“BUCK-UP”

An educator’s guide to cervid species around the world

Version 1

2014

The mission of the Cervidae Taxon Advisory Group is to provide guidance and recommendations to North American institutions to promote responsible captive management of wild cervidae, moschidae and tragulidae species and support global activities and programs that enhance their survival in the wild.

Cervid TAG program leader: Tony Fisher, Minnesota Zoological Garden
Cervid TAG education advisor: Brian Ogle

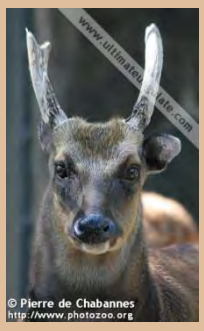
NOTE TO EDUCATORS

This curriculum guide is designed to introduce students, of various grade levels, to the diverse group of animals in the deer family. The guide was developed as a tool for educators of differing backgrounds, content areas, and specialties a way to provide their students with more knowledge in the area of conservation and the natural world. Additionally, it is our hopes that this guide will provide students with a look into a group of fascinating animals that we share our world with.

A variety of multidisciplinary activities are found throughout this guide, and are designed to promote performance in multiple content areas, while enhancing respect and reverence for all living organisms. Each specific activity outline will include appropriate grade levels, procedures, background information, and educator notes. These activities may be presented to students as written, adjusted down, or used as a base with room for enhancement by individual educators. Real-world applications of science and math are built into lessons so students can develop a deeper understanding. All activities are aligned to the National Science Standards, with a detailed breakdown offered at the end of the guide. Student worksheets have been created and are included in this workbook, as well as teacher instructions for each activity. There are some activities that require the student to develop their own worksheet or a data table to encourage the continued growth of the students. However, if you do need examples, or would like to create a worksheet for your class, examples are provided within the resources at the end of the workbook.

The lessons and activities presented are designed to be delivered in a full group setting. However, these activities may easily be broken down into smaller pieces used in a rotation or small group setting. This is ideal for educators in zoos wishing to utilize these activities for special events, public programming, or as part of your exhibit interpretation tool kit.

We hope that you and your students find this information beneficial in developing science, math, and language arts skills while learning about these fascinating creatures.



Beginning the Lessons

It is important for educators to gauge the current knowledge about a subject matter before beginning a themed lesson. This will allow you to effectively tailor the individual activities to match student ability, and focus on class interests if time allows. We recommend using one of the following two tools to assess student's knowledge. These tools will not only provide you with a base understanding of students' ability, but will also be an easy assessment tool for the end of the program. A base outline of two simple activities is listed below. On the next page, instructions for assessing student learning using these tools are provided.

K-W-L Charts

This tool is very simple in nature, and provides educators with a multitude of assessment possibilities. This should be done at the very start of the program, before any activities related to the curriculum is completed, as well as the very last activity of the program. To start, have students divide a piece of paper into three equal columns. Once the columns are created, have the students label the pieces. Reminder, students need to write their names on the paper! The first column will be labeled with a K, which stands for KNOW. In this column, students will list everything they know about a prompt that you provide. In this instance, the prompt will be DEER. In the middle column, the W will stand for WANT or WISH to know. Students should list everything they want to learn about DEER. Once this is completed, have students hand you their papers. You will hang onto these until the very end. Once you have completed all activities and curriculum components, pass the charts back to the students. Instruct them to complete the final column, which is L. L stands for LEARNED, and the students will write everything they learned about DEER in this final column. Once they have completed this column, have them give you the charts.

Graffiti Walls

This is a very simple tool for educators. At the very start of the program, place one large piece of paper in a place that is accessible to the students. Provide students with a marker and instruct them to write anything they know or think about a given prompt, which is written at the top of the paper. It is recommended for activities in this guide to use the word DEER. Give students several minutes to complete this task. Pick up the paper and place it in a safe place until the end of the program. Once you have completed at activities and curriculum pieces, place the blank side of the paper in area accessible to all students. Repeat the activity as before.

Assessing Student Learning

In order to demonstrate the effectiveness of any curriculum, it is important to demonstrate and provide evidence of student learning. A simple way of assessing student learning using either the K-W-L Chart or Graffiti Wall is provided below.

K-W-L Charts

Assessing Student Learning:

In order to document the evidence of student learning, compare the K column to that of the L column. For instance, you will be looking at the number of statements made in each column. Additionally, you should compare the number of correct statements to that of incorrect statements in each column. For example, are there more statements made in L compared to K? Is there an increased amount of correct statements provided?

Assessing Customer Satisfaction:

The students that participate in your programs are the number one customer you aim to satisfy, on varying levels. In order to examine if your programs are meeting the needs and wants of these customers, you can use the K-W-L chart as a preliminary measure. To do this, look at the statements made in the W column. You can compare these statements to those that directly relate in the L columns. The higher percentage of matching statements between W and L usually means the students are learning what they are interested in. Additionally, you can use the W column to compare with themes presented in the program. This will allow you to adjust future programs and develop programs that better match customer wants.

Graffiti Walls

The evaluation for a Graffiti Wall is very similar to that of the K-W-L chart. Compare the number of correct statements to those of incorrect statements for the pre and post measures. Additionally, explore that type of statements that are made by the participants. Statement types you may wish to explore include: Declarative, Exclamatory, and Imperative. It is important to note if the statement is a fact or opinion. You can take this one step further by noting if the statement is a general or vague statement compared to that of a specific or concise statement. For example, the statement “wolves are easier to train that bears” would be classified as a Exclamatory (opinion/specific). A statement “Golden eagles can live to be 60 years old” would be classified as a Declarative (fact/specific) statement. You should be able to see a change in statement types, moving from general to specific statements, as well as from opinions to facts.

Back to the Basics (...of deer biology that is)!

One of the most commonly recognized mammals in North America today is the deer. Many of us have seen them driving down the road, or even possibly in our backyards. However, have you ever stopped to think about what adaptations these unique animals possess? Additionally, have you ever stopped to think of how many different deer species there are around the world? Today, there are a recognized 17 genera and 41 species occurring throughout North America, South America, Eurasia and northern Africa; with introduced populations in Cuba, New Guinea, Australia and New Zealand.

Deer belong to the mammalian family known as *cervidae*, which is a sub-group of a set of animals known as **ungulates**. Today, Merriam-Webster defines ungluates as a "group of herbivorous vertebrates covered with hair and digits ending in a cornified sheath." Literally, "ungulate" refers to any animal with hooves - a hoof being an enlarged toenail. However, in practice, the use of the name "ungulate" has been inconsistent. While it was originally used to refer to the "true" ungulate, or the orders **Artiodactyla** (*hoof having an even number of well-developed digits*) and **Perissodactyla** (*hoof having an odd number of well-developed digits*), the word ungulate over time has expanded to seven different Mammalian orders . . . some of which have no hooves whatsoever! This broadening of the definition was based on presumed family relationships - relationships that recent advances have shown to be artificial.

The body weight is supported entirely on the ends of one, two or three digits clad in a hoof. A foot structure is comparable to a human walking on tip toes. A long stride length coupled with an increased number of strides promotes movement that is swift and energy efficient. Limb adaptations in other species allow flight, swimming, hopping, gliding, climbing, leaping and swinging hand over hand. Deer belong to the group referred to as Artiodactyla.

Foraging (*obtaining food*) not only includes the mechanical eating, but any behavior employed to search, recognize, and obtain food items. A feeding behavior should provide maximum energy gain with minimal energy expense and minimal risk of predation while foraging. Deer are herbivores that are designated by their dietary behavioral preference of browsing, or grazing. Deer digest their food utilizing a four-chambered stomach. Animals that complete this form of digestion are called **ruminants**. When these animals graze, chewed vegetation is swallowed and enters into the rumen. The rumen is the largest chamber in the stomach, and this is where food is broken down by microflora, and then formed into small, round clumps called cud. The animal will periodically return the cud to the mouth where it is re-chewed. Once the cud has been turned into a pulp, it then passes into the next stomach chamber. The order in which the food will travel through the digestive track is the rumen, then the reticulum, then the omasum, and finally into the abomasum. The abomasum is also known as the "true" or acidic stomach, and this is where traditional digestion occurs.

Because deer are commonly preyed upon by predators, they have several adaptations that allow them to survive. For example, being a ruminant, they are able to graze in open areas for a short period of time and can literally "dine and dash." Their eyes are placed on their heads so that they have great peripheral vision. It is believed that they have a vision field of almost 300 degrees! In addition, their eyes have a special membrane known as the tapetum lucidum, which is a shiny, blue-green colored membrane attached to the retina, which enhances their vision in low light. In order to hide from predators, deer are uniquely camouflaged to blend into their surrounding environment.

Most mammals develop some form of a social grouping. Individuals living within social groups tend to have an increased chance for survival, which is due to alertness of individuals and group defense against predators. Related females often form social units whereas the males either live alone or in bachelor groups. Social behavior is any kind of interaction between two or more animals, usually of the same species. Courtship, aggression, and cooperation are all examples.

Each species of deer display unique behaviors that allow them to effectively communicate with members of the herd, and that allow them to survive tough climate conditions. Vocalizations are not uncommon and deer have many, varied types of vocalizations. Different forms of vocalizations include grunts, bugles, bleats, and mews. Vocalizations are typically used for mother and calf communication, such as locating one another. Bugles in male elk are used to attract females and claim territory. Physical, or non-verbal, communication is essential for survival. In animals, it is not just about body language either! Many species of animals, including deer, use scent to communicate. Deer will use feces and urine to detect potential mates, increase social bonding, and to claim individual territories. Several different forms of body language are used for communication with other herd mates. Posturing may be used as an aggressive maneuver, to claim social status, or to warn off potential threats. White-tailed deer flash the base of their tail when alarmed, which alerts the herd and allows them to escape together.

Male deer are called stags, bucks, bulls or hart, depending on the species of deer. Female deer are called cows, does, or hinds.

Discussion Questions-

How does our digestive track differ from that of a deer?
Why would deer need to see in low light?
Can you name any animals that are called an ungulate, but do not have hooves?
What advantage is there to walking on the tips of your toes?

Predator or Prey?

In this activity students will use animal artifacts to compare physical adaptations for survival

Key Words: Predator, prey, anatomy

Objective/s:

*Analyze given objects, and interpret findings

*Develop scientific writing skills

Recommended grades: Grades 3 and up

Evaluation:

*Student developed report

*Discussion participation

Materials:

Skulls (deer, mountain lion or wolf, bear, and rodent)

Time Required: 30 minutes

Procedure:

1) Have students observe the given skulls and write down initial thoughts and findings. Encourage students to look at all parts of the skull
2) Using an educated inference, have students select which skull belongs to a predator (carnivore) and prey (herbivore). For older students, give them more options for skull groups. Examples may include: gnawer, ruminant, or omnivore.
3) Once students have made their choices to proper skull classification, instruct them to write a passage explaining their answers. Details should include observational findings supported by available resource materials.
4) Have a class discussion as to why they believe their answers are correct.

Discussion Questions-

What physical features of each skull lends itself to food consumption?

Are there any structures that support jaw muscles, which skull had a bigger zygomatic arch?

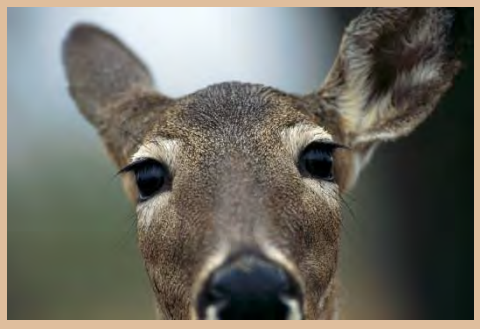
Behavior Sleuths

In this activity students will develop behavior observation charts, also known as ethograms, to record expressed animal behavior

Key Words: Ethogram, behavior

Objective/s:

*Record and analyze expressed behaviors
*Graph development and plotting
*Develop scientific writing skills



Recommended Grades: Grades 6 and up

Evaluation:

*Student developed graph
*Discussion participation

Materials:

Ethogram, writing utensil

Time Required: 45 minutes

Procedure:

1) Discuss potential behaviors. Complete research via sources, such as EthoSearch (http://www.ethosearch.org/)
2) Develop ethogram chart that will be used to record animal behaviors, or use the provided ethogram chart as a base. Be sure to research potential behaviors you may witness to complete the chart.
3) Visit your local zoo or wildlife sanctuary to observe a deer species. Spend 25 minutes recording behaviors that you see the animals expressing.
4) Once you return to the classroom, develop a graph that displays the different types of behaviors and/or the amount of time spent completing each behavior. This is called an activity budget. Create a chart that demonstrates the classroom data average.
5) Have students complete a simple summary comparing their individual ethogram data to the class set of data. To challenge older students, have them develop a lab report that includes data sets, analysis, and methods.

Student Ethogram

Date:

Animal Selected: _____

Now choose a new animal. Begin by listing all the behaviors you see the animals exhibiting in the first 5-10 min. Then transfer the common behaviors to your blank ethogram and begin timed observations.

Start Time: _____ End Time: _____

Observed Behaviors List:

SOLITARY BEHAVIORS	initial	2 min.	2 min.	2 min.	2 min.	2 min.	2 min.	2 min.
SOCIAL BEHAVIORS								
PUBLIC INTERACTIONS								

Behavior Sleuths – Student Worksheet

Define the following:

Ethology-

Ethogram-

Ethologist-

Enrichment-

Husbandry-

Behavioral Husbandry-

Conditioning-

Classical Conditioning-

Operant Conditioning-

You are hired on by the local zoo to develop a new enrichment plan for the animal collection. What are some factors you must consider as you begin to design the new enrichment plan?

Why do you think it is important to observe an animal's behavior in both the wild and a captive setting? List three different scenarios in which you think it is important to observe the behaviors. How would you apply this to a captive setting?

Are Deer Antelope?

There may be confusion regarding the differences between deer and antelope. Both are ungulates and both are ruminants. So, does that make a deer a type of antelope? The answer is no. They are more like distant cousins than exact relatives.

One of the prime examples that exist between deer and antelope is the presence of antlers as opposed to horns. Antlers are a temporary structure that grows seasonally. When antlers emerge they are covered in a substance called velvet. This velvet is essential in providing the antler with proper nutrition and blood supply for growth. Once the antler is fully grown, the velvet sheds and the bare antler remains. The antler is typically shed once the rut, or mating season, is completed. For most species this will occur in early winter; however, tropical deer species do not have a normal antler cycle and can shed and regrow new antlers any time of the year. Antlers are used to attract mates, defend against predators, and to battle other males for the right to breed. Typically, males will only grow antlers. However, as with most examples in nature, there is always an exception to the rule. For example, both male and female reindeer grow antlers.

Horns are a permanent structure that is seen at birth. The horn will continue to grow and develop throughout the animal's life span. These bony structures are hollow and connected directly to the skull. Once a horn is broken or lost, it will not regrow. In some species, both males and females will have noticeable horns. The pronghorn antelope, which is native to North America, sheds its horns annually. Because of this, it is placed into a separate family named antilocapridae, even though it is called an antelope.

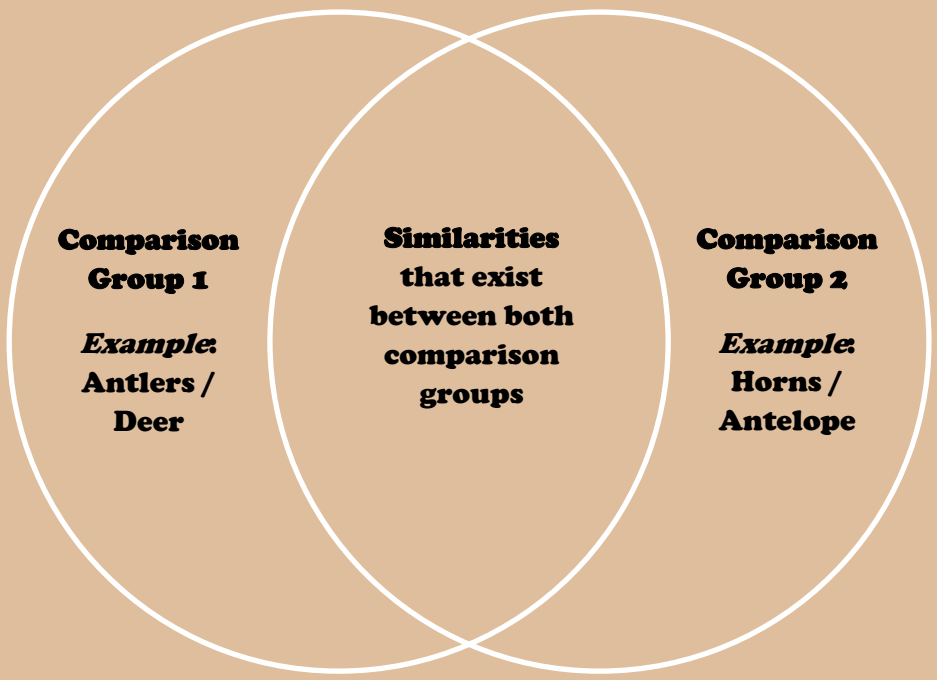
In addition to possessing antlers instead of horns, deer and antelope have distinctive ranges. Deer inhabit all continents, except Australia and Antarctica. Antelope are limited in origin, and are only found in Africa and some parts of Eurasia.

Diagraming the Differences

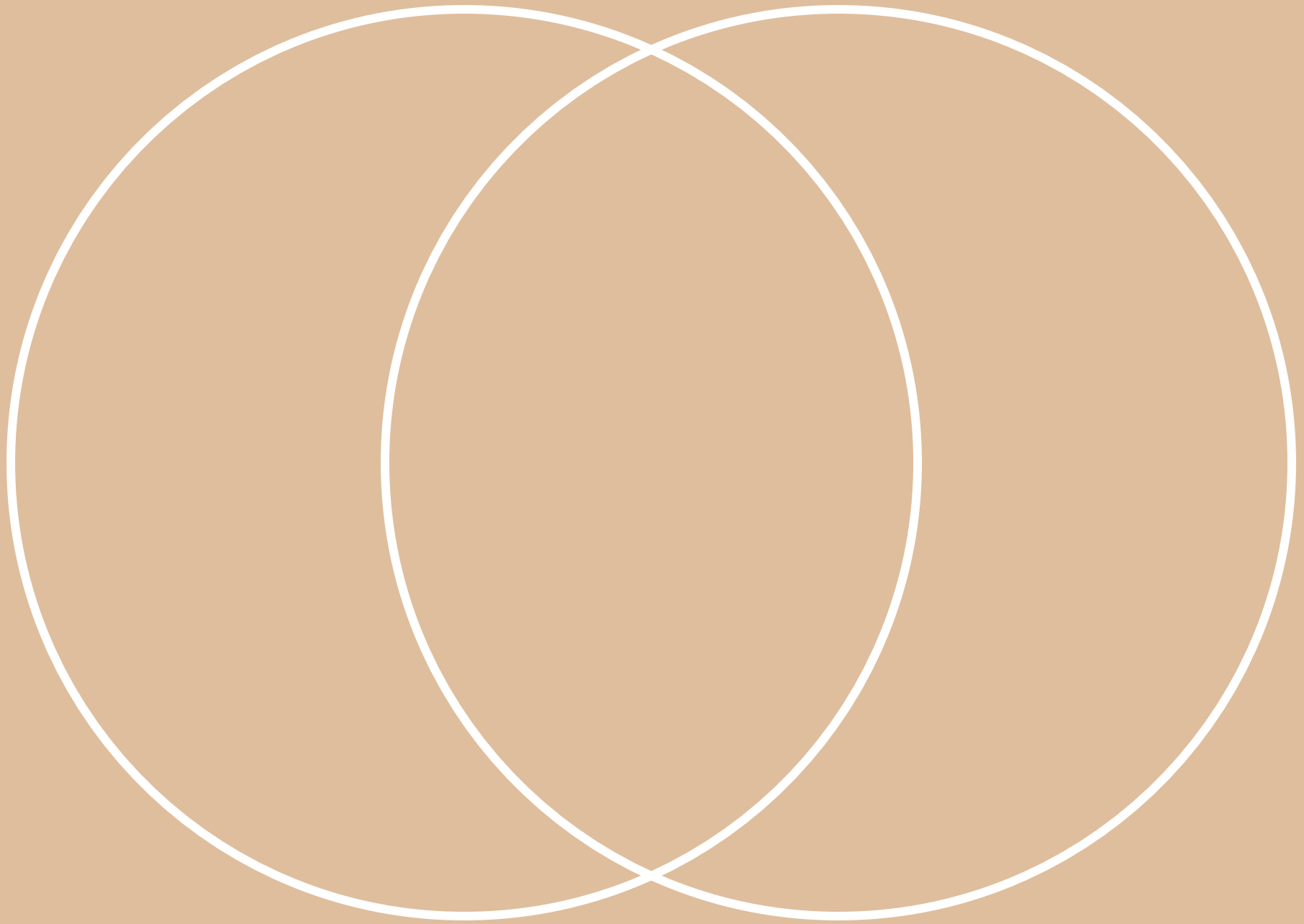
Key Words: Horns, antlers, Venn diagram
Objective/s:
*Use reading skills to correctly place information
Recommended Grades: Grades 5 and below
Evaluation:
*Student developed diagram
Materials:
Paper and writing utensil
Time Required: 15 minutes
Procedure:

1) Read the background information about horns and antlers to the class.
2) Have students create a list of characteristics that describe each structure.
3) From this list, have students fill in the provided student worksheet of the Venn Diagram.
4) For older students, you can take this once step further and create a chart that demonstrates the differences between deer and antelope overall.

Example Venn Diagram



Diagraming the Differences



Measuring Up!

This activity will help students to picture the differences in deer, while using measuring and observational skills

Key Words: antlers, proportion, deer

Objective/s:

*Practice math and measurements

*Understand the physical differences in deer species

Recommended Grades: Grades 4 and above

Evaluation:

*Participation in activity and discussion

Materials:

Masking tape, tool for measuring, antlers, bathroom scale, blank classroom wall

Time Required: 45 minutes

Procedure:

1) Have students research several of the species from the list provided in the guide to determine the physical size (height, length) of the largest and smallest deer species. Select varying species for comparison.
2) Once the physical sizes have been determined, use a blank wall and masking tape to create an outline of these deer species. This will allow students to make connections to physical size and the differences that exist within the deer family.
3) Once you have completed this, use a different part of the wall to create the size of the animal's head and the antlers. Create this at a level that is appropriate for your students. Have them stand in the middle (head) and compare their arm span to that of the span of the antlers. For some species, such as elk, you may want to compare height of the rack to that of the individual students.
4) If you have antlers available (moose, white-tail, elk), use the bathroom scale to weigh them. Record your observations of the weight. You may also measure to find the exact height and width of each. Compare how much a pair of antlers weighs in proportion of the animal's body weight.

Discussion Questions-

How much would your antlers have to weigh to be the same proportion as the ones measured?

How would you be able to carry that additional weight with you?

What physical adaptations would you need in order to support the weight?

Which animal had the heaviest set of antlers in comparison to body size?

Part of the Bigger Picture

All living organisms play a critical role within their habitat and ecosystem. Deer for example, keep vegetation under control through grazing and provide food to predators. Without the presence of deer vegetation would quickly grow out of control, and reshape the landscape. If there were no predators to keep the deer population in check, the habitat would become depleted of vegetation. This would impact the ability to survive not only for the deer population, but for other local wildlife.

The flow of energy and nutrients within a habitat along with the interactions between living organisms is the science of ecology. All of the energy to support life in a specific habitat begins with the Sun. Plants use the light from the Sun to create a food source, or energy. This is the start of the food chain. Each living organism plays a role within the food chain. The three basic roles are: producer, consumer, and decomposer. For examples, plants are producers. This means that they help to transform the Sun's energy into a usable form, both for themselves and other organisms. Consumers are organisms that rely on other organisms for a source of energy. For example, deer eat plants and a predator will eat the deer. Within the food chain, there are primary, secondary, and even tertiary consumers. Both the deer and the predator are a consumer. The decomposers play a vital role in helping to change organic material into a new form. Insects and fungi are the most noticeable organisms that are decomposers.

In order for a population to be sustainable in a given area, animals must have constant access to food, water, shelter, and a place to raise their young. Without these resources, animals are unable to survive in their habitat. When one of these factors is altered, it creates an impact on the health and overall stability of the population.

When you connect all living organisms together, based on their primary source of energy, you are able to create a food chain. This demonstrates the flow of energy from one source to another. A food web demonstrates all of the possible methods of energy transfer within an ecosystem. If any of the components of the ecosystem are altered, this will impact the health of the entire system.

Like their habitats, the living organisms found within that region continuously undergo changes to increase the likelihood of survival. These changes include short-term changes, such as altering foraging behaviors in a drought, to long-term changes that change the physical form of the organism. Replenishing members lost within a population is critical for the survival of the species. If more individuals are lost than replaced, the overall likelihood of survival is decreased. Population size is factored by the number of these deaths and births annually. The finite number of deaths is important, but also needs to be weighed against the average lifespan for the individual. For example, a moose population may only have one or two births, but individuals may live to be 15 years old. Ratio of males to females is another important consideration in ensuring survival.

When a population does change in numbers, this can be represented by a population curve. The population will always be influx due to external pressures on a given population. For example, a rise in the population of prey animals will result in the rise of a predator population. As the predator population becomes larger, the prey population will decrease. As the prey population decreases over time, so will the predators. This process will then repeat once there are fewer predators to keep the prey population under control. There are two different types of growth that a population can endure. The pattern of a steady increase is called an S-shaped (or sigmoid) curve, while a population that experiences rapid changes is called a J-shaped curve. The example of the changing predator and prey populations can be represented by a J-shaped curve. A population with limited external pressures will be represented by an S-shaped curve. Each population will reach an equilibrium, or carrying capacity. This means that the population is unable to grow any further due to the lack of resources available in the ecosystem.

There are many techniques used for monitoring the size of animal populations. The simplest form is that of a direct observation and counting of physical individuals. This is easy to complete for larger species. Different statistical calculations using proportions can also be employed when estimating population numbers.

Barasingha Survival Game

This game allows students to gain an understanding of population dynamics and how environmental resources affect population health.

Key Words: Population, carrying capacity, ecosystem, interaction

Objective/s:

*Identify external pressures and resources that influence carrying capacity

*Describe changes in an ecosystem and how this impacts population size

*Demonstrate graphing and data recording skills

Recommended Grades: All grades

Evaluation:

*Completion of data chart

*Participation in game and discussion

Materials:

Large, outdoor playing area, paper, writing utensil

Time Required: 45 minutes

Procedure:

1) Designate a large playing space in an outdoor area. Mark two parallel lines on the ground 30 to 40 feet apart. Define outer boundary lines if needed.
2) As a group, review the essential resources of a habitat: food, water, shelter, and space. All deer need good habitat to survive. Review the type of habitat that the Barasingha is found in, and how this species of deer survives.
3) Count off the group into four separate groups. Those that were assigned as a Group 1 should line up on one of the marked lines. This group becomes the Barasingha.
4) The Barasingha need to find food, water, and shelter to survive. When a Barasingha is looking for food, it should clamp its "hooves" over its stomach. When it is looking for water, it puts its "hooves" over its mouth. When it is looking for shelter, it holds its "hooves" together over its head. A deer can choose to look for any one of its needs during each round or segment of the activity; the deer cannot, however, change what it is looking for during that round. It can change what it is looking for in the next round, if it survives.
5) The remaining students act as the food, water, and shelter. Each student is allowed to choose at the beginning of each round which component he or she will be during that round. The students depict which component they are in the same way the deer show what they are looking for (i.e., hands on stomach for food, and so on). Have them line up on the opposite line from the Barasingha.

6) The activity starts with all players lined up behind their respective lines (deer on one side, habitat components on the other side)—and with their backs facing the students along the other line. Begin the first round by asking all of the students to make their signs—each deer deciding what it is looking for, each habitat component deciding what it is. Give the students a few moments to put their hands in place—over stomachs, over mouths, or over their heads. (The two lines of students normally will display a lot of variety—with some students portraying water, some food, and some shelter. As the activity proceeds, sometimes the students confer with each other and all make the same sign although do not encourage it. For example, all the students in habitat might decide to be shelter. That could represent a drought year with no available food or water.)
7) When deer see the habitat component they need, they should run to it. Each deer must hold the sign of what it is looking for until getting to the habitat component student with the same sign. Each deer that reaches its necessary habitat component takes the "food," "water," or "shelter" back to the deer side of the line. "Capturing" a component represents the deer successfully meeting its needs and successfully reproducing as a result. Any deer that fails to find its food, water, or shelter dies and becomes part of the habitat. That is, any deer that died will be a habitat component in the next round and so is available as food, water, or shelter to the deer that are still alive.
8) Game-Changer: If you are playing with multiple classes, split the two groups evenly. You will have two groups representing resources in the environment, one group representing the deer, and one group representing wolves (predators).
9) For extension, have students record the number of deer that survive each round. Graph the data so you are able to see the changes in population.

Discussion Questions-

What type of population curve was created?
Did both the predator and prey populations show similar trends?
If you wanted to maintain a consistent deer population, what steps would you need to take?

We Are All Connected

Key Words: habitat, diversity, interdependence

Objective/s:

*Recognize, and describe, the interdependence of all living organisms

Evaluation:

*Participation in class discussion

Recommended Grades: All grades

Materials:

List of animals, yarn, pictures of various habitats

Time Required: 30 minutes

Procedure 1:

1) Class discussion of the attributes of a proper habitat, including each selected habitat.
2) Give each student a list of different plants and animals that correlate with a habitat picture.
3) Have students work in small groups to determine which organism belongs to each habitat. If your habitat pictures are large enough, have the students place them on or near the correct habitat.

Procedure 2:

1) Instruct students to stand in a circle, with one student holding onto the ball of yarn. This student should then pass the ball to another student across the circle. Continue to do this until all students have a section of the yarn in their hand. Keep it random, and the yarn should overlap several times. For older students, you may use the pictures from a selected habitat. Connect the yard ball in the order of a food chain. This should create a visual representation of a true food web found within a habitat.
2) Once all students have a piece of yarn, instruct one student to release their section of the yarn strand. As tension is released, and the yarn loosens, the rest of the group must then tighten their strands of yarn to compensate. Repeat this several more times. Each section dropped should impact several others down the line.
3) Discuss with the class the interdependence of organisms within an ecosystem.

Discussion Questions-

Which of these habitats is most important to maintain?

Which of these habitats is most beneficial to our world?

What value do these habitats have?

What determines value?

What consequences existed as a result of the removal of a specific section?

Fun in the Field!

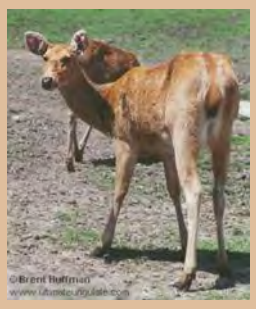
Key Words: observation, wildlife signs, environmental interpretation

Objective/s:

*Utilize observation and data recording skills to interpret the natural environment

*Actively interact with nature and the natural environment

*Communicate verbally using data, charts, and observations



Recommended Grades: Grades 8 and up

Evaluation:

*Student presentations and group discussion

Materials:

*Resources for research, paper, writing utensils

Time Required: 60 minutes

Procedure:

1) Have students research local wildlife commonly found or seen in your area. During their investigation, have them identify common ways to tell if that animal has been in the area recently. For example, dung identification, prints, plant damage, etc.
2) Each student, or small group, should present their findings to the class. Allow students to teach the rest of the group on how to become an expert in tracking their specific animals.
3) As a class, use the information provided by the students to develop a tool to track wildlife. This should be able to be handy when you go outdoors. If available, incorporate technology into this and develop an app for a tablet.
4) Take the group outdoors to locate evidence of wildlife. Be sure to pick a location in which there will be a variety of wildlife. Using your newly developed field guide, examine the evidence for wildlife activity.
5) If you are able to utilize a computer tablet, have students take different roles in recording their observations. Some can have a table to record types and number of sightings. Others can use the camera to record the evidence.
6) Once you return to the classroom, discuss the findings as a group.
7) As an extension, have students enhance their field guide and pass out to local community members. Create a campaign to teach others about local wildlife. Older students may repeat the field experience with younger students and become a young naturalist educator and mentor.

Discussion Questions-

What were the most common signs?

Did the season affect the results?

What would happen if you were to repeat this multiple times?

Exploration of Deer Species

Deer are found on every continent, except Australia and Antarctica. They inhabit a wide variety of habitats and climates. Some species, such as the muntjac, are found in rainforests near the equator. Yet, reindeer are found far north and live on the frozen tundra. Deer are also as varied in size and appearance as their habitats. The largest species of deer is the Moose, which can be nearly six feet at the shoulder and weigh almost a ton (that's 2,000 pounds!). The smallest species of deer is the Pudu, weighing less than thirty pounds and standing less than two feet tall!

The Cervid TAG has listed twelve species of focus, representing all five continents in which deer are found. Throughout the next section, you will find out more information about the continent, habitats, and these twelve unique species. This information will help you as you visit your local zoo on your next field trip, as well as enhance lessons found throughout the workbook.

Education Extension!

Have students write about a time in which they were able to view a wild deer up-close. Instruct them to include their thoughts and feelings about the encounter. This writing activity may take the form of a short story or even a poem.

Education Extension!

Create a public education display, such as a trifold display board, to teach about deer. Students may select one specific species, or select a continent and explore the various species found in a particular region. Be sure to focus on habitat and conservation status.

If possible, include technology into this activity. Students may wish to explore the possibility of creating a video that may be uploaded onto an online platform to share with friends, family, and community members.

Selected Species

The following species have been selected by the Cervid TAG as special species of focus. They are listed by continent, with their scientific name and their conservation status as defined by the IUCN Red List.

North America

Moose *(Alces alces)* - Least Concern

South America

Chilean Pudu *(Pudu puda)*- Least Concern, with subspecies listed as Vulnerable
Red Brocket *(Mazama temama)* - subspecies listed as Data Deficient or Vulnerable

Asia

Barasingha *(Rucervus duvaucelii)*- Least Concern
Eld's Deer *(Rucervus eldii)*- Endangered
Malayan Chevrotian *(Tragulus napu)* – Least Concern
Père David's Deer *(Elaphurus davidianus)*- Extinct in the Wild
Reeves Muntjac *(Muntiacus reevesi)* – Least Concern
Siberian Musk Deer *(Moschus moschiferus)* – Vulnerable
Tufted Deer *(Elaphodus cephalophus)*- Near Threatened
White-lipped Deer *(Przewalskium albirostris)*- Least Concern

Europe

Bactrian Wapiti *(Cervus elaphus bactrianus)*- Least Concern

Red Deer Census Activity

Key Words: population, census, harvest

Objective/s:

*Create and interpret charts and graphs using mathematical formulas

Recommended Grades: Grade 6 and above

Evaluation:

*Completion of data chart and corresponding graphs

Materials:

Student activity sheet, writing utensil

Time Required: 60 minutes

Procedure:

1) Provide students with the Population Data Chart and explain the importance of monitoring population numbers. For this case study, we will be exploring a population of Red Deer.
2) The initial adult deer population has been divided into the categories of buck and doe, with the starting population provided on the data table.
3) Spring reproduction will equal the number of adult doe from the previous year multiplied by 1.7. This equals the number of buck and doe produced. Round to the nearest whole number and divide by two. After dividing if there is .5, this will be dropped for buck and added for doe. For Year 1 we assume all does were adults the previous year.
4) Harvest will equal the adult bucks multiplied by .80, and round to the nearest whole number. No doe or fawns will be harvested.
5) Total deer for next year will use the following equations: Buck = adult buck + reproduction of buck -harvested buck; Doe = adult doe + reproduction of doe.
6) Total population will equal the total buck for next year + total doe for next year.
7) Using total deer for next year return to Step I of the next column and repeat for the remaining years.
8) Once the students have completed the chart, instruct them to create a graph of their choice that represents the data presented in the chart.

Red Deer Census – Student Activity Sheet

Population Data Chart										
Red Deer *(Cervus elaphus)*										
	Year 1		**Year 2**		**Year 3**		**Year 4**		**Year 5**	
	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck	Doe	Buck
Adult Deer Population	10	10								
(+) SPRING Reproduction 1.7 per adult doe (fawns)										
(-) FALL Harvest 80% of adult buck										
Total to begin new year										
Total Population										

One Deer, Two Deer...What's the Limit?

In this activity you will be a wildlife manager and attempt to calculate impacts of variables that influence your deer population.

Key Words: Population management

Objective/s:

*Describe the positive and negative ecological impacts of deer

*Describe how abiotic and biotic factors can impact wildlife populations

*Implement math skills: graph development and plotting, as well as calculating

Recommended Grades: Grades 6 and above

Evaluation:

*Completed charts and graphs

Materials:

dice, graph paper, reproduction cards, condition cards, management cards

Time Required: 60 minutes

Procedure:

1) Cut out the provided population influence cards. Separate them into appropriate piles.
2) Instruct students to create a graph with the following constraints:

   YEAR 1: Spring Summer Fall Winter

   YEAR 2: Spring Summer Fall Winter

   Continue in this manner until you have marked a total of ten years
3) Read the scenario out-loud to the class:

   You are the manager of a deer population. You have a beginning population of 100 animals. The carrying capacity of the habitat is 150 animals. The point of the activity is to end up with a viable population after 9 years. If at any time your population reaches less than 10 or more than 250 individuals, you no longer have a viable "herd" and will watch the other students until the conclusion of the activity.
4) Once you have read the scenario, draw the cards in the following sequence: condition card, reproduction card, condition card, management card, condition card, reproduction card, and so forth. As each card is drawn, it is read aloud to the entire class. You will roll your die and follow the instructions on the card to determine your herd population's new size.
5) Once you have completed the cycle for all ten years, discuss the results with the class. Did populations "managed" under different strategies by different students show different trends? How do these compare? Would you "manage" differently if give a second chance? Have students write a brief statement regarding the following prompt: Some wildlife managers have said that wildlife management involves more management of people than of wildlife. Explain what they might mean by the comment.

Condition Cards

Condition Card	Condition Card	Condition Card
A fire has roared through the forest, resulting in a critical toss of habitat for the herd. **Decrease** herd by the number equal to five times your roll.	Disease has struck the herd. **Decrease** herd equal to one roll.	A good water supply has contributed to lush browse and has had a dramatic impact on the survival of your herd. **Increase** your herd by five times your roll.

Management Cards

Management Card	Management Card	Management Card
One-hundred acres of the forest has been clearcut for a housing subdivision, altering critical habitat. **Decrease** your herd by three times your role.	Habitat acquisition has increased the area of available and suitable habitat. **Increase** herd by five times your roll.	Scientific research has been successfully accomplished concerning the reproductive capabilities of the herd. **Increase *or* decrease** *(students choose which one before rolling the die)* the herd by two times your roll.

Reproduction Cards

Reproduction Card	Reproduction Card	Reproduction Card
Several acres of forest are now used for camping. **Increase** your herd by one times the roll.	There are no predators in the area. All offspring this season survive. **Increase** your herd by three times the roll.	Good ground cover allows for successful offspring growth. **Increase** your herd by two times your roll.

Have students research management related issues and decisions to develop their own cards to be used for the game.

Condition Cards

Condition Card	Condition Card	Condition Card

Management Cards

Management Card	Management Card	Management Card

Reproduction Cards

Reproduction Card	Reproduction Card	Reproduction Card

Captive Populations

The AZA has several programs that are designed for the conservation and preservation of endangered species, including hoofed animals. Through programs sponsored by correlating Taxon Advisory Groups (TAG) and Special Survival Plans (SSP), topics such as regulated breeding, education, husbandry, and conservation sciences are explored.

The AZA Cervid TAG has categorized the 77 species and subspecies held in AZA collections, according to the geographic regions of North Amercia, South and Central America, Europe Middle East-Africa, and Asia, as recommended by the IUCN Deer Specialist Group.

The recent spread of chronic wasting disease (CWD) has created challenges in the management of captive deer. A history of CWD surveillance must be maintained by each institution to enable the transfer of deer species between many states, while several states currently have completely banned any and all imports. A USDA herd certification program has been approved and put into practice. The effect of these new restrictions has resulted in 40 deer species, subspecies falling by more than 10% in total populations in North America (ISIS 2008) since the last edition of the Regional Collection Plan in 2005. Captive rare deer populations have not increased as recommended, but instead have also declined by almost five percent as a result of difficuties and uncertainties that have arisen due to CWD.

Additional constraints on successful population management of captive populations include the availability of large enclosures to house herds. Many zoos are constrained by their current boundaries and have to seek innovative solutions for displaying animals that require large amounts of space.

Current populations are strictly managed using genetic information that is documented by a studbook manager. This individual is charged with keeping animal information up-to-date by recording births and deaths. Information such as the parents of the new offspring ensures a healthy genetic population exists in captive populations. Computer software is utilized in many scenarios for making the best breeding recommendations for animals in accredited zoos.

Conservation of Deer

Conservation of living organisms in today's modern world can no longer focus upon the development of protected areas for the confinement of wild species. Modern conservation techniques need to include approaches for both captive and wild populations, while delicately balancing the needs of the human population. Programs should decrease the impacts felt from human development and reduce the competition for food, space, and water. All animals, especially large herbivores, are feeling the pressures created by the development of the human infrastructure around the world. Once plentiful grazing areas are now being replaced by farm operations, migration routes are disrupted by fences and roads, and un-regulated hunting activities has taken a drastic toll on many species. Illegal hunting (poaching) and trade of species has created a market in which the animal, or select animal parts, have become more valuable dead than alive. In areas where war and conflict are active, wild species are continuously impacted, and minimal effort is made to maintain habitat or recognize conservation status. The AZA Cervid TAG is not opposed to legal hunting as a conservation tool. Regulated hunting is used by many states in this country to control overpopulated species and keep large ungulates in balance with the environment. Legal, regulated hunting usually does not impact long species sustainability.

Large vertebrates around the world are rapidly engaging conflicts with humans. As historical ranges and migration routes are disrupted, animals are migrating through new settlements, feeding on crops, and defending their young against threats. These animals are listening to their instincts dictated by genetics that were designed to endure hardships and keep their kind alive.

Hope is on the horizon for many species as we continue to improve our relationship and interactions with these animals. Although progress is being made in many places, it is slow. Practical solutions are continuously being developed to improve human life without destroying wild lands. Human behaviors that have existed for centuries are being altered, which is securing a better way of life through new, sustainable practices that not only protect the wildlife, but increase quality of life for the human. For example, in Central Asia, incentives are offered to herders that vaccinate their herds, which in return reduce disease in livestock that can be transmitted to local wildlife. Communities that comply with their agreement to reduce herd size, and not to poach wild animals, receive a financial bonus at the end of the year. There is no bonus if anyone in the community breaks the agreement.

Local Icon or Local Menace?

Impacts of placing a wildlife management area near a suburban development

Key Words: population management

Objective/s:

*Display and integrate beliefs and behaviors

*Use deductive and/or inductive thinking ability

*Developing reasoned and thorough arguments for valid/meaningful conclusions

Recommended Grades: Grade 6 and above

Evaluation:

*Participation and relay of information during discussion

Materials:

Resources for research, paper, writing utensils

Time Required: 90 minutes

Procedure:

1) Many individuals have a complex relationship with local wildlife. They enjoy watching the animals from a distance, but become upset when the animals destroy property or become a nuisance. In North America, deer often cause damage to gardens and landscaping that has been put into place by homeowners.
2) Split the class up into small groups. Each group will represent a specific viewpoint on a wildlife conflict.
3) Have students research about potential benefits, costs, and conflicts that exists with sharing your home with deer. Resources should include newspaper articles, online databases, and academic sources.
4) Read the provided scenario to the group. Once the group has heard the scenario, give them some time to collaborate. Each group should find sources and information that supports their viewpoint.
5) Once the research has been completed, come back together as a group to debate the topic. The format should be that of a public hearing. This means that each group should be given ample time to discuss their findings and to create counter-points during the discussion. The instructor should serve as the mediator and facilitate a consistent flow of idea sharing.
6) Once the debate has taken place, try to develop a plan that will benefit all interested parties. For older students, you may elect to have one group serve as the city council that observes the public hearing. Once the debate has concluded, they can retreat to vote on a plan of action, citing sources and examples given during the debate.

Scenario

Concern over the increasing development of suburban neighborhoods near a local lake and wooded area has individuals worried about the impacts on the habitat and wildlife. A new proposal from a local naturalist group has been presented to the city council. The proposal calls for the lake and surrounding habitat to be turned into a wildlife management area, with a special emphasis on deer. This has the local homeowners upset because they have been continuously attempting to push the deer away from the area. They claim that the local deer population is too large and that the animals are eating all of the expensive landscaping. They city council has called a special town meeting in which interested parties may express their views on the new proposal.

Recommended Groups

Homeowners- concern about proposal, conflict with deer

Land developers- worried about home sales if conflict continued; can see potential economic gain from selling land to city

Naturalist group- wants to see protected area for wildlife

Natural Resource District Representative- wants mixture of protected area, land use for residents, and controlled deer population

Creative Community Campaigns

A service learning project in which students are able to learn about human-deer conflicts

Key Words: Conservation

Objective/s:

*Practice verbal reasoning skills

*Scientific writing skills to interpret information

*Use deductive and/or inductive thinking ability to create an effective argument

Recommended Grades: Grades 6 and up

Evaluation:

*Completion of final project

Materials:

Resources for research

Time Required: 60 minutes or more

Procedure:

1) Read the conservation background information to students.
2) As a group, discuss ways that humans and deer populations are in conflict, both intentionally and non-intentionally. For example, motor vehicle collisions.
3) Once you have brainstormed a list of human-deer conflicts, have students select which topic they would like to develop a community campaign.
4) Discuss the purpose of a community campaign. What are the realistic goals that the campaign should achieve? What is the primary purpose of the campaign, and who is the target audience to receive your messages?
5) Campaigns should include background information and practical ways that the community can help. Use creative ways of delivering the message. For example, develop a video that can be shared on social media or creating a community action night.

Education Extension!

Turn this into a service learning opportunity!

If you successfully create a community campaign, share your results with the members of the Cervid TAG, as well as members of your local zoo, nature center, and natural resources district. Many of the above-mentioned groups may be willing to participate in your community campaign.

Glossary

Antler

One of a pair of non-permanent (deciduous) bony structures located on the head of ungulates from the family Cervidae. Antlers are almost always branched, and grow from pedicels on the frontal bones. They are generally shed and regrown every year.

Browser

Herbivore which eats primarily leaves, shoots, twigs of trees, bushes, forbs, and other vegetation which is up off the ground.

Crepuscular

Active primarily around dawn and dusk.

Cursorial

Adapted for running.

Dimorphism

The existence two distinct forms of a single species that differ in one or more characteristics, such as coloration, size, or shape. Example: males have horns, females do not.

Graminivore

An animal that eats mainly grass

Hoof

The hard, keratinized sheath covering the toes of certain mammals

Horn

One of a pair of hard, permanent structures on the frontal bones of the head in member. True horns consist of a bony core covered with a sheath of keratinous material.

Ungulate

A mammal with hooves.

Additional Resources & Resources Cited

Deer Biology & More Information

AZA Cervid TAG regional collection plan

The IUCN Red List of Threatened Species. Retrieved from http://www.iucnredlist.org/

Macdonald, D. (2001). *The encyclopedia of mammals*. (pp. 504-513). Oxfordshire, UK: Andromeda Oxford Limited.

National Wildlife Federation. Retrieved from http://www.nwf.org/

Whitetail Unlimited. Retrieved from http://www.whitetailsunlimited.com

The Wildlife Management Institute. Retrieved from http://www.wildlifemanagementinstitute.org/

Predator or Prey

Skulls unlimited educational resources. Retrieved from http://www.skullsunlimited.com/index_education.php

Behavior Sleuths

Ethosearch. (2013). Retrieved from http://www.ethosearch.org/

Diagramming the Differences

"Welcome to the A&G TAG." *Antelope & Giraffe TAG*. <http://www.antelopetag.com/>.

Barasingha Survival Game*

*This activity was adapted from “Oh Deer!” from Project WILD (http://www.projectwild.org/documents/ohdeer.pdf)

We Are All Connected & Fun in the Field

National Wildlife Federation. Access Nature Curriculum Guide

Braus, Judy (1999). World Wildlife Fund, Windows on the Wild: Biodiversity Basics, an Educators Guide to Exploring the Web of Life

Leopold Education Project (http://www.aldoleopold.org/Programs/lep.shtml)

Project Learning Tree - Environmental Education Activity Guide

Red Deer Census & One Deer, Two Deer*

*This activity was adapted from "Deer Population" written by Robert Cooper, Wilmington Area School District (http://ecosystems.psu.edu/youth/sftrc/lesson-plans/wildlife/9-12/deer-population) and "White-tailed Deer Issues" written by Barbara Neuburger, General McKlain High School (http://ecosystems.psu.edu/youth/sftrc/lesson-plans/wildlife/9-12/deer-issues)

Rocky Mountain Elk Foundation *The north american wildlife conservation model*. Retrieved from http://www.rmef.org/Conservation/HuntingIsConservation/NorthAmericanWildlifeConservationModel.aspx

Local Icon or Menace

DuBrock, Calvin W. (2001). *Pennsylvania's Deer Management System: Design and Practice* Bureau of Wildlife Management, Pennsylvania Game Commission.

Duda, Mark, and Martin Jones. "Public Opinion on and Attitudes Toward Hunting." *THE NORTH AMERICAN MODEL OF WILDLIFE CONSERVATION:*. Responsive Management. Web.<http://www.responsivemanagement.com/download/reports/NAMWC_Public_Opinion_Hunting.pdf>.

Maryland Department of Natural Resources (2001). *Deer and Humans*. Maryland Department of Natural Resources.

Project Learning Tree - Focus on Risk.

Community Campaign

Stein, D. (2006, March). *Creating a community outreach plan*. Retrieved from http://www.gcastrategies.com/booksandarticles/138/

Things Natural, Wild, and Free: The Life of Aldo Leopold by Marybeth Lorbiecki

The Goldman Environmental Prize & The Video Project (2005). Environmental ethics:Examining your connection to the environment and your Community

Alignment to the Common Core Standards

Science

ACTIVITY	GRADE				
	K	1	2	3	5
Readings	ESS3-1	LS1-A; LS1-D; LS3.B;	LS2-2	LS4.A; LS2.D; LS4.D	
Predator or Prey				LS4.C; LS3-1	
Behavior Sleuths					
Diagramming the Differences	L-LS1-1	LS1-1	LS2-2	LS3-2; LS3.B; LS4-2	
Measuring Up					ESS2-2
Barasingha Survival Game	LS1-1; ESS3-1		LS2-A; LS2-1	LS4-3; LS4-4; LS2-1; LS4-2	PS3-1; LS2-1
We Are All Connected	LS1-1; ESS2-2; ESS3-1		LS2.A	LS4-3; LS4-4; LS4-3	PS3-1; LS2-1; PS3.D; ESS2-1; ESS3-1
Fun in the Field					
Red Deer Census					
One Deer, Two Deer					
Local Icon or Local Menace					
Community Campaigns					

ACTIVITY	GRADE BAND	
	Middle School	High School
Readings	LS4-4; LS4-6	LS4-6
Predator or Prey	LS2-1; LS2-6; LS2-2; LS4-2; LS4-6	LS4-6
Behavior Sleuths	LS2-2; LS2-6; LS4-5; LS3-2; LS4-1; LS4-2	LS2-8
Diagramming the Differences		
Measuring Up	LS4-5; LS4-6; LS4-4; LS2-4	
Barasingha Survival Game	LS2-1; LS2-2; LS2-3; LS2-4; LS2-5	LS2-5
We Are All Connected	LS1-6; LS2-3; LS2.A; LS2-1; LS2-4	LS2-5
Fun in the Field		LS1-6; LS2-3; LS4-1
Red Deer Census	LS2-4	LS2-1; LS2-6
One Deer, Two Deer	LS2-3; LS2-1; LS2-4; LS2-5	LS2-1; LS2-6; LS4-5
Local Icon or Local Menace	LS2-4; ETS1.B; ESS3-3; ESS3-4	LS2-7; LS2-8; LS2-6; LS4-6
Community Campaigns	LS2-4; ETS1.B; ESS3-3; ESS3-4	LS2-7; LS4-6; LS2-8; LS4-6; LS4-1

Alignment to the Common Core Standards

Mathematics

ACTIVITY	GRADE		
	4	Middle School	High School
Readings			
Predator or Prey			
Behavior Sleuths		MP.4; 6.SP.B.4; 6.SP.B.5; MP.2; 7.EE.B.3	MP.4; MP.2; HSN-Q.A.1; HSN-Q.A.2; HSN-Q.A.3; HSS-IC.A.1; HSS-IC.B.6
Diagramming the Differences			
Measuring Up	MP.4; MP.2; 4.MD.A.1	MP.4; 6.SP.B.5	MP.4; MP.2; HSN-Q.A.1; HSN-Q.A.2; HSN-Q.A.3; HSS-IC.A.1; HSS-IC.B.6
Barasingha Survival Game		MP.4; 6.SP.B.5; 6.EE.C.9	MP.4; MP.2; HSN-Q.A.1; HSN-Q.A.2; HSN-Q.A.3; HSS-IC.A.1; HSS-IC.B.6
We Are All Connected			
Fun in the Field			
Red Deer Census		MP.4; 6.SP.B.5; 6.RP.A.3	MP.4; MP.2; HSN-Q.A.1; HSN-Q.A.2; HSN-Q.A.3; HSS-IC.A.1; HSS-IC.B.6
One Deer, Two Deer		MP.4; 6.SP.B.5; 7.EE.B.4	MP.4; MP.2; HSN-Q.A.1; HSN-Q.A.2; HSN-Q.A.3; HSS-IC.A.1; HSS-IC.B.6
Local Icon or Local Menace			
Community Campaigns			

Alignment to the Common Core Standards

Language Arts

ACTIVITY	GRADE			
	K-5	6-12	6-8	9-12
Readings	CC.LA.SL.(3-5): 1.D; 3.3		CC.LA.SL.6: 1.B; 1.C; 1.D	
Predator or Prey	CC.LA.W.: 3.2; 4.2; 3.4; 4.4; 3.10; 4.10; 5.2; 4.4; 5.10	CC.LA.W. (6-12): 2,4,10		
Behavior Sleuths		CC.LA.WHST.(6-10): 2,4,7,8,9,10		
Diagramming the Differences	CC.LA.SL.(3-5): 1.D; 3.3			
Measuring Up		CC.LA.RST. (6-12): 3,4,7,10		
Barasingha Survival Game	CC.LA.SL. (K-2): 1,3,6 (3-5): 1,4,6	CC.LA.SL. (6-12): 1,4,6		
We Are All Connected				
Fun in the Field				CC.LA.RST: 1,2,3,4,7,10 CC.LA.WHST: 2,4,5,6,7,8,9,10 CC.LA.SL: 4.5.6.
Red Deer Census				
One Deer, Two Deer		CC.LA.SL: 1.B, 1.C, 1.D		
Local Icon or Local Menace			CC.LA.SL: 1,2,3,4,6 CC.LA.RST: 1,2,4,8,9,10	CC.LA.SL: 1,2,3,4,6 CC.LA.RST: 1,2,3,4,8,9,10
Community Campaigns		CC.LA.RST: 1,2,3,4,8,9,10 CC.LA.WHST.10 CC.LA.SL: 1,2, 4,5,6		