in a buffalo robe or wolf skin might stalk the animal carefully. Beneath the skin of a wolf he would move and even jump about trying to pique the bison's curiosity. Bison, or buffalo as they are also called, have sharp smell and good hearing, both characteristics helping bison species survival. Bison are also very curious animals, and the bulls in particular are relatively fearless. Therefore, drawing a bull, or several, away from the herd proved to be an effective hunting strategy. Dressed in a wolf skin or buffalo robe, the Plains Indian would slowly draw a bison away from the herd to a place where others lying in wait could ambush it. At other times many hunters drove bison onto soft ice or into deep snow, a ravine, a box canyon, or enclosure or pound. In these places the animals could be more easily killed for food.

The most efficient technique was what Crow Indians called "driving buffalo over embankments," which involved enticing and leading buffaloes to the edges of cliffs or bluffs up to seventy feet high, then driving them over the cliff. This hunt involved an entire society: the "chaser" or "runner," who possessed special skills and knowledge, led animals he had found toward the precipice, where other people, hidden behind trees or rock piles, waved blankets and shouted the animals onward to their doom at the base of the cliff. By about 2,000 years ago, the bow and arrow replaced the older throwing board and dart, increasing effectiveness in hunting. During this time period, bison became very important in many Indian rituals, festivals, and symbolism. The buffalo dance is once such festival. The festival traditionally coincided with the return of the buffalo herds, and included a feast and a dance with a number of men wearing buffalo and other animal skins. Since the buffalo, or bison, were so central and important to society, it was necessary to assure the return of the herd and an abundance of food and resources.

Bison ranged from northern Mexico into Alaska, from the east to the west coasts. Bison would group into huge, constantly moving herds in the summer months. They lived in river valleys, and on prairies and plains. Typical habitat at this time was open or semi-open grasslands, as well as sagebrush, semi-arid lands and scrublands. Bison will also graze in hilly or mountainous areas where the slopes are not steep and in some wooded areas. Bison are migratory and herd migrations can occur over long periods of time and over vast distances, particularly so over the summer when herds congregate for mating.

The climate during this time period began to stabilize in comparison to the warming trend that characterized the early Holocene. Around this time, about 5,500 years ago, the climate became fairly similar to that of today. Habitable zones for the bison expanded northwards as glaciers retreated and temperatures began to rise. The climate, though relatively stable, did have a slightly warmer period from the 10th–14th centuries known as the Medieval Warm Period. This was followed by the Little Ice Age, from the 13th or 14th century to the mid-19th century, which was a period of significant cooling.

Handout 1: Bison Timeline Summary Reading for
Middle to Late Holocene (A.D. 1500 to Present)

The acquisition of the horse by native peoples in the early 1700s completely altered the ancient hunting lifeway of Plains Indians. The horse allowed Indian groups, such as the Salish, Kutenai, Blackfeet and Shoshone, to become highly mobile and roam over a large territory. Bison, the principle food source, could now be sought out instead of waiting for the herds to come to them. Rather than using the ancient methods of traps and bison "jumps" (driving bison over cliffs), bison were now more often hunted by Indian riders on highly trained horses ("buffalo runners") who charged into the herd to make individual kills. European fur traders also began hunting bison at this time for the bison hides. As the demand for bison hides grew, more and more bison were killed for profit.

The decline of the bison, or buffalo as it is also often called, is largely a 19th century story. The size of the herds was affected by predation (by humans and wolves mostly), disease, fires, climate, competition from horses and later cattle for grass and land, the fur trade market, and other factors. Fires often swept the grasslands, sometimes maiming and killing bison. Drought was perhaps most significant; severe prior to the fifteenth century, and episodic in the eighteenth, it might have been worst at the very moment when other pressures converged in the early years of the decades from 1840 to 1880. Yet no matter the impact from drought, horses, or fires, what doomed the buffalo most were (1) the commodities markets for buffalo tongues, skins, meat, and robes; and (2) the railroads, which provided the means of transporting the materials to rapidly expanding European-American settler populations.

The final stage from 1867 to 1884 was notable for the intensity of the slaughter in order to acquire hides and other products. In 1867 the first of five railroads split the herd in the heart of bison range, a process repeated again and again. At one time bison were able to freely range from northern Mexico into Canada, but with the continued settlement of the Great Plains bison were faced with a quickly shrinking area in which to live. Sportsmen, farmers, and ranchers who wanted the prairies for crops and cattle—all placed new pressure on bison. The railroads made transportation of buffalo hides easy and cheap, so market hunters flooded into the area, wasting three to five times the numbers they killed. The carnage from herds already depleted by other factors defied description: 4-5 million killed in three years alone. The commercial hunt was finished by the fall of 1883. The final shipment of hides took place in 1884. With very few exceptions, bison were gone from the Great Plains completely. It was shortly after this point that several small herds were found, one in Yellowstone National Park. Where once there were millions of bison roaming the plains, by the end of the 1800s there were fewer than a thousand left!

Today, just over one hundred years later, the bison have returned from the brink of extinction to roam the grasslands again in Yellowstone National Park and beyond. Feared by farmers for diseases like brucellosis that they might give to cattle herds, their fate beyond Yellowstone is uncertain. However, Indian people have joined forces with many organizations in a cooperative effort to save and protect the bison, as well as to raise viable herds of this important and deeply symbolic animal.

Handout 2: Research Resources for Students

Early-Middle Holocene (10,000 B.C. to 6,000 B.C.)

--Book (class readings): *The Buffalo and the Indians*, pp. 1-4, 11-13
--Paleoindians: http://www.fs.usda.gov/detail/helena/learning/history-culture/?cid=stelprdb5373555
--Holocene Description Encyclopedia for Kids: http://encyclopedia.kids.net.au/page/ho/Holocene
--Early Holocene Extinction of Megafauna (Large Animals): http://encyclopedia.kids.net.au/page/ho/Holocene_extinction_event
--Early Holocene Peoples: http://www.learnnc.org/lp/editions/nchist-twoworlds/1675

Middle-Late Holocene (6,000 B.C. to A.D. 1500)

--Book (class readings): *The Buffalo and the Indians*, pp.11-13, 15-29
--Early History of Bison, Part 1 and 2: http://nationalhumanitiescenter.org/tserve/nattrans/ntecoindian/essays/buffalo.htm
--Holocene Description Encyclopedia for Kids: http://encyclopedia.kids.net.au/page/ho/Holocene
--Bonfire Shelter Bison Jump: http://www.texasbeyondhistory.net/bonfire/index.html
-- Montana Bison History: http://montanakids.com/history_and_prehistory/buffalo_jumps/pishkuns.htm

Contact Period (A.D. 1500 to Present)

--Book (adoption of the horse): *The Buffalo and the Indians*, pp. 44-49
--Fact sheet website: http://www.bisonbasics.com/history/past_future.html
--Website of the history of bison during the contact period, Part 2 and 3: http://nationalhumanitiescenter.org/tserve/nattrans/ntecoindian/essays/buffalo.htm
--American Bison Informational Timeline: http://www.fws.gov/bisonrange/timeline.htm
--Thunder Ridge Bison, A Recent History: http://www.thunderridgebison.com/bison_history.htm
--Buffalo Field Campaign, The Slaughter of the Buffalo: http://www.buffalofieldcampaign.org/aboutbuffalo/bisonnativeamericans.html

General Info

--Buffalo/Bison Jumps: http://www.digonsite.com/drdig/native/8.html
--Buffalo Jumps: *The Buffalo and the Indians*, pp18-21
--Blackfoot History: http://history.alberta.ca/headsmashedin/history/blackfoothistory/blackfoothistory.aspx
--Bison Species Description: http://www.fws.gov/species/species_accounts/bio_buff.html
--Bison Species Fact Sheet (great website!): http://animaldiversity.ummz.umich.edu/site/accounts/information/Bison_bison.html
--Archaeology for Kids Encyclopedia Article: http://encyclopedia.kids.net.au/page/ar/Archaeology
--Kids Encyclopedia Article on Bison: http://encyclopedia.kids.net.au/page/am/American_bison
How Many Ways Can You Use a Buffalo: http://www.texasbeyondhistory.net/kids/buffalo.html
Bonfire Shelter Bison Jump: http://www.texasbeyondhistory.net/bonfire/index.html
Short History of Buffalo (Buffalo Groves): http://www.buffalogroves.com/buffalo_history.html
Bison Fact Sheet: http://library.sandiegozoo.org/factsheets/bison/bison.htm#behavior
Bison Fact Sheet #2: http://www.defenders.org/bison/basic-facts

BISON FACT SHEET

ADAPTED FROM http://www.defenders.org/bison/basic-facts

Fast Facts:

Height: 6-6.5 feet at the shoulder
Length: 10-12.5 feet
Weight: 900-2,000 lbs. Males are larger than females.
Lifespan: 18-22 years in the wild; over 30 years in captivity.
Mating Season: June-September, peak activity in July-August
Gestation: 270-285 days. Calf is born April-May.
Litter size: 1 calf

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Millions of bison once thundered across North America. These massive animals, characterized by their long, shaggy brown coats, have poor eyesight but very good hearing and an excellent sense of smell.

Historically, the American bison played an essential role in shaping the ecology of the Great Plains. They graze heavily on native grasses and disturb the soil with their hooves, allowing many plant and animal species to flourish. Prairie dogs prefer areas grazed by bison where the grass is short so they can keep a lookout for hungry predators, and wolves once relied on bison herds as a major food source. Today, wild bison are making a small comeback in a few scattered places, but they need more room to roam.

Diet

Bison mainly eat grasses and sedges which are both very plentiful foods on the Great Plains. Bison have adapted to eat grass because it is so plentiful, especially during the spring and summer months when the bulls need it before mating and the calves need it to grow strong before winter. With the snow covering the ground in the winter, bison's massive, "snow-plow" like heads have adapted so they can move the snow and get at the winter grasses below.

Population

The trails carved by animals like bison and deer in their seasonal migrations formed some of the earliest traceable paths into the American wilderness, and were followed by Native Americans, explorers and pioneers.

An estimated 20 to 30 million bison once dominated the North American landscape from the Appalachians to the Rockies, from the Gulf Coast to Alaska. Habitat loss and unregulated shooting reduced the population to just 1,091 by 1889. Today, approximately 500,000 bison live across North America. However, most of these are not pure wild bison, but have been

cross-bred with cattle in the past, and are semi-domesticated after being raised as livestock for many generations on ranches. Fewer than 30,000 wild bison are in conservation herds and fewer than 5,000 are unfenced and disease-free.

Range & Habitat (where they live)

Though bison once roamed across much of North America, today they are “ecologically extinct” as a wild species throughout most of their historic range, except for a few national parks and other small wildlife areas. Yellowstone National Park has the largest population of wild plains bison (about 4,000), and Wood Buffalo National Park has the largest population of wild wood bison (about 10,000). With help from Defenders, two small herds of pure, wild Yellowstone bison were recently reintroduced onto two Indian Reservations.

Behavior

A bison's thick fur offers great protection against the harsh elements of the American plains. Their winter coat is so thick and well insulated that snow can cover their backs without melting. Known for roaming great distances, bison move continuously as they eat. The females, or cows, lead family groups. Bulls remain solitary or in small groups for most of the year, but rejoin the group during mating season.

Bison are adapted to the extreme weather conditions of the Great Plains, from summer heat to winter cold and blizzards. In winter, bison can dig through deep snow with their heads to reach the vegetation below. Bison often rub, roll and wallow. Wallowing creates a saucer-like depression in the earth called a wallow. These wallows are dust bowls without any vegetation.

Reproduction

Bulls and cows do not mingle until breeding season which happens in the late summer. This is called “rutting”. Dominant bulls “tend” to cows, paying attention only to the cow and sometimes not even eating for fear the cow will leave! The bull will follow the cow around until the cow chooses to mate. During this period, the bull blocks the cow’s vision so that she may not see other competing bulls, and bellows at males striving for the cow’s attention.

Mating or rutting happens in late summer so that the calves will be born in the spring, giving the calves plenty of time to feed on the spring and summer grass to become big and strong before the arrival of the cold winter. During the spring and summer, the bigger herds also protect the calves from predators like wolves.

Calves have the ability to run just hours after birth, an important survival adaptation when the herd is continually moving or is targeted by predators like wolves. Wolves often target young calves. Thus, there is a big need for calves to be able to run soon after birth!

Unit 2: Bison Through Time

Lesson 3: Bison Ecosystem Timeline Collage and Writing Assignment

Objective: Drawing from the students' research in the previous lessons and what was presented in class, students will work in groups to design a collage of words and images displaying their time period in bison history. Whereupon, they will write a 1-2 page essay.

Estimated Time: 1 class period

Students Will Understand: That the bison ecosystem encompasses a vast spatial and temporal area with a great amount of diversity, change, and fluctuation. Examples of this include:

- Bison herds once dominated the grassland ecosystems of the United States.
- It has been estimated that with the first human interactions in the Great Plains, estimates of over 40 million *Bison bison,* or American Bison, roamed the land.
- By 1900, a little over 1,000 bison could be found with only a handful of wild bison left in Yellowstone National Park.

Students will be able to: Critically engage with the topic and themes by synthesizing what they learned during their research and class discussions into a final product, a timeline collage. From this final product and use of a comparative and contrastive Venn diagram, students can easily assess the similarities and differences between the time periods. Drawing upon this, students will write a 1-2 page paper explaining these similarities and differences in the bison ecosystem.

Essential Question(s): How has the bison eco-niche changed over time? How have humans played a role in impacting the bison eco-niche?

Prior Knowledge: Though not critical for the completion of this module, Unit 1 will more fully introduce the students to the bison species.

Students Will Need: No materials are need for lesson 1

Handout(s)/Worksheet(s)/Teacher Guide(s):
(1) Handout 3: Collage Example Template

Readings: No readings are required for this section of the module

Key Terms: Ecosystem, Pleistocene, Holocene, Pre-contact Period, Contact Period, National Park, Human Predation, Population Pressure, Population Density, Great Plains

National Science Standards:
MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2: Construct and explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4: Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Disciplinary Core Ideas: LS2A, LS2B, LS2C

Crosscutting Concepts Patterns, Cause and Effect, Stability and Change

Lesson Outline:

Part 1: Presenting the Collage Poster

Once students have completed their research, they will join with other students in their particular time period and work collectively on a group collage activity.

1. Students will compile the information from their **Worksheet 2: Bison Ecosystem Time Period**, including their image(s). To do this, students will:
    a. Group up into their time periods
    b. All students researching the same time period will collaborate to design a collage of images and key terms that illustrate their time period.
    c. Students will utilize their answers on their **Worksheet 2: Bison Ecosystem Time Period** to generate the content for their group collages as well as utilize the images they brought with them to class.
    d. The goal is to convey in **words**, **phrases**, and **imagery** what that time period looked like for the bison.
    e. Three poster-size sheets of paper, one for each time group, will need to be provided for the students. *(NOTE:* **Handout 3: Collage Example Template** *has been provided at the end of the module to use as a template for the project. This is a miniature collage as an example, students' collages should be much larger)*

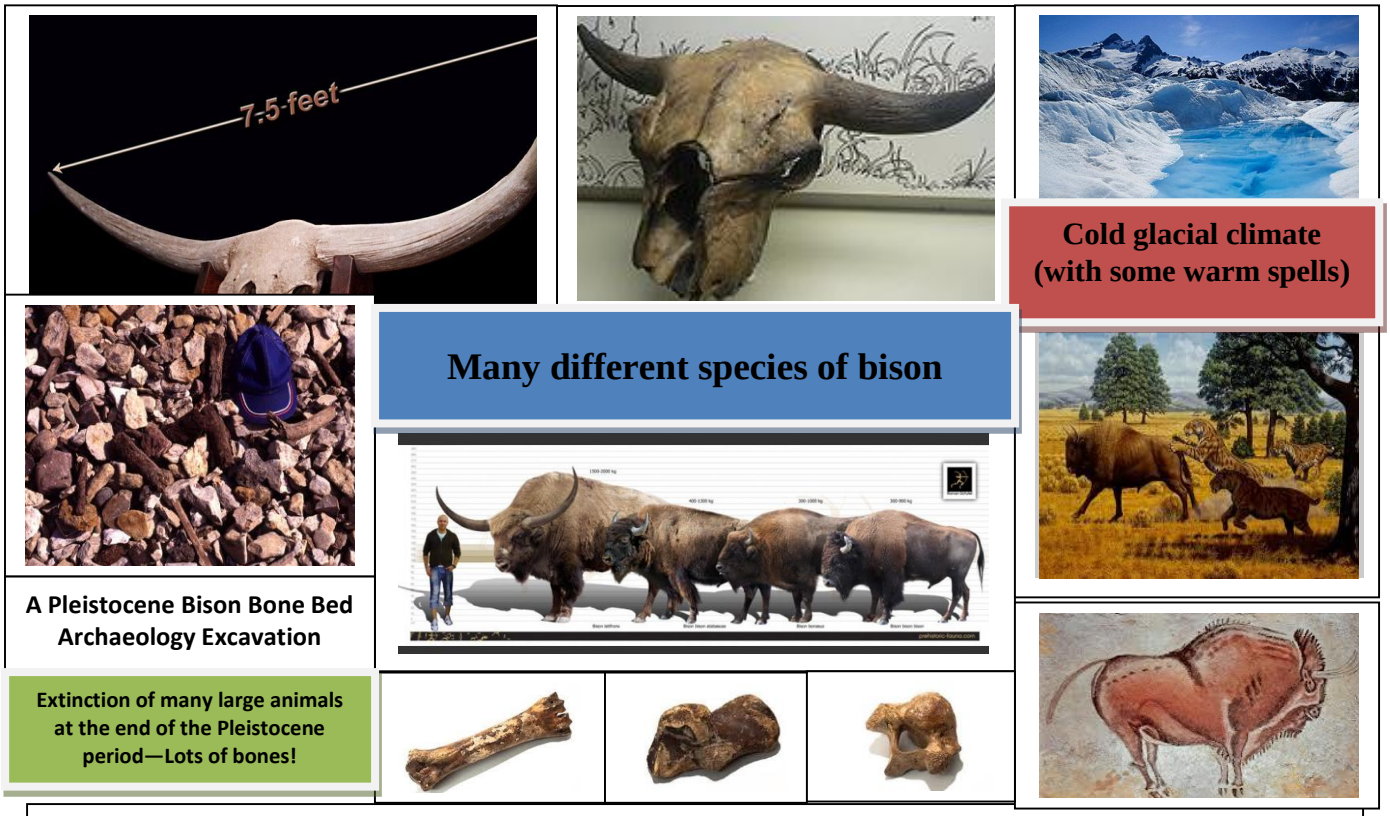
1. Collage posters will be displayed in the classroom and the 3 time periods (10,000 BC to 6,000 B.C.; 6,000 B.C. to A.D.1500; and A.D. 1500 to Present) can be discussed as a class or through short group presentations.
    a. Suggestion: Teacher can draw a Venn diagram as a recording tool for the discussion. Students will need to record the Venn in their notes.

Part 2: Unit Reflection Essay Assignment:

1. Using the 3 poster collages for reference and after the group discussion about the time periods, students must each **WRITE a 1-2 page essay** describing the similarities and differences between the 3 time periods specifically as it pertains to bison history. In it they should also make note of the Essential Questions of Unit 2: How has the bison eco-niche changed over time? How have humans played a role in impacting the bison eco-niche?
2. To help students make connections of similarities and differences for the essay, refer back to the Venn diagram created in class.
    a. This paper can be done at the end of class if there is time and/or assigned for homework if students are unable to complete the 1-2 page comparison essay in class.
    b. The essay must have
        1. Introduction statement
        2. 2 similarities between time periods and 2 differences between the time periods
        3. Closing statements

Handout 3: Collage Example Template

Pleistocene Bison (300,000 to 10,000 BC) with Time Period Description



Bison antiquus, the skull of which is shown at the top of the collage, is sometimes called the "ancient bison" and lived in the Pleistocene era. This bison was the most common large herbivore of the North American continent for over ten thousand years, and is a direct ancestor of the living American bison we see today. This species of bison was taller and had much larger bones and horns than the modern bison. *Bison antiquus* reached up to 7.5 ft. tall, 15 ft. long, and weighed 3500 lbs. That is one big animal! From tip to tip, the horns of *Bison antiquus* measured approximately 3 feet.

During the later Pleistocene Epoch, between 240,000 and 220,000 years ago, *Bison priscus*, a relative of *Bison antiquus*, migrated from Siberia into Alaska. This species inhabited parts of northern North America throughout the remainder of the Pleistocene. In midcontinent North America, however, *Bison priscus* was replaced by the long-horned bison, *Bison latifrons*, distinguished by its very long horns (up to 7 feet—WOW!) as shown in the top right picture. The larger *Bison latifrons* appears to have died out by about 20,000 years ago. In contrast, *Bison antiquus* became increasingly abundant in parts of midcontinent North America from 18,000 years ago to about 10,000 years ago. After this point, the species appears to have given rise to the living species, *Bison bison*, which we see today.

Pleistocene climate was marked by repeated glacial cycles of warming trends followed by cold glacial conditions. It is estimated that, at the maximum glacial periods, 30% of the Earth's surface was covered by ice. In addition, a zone of permafrost stretched southward from the edge of the glacial sheet, a few hundred miles into North America. The average annual temperature at the edge of the ice was about 21 degrees Fahrenheit. BRRRR!

Predators such as the saber tooth tiger and eventually humans hunted the bison. Even before 10,000 years ago, bison were very significant to human populations in North America.

Much is still unknown about this era, such as what caused the extinction of many megafauna (large animals) at the end of the Pleistocene about 10,000 years ago. Perhaps archaeology can help provide some answers!

Unit 3: Archaeology, Hunting, and Bison Anatomy

Lesson 1: Introduction to Archaeology and Bison Bones

Objective: The students will view a film and/or presentation and be given readings introducing the discipline of archaeology, bison skeletal anatomy, and culturally processed bison bone. Students will do the reading assignment and answer the subsequent questions to complete the lesson.

Estimated Time: Approximately 1-2 class periods

Students will understand: The impact of human hunting of bison through time and the role of:

- Oral histories of human predation among Native American tribes;
- Archaeological evidence of bison hunting through marks on bones;
- Technological and social advances evidenced in landscape features such as drive lanes and bison jumps;
- Written documentation of bison hunting into historical times.

Students will be able to: Learn about the basics of archaeology, bison skeletal anatomy and physiology, and how the two relate to each other when explaining past human interactions with bison. By the end of the lesson, students will be able to identify bison skeletal anatomy and explain how culturally modified bones can help with archaeological interpretation of the past.

Essential Question(s): How can archaeological practices help solve some of the mysteries of the past? In particular, what can examining bison processing camps and butchered bison bone tell us about past human life-ways and practices?

Prior Knowledge: This module is designed to be a stand-alone unit, however, the previous modules would provide a more comprehensive background. This is especially so for *Science Unit 2: Bison Through Time* which would introduce students to the human-bison relationship.

Students Will Need: No further materials for Unit 3: Lesson 1.

Provided Handouts: (1) Reading 1: What is Archaeology? (2) Handout 1: Bison Bone Guide

Readings: No additional readings are required for Unit 3: Lesson 1 other than the readings provided in Reading 1: What is Archaeology?

Key Terms: Archaeology, Archaeologist, Predation, Overkill, Extinction, Endangered Species, Processing, Bison Drive Lanes, Bison Jumps, Skeletal Anatomy, Processing Camp

National Science Standards: Earth and Human Activity

MS-ESS3-3: Apply Scientific Principles to design a method for monitoring and minimizing human impact on the environment

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Disciplinary Core Ideas:
ESS3.C: Human Impacts on Earth Systems

Crosscutting Concepts: Patterns, Cause and Effect

Lesson Outline:

Introduction to Archaeology

1. Using the provided short PowerPoint Presentation, the teacher will introduce archaeology and bison bones to the students. The PowerPoint will define archaeology and present information about bison skeletal anatomy. *Note: stop once you get to the Station Exercise (Slide 21).*
    a. The introductory PowerPoint presentation includes:
        i. Debunking pop-culture misconceptions (Indiana Jones and Tomb Raider)
        ii. Goals of contemporary archaeology
        iii. Some basic information about bison skeletal anatomy
    b. In addition to the introductory PowerPoint, a short film explaining archaeology can supplement the presentation:
        i. *What is Archaeology?* YouTube Film Clip: https://www.youtube.com/watch?v=hSY6-bV0ATk
    c. After the presentation, students will be given **Reading 1: What is Archaeology?** This reading should be completed during class or as homework before the Exploratory Lab Challenge begins.
        i. **Reading 1: What is Archaeology?** This readings can also be found at: http://encyclopedia.kids.net.au/page/ar/Archaeology
        ii. Students will receive **Handout 1: Bison Bone Guide**
        iii. *NOTE: if previous lesson modules were not utilized, the* **Bison Fact Sheet** *can be an additional homework reading OR made into another lab station.*

2. *As an optional piece, the teacher may opt out of a full PowerPoint presentation and instead invite a guest speaker to talk about archaeology. Speakers could be:*
    a. Native Speaker (an elder or cultural expert)
    b. Archaeologist/Museum Curator
    c. Other qualified professional

3. *Also optional, after the introductory teacher presentation, students can read*: **Reading 2: What the Bones Say about Bison.** These optional readings can be included as in class assignments if time allows or as homework assignments if teacher desires.

Teacher's PowerPoint Guide

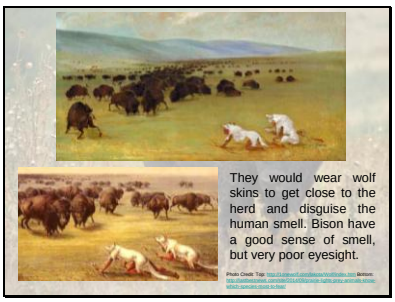
SLIDES | **NOTES**

Slide 1

Slide 2

Slide 3

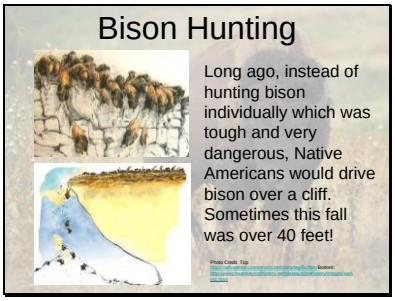
Slide 4



They would wear wolf skins to get close to the herd and disguise the human smell. Bison have a good sense of smell, but very poor eyesight.

Photo Credit: Top: http://t.qkpart.com/pages/wolfhides.htm Bottom: http://wolfhome.net/_cache/0/0/c4/f0/wolves-suits-prey-animals-know-which-species-speak-to-them

Slide 5



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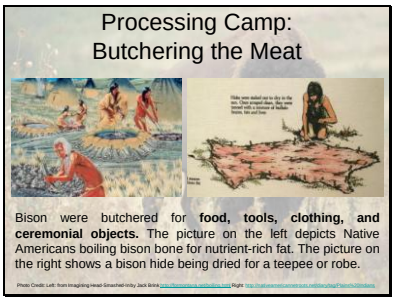

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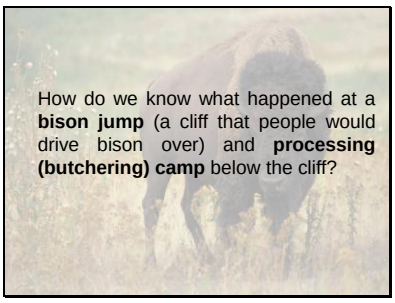

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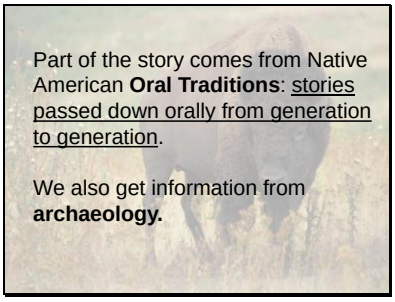

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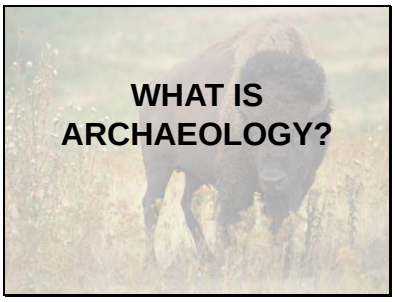
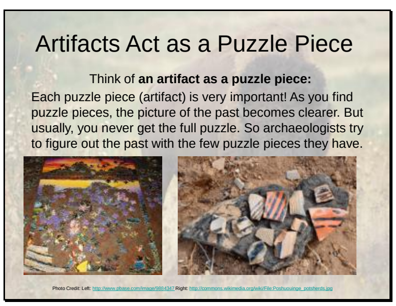


Slide 10

Slide 11

Slide 12



Slide 13

Study of the Bison Skeleton

The study of the bison bones left behind can tell you a lot about what people were eating and not eating, what people were using for tools, and the ways in which people prepared the food and manufactured the tools.

DO YOU SEE THE **CUTMARKS** ON THE BISON BONE?

What might people have been doing to these bison bones to make them dark black?

Photo Credit: Left: http://www.thebisonbook.com/index.php?/archives/4-Bison-and-Human-Bone-with-Butcher-Markings.html Right: http://www.woodlandculturecrew.com/history/images/%20-%20Copy.jpeg.html

Slide 14

Many Parts of the Bison Were Used

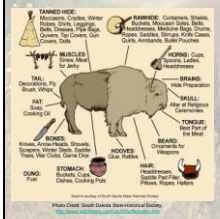


Photo Credit: South Dakota State Historical Society, http://www.sdshistory.com/cultofthebuffalo.htm

- For many thousands of years before European settlers came to North America, the bison were hunted by many Native Americans for food and tools.
- Many parts of the bison were used for not just food, but tools, clothing, weapons, ceremonial purposes, and fuel.

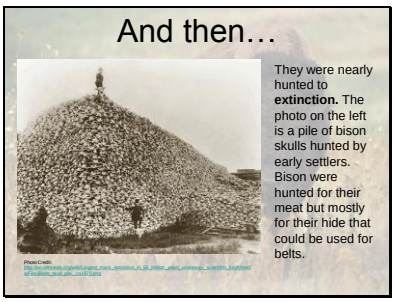
Slide 15

The Many Uses of Bison

A "Walking Department Store"

Photo Credit: http://historical.ha.org.hk/en/events/bison-transformation/bison-1200-1880/display-2-making-living/box-2-5/dish-humpback/dish-2-introduction

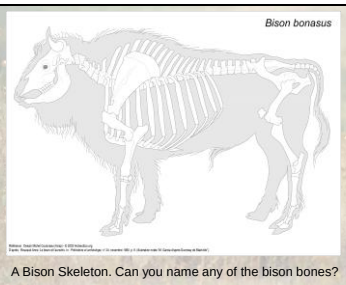
Slide 16



Slide 17

Slide 18

Slide 19

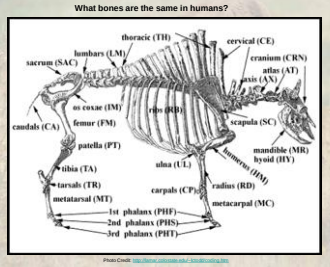


A Bison Skeleton. Can you name any of the bison bones?

Slide 20

Bison Skeletal Anatomy

What bones are the same in humans?



Slide 21

STATION ACTIVITY

Put on the hat and shoes of an archaeologist and try to solve some of the mysteries of the past!

Before proceeding further in this PowerPoint, students will do the lab station activity

Slide 22

Station 2: Bison skeleton reassembling

How did you all do?

Were you able to assemble the whole skeleton?

Was it tough?

Do you think you could reassemble the skeleton if half the bones were missing?

Slide 23

Station 3

Photo Credit: http://www.flickr.com/photos/jpg/5284410202/in/photostream/

The phalanges are the bones in the toes. The greyish clay coloring suggests a wetland location where it was **deposited.** The roots on, in, and around the bone point to A LOT of vegetation. **The darker black stain is likely from the soil, darker soils usually suggesting a high level of organic material (vegetation).**

Slide 24

Station 3 (Continued)

Photo Credit: http://www.flickr.com/photos/jpg/5284410202/in/photostream/

Tarsal: ASTRAGULUS

The astragulus bone, or ankle bone, is in the collection of bones in the foot, otherwise known as the tarsus. The grey clay color suggests a wetland environment. The reddish discoloration on the bone is natural oxidation. **What is oxidation?**

Slide 25

Station 4

UNIDENTIFIABLE BURNT BONE

What could burned bone mean?

Slide 26

Photo Credit: Left: Imagining Head- Smashed-In by Jack Brink. http://homepages.nyit.edu/jbrink/ Right: http://www.knowledgeofmisery.com/bison-slaughter.html

The bones display clear signs of **breakage and carbonization** (or burning of the bone) giving it that **blackened, ashy color and texture.** This is likely due to human processing, but could have resulted from prairie bush fires. Breaking, burning, or boiling the bones allowed the fat to be extracted. Fat extracted from bone, often done by large boiling pits.

Slide 27

Station 5

Photo Credit: Left: http://www.skullsunlimited.com/product_specs.php?id=1512 Right: http://www.cosmiclex.com/~vince/bisonskull.htm

This bone, **part of a bison cranium**, has clearly been broken, perhaps by human processing. The skulls are typically smashed, and the jaws broken apart. In this case, it is the brains and tongue that were likely being removed. The brains were used in the tanning of the hide and other animal skins. Skulls were also broken up to remove the horns and horn cores.

Slide 28

Station 5 (continued)

A broken PELVIS bone

This bone is much lighter and more porous than the bison rib (#3) for example. Breakages of this bone could be related to human processing or cattle trampling.

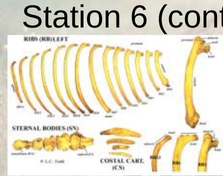
Slide 29

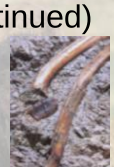
Station 6

Phalange (Bison toe bone): on one end there are clear cut marks. Cut marks usually exemplify human butchering, though you have to be careful, sometimes marks such as these could be caused by carnivores such as wolves or bears munching and gnawing on the bone! The greyish color of the clay suggests an anaerobic (low oxygen environment), low-iron, marshy or wetland environment.

Slide 30

Station 6 (continued)

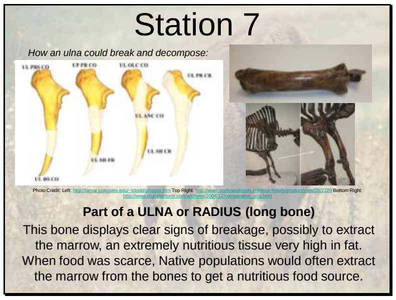




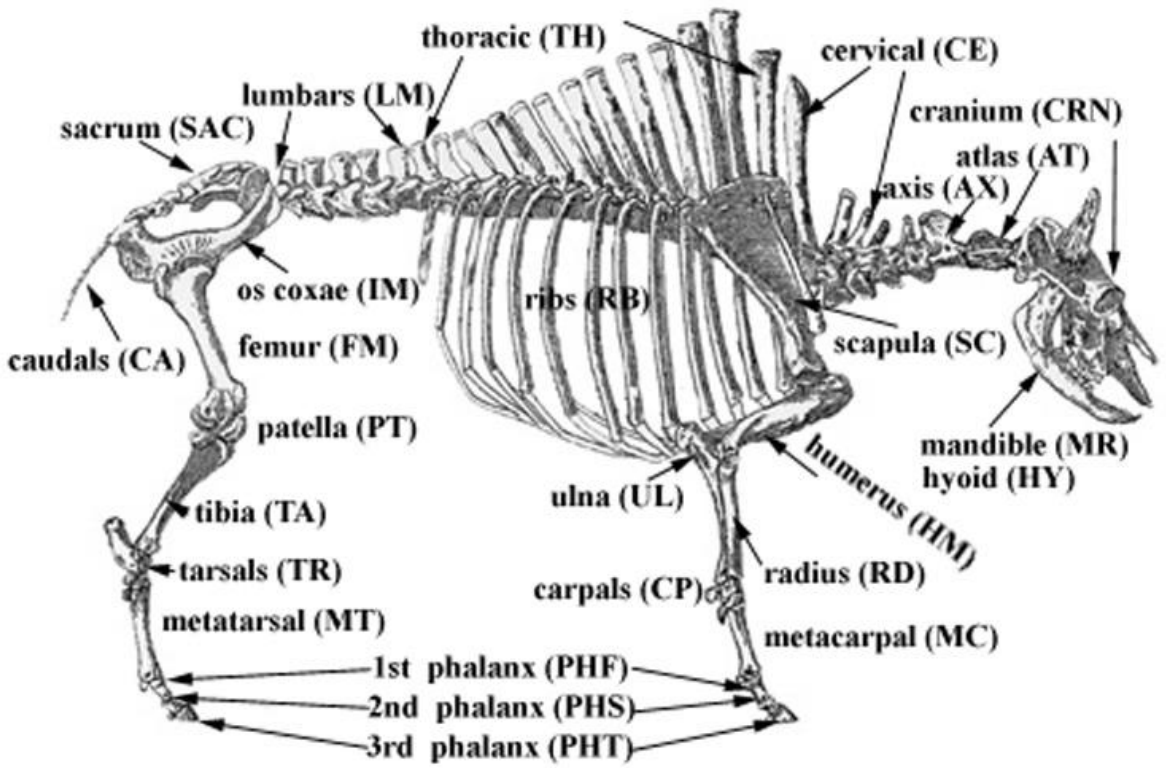
Bison Rib: this bone is broken at the midpoint. If you examine it closely, on one side there are also faint cut marks going perpendicular to the cracking of the rib.

What do cut marks mean again???

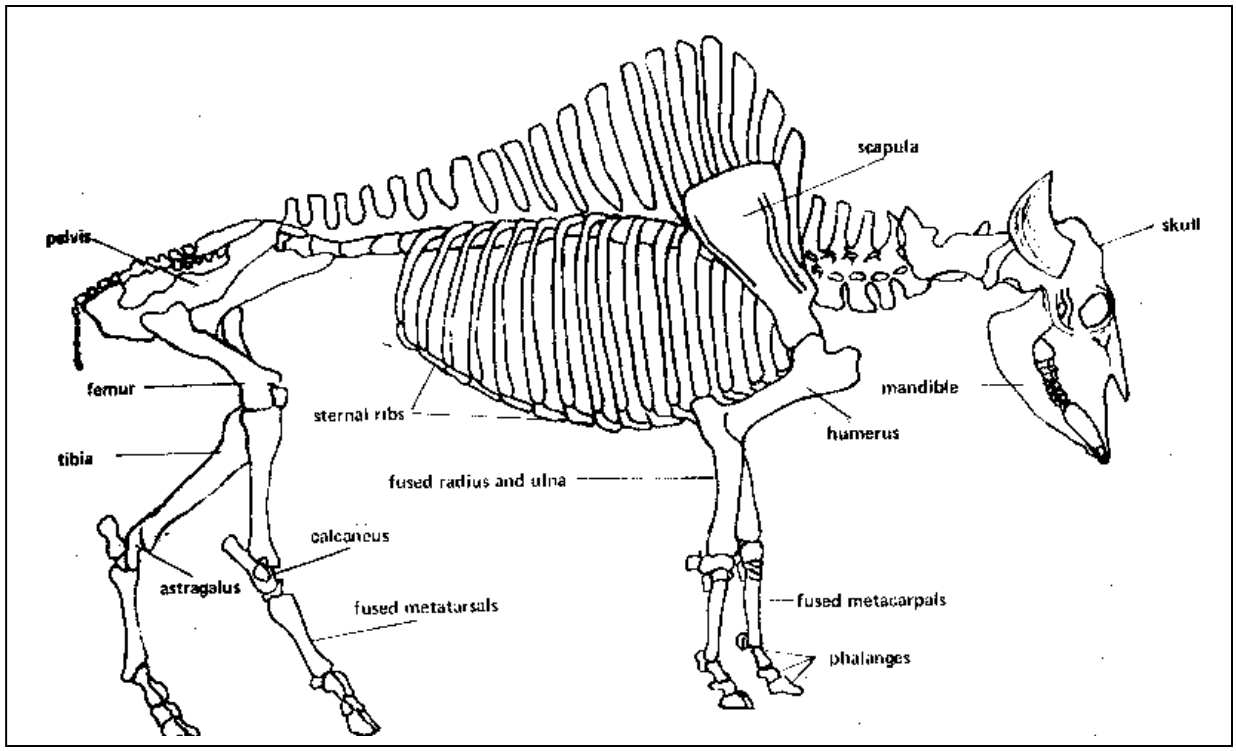
Slide 31


Station 7
How an ulna could break and decompose:
UL PRS CO
UP PR CO
UL OLC CO
UL PR CR
UL ANC CO
UL SH CR
UL SH FR
UL DS CO
Photo Credit: Left: http://lamar.colostate.edu/~lctodd/ulnapor.htm Top Right: http://www.northseafossils.com/our-fossils/product/view/39/2220 Bottom Right: http://www.digitalartform.com/archives/2004/12/comparative_ana.html
Part of a ULNA or RADIUS (long bone)
This bone displays clear signs of breakage, possibly to extract the marrow, an extremely nutritious tissue very high in fat. When food was scarce, Native populations would often extract the marrow from the bones to get a nutritious food source.

Handout 1: Bison Bone Guide



Information from online website: http://lamar.colostate.edu/~lctodd/coding.htm



Reading 1: What is Archaeology?
Adapted From: http://encyclopedia.kids.net.au/page/ar/Archaeology

Archaeology is the study of human activity, primarily through the study of its material remains like artifacts and skeletal remains. Since most human activity is in the past, and most past human activity occurred before any written record, archaeology is the most important method for the study of past human life-ways. Moreover, since the historical (i.e. written) record is incomplete and possibly biased at times, archaeology provides a vital contribution to the study of human history. Archaeology is helping the past to be understood more clearly through the material remains left behind by human activity. The understanding of the past is also benefited greatly through Native American **oral traditions**. Oral traditions are Native American wisdom, history, and stories that have been passed down vocally from generation to generation.

The material remains of human activity often have political and monetary value. Consequently, many people identify archaeology with only the collection of treasures. For example, this is often been the case in popular movies dealing with the exploits of fictional archaeologists like Indiana Jones or Laura Croft in *Tomb Raider*, or even the archaeologists in the more recent film *The Mummy*.

However, archaeology is much more than these common (mis)conceptions presented in these movies. For example, **ethnoarcheologists** contribute to the study of contemporary societies by working with living communities. **Indigenous Archaeology** takes this one step further and collaborates directly with indigenous communities and their interests. In the United States, **repatriation** has become a very important part of archaeology. Repatriation is the return of burial remains and associated artifacts to the community it originally belonged to before it was excavated and put in a museum or private collection. **CRM** (cultural resource management) archaeology works with housing development or roadwork to make sure archaeology sites are protected, preserved, or excavated before any development occurs.

Archaeology is one of the four fields of **anthropology**, the scientific study of humanity as a whole. The four fields of anthropology are Cultural, Biological, Linguistic, and Archaeology. When archaeology first started much of the interpretation of the past was centered on the interests of men. For example, the assumption that men produced most of the food by hunting, and women produced very little by gathering. However, more recent studies have exposed the inadequacy and incorrectness of these ideas.

There is still much more to learn and understand about the past and especially about human history. Through respectful collaboration with native communities, archaeologists can continue to interpret the past and discover many fascinating new things about what people were doing hundreds and even thousands of years ago!

QUESTION 1: What is archaeology?

QUESTION 2: What does an archaeologist do (list 2 activities)?

QUESTION 3: Why is archaeology important?

Unit 3: Archaeology, Hunting, and Bison Anatomy

Lesson 2: Lab Challenge

Objective: Students will participate in a lab station exercise in order to identify bison skeletal anatomy, briefly read key articles, and participate in short activities all related to the hunting of bison, culturally modified bone, and archaeology.

Estimated Time: 1 class period

Students will understand: The impact of human hunting of bison through time. Students will also understand the role of:

- Oral histories of human predation among Native American tribes;
- Archaeological evidence of bison hunting through marks on bones;
- Technological and social advances evidenced in landscape features such as drive lanes and bison jumps;
- Written documentation of bison hunting into historical times.

Students will be able to: (1) participate in a lab to reinforce ideas about the human impact on natural and animal resources (specifically with bison), per-capita consumption of bison meat, changes in human predation and consumption practices, and assess the overall human impact on the ecosystem and bison eco-niche, especially in terms of the human influence upon the near extinction of bison. (2) Synthesize the information from the lab and write a 1-2 page report on how archaeological knowledge gained from the study of bison bones informs our understanding of the past.

Essential Question(s): How can archaeological practices help solve some of the mysteries of the past? In particular, what can examining bison processing camps tell us about past human life-ways and practices?

Prior Knowledge: This module is designed to be a stand-alone lesson, however, the previous modules would provide a more robust and comprehensive background.

Students Will Need: (1) *Bison Curriculum Project* Bison Bone Kit. The kit is available upon request, email Mario Battaglia at mbattaglia23@gmail.com, further details in lesson outline. Bison Bone Kit includes: Paper cutouts of bison skeleton (also provided below) and bison bones with cut marks. (2) Students will also need lab gloves, pencils, and worksheets.

Provided Handouts: (1) *Worksheet 1: Exploratory Lab Station Challenge!* (2) Extra station readings as an alternative if the module textbook *The Buffalo and the Indians: A Shared Destiny* is unavailable (a) *Bison Fact Sheet* if previous modules were not used (b) *Bison Jump Reading*, (c) *What the Bones Say*,

Readings: Selected sections from *The Buffalo and the Indians*, pp. 22-29

Key Terms: Archaeology, Archaeologist, Predation, Overkill, Extinction, Endangered Species, Processing, Bison Drive Lane, Bison Jump, Skeletal Anatomy, Processing Camp, Environment, Culturally Modified Bone, Cut Mark, Faunal, Microfauna, Megafauna, Anatomy, Oxidation

National Science Standards: Earth and Human Activity

MS-ESS3-3: Apply Scientific Principles to design a method for monitoring and minimizing human impact on the environment

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Disciplinary Core Ideas:
ESS3.C: Human Impacts on Earth Systems

Crosscutting Concepts: Patterns, Cause and Effect

Lesson Outline

Part 1: Be the archaeologist--Exploratory Lab Station Challenge!

NOTE: The Bison Curriculum Project: Bison Bone Kit is available upon request. Contact Mario Battaglia (mbattaglia23@gmail.com) for further information. Shipping costs will need to be covered by the school submitting the request. AS AN ALTERNATIVE, printouts of the pictures found in the Teacher Guide for the Exploratory Lab Challenge can be used. Either option is possible with this lesson module.

1. Students will move from station to station in the following format:
    a. There will be 6-10 stations (depending on supplies, number of students, and time).
    b. Students will have approximately 5-10 minutes (adapt as needed) at each station.
    c. Students must complete all the stations (or as many as possible in the given time).
    d. At each station they will fill out the questions provide on **Worksheet 1: Exploratory Lab Station Challenge!** This has been included in the module below.

2. Before starting the stations, students will take 5-10 minutes to read pages 22-24, the "Buffalo Meat" subsection, from the textbook *The Buffalo and the Indians: A Shared Destiny.* If the textbook *The Buffalo and the Indians: A Shared Destiny* is unavailable, an alternative option is to use the Station 10 reading: *What the Bones Say* provided in the module.

NOTE: Bone identification can be hard even for archaeologists. Therefore, treat this lab exercise more as a fun activity where the students can make educated guesses to identify the bone and processing technique. Then, as a class, you can review each station in more detail.

Part 2: Exploratory Lab Challenge—The 10 Stations:

Follow the PowerPoint included in the module. After the lab station exercise, use the PowerPoint slides to go through each station. A **Teacher Guide** is included to help guide the discussion of each station. Several stations have 2 bones the students can choose from.

Station 1: Bison Skeleton Labeling. AS A WHOLE CLASS: Students will label the bison skeleton using the PowerPoint as a guide. They can then use this as a reference guide for the rest of the lab activity. A full page of the bison skeleton is included in the lesson contents below and can be enlarged into placemat size labeling sheets if desired.

Station 2: Bison Skeleton Reassembling. Cut along the dotted lines of Bison Cutout, randomly assign numbers to the back of each cutout, and mix into a bag. **Record the numbers you use for (1) Mandible, (2) Femur), (3) Scapula, (4) Ribs.** During the lab, students will reassemble the skeleton and identify these bones by placing the corresponding number on their worksheet.

Station 3: Unmarked Bone. Students will answer the questions on the worksheet. *Bison Bone Kit*: A reddish tinged bone caused by oxidation (rusting effect).

Station 4: Burned Bone. Students are asked" What is the processing technique used? What bone is it? Why was the purpose of burning this bone?

Station 5: Crushed/Broken Bone. Students are asked: What is the processing technique used? What bone is it? What do you think was the purpose of this processing technique?

Station 6: Bone with Cut Marks. Students are asked: What is the processing technique used? What bone is it? Why do you think there are cut marks on this bone?

Station 7: Bone Marrow Extraction. Students are asked: What is the processing technique used? What bone is it? What do you think was the purpose of this processing technique?

OPTIONAL STATIONS:

Station 8: Reading from *The Buffalo and the Indians:* Using pp. 24-29, students must answer the 2 questions listed in the worksheet.

Station 9: Bison Jump Reading. Students must answer the 2 questions from the *Bison Jump Reading*. The reading IS provided in the module and can also be found at: http://www.texasbeyondhistory.net/bonfire/index.html

Station 10: *What the Bones Say* Reading. Students must answer the question from the readings for station 10 provided in the module. Excerpt Taken From: http://www.texasbeyondhistory.net/bonfire/index.html

Optional Station 11 (if previous lesson modules were not utilized): Students can read the ***Bison Fact Sheet*** as an additional station. The fact sheet is provided below.

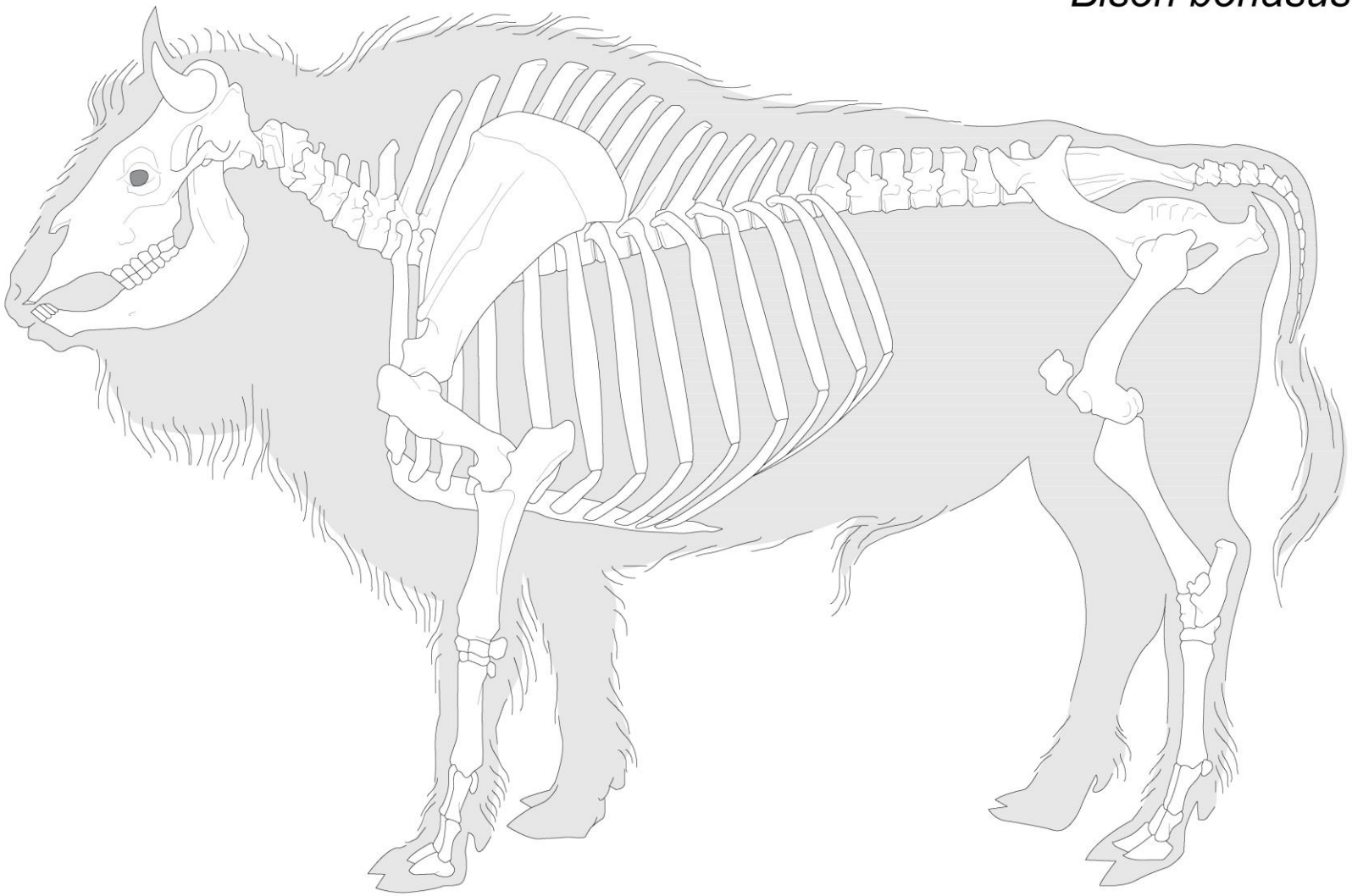
<u>Part 3: Module Completion Writing Assignment</u>:

Students will write a 1-2 page position piece on how archaeological knowledge gleaned from bison bones informs the present. The Unit 3 Essential Questions should be answered in the essay: How can archaeological practices help solve some of the mysteries of the past? In particular, what can examining bison processing camps tell us about past human life-ways and practices?

1. Students must use what they learned from the stations to also address:
   a. What is archaeology and why is it important?
   b. How do archaeologists know what humans did in the past?
   c. What could painting a bone signify?
   d. What do cut marks, burning, or crushing of the bone say about the processing technique?

NAME: _____

Bison bonasus



Référence : Dessin Michel Coutureau (Inrap) - © 2003 ArcheoZoo.org
D'après : Rouzaud Anne, Le bison et l'aurochs. *In : Préhistoire et archéologie*, n° 24, novembre 1980, p. 9. (illustration notée "M. Garcia d'aprés Ducrotay de Blainville").

Can be printed on enlarged, placemat size paper for students to label.

Worksheet 1: Exploratory Lab Station Challenge!

Station 1: Bison Skeleton Labeling: AS A CLASS: Work together using the list and picture provided below to label all the bones of the bison skeleton following the cranium example:

Cranium

Mandibles

Cervical Vertebrae

Scapula

Humerus

Radius

Metacarpal

Carpals

Ulna

Ribs

Os Coxae

Sacrum

Femur

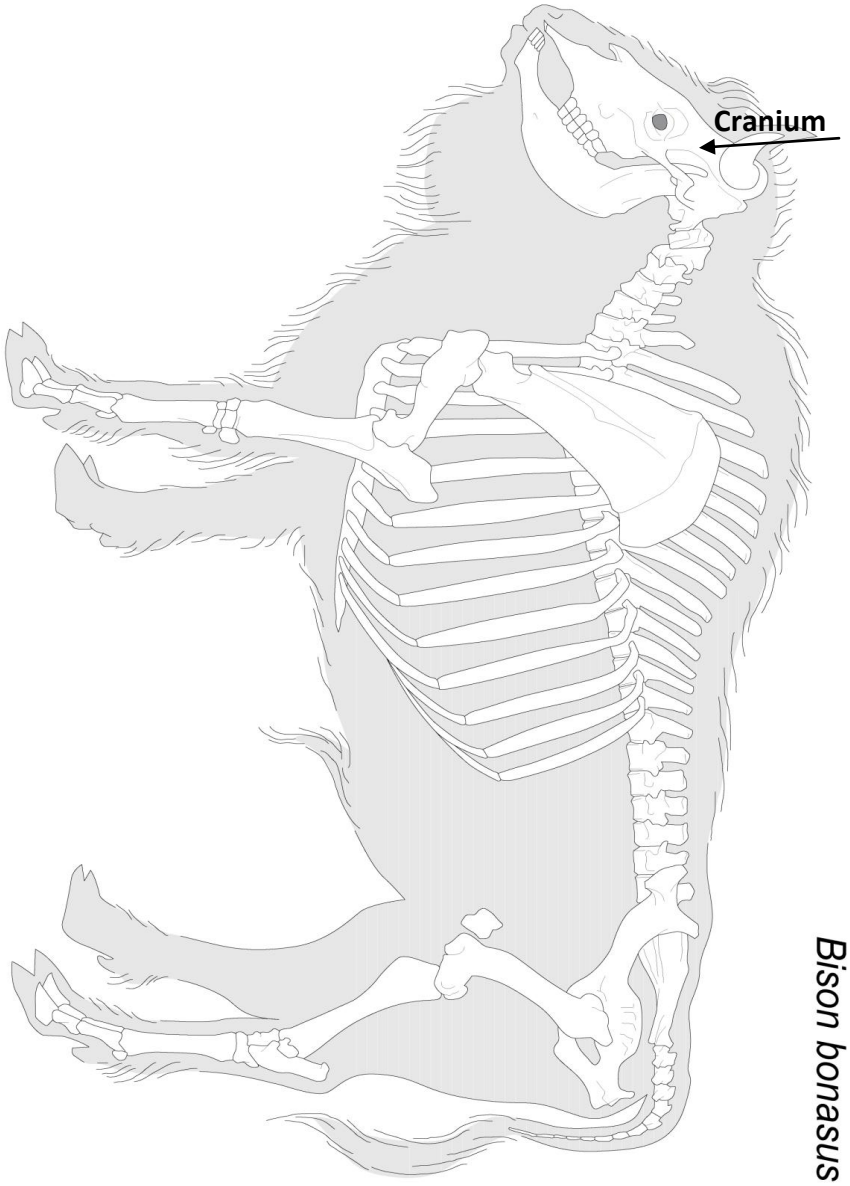
Patella

Tibia

Tarsals

Metatarsals

Phalanges



Name: _____

For a digital version with links describing each bone of the bison skeleton, go to http://lamar.colostate.edu/~lctodd/skelel.htm

Time to put on the hat and shoes of an archaeologist! You will spend 5 minutes at each station studying the bones and trying to uncover the mysteries of the past by figuring out what might have happened to that bone. Then, as a whole class, we will talk about the bones at each station to figure out what happened long ago. For each question, write down your best educated guess.

Station 2: Write the correct corresponding letter found on the back of each piece of paper: What number is the **mandible**? _____What number is the **femur**? _____ What number is the **scapula**?_____ What number are the **ribs**? _____

Station3: Answer the following:
Pick **ONE** bone: What bone do you think it is? _____
(If bison bone kit is used) What do you think causes the darker black and reddish stains on the bones? _____

Station 4: Answer the following:
What do you think was the processing technique used?_____
Can you identify any of the bones?_____
What do you think was the purpose of this processing technique?_____
_____

Station 5: Answer the following:
What do you think was the processing technique used? _____
Pick **ONE** bone: what bone do you think it is?_____
What do you think was the purpose of this processing technique?_____
_____

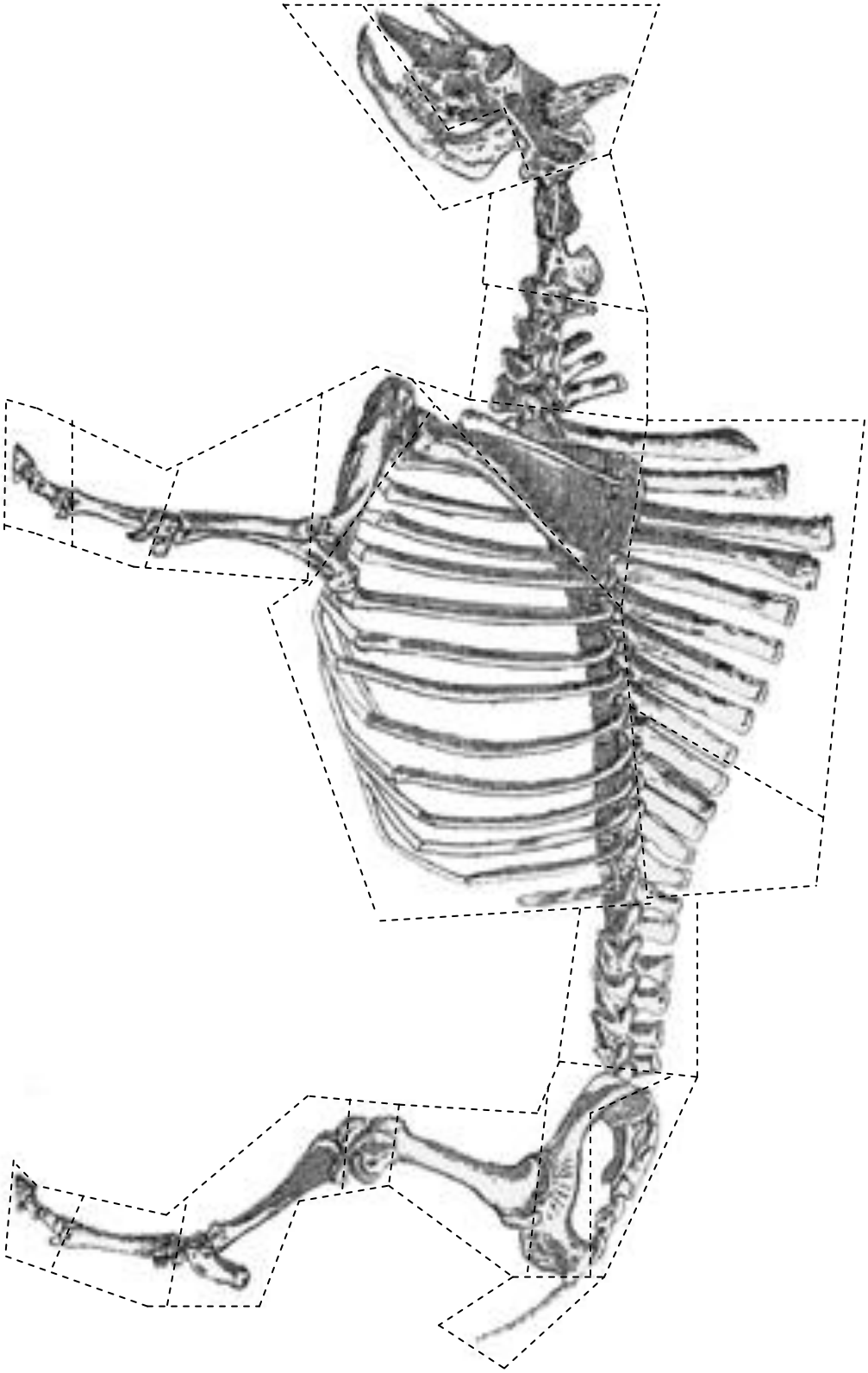
Station 6: Answer the following:
What do you think was the processing technique used? (Hint: look very closely at the bone or picture. See anything?) _____
Pick **ONE** bone: what bone do you think it is? _____
Why do you think there are marks on this bone?_____
_____

Section 7: Answer the following:
What do you think is the processing technique used? _____
What bone do you think it is? _____
What do you think was the purpose of this processing technique? _____
_____

TOGETHER AS A CLASS AFTER THE STATION EXERCISE:
Some of the bison bones are black and charred, while others look fairly fresh with no discoloration, while still others look bleached and weathered. What do you think these variations tell archaeologists about what was happening in the past?

Station 2: Bison Cutouts

Cut along dotted lines, write numbers on the back of each cutout, and have the students reassemble to pieces.



Bison Bone Exploratory Lab Challenge
TEACHER GUIDE

NOTE: The provided pictures below can be printed and cut out to be used for each station if the Bison Curriculum Project: Bison Bone Kit is unavailable. Refer to the provided information included with each station, but ignore the bone numbering as it applies only to the physical bones and ignore any additional information applicable only to the Bison Bone Kit.

NOTE: Identifying bones can be tricky even for archaeologists. Therefore, it is recommended this be a fun activity where students make educated guesses. Then, as a class, each bone and the processing technique can be identified and discussed in greater detail.

STATION 1: Bison Skeleton Labeling Sheet: Done as an ENTIRE CLASS. Students can use this as a reference sheet during the lab.

STATION 2: Bison bone paper cutouts: Cut along the dotted lines of Bison Cutout, randomly assign numbers to the back of each cutout, and mix into a bag. **Record the numbers you use for (1) Mandible, (2) Femur), (3) Scapula, (4) Ribs.** During the lab, students will reassemble the skeleton and identify these bones by placing the corresponding number on their worksheet.

STATION 3 (option 1): UNMARKED BONE
Bone #5: Phallanx (pl. phalanges or toe bones)

-- The phalanges are the bones in the toes. Phalanges often have cut marks because the hide is more difficult to remove from this area than to remove from areas with larger bones.

--*(Extra info for the bone from the Bison Bone Kit)* The gleysol (grayish clay) is suggestive, as mentioned before, of a wetland, anaerobic location of deposition. The roots around the bone suggest a high degree of vegetation. The darker black stain is likely from the soil, darker soils usually suggesting a high level of organic material.

Image taken from http://www.thefossilforum.com/index.php?/gallery/image/27143-bison-phalanges/

STATION 3 (option 2): UNMARKED BONE

Bone #7: Tarsal (Astragulus or Ankle bone)

--The astragulus bone, or ankle bone, is in the collection of bones in the foot, otherwise known as the tarsus.

--*(Extra info for the bone from the Bison Bone Kit)* The greysol (grey clay) is present on this bone suggesting a wetland environment. The reddish discoloration on the bone is evidence of a natural oxidation process.

IMAGE HINT:

Images taken from: (1) http://www.thefossilforum.com/index.php?/gallery/image/5-bison-astragalus-a/ and (2) http://bisonjeff.weebly.com/research.html

STATION 4: (UNIDENTIFIABLE) BURNED BONE

Bones #8, #9, #10: Unidentified

--Bones 8, 9, and 10 display clear signs of breakage and carbonization (burning of the bone) giving it that blackened, ashy color and texture. This is likely due to human processing, but could have resulted from prairie bush fires. Breaking, burning, or boiling the bones allowed the fat to be extracted. Fat extracted from bone, often done by large boiling pits. Large leg bones were smashed to remove the nutritious marrow, and boiling pits were subsequently dug in which these broken bones were also boiled to render grease. Boiling was done by throwing red-hot rocks into hide-lined pits filled with water. This grease was often mixed into mashed bison meat and berries to create pemmican, a nutritious food source that stored extremely well.

Image taken from: http://www.texasbeyondhistory.net/choke/images/MC222-burnt-bone.html

STATION 5 (option 1): CRUSHED/BROKEN BONE

Bone #2: Skull/Cranium

This bone, part of a bison cranium, has clearly been broken, perhaps by human processing. The skulls are typically smashed, and the jaws broken apart. In this case, it is the brains and tongue that were likely being removed. The brains were used in the tanning of the hide and other animal skins. Skulls were also broken up to remove the horns and horn cores. Bison horns were used in many dances and other ceremonies of later Plains Indians, and there is reason to believe that Paleoindians also placed special importance on bison skulls and horns. The most spectacular example is the now-famous painted bison skull from the Cooper site, a Folsom kill site in northwest Oklahoma that Lee Bement excavated. This skull had a red zig-zag emblem painted on the forehead and was apparently placed atop a pile of butchered bison bone as a ritual offering.

Image taken from: http://www.texasbeyondhistory.net/plateaus/images/hy209-skull.html

STATION 5 (option 2): CRUSHED/BROKEN BONE

Bone #6: Part of the Os Coxae or hip bone

--This bone is much lighter and more porous than the bison rib (#3) for example. Breakages and crushed bone could be related to human processing or perhaps simply post-depositional processes such as cattle trampling.

IMAGE HINT:

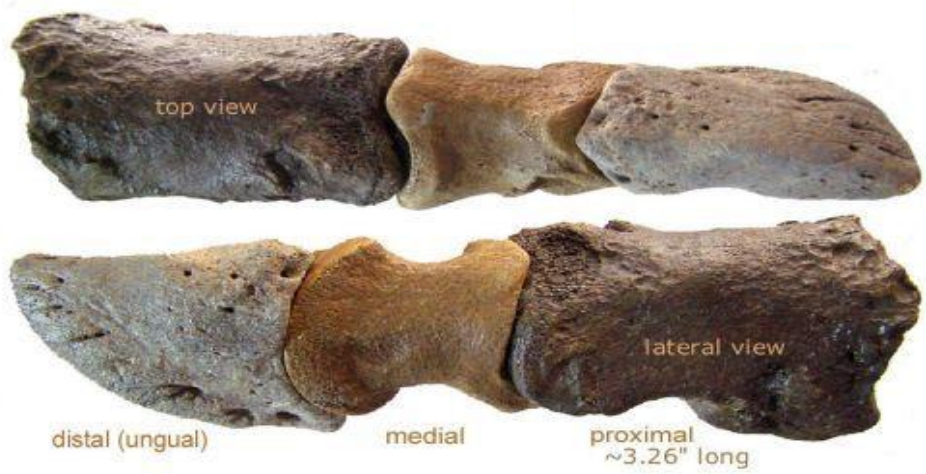
Images taken from: http://www.tarpits.org/blog and
http://www.nps.gov/features/yell/slidefile/mammals/bison/Images/01672.jpg

STATION 6 (option 1): CUTMARKS

Bone #1: Phalanx (pl. phalanges or toe bones)

--The phalanges are the bones in the toes. If you examine it closely, on one end there are clear cut marks. Cut marks usually exemplify human butchering, though you have to be careful, sometimes marks such as these could be caused by carnivores such as wolves or bears munching and gnawing on the bone! Also, striations (linear marks) might have been caused by humans that were removing skin and muscle from the bone. Careful analysis can usually tell this apart.

--(*Extra info for the bone from the Bison Bone Kit*) The gleysol (greyish clay) provides insights into the bones deposition (burying) and the subsequent taphonimic processes (how the bone was affected over time by post-depositional processes such as burial, decay, and preservation as it slowly becomes fossilized). The grayish color of the clay suggests an anaerobic (low oxygen environment), low-iron, marshy or wetland environment. Clays high in iron, on the other hand, result in darker, redder clays that stain the bone with a reddish tinge.



Images taken from: http://dpc.uba.uva.nl/cgi/t/text/text-idx?c=jalc;rgn=main;idno=m0101a04;view=text and http://www.thefossilforum.com/index.php?/gallery/image/27143-bison-phalanges/

STATION 6 (option 2): CUTMARKS

Bone #3: Part of a Rib

--This bone displays characteristics of possible human processing through breakage. If you examine it closely, on one side there are also faint cut marks going perpendicular to the cracking of the rib. Cut marks usually exemplify human butchering, though you have to be careful because sometimes cut marks could be caused by carnivores such as wolves or bears munching and gnawing on the bone! Careful analysis can usually tell that apart.

--(*Extra info for the bone from the Bison Bone Kit*) The gleysol (greyish clay most prominent on either end of the bone) provides insights into its deposition and the subsequent taphonomic processes (how the bone was affected over time by the post-depositional processes such as burial, decay, and preservation as it becomes fossilized). The greyish color of the clay suggest an anaerobic, marshy or wetland environment. Clays high in iron, for example, make for darker, redder clays. The bones lighter color also suggests possible sun-bleaching, exposed to the sun on the surface for an extended period of time.

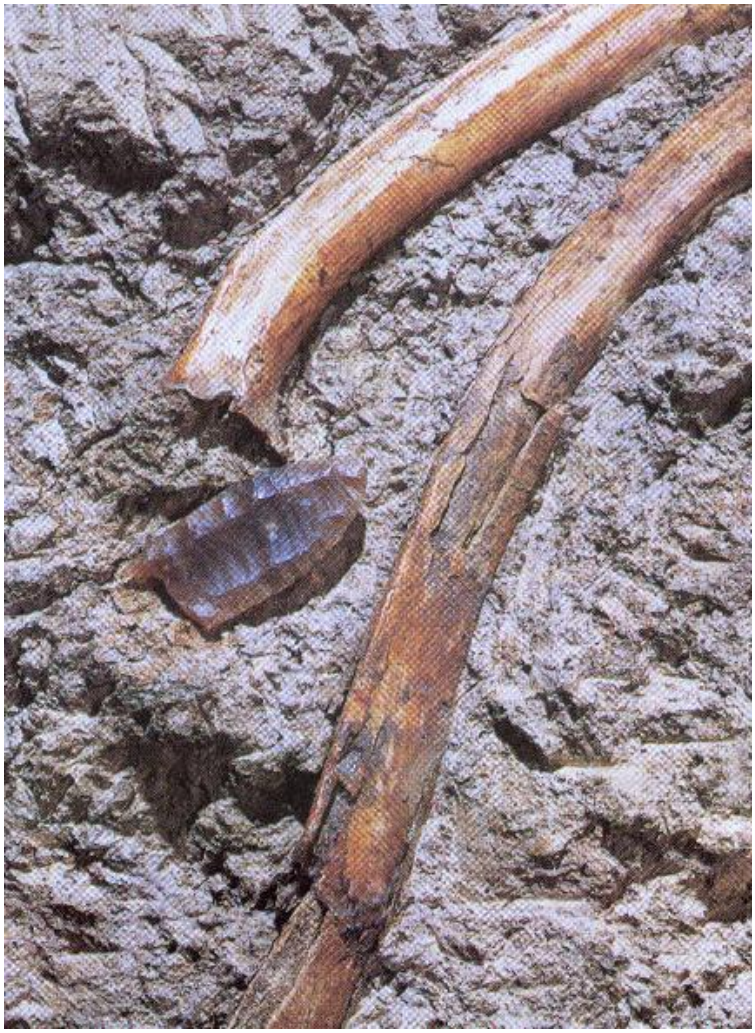


Image taken from: http://www.irwinator.com/126/p6.htm

STATION 7: BREAKAGE FOR MARROW EXTRACTION

Bone #4: Part of a Ulna or Radius (long bone)

--This bone displays clear signs of breakage, possibly to extract the marrow, an extremely nutritious tissue very high in fat. When food was scarce, Native populations would often extract the marrow from the bones (often long bones) to get a rich, nutritious food source. The cavities within large leg bones, especially the femur, tibia, and humerus, are filled with marrow, which is full of fat and is, thus, highly desirable to eat. While today many people try to avoid eating too much fat, the prehistoric Indians of the region had few sources of fat. Most meat is lean and contains little fat; the same is true for most plant foods (except nuts and seeds). So fat would have been craved, and fresh marrow is actually quite delicious. The organic material and residue on the bone (the roots still evident) suggest a high level of vegetation during and after this bison was processed, perhaps in a grassland or wetland environment.

--*(Extra info for the bone from the Bison Bone Kit)* Looking at the bone closely, you can see the erosion and discoloration caused by roots. Root "etching" as it is sometimes called shows evidence that the bone was buried, or otherwise came in contact with the ground at some point in time.

Images taken from: http://www.fossiliferous.co.uk/mammalseurope.htm

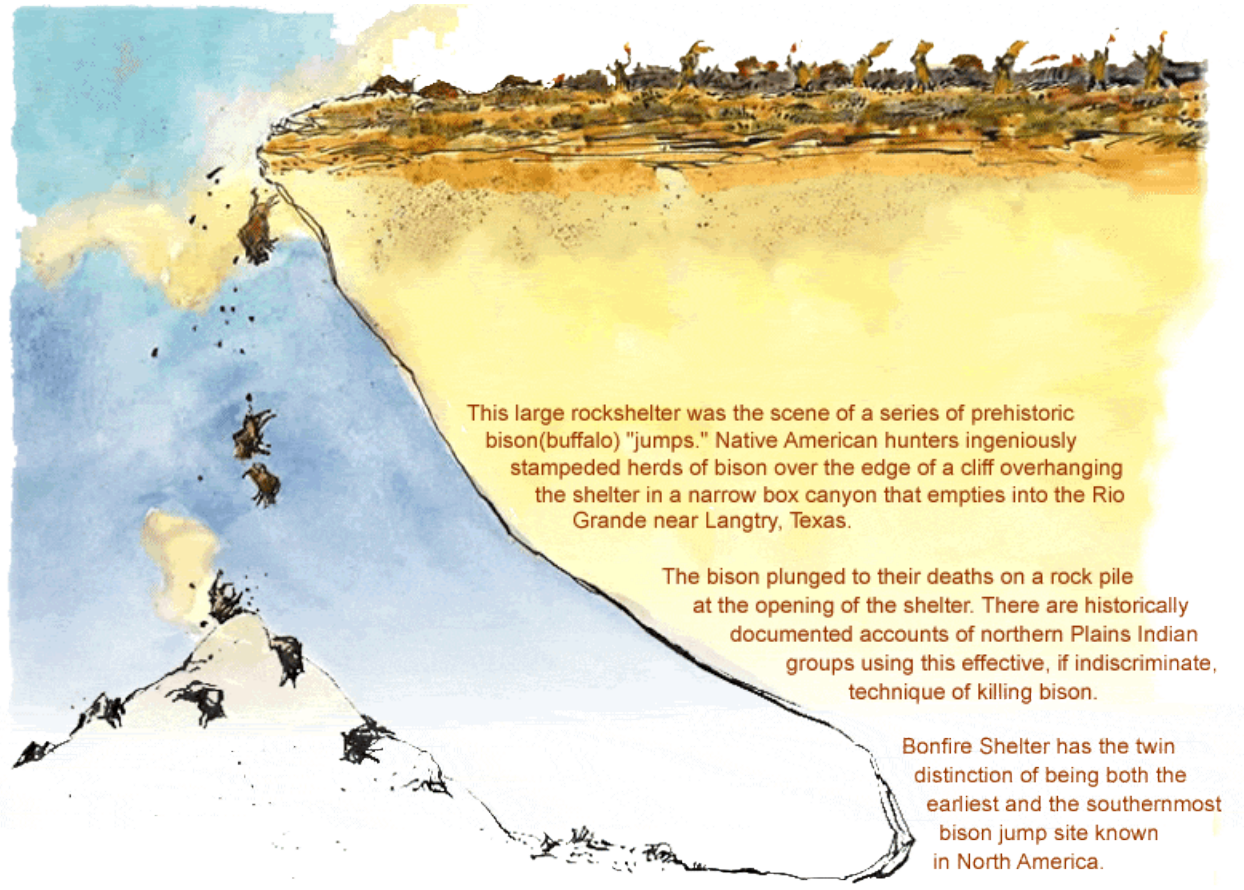
Additional Resources

Virtual Bison/3-D, Interactive Bison Skeleton:
http://www.uwyo.edu/reallearning/bisonindex.html

Bison Osteology: http://lamar.colostate.edu/~lctodd/bison.htm

Station 9: Bison Jump Reading

Excerpt Taken From: http://www.texasbeyondhistory.net/bonfire/index.html



The thousands of bones that archeologists have carefully collected from Bonfire Shelter have quite a lot to say. If the bones actually could talk, they might be able to tell us fascinating things about the past including the details of how they came to rest where they were found. But they can't and so we must rely on faunal (animal) experts, archeologists, or paleontologists who develop specialized knowledge about animal bones, to study the bones and speak for them.

What the faunal experts can tell us has a great deal to do with the kinds of questions they pose in the first place. Usually they start with basic questions—what animal is this bone from? Which specific bone element is this fragment a part of? But as they figure out the basics, they start asking more difficult "why" and "how" questions. How were the buffalo butchered? Why did the bones catch on fire?

Regardless of the evidence we might muster to answer such questions, there really is not much in archeology that we can prove beyond doubt. We are usually dealing with the remote human past that left behind no eyewitness accounts, only mute bones and stones. What we can hope for, however, is greater insight and understanding. Although scientists may hold different opinions, it really isn't about being right; it's about trying to understand what the bones can tell us about what happened at Bonfire shelter.

Station 10 Reading: *What the Bones Say*

Excerpt Taken From: http://www.texasbeyondhistory.net/bonfire/index.html

The Bones

Two "bone jocks," as faunal (animal) experts are sometimes known, have studied bones from Bonfire Shelter. They are both archaeologists. Today the excavated bones from Bonfire Shelter are kept in neatly labeled wooden drawers within the rows of metal cabinets that line the "big room" at the VP Lab. They are stored here for posterity (into the future) because of their research value. Sometimes the bones from Bonfire are used for comparative purposes—a researcher studying bison bones at another kill site might want to compare sizes, species, breakage patterns and so on. But their most important value is their potential to address new questions and provide new information.

Perhaps the best example of untapped potential in the Bonfire collection is the microfauna—vial upon vial of tiny bones from rats, mice, gophers, birds, snakes, and other small animals. These bones were collected as part of a special set of soil samples. The bags of dirt were washed through fine mesh sieves that capture even the tiniest fragment. Then the hard part comes: someone has to spend hundreds of hours picking through each pile of bone fragments (and pieces of stone and other debris) to sort out the identifiable bones from the miscellaneous fragments.

What makes one bone fragment identifiable and the next one not? Experts look for distinctive features, especially whole bones and bone fragments bearing the intact ends of a bone, such as the ball joint where the femur (upper leg) fits into the hip (pelvis) socket. But telling the difference between the tiny femur of a pack rat and the tiny femur of a wood rat can be mighty tricky. The easiest bones to identify among the small animals are usually the teeth. Teeth are especially important because they are harder and more durable than most other bones, hence, most likely to survive the passage of time.

Although the Bonfire Shelter microfauna (small animal) collection has never been fully analyzed, it holds enormous potential to answer many questions. Here's one example: scientists know that small creatures are much more sensitive to environmental change than most large animals. While creatures large and small are equally affected by such drastic changes as the end of the last Ice Age, large animals like deer and bison are mobile and can survive smaller events—droughts and floods—just by moving. In contrast, mice and gophers cannot move very far. When climatic conditions gradually shift from wet to dry, small animal populations change in response; water-loving rodents die and over time are replaced by those that do well in the desert. By looking at the percentages of one kind to the other through time, these tiny bones can tell us a lot about how the local environment around Bonfire Shelter has changed. The microfauna are just one example of how the bones provide useful information to archaeologists.

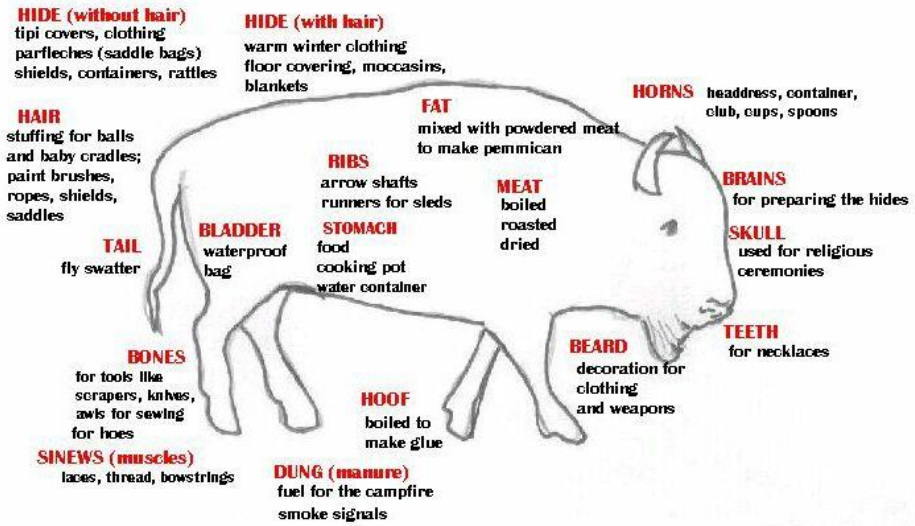
You might be wondering how all the rodent bones ended up in Bonfire. Most of the bones, it appears, did not go there of their own accord. Owls and hawks both eat a lot of small animals and like to roost or perch on high, protected spots like the top of the roof

blocks at the mouth of Bonfire Shelter. These big birds eat the rodents whole, bones and all. The crunched-up bones (with many identifiable pieces) go through the bird's digestive system and end up as "pellets" on the floor of Bonfire shelter. These gradually break apart as they weather and the tiny bones become part of the cave sediments.

The larger bones in the Bonfire collection have much to tell us as well. The most numerous, of course, are the bison bones. Far fewer whole leg bones were found, and of those, most were the smaller ones. The larger leg bones are the main meat-bearing bones. The cavities within large leg bones, especially the femur, tibia, and humerus, are filled with marrow, which is full of fat and is, thus, highly desirable to eat. While today many people try to avoid eating too much fat, the prehistoric Indians of the region had few sources of fat. Most meat is lean and contains little fat; the same is true for most plant foods (except nuts and seeds). So fat would have been craved, and fresh marrow is actually quite delicious. This explains why most of the leg bones from Bonfire are broken up, having had the marrow extracted by the prehistoric peoples processing the bone.

The skulls, too, are typically smashed, and the jaws broken apart. In this case, it is the brains and tongue that were being removed. Skulls were also broken up to remove the horns and horn cores. Bison horns were used in many dances and other ceremonies of later Plains Indians, and there is reason to believe that Paleoindians (early Native Americans) also placed special importance on bison skulls and horns.

Some of the bison bones are black and charred, while others look like fairly fresh bone, while still others look bleached and weathered. These variations reflect where the bones came from in the deposits, how old they are, and how much time they spent on the surface before being covered by cave dust or more bones. Such factors also affect whether a given bone will be preserved at all or whether the bone surfaces preserve the evidence archaeologists need to figure out hunting, butchering, and processing patterns.



Station 11: BISON FACT SHEET
ADAPTED FROM http://www.defenders.org/bison/basic-facts

Fast Facts:
Height: 6-6.5 feet at the shoulder
Length: 10-12.5 feet
Weight: 900-2,000 lbs. Males are larger than females.
Lifespan: 18-22 years in the wild; over 30 years in captivity.
Mating Season: June-September, peak activity in July-August
Gestation: 270-285 days. Calf is born April-May.
Litter size: 1 calf

© Midori Layzell

Millions of bison once thundered across North America. These massive animals, characterized by their long, shaggy brown coats, have poor eyesight but very good hearing and an excellent sense of smell.

Historically, the American bison played an essential role in shaping the ecology of the Great Plains. They graze heavily on native grasses and disturb the soil with their hooves, allowing many plant and animal species to flourish. Prairie dogs prefer areas grazed by bison where the grass is short so they can keep a lookout for hungry predators, and wolves once relied on bison herds as a major food source. Today, wild bison are making a small comeback in a few scattered places, but they need more room to roam.

Diet

Bison mainly eat grasses and sedges which are both very plentiful foods on the Great Plains. Bison have adapted to eat grass because it is so plentiful, especially during the spring and summer months when the bulls need it before mating and the calves need it to grow strong before winter. With the snow covering the ground in the winter, bison's massive, "snow-plow" like heads have adapted so they can move the snow and get at the winter grasses below.

Population

The trails carved by animals like bison and deer in their seasonal migrations formed some of the earliest traceable paths into the American wilderness, and were followed by Native Americans, explorers and pioneers.

An estimated 20 to 30 million bison once dominated the North American landscape from the Appalachians to the Rockies, from the Gulf Coast to Alaska. Habitat loss and unregulated shooting reduced the population to just 1,091 by 1889. Today, approximately 500,000 bison live across North America. However, most of these are not pure wild bison, but have been cross-bred with cattle in the past, and are semi-domesticated after being raised as livestock

for many generations on ranches. Fewer than 30,000 wild bison are in conservation herds and fewer than 5,000 are unfenced and disease-free.

Range & Habitat (where they live)

Though bison once roamed across much of North America, today they are “ecologically extinct” as a wild species throughout most of their historic range, except for a few national parks and other small wildlife areas. Yellowstone National Park has the largest population of wild plains bison (about 4,000), and Wood Buffalo National Park has the largest population of wild wood bison (about 10,000). With help from Defenders, two small herds of pure, wild Yellowstone bison were recently reintroduced onto two Indian Reservations.

Behavior

A bison's thick fur offers great protection against the harsh elements of the American plains. Their winter coat is so thick and well insulated that snow can cover their backs without melting. Known for roaming great distances, bison move continuously as they eat. The females, or cows, lead family groups. Bulls remain solitary or in small groups for most of the year, but rejoin the group during mating season.

Bison are adapted to the extreme weather conditions of the Great Plains, from summer heat to winter cold and blizzards. In winter, bison can dig through deep snow with their heads to reach the vegetation below. Bison often rub, roll and wallow. Wallowing creates a saucer-like depression in the earth called a wallow. These wallows are dust bowls without any vegetation.

Reproduction

Bulls and cows do not mingle until breeding season which happens in the late summer. This is called “rutting”. Dominant bulls “tend” to cows, paying attention only to the cow and sometimes not even eating for fear the cow will leave! The bull will follow the cow around until the cow chooses to mate. During this period, the bull blocks the cow’s vision so that she may not see other competing bulls, and bellows at males striving for the cow’s attention.

Mating or rutting happens in late summer so that the calves will be born in the spring, giving the calves plenty of time to feed on the spring and summer grass to become big and strong before the arrival of the cold winter. During the spring and summer, the bigger herds also protect the calves from predators like wolves.

Calves have the ability to run just hours after birth, an important survival adaptation when the herd is continually moving or is targeted by predators like wolves. Wolves often target young calves. Thus, there is a big need for calves to be able to run soon after birth!

(Optional) Reading 2: *What the Bones Say*
Excerpt Taken From: http://www.texasbeyondhistory.net/bonfire/index.html

The Bison

There were bison bones in all three of the bone beds. The bison bones in Bone Beds 1 and 2 were those of an extinct species, either *Bison antiquus* or *Bison occidentalis*, while the Bone Bed 3 bones were all of the modern buffalo, *Bison bison*. The best way of determining the species of extinct bison is to look at intact skulls, but none were found in either deposit. Faunal analyst Lorrain compared a variety of measurements of specific bones from Bone Bed 2 such as the width of the distal (lower) end of the tibia (upper front leg) to the same measurements from Bone Bed 3 specimens and those from bison samples at other sites. While she wasn't able to answer the question of species, she did demonstrate that the mature adult bones of the extinct bison at Bonfire were at least 12-18% larger than those of the modern bison. Taking other comparative studies of bison species measurements into consideration, the extinct species at Bonfire was at least 15% larger than modern bison.

In more concrete terms, a large modern bison bull can weigh as much as a ton (2,240 pounds) and stand 6 feet high, while the adult males of *Bison antiquus* may have weighed as much as 3,500 pounds and stood 7 1/12 feet high according to Dr. David Meltzer, archeologist and Paleoindian expert. From the mindset of a hunter, imagine a full-grown modern buffalo, add a foot or two, and consider the courage it must have taken to get up close to an Ice Age bison and wave a spear or a blanket in its face.

The Bone Bed 3 Animals and their Butchering

Successful hunters carve up bison into manageable parts,
separating front and hindquarters and the heads. Drawing by Charles Shaw.

Lorrain estimated that there were bones of 800 bison in Bone Bed 3, mainly cows (adult females) and yearling calves. The absence of adult males and the relative uniformity of the age of the calves led her to argue that Bone Bed 3 formed as the result of a single event that occurred during the late winter or early spring. Dibble had trouble accepting Lorrain's single-event argument and so have other archeologists familiar with the site (including this author). The mass of bones in Bone Bed 3 more likely is the result of multiple jumps that occurred over a relatively short period of time.

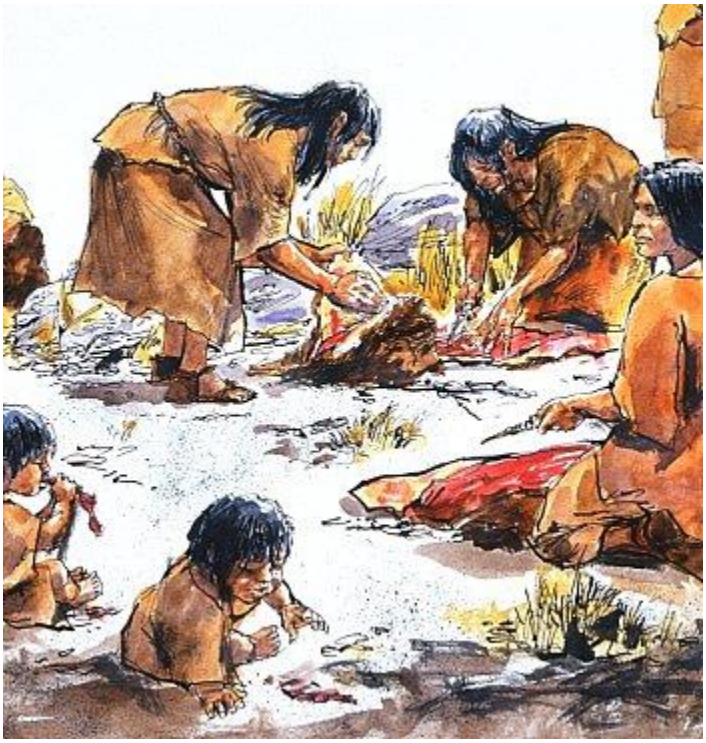
One event or several, the incinerated condition of much of the bone makes it difficult to say a great deal about what happened after the buffalo jump event(s) that created Bone Bed 3. The finding of at least one intact bison calf skeleton and numerous partial articulations shows that there were so many animals heaped up that the lower ones were either not reached or only partially butchered. Given that over 50% of the bison in Bone Bed 3 were immature animals, it is likely that some were dragged out of the shelter for butchering. The absence of intact skulls suggests that the heads of most were smashed for the removal of the brains. The uneven counts of certain bones show that some parts of the animals were removed from the shelter, especially the forequarters and hindquarters, minus the feet and hooves, which were cut off and discarded on the spot.

Faunal analyst Lorrain observed that the Late Archaic butchers who worked the bones in Bone Bed 3 were not as skilled or at least not as careful as the earlier Paleoindian butchers. The prime evidence is the difference in how the legs were severed from the bodies. In Bone Bed 2, the ends of the leg bones that fit into the sockets in the pelvis and scapula were intact and sometimes showed cutmarks from severing the tendons and joining tissues. In Bone Bed 3, the ball joints were often smashed. This is likely simply a reflection of the greater mass of meat—there was no need to "waste not;" the successful hunters and their families did not "wont" for meat for many moons.

The relatively small number of butchering tools found amid the bones suggests that most of the butchering took place outside the confines of Bonfire Shelter, a not-surprising inference for several reasons. The only real tasks that had to be done upon the mass of dead animals would have been the initial stages of butchering wherein the animals were cut open, the favorite pieces removed (tongues, brains, and stomach contents), and the major meat parts—probably forequarters, hindquarters and backstraps—were cut loose and carried out of the shelter. In order to make use of the bonanza, the meat would have been cut into strips and hung to dry in the sun or perhaps smoked. Either way, it must have taken weeks of work to preserve and cart off the meat. Most of this work probably took place outside the shelter within the canyon, where meat strips could be spread out on numerous large, clean boulders and hung from trees, bushes, and pole frames. Along the canyon floor are also extensive flat areas of exposed bedrock as well as gravel bars that may have served as work areas for the multi-step process of hide preparation: defleshing, scraping, drying, and tanning. Where exactly these activities took place will never be known, but it wasn't in the shelter.

It is also worth noting that there wasn't much evidence of any sort of activities elsewhere within Bonfire Shelter away from the main Bone-Bed 3 deposit. The only indication at all of occupation, apart from the bone bed, was two small hearths found near the back of the shelter in the thin, outer part of Bone Bed 3. It is, of course, possible that additional materials are still present at the north end of the shelter where only a few test pits were dug.

The Bone Bed 2 Animals and their Butchering



Women work outside Bonfire Shelter cutting meat into strips for drying, a process that must have taken many days after a successful jump kill. Drawing by Charles Shaw.

It is known that Bone Bed 2 resulted from at least three separate jumps because three distinct layers were clearly visible in certain places within the deposit. Unfortunately, many of the bones from the three or more jumps were mixed together, making it difficult to tell how many animals were killed during each event. A complicating factor is the Bone Bed 2 bonfire, which occurred after the earliest jump(s) and before the latest jump(s).

Lorrain estimated that a total of 120 animals from an extinct species of bison was present in Bone Bed 2 including bulls (mature males), cows, and calves of differing ages. Bison aren't considered full adults until they reach an age of 5 to 6 years. Interestingly, over half of the animals in Bone Bed 3 were immature animals with, the 3- to 4-year-old age group having the greatest numbers. Assuming that the extinct species behaved more or less the same as modern bison, mature bulls would have been with the cows and calves only in certain times of the year, such as the fall rutting season. Taken together, the evidence suggests that the Bone Bed 3 jumps occurred in several different seasons.

In contrast to Bone Bed 3 where there was abundant evidence of waste and incomplete butchering amid the dregs of one or several overwhelming successes, the evidence from Bone Bed 2 suggests a much more systematic and thorough harvest of smaller kills. Part of the reason we know a lot more about the Bone Bed 2 slaughter and its aftermath is simply because most of

the evidence in Bone Bed 3 went up in smoke, so to speak, in the conflagration. The earlier Bone Bed 2 blaze was smaller and most of the bones and tools survived unscathed (or came to rest after the Paleo bone-fire).

By carefully plotting and studying the distribution of different bone elements and by examining the fracture patterns and stone tool cut marks on bones, the archeologists were able to understand how much of the butchering took place within the confines of Bonfire Shelter. What they found was that following each jump the Paleoindians systematically and thoroughly butchered the animals and made use of a great deal of the animals. While little or no direct evidence survives of what they did with the hides and stomach contents, the efficiency with which the animals were dismembered and some of their bones broken apart for marrow extraction leaves little doubt that not much was wasted.

From the absence of evidence for hide-scraping and cooking fires within the shelter (only one small hearth and a few scraping tools were found), we can infer that much of the post-butchering work took place elsewhere as was the case with Bone Bed 3. But most or all of the primary butchering seems to have taken place within the confines of Bonfire Shelter.

The patterning of bones across Bone Bed 2 was most interesting. In contrast to Bone Bed 3, the bones in Bone Bed 2 were fully disarticulated (pulled apart), sorted into different parts of the animal, and systematically and thoroughly butchered. Despite the careful exposure of relatively large areas of the bone bed during the 1963-64 work, only seven partial articulations were recorded, situations where several of bones were found together in correct anatomical position. When articulated bones are found, it is inferred that they were still held together by flesh and connecting tissue at the time they were originally deposited. Of the seven Bone Bed 2 articulations, most of these were only two bones, indicating only a relatively small part of the animal. Compare this to the 90 articulations recorded in Bone Bed 3, where the burning hampered investigation. Many of these articulations were entire limbs or vertebral columns and in at least one case, a virtually complete skeleton. In Bone Bed 2 there was much less evidence of waste.

Based on her analysis of the Bone Bed 2 bones, Lorrain outlined a fairly detailed two-step process and showed that the entire butchering process took place in the shelter. The first step was to cut apart the animal and separate the major parts that yielded different things and/or required different butchering techniques. Although short on articulations, Bone Bed 2 contained considerable evidence of the animals being divided into sections and parts and sorted into piles of like kind. For example, a concentration of partial skulls (mostly the maxilla or upper palate), mandibles, and atlas and axis vertebrae (the uppermost in the spinal column) was recorded near the rear of the shelter near the one hearth that was found in Bone Bed 2. The upper part of the skulls and horn cores were found clustered in another area of the shelter. A stack of at least seven scapulae was recorded that must have been gathered after being separated from the frontquarter. For what purpose is unknown; perhaps they were just set aside for discard. The bones of the major meat units, the frontquarters (humerus, radius, and ulna) and hindquarters (tibia and femur) show similar distributions, suggesting that the meaty legs were separated from the carcass and from the feet and then butchered in one general area of the shelter.

After the prehistoric butchers completed the sorting process, the second step was to complete the butchering of each group. The skulls were cut and bashed apart at the back of the skull,

presumably to extract the brains. The mandibles (lower jaws) were split apart and separated from the maxilla, probably to free the tongue. Lorrain suggested that the concentration of head parts near the hearth might indicate that brains and tongues, parts known to be favorites among historic bison hunters, were eaten on the spot.

The front and rear legs were cut apart at the joints, and the meat was carefully cut from each bone. Following this the long bones were systematically broken open, no doubt to extract the fat-rich marrow. Because the long-bone fragments were not further crushed and splintered, it is obvious they were not rendered for bone grease, a common practice in later times. This was one of the few steps not taken to extract useful matter.

One last pattern deserves special mention, that of stone anvils or butcher blocks. Hefty limestone boulders 1 to 2 feet (.3 to .6 meters) across were found in several places in Bone Bed 2 amid broken and splintered bones. These boulders were not present elsewhere in the natural layers immediately below and covering the bones, making it clear that they were brought in during the butchering, or perhaps a bit earlier. Such heavy stones also could have served well to dispatch wounded animals.

While most of the boulders were found in the thick of things where it is more difficult to sort out which specific bones they were associated with, better-defined evidence was documented during the 1983-84 investigations at the base of Bone Bed 2. There (Stratum C), a spoke-like pattern of long bones was found arrayed around a broken limestone rock. The bones included those from at least three bison and a young horse. Several of the bones were broken, the best example being an ulna with a green (fresh bone) break and battering marks that Bement attributed to its separation from a nearby radius. This scene suggests that the Paleoindian butchers broke the leg bones atop the stones, as a modern-day butcher would use a butcher block.

Who Were the Bone Bed 1 Predators?

Dibble and Bement both argued that humans were the primary predators responsible for the accumulation of bones in Bone Bed 1. Lacking a smoking gun (i.e., definite proof, such as the finding of an obvious chipped-stone tool in unequivocal association with the bones), the argument is based on a series of inferences and both positive and negative evidence. First, however, consider the argument that carnivores were the main predators.

Carnivores

Bement carefully examined the bones to search for evidence of carnivore behavior. Carnivores such as the Late Pleistocene cats, bears, and wolves tend to leave ample evidence of their work. They kill prey animals in specific ways, sometimes puncturing or breaking the bones of their prey. In the process of devouring their prey, carnivores may break more bones, crunch up small bones, gnaw on large meaty ones, and haul entire animals or favored parts (with or without attached flesh) to feeding stations or into their lairs. Some carnivores scavenge already dead animals as well and may even chew on bones when food is scarce.

Informed by studies on various carnivore behavioral traits and telltale marks, Bement found only limited evidence for carnivore action on the bone in Bone Bed 1 and in Bone Bed 2, where we know humans were the main predator. In the Stratum H-1 layer within Bone Bed 1, two horse bones had conical punctures as well as carved grooves with U-shaped cross-sections like those made by carnivore canines. A third bone, a mammoth long bone fragment, had three large conical punctures, two of which were a little more than 2-inches (5.6-cm) deep. Bement narrowed the possibilities down to the short-faced bear and the sabertoothed cat species known from the region, scimitar cat. Both carnivores had large canines and powerful jaws and are known to have denned in caves. The short-faced bear was the largest and most powerful predator in North America during the Late Pleistocene and was mainly a flesh-eater. Scimitar cat was about as large as a modern lion and had wicked-looking, long-curving fangs. (For another view of scimitar cat, see http://www.museum.state.il.us/exhibits/larson /homotherium_skull.html).

Bement used fossil specimens of scimitar cat and the short-faced bear to produce punctures in a piece of Styrofoam the same thickness as that of the mammoth bone and compared these to the size and shape of the holes. What he found was that the size and shape of the punctures in the mammoth bone most closely resembled those of the scimitar cat. Lundelius is not quite convinced because he thinks the short-faced bear had a much stronger bite and would have been much more capable of puncturing a mammoth bone. Either way, something extremely large and powerful obviously played a role in the accumulation of the bones in Stratum H-1.

The only other conical puncture noted was that in a bison scapula (shoulder bone) in Stratum I (the lowest layer of Bone Bed 1). Bement suggested that this hole compared more favorably to a wolf-sized carnivore. Otherwise, there was very little definitive evidence of carnivores. Two juvenile horse long bones also in Stratum H-1 were missing one end and resembled wolf-chewed bones known from other sites. But many of the other breakage patterns often associated with carnivores were not seen in the Bonfire bone assemblage. There were, for example, numerous long bones from juvenile horses and bison that did not show carnivore damage, as might be expected if the bones accumulated in a den. Bement argued that the relative dearth of carnivore evidence weakens the carnivore-only hypothesis. The conical punctures show that one or several carnivores were present at Bonfire and did chew on horse, mammoth and bison bones, but were scimitar cats, wolves, and/or short-faced bears the primary predators or after-the-fact scavengers?

Humans as Predators

Multiple lines of evidence suggest that humans played a significant role in the accumulation of Bone Bed 1. Apparent cut marks were found on several different bones in Strata H-1 and I. Cuts made on fresh bone with a sharp stone tool typically create V-shaped grooves that are distinct from the more-rounded, U-shaped grooves typical of carnivore teeth. Yet both U- and V-shaped marks were found on a single horse femur (lower back leg) in Stratum H-1. Bement suggested that carnivores and humans may both have damaged the bone. In this scenario, the carnivore damage would presumably represent the scavenging of an abandoned butchering site, a pattern well known among wolves and other canines.

Another clue was the presence of spiral fractures, spiral-shaped green (fresh) bone fractures that are typical of intentional breaks made by humans on fresh bone. Numerous spiral fractures were

observed on Bone Bed 1 bones including the broken end of the horse femur shown in the drawing. The problem with using spiral fractures as evidence of human involvement is that they also can be created by carnivores and even by rock falls or water-borne impact. While there is no evidence of either rock falls or stream deposits at Bonfire in Bone Bed 1, there is at least some evidence of large carnivores.

Perhaps more convincing is the finding of several apparent bone tools. The same horse femur with a spiral fracture and both U- and V-shaped incisions also has what Bement describes as smoothing and polish along the broken edge. He thinks this may well be a butchering tool. Another example is a broken bison ulna (lower front leg) bone that forms a smooth point bearing numerous V-shaped cut marks; Bement interprets this bone as a butchering tool. The finding of numerous apparent cut marks begs the question: where are the stone tools that presumably left the cuts. Perhaps these were removed from the scene or else dropped in a different part of the shelter.

Yet another suggestive finding in Stratum H-1 is that of several large mammoth bones with small depressions caused by the impact of something hard and/or sharp. Both a pelvis (hip) fragment and a cervical vertebra (spinal bone from neck) had apparent dents that Bement believes resulted from these large bones being used as anvils during butchering. The opposite face of the vertebra also had numerous small triangular depressions seemingly caused "by pressing a sharp edge into a soft material." These could have been caused by small angular limestone spalls upon which the bone was lying if a strong force was applied to the opposite face.

Finally, there is the repeated pattern of the occurrence of large limestone blocks amid the bones in direct association with splintered and broken long bones. This pattern has been documented in the three major Bone Bed 1 layers as well as in Bone Bed 2 and Bone Bed 3. Bement argues that these are butcher blocks or anvils where long bones were broken to extract marrow and upon which other bones were laid during the butchering.

In summary, while much of this evidence is circumstantial and subject to alternative explanation, collectively the various patterns just described led Bement to tentatively accept the idea that humans were the major predator responsible for the accumulation of the bone layers in Bone Bed 1. To explain how the animals were killed, Bement offered the following Natural Trap hypothesis:

So, after reading all this and seeing some of the evidence, who do you think was the main predator responsible for the Bone Bed 1 accumulations, (hu)man or beast? As far as most archeologists are concerned, the question is still open unless and until a smoking gun can be found.

Unit 4: Human Impact, Activity, and the Survival of Bison

LESSON 1: Bison Protection and Conservation

Objective: Students will discover the trajectory of bison conservation from the initial efforts in the late 1800s to the present.

Estimated Time: 2-3 class periods with time required outside of class for students to work on the brochure assignment.

Students will understand: The concept of endangered and extinct species, what efforts were done to minimize human impacts in the past, and what is currently being done to minimize human impact on the bison eco-niche in the present.

Students will be able to: Design and create a brochure about bison conservation, synthesizing all information learned in this module (and the previous ones if applicable) to formulate an argument for the need of bison conservation.

Essential Question(s): What efforts were made early on to protect bison from outright extinction? What efforts are currently being made toward bison protection, conservation, and restoration?

Prior Knowledge (if any): Previous lesson modules are not necessary, however, they would provide a more robust and comprehensive background for this assignment

Students Will Need: Paper for the brochure, internet connection, examples of local tri-fold brochures to use as a reference.

Handouts: (1) Handout 1: *The Great Buffalo Saga* Documentary Worksheet, (2) Handout 2: Bison Conservation Area Worksheet (to be filled out during the recommended field trip or guest speaker presentation if possible), (3) Handout 3: Bison Fact Sheet (4) Handout 4: Bison Conservation Brochure Template, (5) Handout 5: Resources for Students

Readings: (1) *The Buffalo and the Indians* and (2) Buffalo Field Campaign

Key Terms: Conservatory, Endangered Species, Extinct, Eco-niche, Human Predation, Natural Resources, Human Pressure, Environment, Over-hunting

National Science Standards: Earth and Human Activity

MS-ESS3-3: Apply Scientific Principles to design a method for monitoring and minimizing human impact on the environment.
MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Disciplinary Core Ideas: ESS3.C: Human Impacts on Earth Systems
Crosscutting Concepts: Patterns, Cause and Effect

Lesson Outline: Bison Conservation Brochure and Presentation

Part 1: Background Film and Presentation

1. Films and Film Worksheets
    a. Students will watch *The Great Buffalo Saga* Documentary, approx. 56 min., showing the bison revival and conservation efforts from the late 1800s onward, film worksheet included with this module. The Great Buffalo Saga is available to watch online at: http://www.nfb.ca/film/great_buffalo_saga
    b. They will fill out **Handout 1: *The Great Buffalo Saga* Documentary Worksheet** while watching the documentary.
2. Upon completion of the film, the teacher will present a short PowerPoint (included in this module) reviewing some key points on bison conservation and restoration. Students should be told to take notes as the teacher presents the content to be used later in the module. Included in the lesson module PowerPoint are the following:
    a. What has been done in the past to halt illegal poaching and bison extinction
    b. Yellowstone National Park as a conservation area for bison
    c. Difficulties and challenges faced by bison conservationists and restorationists
    d. Embedded YouTube Videos in the PowerPoint of bison restoration efforts:
        i. If the embedded video does not work, the film clip *Home at Last: Journey of the Bison* can be found at*:* https://www.youtube.com/watch?v=hNkOWYm9Tbc#t=186
        ii. If the embedded video does not work, the film clip *Iinnii Initiative: The Return of the Buffalo* can be found at https://www.youtube.com/watch?v=6LJfPMoGMAg#t=20
        iii. If the embedded video does not work, the film clip *Restoring Bison* can be found at https://www.youtube.com/watch?v=hlpHJLcmK2o

NOTE: Videos can also be found at http://www.conservemontana.org/content/restore-wild-bison-to-montana/cnmBA7C623F212912AB9

Note: the PowerPoint content has been taken in large part from:

    e. *The Buffalo and the Indians*, pp. 59-61 (bison conservation efforts) and pp. 63-78 (Living in the Present and the Future)
    f. *Buffalo Field Campaign*: http://www.buffalofieldcampaign.org/actnow/solutions.html
    g. *Restoring the Thunder: Bison Conservation in Great Plains National Parks*: A look at the past, present, and future of bison conservation in the Great Plains: http://www.nps.gov/badl/naturescience/bison-conservation.htm

3. If previous Science Unit modules were not utilizes, hand out the **Handout 3: Bison Fact Sheet** to students to provide more information.

Part 2: Field Trip or Guest Expert (if Possible)

1. To be able to experience what conservation strategies are like, students will go on a Field Trip to a bison conservation area. If that is not possible a guest speaker and bison expert can be invited to the classroom to talk to students.
2. Students will record their visit to the bison conservation site on the worksheet provided (**Handout 2: Bison Conservation Area Worksheet**).

Part 3: Tri-Fold Brochure

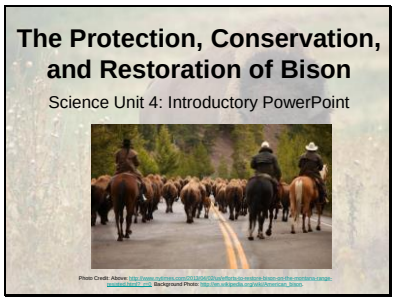
1. Teacher can review with students the qualities of what makes an effective brochure.
2. Students will use their notes, examples of the tri-fold brochures from local organizations, information from the documentary, lecture, and field trip to design a tri-folded brochure of a hypothetical bison conservatory in which they will list:
    b. The negative and positive impacts caused by humans upon the bison ecosystem
    c. Address how human population pressures and consumption of natural resources has adversely impacted bison over time
    d. Promote the bison conservatory to counteract adverse impacts to the bison ecosystem.
        i. Describe why it is necessary and defend the position
        ii. Briefly explain the history of bison
        iii. How it minimizes human impact upon the species
        iv. What aspects of the conservatory are sustainable and why is it effective
    e. See example of brochure provided (**Handout 4: Bison Conservation Brochure Template**, back and front side) and hand it out as a template for students to follow.
    f. Give students **Handout 5: Resources for Students** which is full of links to websites about bison conservation to give students ideas for their hypothetical bison conservation plan and brochure.
3. Supplementary readings and resources are likely needed. Therefore, please provide the following links to students:
    a. A Vision for 21st Century Bison Conservation in the Midwest Region: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
    b. Bison Conservation video: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
    c. *Buffalo Field Campaign*: http://www.buffalofieldcampaign.org/actnow/solutions.html
    d. *The American Bison Society*: http://www.wcs.org/saving-wildlife/hoofed-mammals/bison/the-american-bison-society.aspx

4. As an optional completion assessment, students can write a 1-2 page essay answering the essential questions listed in Unit 4: What efforts were made early on to protect bison from outright extinction? What efforts are currently being made toward bison protection, conservation, and restoration?

Teacher's PowerPoint Guide

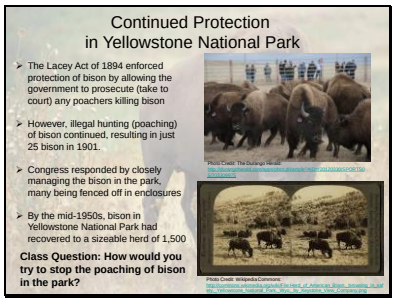
SLIDES | **NOTES**

Slide 1



Slide 2

Slide 3



Slide 4

Bison Management: Groups and Organizations Currently Managing Bison

- Native American Tribes
- National and State Parks
- Wildlife Preserves
- Private Ranches

Map of historic bison range and current herd locations

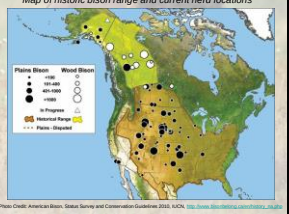


Photo Credit: American Bison. Status Survey and Conservation Guidelines 2010. IUCN. http://www.fbbonlinetrip.com/history_ecology

Slide 5

Challenges and Concerns with Bison Conservation and Restoration

- **Disease:** A major management concern, particularly *brucellosis* (an infection that causes still-born calves)
- **Overpopulation:** Concerns for environmental and habitat quality led to reducing the bison herd
- **Over-Grazing:** Has prompted some park managers to reduce the bison herd size through capture or shooting

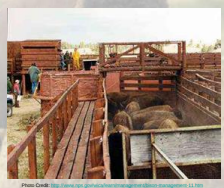


Photo Credit: http://www.nps.gov/ncrc/learn/management/bison-management-11.htm

Slide 6

Wood bison restoration in Canada

Photo Credit: https://www.slave-lake.ab.ca/2015/conservation-of-wood-bison/

Slide 7

The Return of Bison to the Tribes

- Arikara, Mandan, and Hidatsa have received over 900 bison
- Intertribal Bison Cooperative has helped in the transportation of bison to various tribes
- Today, more than 50 tribes have bison herds
- Some tribes are also attempting to manage herds more like wildlife and less like livestock

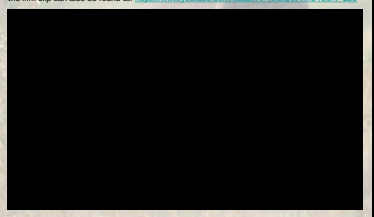
Photo Credit: http://www.usatoday30.usatoday.com/news/nation/2008-04-04-bison-reintroduction_N.htm?csp=34&POE=click-refer

Class Question:
What differences in practice might there be between Wildlife Management and Livestock Management?

Slide 8

Efforts in Bison Restoration in Montana

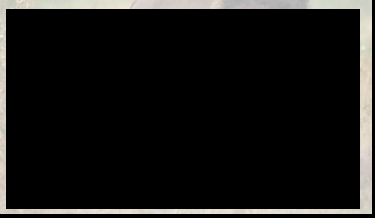
Home at Last: Journey of the Bison: If unable to view the embedded YouTube Video, the film clip can also be found at: https://www.youtube.com/watch?v=hNkCWYrn9Tbc#t=186



Slide 9

Efforts in Bison Restoration in Montana

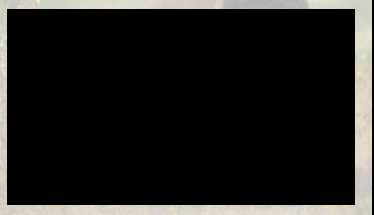
Iinnii Initiative: Return of the Buffalo: If unable to view the embedded YouTube Video, the film clip can also be found at: https://www.youtube.com/watch?v=6LJfPMoGMAg#t=20



Slide 10

Efforts in Bison Restoration in Montana

Restoring Bison: If unable to view the embedded YouTube Video, the film clip can also be found at: https://www.youtube.com/watch?v=hlpHJLcmK2o



Slide 11

Brochure Assignment

Class Question: After watching the various film clips and *The Great Buffalo Saga,* how have bison been conserved and restored?

- For your brochure assignment, think about these different bison conservation strategies. Then, pick one of these conservation strategies
- For example, some strategies presented in the films were (1) fenced protected areas and managed as wildlife, (2) bison ranches and managed as livestock, (3) national or state parks, (4) Native American herds
- Once you have selected the type of strategy you will use for your hypothetical (pretend) conservation area, design a brochure advertising your conservation area:
  - How big is it?
  - Where is it?
  - How many bison will there be?
  - Can there be visitors/tourists?
  - What will you call it?
  - How will you manage the number of bison?
  - Will bison be treated as livestock or as wildlife?

Handout 1: *The Great Buffalo Saga* Documentary Worksheet

What do you think you will see in this documentary? List three concepts or ideas you might expect to see based on the title of the film and the introduction given in class. AFTER the film, list three new things you learned from the film:

Concepts/Info You Hope to Learn	New Information You Learned
1.	1.
2.	2.
3.	3.

Section 2:

In the story of the revival of bison in Canada, how did Samuel Walking Coyote help save and conserve bison?
Describe the physical differences between Wood Bison and Plains Bison presented in the film (provide two examples of each):
At the end of the film, several First Nation indigenous speakers gave their perspective on bison conservation. Name one thing they said?
What was the central message(s) of the documentary? (use a complete sentence)
Describe 2 things about bison conservation practices mentioned in the film: 1. 2.

TEACHER GUIDE

Handout 1: *The Great Buffalo Saga* Documentary Worksheet

What do you think you will see in this documentary? List three concepts or ideas you might expect to see based on the title of the film and the introduction given in class. AFTER the film, list three new things you learned from the film:

Concepts/Info You Hope to Learn	New Information You Learned
1. *Answers will vary*	1. *Answers will vary*
2.	2.
3.	3.

Section 2:

In the story of the revival of bison in Canada, how did Samuel Walking Coyote help save and conserve bison? *Story begins in the hills of the Montana territory, where Walking Coyote and his wife captured anywhere from 3-8 bison calves by first getting them familiar with the scent of humans. He then trekked them 250 miles across the prairie, and brought them home as a peace offering.*
Describe the physical differences between Wood Bison and Plains Bison presented in the film (provide two examples of each):: *WOOD BISON: Taller, narrower, 20% larger than the Plains Bison, tall narrow hump, square beard if any, cape not clearly marked. PLAINS BISON: low slung hind quarters, clearly marked cape, heavy chaps behind back legs, long beard, low hump, head is close to the body, and the neck is short in comparison to Wood Bison.*
At the end of the film, several First Nation indigenous speakers gave their perspective on bison conservation. Name one thing they said? *It is a very happy moment since many first nations had not seen wild buffalo (or bison) in a very long time. It is also a very important moment because the natural habitat is slowly decreasing, so hopefully the buffalo will be able to breed and become plentiful in this conservation area.*
What was the central message(s) of the documentary? (Use a complete sentence) *By the late 1800s the free-ranging buffalo of the western plains of North America and Canada were almost extinct. This documentary relates the story of the buffalo's revival through early conservation efforts made by Indians as well as settlers. Overall, it is not only a story of survival, but of perseverance as conservationist groups actively work to create protected areas for the continuation of Plains and Wood bison.*
Describe 2 things about bison conservation practices mentioned in the film: 1. *Possible Answer: Successful conservation requires expert handling and a great deal of knowledge about bison behavior.* 2. *Possible Answer: Reintroducing bison back into the wild is slow and difficult. So far, only 1 wood bison herd has been reestablished back into the wild north of Great Slave Lake. Until 3 herds have been transplanted, the wood bison will continue to be defined as an endangered animal. More conservation is still clearly needed to actively protect and help the survival of this incredible animal.*

Handout 2: Bison Conservation Area Worksheet

Name_____ Date_____

What is the name of the bison conservation area? What state is it located in? How big is the area (number of sq. acres, miles, etc.?

_____
_____
_____

What are the goals of the bison conservation area?

_____
_____
_____
_____

What strategies or activities do they use to accomplish those goals listed above?

_____
_____
_____
_____

What are some of the management challenges the bison conservation area has faced since it was started?

_____
_____
_____
_____

How does it receive funding to continue? (Is funding a challenge?)

_____
_____

What activities does the bison conservation area do to try to raise awareness about bison, specifically the need for the protection of bison?

_____
_____
_____

Handout 3: Bison Fact Sheet

Fast Facts:
Height: 6-6.5 feet at the shoulder
Length: 10-12.5 feet
Weight: 900-2,000 lbs. Males are larger than females.
Lifespan: 18-22 years in the wild; over 30 years in captivity.
Mating Season: June-September, peak activity in July-August
Gestation: 270-285 days. Calf is born April-May.
Litter size: 1 calf

© Midori Layzell

Millions of bison once thundered across North America. These massive animals, characterized by their long, shaggy brown coats, have poor eyesight but very good hearing and an excellent sense of smell.

Historically, the American bison played an essential role in shaping the ecology of the Great Plains. They graze heavily on native grasses and disturb the soil with their hooves, allowing many plant and animal species to flourish. Prairie dogs prefer areas grazed by bison where the grass is short so they can keep a lookout for hungry predators, and wolves once relied on bison herds as a major food source. Today, wild bison are making a small comeback in a few scattered places, but they need more room to roam.

Diet

Bison mainly eat grasses and sedges which are both very plentiful foods on the Great Plains. Bison have adapted to eat grass because it is so plentiful, especially during the spring and summer months when the bulls need it before mating and the calves need it to grow strong before winter. With the snow covering the ground in the winter, bison's massive, "snow-plow" like heads have adapted so they can move the snow and get at the winter grasses below.

Population

The trails carved by animals like bison and deer in their seasonal migrations formed some of the earliest traceable paths into the American wilderness, and were followed by Native Americans, explorers and pioneers.

An estimated 20 to 30 million bison once dominated the North American landscape from the Appalachians to the Rockies, from the Gulf Coast to Alaska. Habitat loss and unregulated shooting reduced the population to just 1,091 by 1889. Today, approximately 500,000 bison live across North America. However, most of these are not pure wild bison, but have been cross-bred with cattle in the past, and are semi-domesticated after being raised as livestock

for many generations on ranches. Fewer than 30,000 wild bison are in conservation herds and fewer than 5,000 are unfenced and disease-free.

Range & Habitat (where they live)

Though bison once roamed across much of North America, today they are "ecologically extinct" as a wild species throughout most of their historic range, except for a few national parks and other small wildlife areas. Yellowstone National Park has the largest population of wild plains bison (about 4,000), and Wood Buffalo National Park has the largest population of wild wood bison (about 10,000). With help from Defenders, two small herds of pure, wild Yellowstone bison were recently reintroduced onto two Indian Reservations.

Behavior

A bison's thick fur offers great protection against the harsh elements of the American plains. Their winter coat is so thick and well insulated that snow can cover their backs without melting. Known for roaming great distances, bison move continuously as they eat. The females, or cows, lead family groups. Bulls remain solitary or in small groups for most of the year, but rejoin the group during mating season.

Bison are adapted to the extreme weather conditions of the Great Plains, from summer heat to winter cold and blizzards. In winter, bison can dig through deep snow with their heads to reach the vegetation below. Bison often rub, roll and wallow. Wallowing creates a saucer-like depression in the earth called a wallow. These wallows are dust bowls without any vegetation.

Reproduction

Bulls and cows do not mingle until breeding season which happens in the late summer. This is called "rutting". Dominant bulls "tend" to cows, paying attention only to the cow and sometimes not even eating for fear the cow will leave! The bull will follow the cow around until the cow chooses to mate. During this period, the bull blocks the cow's vision so that she may not see other competing bulls, and bellows at males striving for the cow's attention.

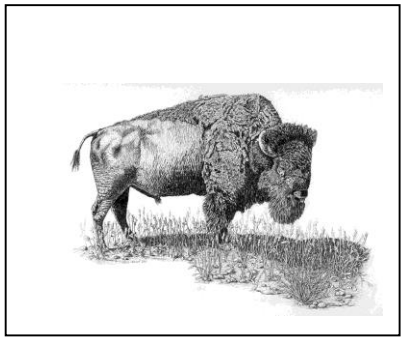
Mating or rutting happens in late summer so that the calves will be born in the spring, giving the calves plenty of time to feed on the spring and summer grass to become big and strong before the arrival of the cold winter. During the spring and summer, the bigger herds also protect the calves from predators like wolves.

Calves have the ability to run just hours after birth, an important survival adaptation when the herd is continually moving or is targeted by predators like wolves. Wolves often target young calves. Thus, there is a big need for calves to be able to run soon after birth!

Handout 4 (Inside): Bison Conservation Brochure Example Template

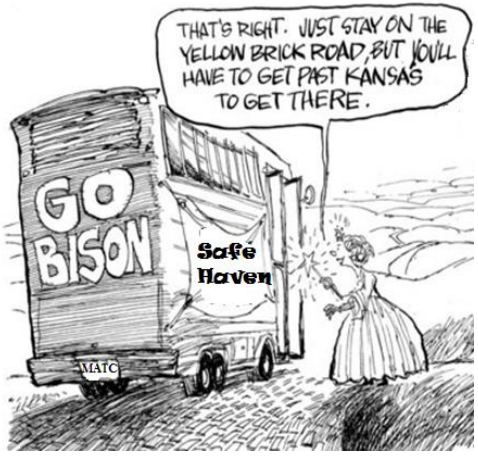
(1st inside section)

What is a bison? What is the difference between buffalo and bison? How many species of bison are there? Where do they live currently? Where did they live in the past? Give some interesting facts about bison. Most people don't know much about bison, so here is the space to tell them!

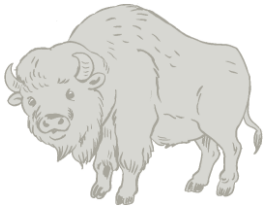


(2nd inside section)

Once you've hooked the reader with your interesting introduction and info about bison, now tell them what a bison conservation area is? This shouldn't be too wordy, yet it should still give a lot of specifics about your specific bison conservation effort and plan. Try to include a picture, infographic, or other image, drawn or not.



(3rd inside section)

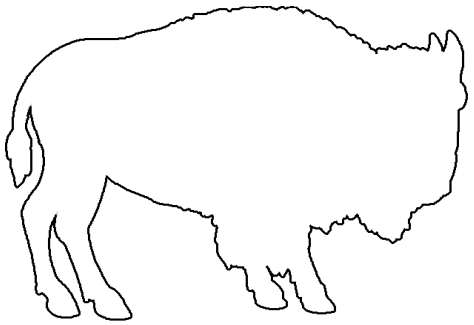


This is where you can talk about the **History**, the current **Laws**, and **Main Goals** of your Bison Conservation Effort. What has been done so far? Has it been enough? What does *your* bison conservation area accomplish? Are you presenting any new ideas? This is the spot to really sell the need and reason for why the bison conservation area should be done in the first place. Remember to be creative and have fun with it, but also make sure to give some good points (continue onto next flap)

Handout 4 (Outside): Bison Conservation Brochure Example Template

(backside flap)

(continued from inside section) Continue to describe your hypothetical bison conservation area. What features, landscapes, facilities are located in it? How big is it? Describe the general design. Don't be afraid to be original! Just because it hasn't been done before doesn't mean it shouldn't be done! Think about how the bison are protected? Is it tourist friendly and available to the public or is it private, very remote, and largely inaccessible? If you are able to, create a little map of your imagined bison conservation area below.



(back of brochure)

Contact information: where do you plan to have the bison conservation area? How would people get in contact with those running it? Is there a website to locate it? Have fun creating imaginary contact info!

Here is the space for the last few bullet points to really hit your bison conservation plan home to the readers of the brochure.

- Sum up the main points of the brochure
- Give a reason for people to donate money
- Are there any websites or organizations where they can learn more?

(front of the brochure)

Title of the Brochure

In this section, include a graphic or an image that catches the attention of the targeted audience.

Introductory Paragraph: What is the brochure about? Why should we care? Make your brochure really **stand out** and make it **FLASHY**!

Handout 5: Resources for Students

1. A Vision for 21st Century Bison Conservation in the Midwest Region: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
2. Bison Conservation video: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
3. *Buffalo Field Campaign*: http://www.buffalofieldcampaign.org/actnow/solutions.html
4. *The American Bison Society*: http://www.wcs.org/saving-wildlife/hoofed-mammals/bison/the-american-bison-society.aspx
5. Wildlife Conservation Society: http://www.wcs.org/saving-wildlife/hoofed-mammals/bison.aspx
6. Bison Conservation Initiative: http://www.nature.nps.gov/biology/documents/Bison_Genetics_Report.pdf
7. National Bison Range: m http://www.fws.gov/refuge/National_Bison_Range/about.html
8. Yellowstone: http://www.greater-yellowstone.com/animals/American-Bison-buffalo.html

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Handout 5: Resources for Students

1. A Vision for 21st Century Bison Conservation in the Midwest Region: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
2. Bison Conservation video: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
3. *Buffalo Field Campaign*: http://www.buffalofieldcampaign.org/actnow/solutions.html
4. *The American Bison Society*: http://www.wcs.org/saving-wildlife/hoofed-mammals/bison/the-american-bison-society.aspx
5. Wildlife Conservation Society: http://www.wcs.org/saving-wildlife/hoofed-mammals/bison.aspx
6. Bison Conservation Initiative: http://www.nature.nps.gov/biology/documents/Bison_Genetics_Report.pdf
7. National Bison Range: http://www.fws.gov/refuge/National_Bison_Range/about.html
8. Yellowstone: http://www.greater-yellowstone.com/animals/American-Bison-buffalo.html

Bison Curriculum Project

LANGUAGE ARTS MODULE ON THE SIGNIFICANCE OF BISON

UNIT 1: Discovering Bison Through Narration and Arts

LESSON 1: Bison and Ritual in Native Culture

Objective: Students will learn about the significance of bison in the ritual practices of native peoples. Utilizing this information, students are assigned to design an 8-10 page story book with images and /or drawn pictures about the oral histories, historical records, stories, music, art, ceremonies and/or rituals of bison within native culture. The narrative piece serves to synthesize what students learned about native ritual and storytelling in a visual and textual manner. The students can then present on their work. Several lesson options for presentations are suggested below:

Lesson Options for Teachers:

- Option 1—This option requires students to submit their work to a younger audience (ideally a younger grade school class) who are each given one story book to read, analyze and "grade" (i.e. give suggestions) to the student author.
- Option 2—This option is largely the same, however adding an oral presentation. The student author will read and present his or her work to the younger grade student or the entire class. Comments and suggestions will similarly be given by the younger student or class.
- Option 3—This option allows for students to create some other narrative art piece rather than a book. The textual narrative content still needs to be provided in some way (even if it is just a separate piece of paper), but this option allows for the student to not be tied to the western-centric narrative format of a book. The two presentation options suggested above can be combined with this 3rd option.

Students will understand: the significance of bison among the various Native tribes in Montana. Specifically, students will gain a broader understanding of the oral tales and stories, music, art, ceremonies, and various rituals that involve bison.

Students will be able to: to synthesize and express their perspective and understanding on the significance of bison among the native peoples in Montana through the creation of an 8-10 page story book that can then be used to teach a younger elementary grade class.

Prior Knowledge: No prior knowledge is necessary for this module.

Students Will Need: Paper, stapler, arts and crafts supplies like colored pencils and crayons, glue, construction paper, magazines containing a variety of assignment appropriate pictures (i.e. *National Geographic*, *Wildlife*, etc.), and an internet connection with ability to print photos. A suggested storybook template showcasing 1 page is provided for student inspiration has been provided.

Handouts/Readings: (1) *The Buffalo and the Indians*, (2) Handout 1: Bison Fact Sheet (2) Handout 2: Sources for Students. (All these readings are available online, the URLs have been provided in the lesson outline).

Documentaries/Film Clips: Short 5-10 minute YouTube clips have been suggested: *Elder Stories of Buffalo Hunting*, a Head-Smashed-In documentary sequence.

Key Terms: bison vs. buffalo, ritual, ceremony, oral history, medicine lodge, bundles

Common Core Language Arts Standards:

Found at: http://www.corestandards.org/ELA-Literacy/

(1) Craft and Structure
(2) Integration of Knowledge and Ideas
(3) Production and Distribution of Writing
(4) Research to Build and Produce Knowledge

Lesson Outline:

Part 1: Introduction to native ritual and ceremony about bison

A. Background
   1. Give students **Handout 1: Bison Facts Sheet**, can be also found at: http://www.defenders.org/bison/basic-facts
   2. Readings from *The Buffalo and the Indians*, chapter 6, pp. 63-78

B. Possible sources for students, pass out **Handout 2: Sources for Students**, designed to be cut in half to conserve paper. Handout includes:
   1. Short story about the origins of the Buffalo Dance: http://www.indians.org/welker/buffalo2.htm
   2. *Elder Stories of Buffalo Hunting, a Head-Smashed-In Documentary sequence*: https://www.youtube.com/watch?v=8bjY4xvMNYY&index=16&list=PL9046FD4FDB1FA786
   3. Historical account of a white bison named "Big Medicine": http://mhs.mt.gov/museum/permex.asp (Scroll to the bottom of the page)
   4. Historical account of bison: http://www.storyofthebison.com/index.htm
   5. If possible, the module recommends the option of a field trip to hear a native speaker or have a guest Native American speaker (or other appropriately knowledgeable presenter) come to the class to present on the significance and ritualized nature bison hold in the community.

Part 2: Assignment: 8-10 Page Story Books (or other narrative piece)

A. Storyboard
   1. Students will take one narrative element they learned during the beginning sequence of the module and create rough draft storyboard that will be adapted into the final product. The stories used can be inspired from what was presented

in the module, but certainly not limited to it. Possibilities include:

a. A historical account about bison
b. Oral tradition, story, or tale about bison
c. Native bison ritual or ceremony
d. Current news article or event related to bison

2. Upon the completion of student storyboards, the students will submit their storyboard for edits and suggestions from the teacher.

B. Story Book (or other narrative piece)

1. After teacher approval, students will design their 8-10 page story books (or narrative art piece if this option is deemed acceptable by the teacher). Each page should have a picture depicting the scene with some text describing the illustrated scene. (Note: students can be as creative as they want in depicting each picture scene from drawings to construction paper cutouts to paintings).
2. Utilizing the art and craft supplies available, students will take 5 blank pages (ideally 8x11 copy paper), fold them in half and staple all of them together along the creased edge to create a blank book.
3. Once stapled, students can then begin transcribing their storyboard ideas onto their story book pages. Note that this book assignment is very open ended, however accurate and factual depictions of what they learned in class for both the textual content and in the pictures created should be stressed.
4. Make sure the class has fun and encourage creativity!

<u>Part 3: Presentation of the Story Book or Narrative Piece</u>

A. Finding a younger grade school class if available

1. Once the story books (or other narrative art piece) is finished, there are several presentation options the teacher leading the lesson can choose from. (These were listed above as well in the lesson summary above). They are:

a. Option 1— This option requires students to submit their work to a younger audience (perhaps a younger grade school class) who are each given one picture book to read, analyze and "grade" (i.e., give suggestions) to the student author.
b. Option 2— This option is largely the same, however adding an oral presentation. The student author will read and present his or her work to the younger grade student or that whole class. Comments and suggestions will similarly be given by the younger student or class.

HANDOUT 1: BISON FACT SHEET #1
ADAPTED FROM http://www.defenders.org/bison/basic-facts

Fast Facts:
Height: 6-6.5 feet at the shoulder
Length: 10-12.5 feet
Weight: 900-2,000 lbs. Males are larger than females.
Lifespan: 18-22 years in the wild; over 30 years in captivity.
Mating Season: June-September, peak activity in July-August
Gestation: 270-285 days. Calf is born April-May.
Litter size: 1 calf

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Millions of bison once thundered across North America. These massive animals, characterized by their long, shaggy brown coats, have poor eyesight but very good hearing and an excellent sense of smell.

Historically, the American bison played an essential role in shaping the ecology of the Great Plains. They graze heavily on native grasses and disturb the soil with their hooves, allowing many plant and animal species to flourish. Prairie dogs prefer areas grazed by bison where the grass is short so they can keep a lookout for hungry predators, and wolves once relied on bison herds as a major food source. Today, wild bison are making a small comeback in a few scattered places, but they need more room to roam.

Diet

Bison mainly eat grasses and sedges which are both very plentiful foods on the Great Plains which resulted in massive herds of bison. Bison have adapted to eat these grasses because it is so plentiful, especially during the spring and summer months when the grass is more nutritious. This is a very important time because the bulls need the nutritious grasses to bulk up before mating in the late summer and the calves need it to grow strong to prepare for the harsh winter. During the winter when grasses are less plentiful and snow covering the ground, bison have adapted their massive, “snow-plow” like heads and powerful neck muscles to move the snow and get at the sparse winter grasses below.

Population

An estimated 20 to 30 million bison once dominated the North American landscape from the Appalachians to the Rockies, from the Gulf Coast to Alaska. Habitat loss and unregulated shooting reduced the population to just 1,091 by 1889. Today, approximately 500,000 bison live across North America. However, most of these are not pure wild bison, but have been cross-bred with cattle in the past, and are semi-domesticated after being raised as livestock

for many generations on ranches. Fewer than 30,000 wild bison are in conservation herds and fewer than 5,000 are unfenced and disease-free.

Range & Habitat (where they live)

Though bison once roamed across much of North America, today they are “ecologically extinct” as a wild species throughout most of their historic range, except for a few national parks and other small wildlife areas. Yellowstone National Park has the largest population of wild plains bison (about 4,000), and Wood Buffalo National Park has the largest population of wild wood bison (about 10,000). With help from Defenders, two small herds of pure, wild Yellowstone bison were recently reintroduced onto two Indian Reservations.

Some Behaviors and Adaptations

A bison's thick fur offers great protection against the harsh elements of the American plains. Their thick hide helps to insulate them to conserve heat. This winter coat is so thick and well insulated that snow can cover their backs without melting because so little heat escapes! Known for roaming great distances, bison move continuously in order to get at fresh grasses to keep eating. The females, or cows, lead family groups during this continual movement. Bulls, however, remain solitary or in small groups for most of the year, rejoining the group during late spring and summer to prepare for rutting or mating season.

Bison also have a tendency to run if spooked. This behavior allows the herd to escape fast if predators (like wolves or humans) are threatening the bison. This behavioral tendency was utilized by Native American hunters (like the Blackfeet) in the past to get large bison herds to run away from the perceived danger, usually toward a cliff face (“bison jump”) or a corral.

Reproduction

Bulls and cows do not mingle until breeding season which happens in the late summer. This is called “rutting”. Dominant bulls “tend” to cows, paying attention only to the cow and sometimes not even eating for fear the cow will leave! The bull will follow the cow around until the cow chooses to mate. During this period, the bull blocks the cow’s vision so that she may not see other competing bulls, and bellows at males striving for the cow’s attention.

Mating or rutting happens in late summer so that the calves will be born in the spring, giving the calves plenty of time to feed on the nutritious spring and summer grass in order to become big and strong before the arrival of the cold winter. This timing in birth also allows for added protection with larger herds to protect the calves from predators like wolves.

Calves have the ability to run just hours after birth, an important survival adaptation when the herd is continually moving or is targeted by predators like wolves.

Handout 2: Sources for Students

1. Origins of the Buffalo Dance: http://www.indians.org/welker/buffalo2.htm

2. Elder Stories of Buffalo Hunting, a Head Smashed In Documentary sequence: https://www.youtube.com/watch?v=8bjY4xvMNYY&index=16&list=PL9046FD4FDB1FA786

3. Historical account of a white bison named "Big Medicine": http://mhs.mt.gov/museum/permex.asp (Scroll to the bottom of the page)

4. Historical account of bison: http://www.storyofthebison.com/index.htm

5. Buffalo tales and historical accounts: http://nationalhumanitiescenter.org/tserve/nattrans/ntecoindian/essays/buffalob.htm

6. Plains Indian Culture: http://whitewolve.com/native_americans/indexblok.plains.htm

7. Legend of the White Buffalo: http://www.in5d.com/white-bison-prophecy.html

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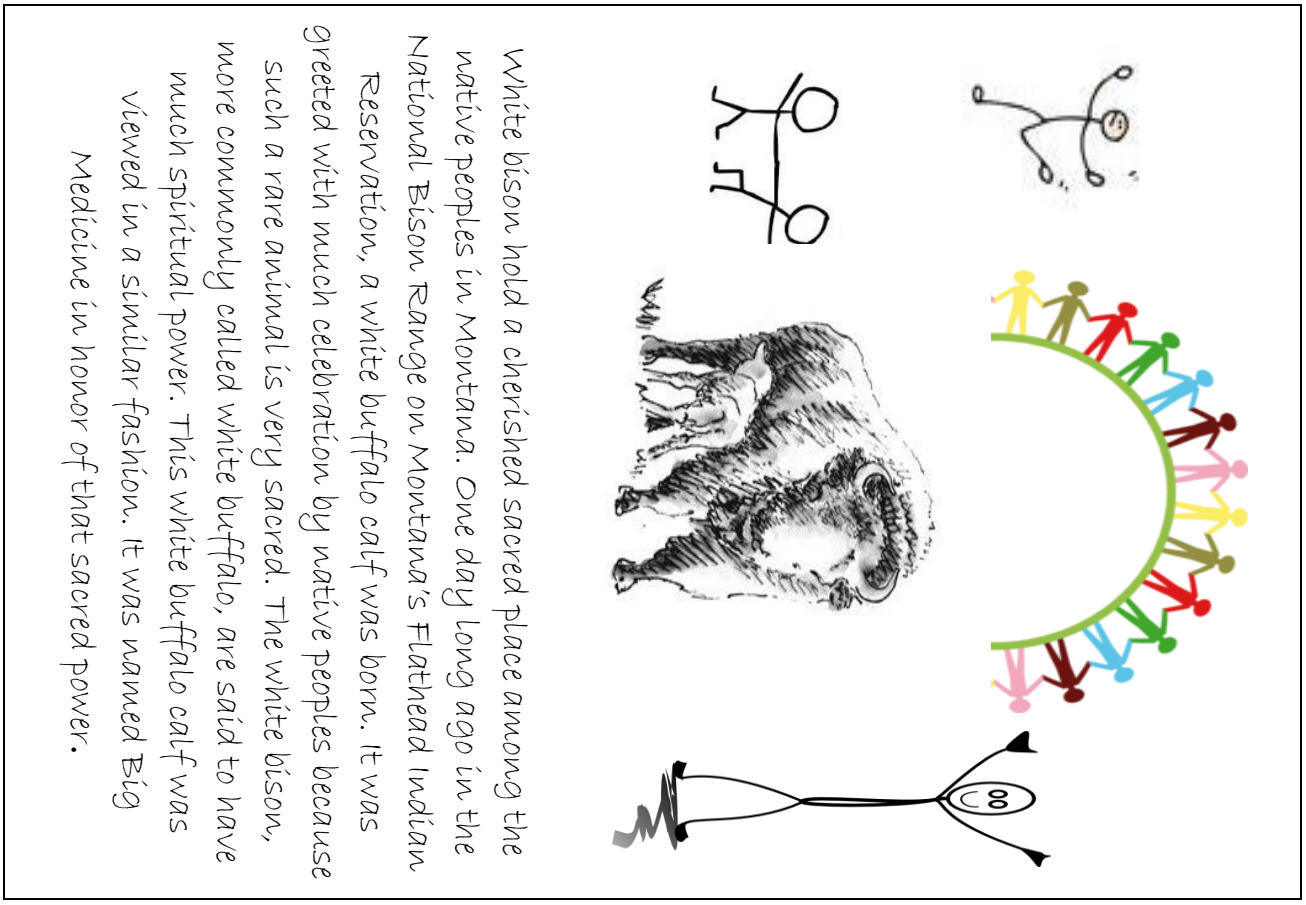
Picture and Story Book Example Page

The Story of a White Buffalo Born in Montana That Was Named Big Medicine

(NOTE: This story page example has been rotated to match the alignment of the students' picture books)



Students should design 8-10 pages similarly, including drawn, cut and pasted, and/or printed images along with a textual story element.

There are no restrictions to what the story is about other than relating to buffalo or bison. However, several potential native oral histories, historical documentations, and resources have been provided in Handout 2: Sources for Students

Most of all, this is a creative and fun assignment!

Evaluation Forms for Student Graders

NAME_____ BOOK TITLE_____

What was your favorite part of the book?

_____

_____

_____

_____

_____

_____

What parts of the story were unclear to you?

_____

_____

_____

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_____

_____

What things do you think would make the story better?

_____

_____

_____

_____

_____

_____

Do you have any other suggestions for the author?

_____

_____

_____

_____

Further Resources for Teachers

BISON:

Reading: http://www.nps.gov/badl/naturescience/upload/BisonVision.pdf
Bison Documentary: http://www.bison.tv/videos-bison-documentary-on-the-buffalo-%5BUo8CH3cGCGU%5D.cfm
Reading: http://www.texasbeyondhistory.net/bonfire/index.html
Fact Sheet: http://www.defenders.org/bison/basic-facts
Bison Osteology: http://lamar.colostate.edu/~lctodd/bison.htm
Great Buffalo Saga Documentary: https://www.nfb.ca/film/great_buffalo_saga
Cold Warriors Bison Documentary: http://www.youtube.com/watch?v=Zj82dImOwdw
Yellowstone Bison Reading: http://www.nps.gov/yell/learn/nature/bison.htm
Reading: http://animals.nationalgeographic.com/animals/mammals/american-bison/
Fun Facts for Kids: http://www.animalfactguide.com/animal-facts/american-bison/
Bison in Yellowstone Film Clip: https://www.youtube.com/watch?v=_XWL31_50R8
Facing the Storm: https://www.youtube.com/watch?v=_XWL31_50R8
The Buffalo War: http://www.pbs.org/buffalowar/
- **--Resources:** http://www.pbs.org/buffalowar/resources.html
- **--Lesson Modules:** http://www.pbs.org/buffalowar/guides.html

The Montana Experience: Stories from the Big Sky Country: The Return (2012): https://www.youtube.com/watch?v=kZ3HtWcXXbE&list=PLYSMxORqGlAkk3NI0Di8x5cLRw-t6wl-B&index=4
Bison Facts: http://www.bioexpedition.com/american-bison/
Bison Skeleton Image: http://photos.archeozoo.org/picture/2602-bison_bonasus/category/91-bovides_langen_bovidae_lang_langes_bovidos_lang_
Conserve Montana: Restore Wild Bison to Montana: http://www.conservemontana.org/content/restore-wild-bison-to-montana/cnmBA7C623F212912AB9

ARCHAEOLOGY:

Archaeology for Kids: http://idahoptv.org/dialogue4kids/season7/archaeology/facts.cfm
Archaeology for Kids: http://www.digonsite.com/
Introduction to Archaeology Video for Kids: https://www.youtube.com/watch?v=hSY6-bV0ATk
Archaeology Science for Kids: http://www.sciencekids.co.nz/sciencefacts/careers/archaeologist.html
Public Archaeology: http://www.saa.org/publicftp/public/resources/lessonplans.html
Beyond Artifacts: Teaching Archaeology in the Classroom (Lesson Modules): http://www.flpublicarchaeology.org/resources/BeyondArtifacts2011.pdf
Education: https://rcnnolly.files.wordpress.com/2013/11/ncss-handouts.pdf
Archaeological Educational Resources (A Comprehensive Bibliography): http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=10&ved=0CFgQFjAJ&url=http%3A%2F%2Fwww.nh.gov%2Fnhdhr%2Fprograms%2Fdocuments%2Farchaeological_edu_resources.doc&ei=ZCwTVau1CYqpNqfYg-gG&usg=AFQjCNGYFBSotCaLjo4VcCCNCHvprXrruw&sig2=9BfdJpwIQHXeLFWHQcD57w&bvm=bv.89217033,d.eXY