Deer Ecology

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Program Purpose
Through discussions and hands-on activities, students will learn about how white-tailed deer live, their adaptations and their role as a keystone species.

Length of Program: 1 hour

Age: Grades 3rd-12th

Maximum Number of Participants: 20 for classroom version as described below (more interactive), 120 for evening program version (PowerPoint based).

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

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

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

Relevant Disciplinary Core Ideas:
LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Preparations:
Before the class arrives:

- Locate program box in NC
- Set up touch tables (for all ages)
- Review and set up powerpoint (for larger groups)
- Determine hike route and where to play Oh Deer!
- If group is large coordinate with other naturalists so two groups aren't doing activities at the same time

Materials:
Preserved ankles/ hooves
Rubber hoof and scat molds
Antler sheds
Jawbones
Skulls
Bones with chew marks
Oh deer laminated card (can also use hand signs)
Oh deer tracking/graphing sheets or whiteboard (older kids)

Outline:

I. Introduction & General Deer Biology
II. Herbivore hike
III. Search for food
IV. Oh Deer!
V. Conclusion
VI. Additional information

Introduction (10 minutes): Assessing Prior Knowledge and Discussing Adaptations

Introduce yourself to the class and explain that we will be talking about white-tailed deer. Engage the students in sharing prior knowledge about white tailed deer and starting the discussions around key concepts (adaptations). Define Adaptations if needed. If you are looking for some talking points, the appendix contains additional information about deer. Try to avoid mentioning the deer exclosures during the introduction, and instead have kids guess what it is during the hike.

Activity options:

1. Touch tables of artifacts (hooves, antlers, hides etc.). Implement the BEETLES activity "I Notice, I Wonder, It reminds me of." This will help students increase curiosity, make observations, ask questions, and relate findings to past experiences.
2. Let's draw a deer activity! Using a whiteboard draw a circle on the board and say that it is a deer. When the students say "no It's not" ask what is missing. This gives them a chance to say different body parts (like legs, head, antlers etc.) and then for you to add facts about those body parts and pass the artifacts around. Also ask them about the environment where they expect to find this deer.
3. Use the PowerPoint.

Herbivore Hike (30 min):

Head out on a hike along the riverbend trail towards the deer exclosures. Have students keep an eye out for animal signs and then use what we learned during the introduction to assess if the signs came from deer or other animals. Try to find signs in all of the categories if possible: hoofprints, scat, rubs, nipped plants and areas where deer bed down for the night.

When you are near the exclosure have kids guess what it is. What does the word exclosure mean and why we would want to keep deer out of a certain area?

Define Keystone Species: A keystone species is an organism that has a disproportionately large impact on its ecosystem, meaning its removal would drastically change or collapse the community, even if it's not the most abundant. These species hold the ecosystem together by controlling populations (like predators i.e. wolves), altering habitats (like deer), or providing essential functions (like pollination/seed dispersal), thereby maintaining biodiversity and structure.

Discuss the impact of deer browsing at Upham and the significance of the exclosures. They have favorite foods just like us. Left uncontrolled they can eliminate certain plant species from that section of the forest. This plant preference can allow invasives to flourish, and oftentimes affects certain bird populations. Examples: Deer love acorns which helps maples dominate in what was once an old growth oak forest. They also love saplings (especially pine/fir saplings) which helps spruce flourish.

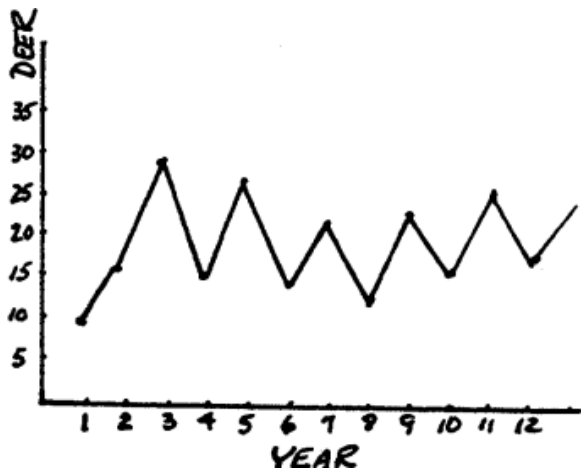
There is also a lack of predators in the Dells area. If you're working with older kids, highlight trophic cascades and the importance of predator-prey relationships in the context of deer over browsing at Upham (less wolves means more deer and therefore less plants).

Game (10 min): Oh Deer!

Oh Deer! is a game which should get kids thinking about concepts like carrying capacity, limiting factors, and population abundance. This game will require a large area for kids to run and can be played indoors or outdoors.

Instructions:

1. Discuss with students the 4 things that make up a habitat: Food, Water, Shelter, Air. In this game, people will be acting as 3 of these habitat factors, while some of us are deer searching for these resources.
2. Count off students in fours and assign one group as the deer. Separate the deer from the others by ~25 ft and have them face their backs to the other students.
3. The other kids will be food, shelter or water which are the potential limiting factors in this simulation. Every student chooses one factor to embody. The deer in this simulation will pick one essential factor and **cannot change their mind during that round** once chosen. Every student, including the deer, should make the hand signal corresponding to the factor (shelter is hands over the head, food is hands on the stomach and water is a w on the chin).
4. Once everyone has picked their chosen factor you are ready to begin. Count to three and have everyone turn around to face each other. It is now a race for the deer to get to their choosen factor before the other deer.
5. Once the deer find their factor, they bring them back to the deer side. These kids are now new deer. The population should go up at this point. Any deer who did not find their chosen factor die and become habitat (have them pick a factor).
6. Make sure to record the new number of deer after each round so you can discuss at the end. After two or three rounds (years) the deer population will crash, but shouldn't go to zero. After 10-15 rounds you can wrap up and discuss.
7. If time allows, have the kids help you make a graph of the results, or if they are older kids have them work in small groups to make their own graphs. The graphs should look something like this.



8. Have a wrap-up discussion and ask questions like what do animals need to survive, what are some limiting factors, do animal populations change or stay the same, how does the graph tell us whether they change or stay the same?

Conclusion (10 min):

See Appendix B for more information related to this section. Below are a few options for conclusion discussion.

1. What did we learn today? How do deer adaptations help it survive in the ecosystem?

Historically deer populations were kept in check through predators (like wolves) and limited resources in the habitats, but humans have had a huge impact on this balance. Humans have removed wolves from many ecosystem and put pressure on deer through hunting. There was a large population crash in the 1900s due to uncontrolled hunting (show poster). Since then, different organizations have worked together to manage the deer population and put limits on deer hunting. Discuss:

2. How do you think we should be managing deer? Potential answers: Following DNR regulations, Have DNR change regulations, reintroducing wolves, doing nothing and let nature take its course, etc.

In the modern era there are now new threats facing deer including increased habitat changes and Chronic Wasting Disease.

3. What responsibility do individual citizens have in the effort to balance the increasing pressure of human development with the need to maintain viable ecosystems? What responsibility do communities have?

Appendix A: General Deer Biology

White-tailed deer are medium-sized deer native to the Americas and their range extends from Canada to Peru. This range encompasses about 38 subspecies of white-tailed deer. In addition to being mammals, they are also ungulates (large hooved mammals) and Cervidae (deer). These highly adaptable mammals typically live in temperate regions which experience all four seasons. Their yearly routine depends very much on all four seasons. They are herbivores and their diet changes with the seasons. They are also ruminants, so they have a four chambered stomach which uses a special microbiome to break down cellulose, similar to cows.

Male whitetails are referred to as bucks and can be easily distinguished by their antlers which are visible for most of the year. Female whitetails are called does and their offspring are called fawns which can be identified by their white spots. Some behaviors associated with bucks are rubbing their antlers/forehead against trees to mark territory and leave their scent. Scent glands are essential to whitetail communication especially during their mating season, the rut, which takes place at the end of fall. All deer use their scent glands to communicate. There are eight different scent glands, the most important of which is the tarsal gland located on the ankle joint. These glands take advantage of the white-tailed deer's incredible sense of smell which surpasses that of even the famed bloodhound. Hearing is also an important sense for deer and some of the noises they make include bleating, grunting, snorting, and wheezing. Their vision is one of their weaker senses and they have more rods than cones which are cells in the eye. Rod cells are more sensitive to light and useful in low-light situations like dawn and dusk. Cone cells are used for color vision and more useful during the day. They have good night vision but do not see as well during the day and do not distinguish colors easily. Due to this phenomena they are crepuscular, which means they are most active near dawn and dusk. If a deer feels threatened enough to move away it will likely have its iconic white tail up to communicate potential danger to other deer.

In addition to being known for their white tail, buck antlers are one of their defining features. Like all cervids, these antlers are shed and regrow yearly. Whitetails will start growing their antlers in spring and rapid growth occurs in early summer. This growth can be up to one inch every two days, which makes it the fastest growing tissue on earth. These antlers will grow with rounded tines and covered in velvet. As days get shorter, testosterone levels go up and antlers become calcified and harden while the velvet is shed. Bucks will also become more aggressive when this change occurs. Fresh rubs are another sign of antler hardening. Antler calcification coincides with the beginning of the rut. Once the rut is finished (normally after the solstice) antlers will start being shed in the months of January to March. After shedding antlers, growth of a new pair will take place in about three weeks and the cycle continues.

Digestion in ruminants

Ruminants will typically only chew their food enough to swallow it and a foraging deer can fill its stomach (rumen) in only an hour or two. After the first chewing, the rumen is used as a storage chamber in the four-chambered stomach of ruminants. The food stored in the rumen will then be regurgitated and chewed again. This can be called chewing cud or ruminating. In the second chamber, the reticulum, there are microorganisms which break down plant material called cellulose which ruminants couldn't break down otherwise. This symbiotic relationship is critical to ruminant digestion. Chewed cud will be sent to the reticulum and those microorganisms will use a chemical process called fermentation which breaks down cellulose into simpler substances to be absorbed by deer and microorganisms. This also makes methane gas which causes the deer to burp regularly. The chewed cud is now mixed with the microorganisms which provide nutrition to the deer. This third chewing will travel to the third chamber called the omasum which will absorb water. The fourth chamber, the abomasum, contains gastric juices which chemically digest the cud and send it to the intestines. Most nutrient absorption occurs in the intestines and deer intestines are about 28 feet long.

Appendix B: Modern Society and Deer

Socio-economic impact

Some suburban settings have seen deer populations skyrocket. With a lack of predators and abundance of food these deer can flourish uninhibited. In suburban Cayuga Heights, NY there are estimated to be 125 deer per square mile, which results in many garden plants being destroyed and a sharp increase in deer-vehicle collisions. We know they are a keystone species and can impact biodiversity, but they also cause about 1.5 million car accidents nationwide a year which result in about one billion dollars in damages. In addition to this, hunting is a major industry in Wisconsin and other states. 2.5 billion dollars are spent in Wisconsin annually on hunting related items and 88% of hunters pursue deer.

Hunting

Deer and deer hunting hold significant importance to the culture of the Ojibwe or Anishinaabe people. In the 1800's tribal leaders reserved special hunting and gathering rights for the Ojibwe in a region called the Ceded territories. This region covers about a third of the state, mostly in the northern portion. A consensus on deer management policies was determined in the 1980s between six Wisconsin Ojibwe tribes and the State of Wisconsin. The Ojibwe tribes are legally entitled to a portion of the harvestable surplus in the Ceded Territories and harvest about 4,000 deer each year.

In 1851, the first closed deer season was held in Wisconsin with very few regulations. Throughout the rest of the 19th century regulations were put in place, like prohibiting use of dogs for hunting in 1876 and prohibiting hunting at night in 1887. Bag limits were introduced in 1897 and license sales began at $1 for residents. In the early 1900s white tailed deer populations in most states began to plummet due to overhunting. Many states including Wisconsin suspended their seasons during the interwar period to allow these populations to recover. There was no deer hunting season in Wisconsin from 1919 to 1950. Additional regulations were put in place during the 20th century such as required registration in 1953 and requiring blaze orange clothing in 1980. Some more recent changes to hunting have been in the context of CWD, a neurological disease affecting cervids. Three deer shot in 2001 in Dane County tested positive for CWD. In 2002 there was a 10 percent drop in licensed hunters with much of the decrease attributed to concerns surrounding CWD.

Hunting is now a multi-billion-dollar industry here in Wisconsin, as is the case in many other states. The hunting season can help control population and the DNR will determine license numbers based on previous population estimates. Bow hunters have longer seasons but the majority of deer harvesting occurs during the nine day gun deer season in late November.

CWD

Chronic Wasting Disease (CWD) is a transmissible spongiform encephalopathy (TSE) affecting deer. It is also known as the Zombie Deer Disease. TSEs are caused by misfolded proteins called prions which also cause a disease in cattle known as BSE or mad cow disease. These diseases have neurodegenerative effects and result in severe weight loss and abnormal behavior. CWD has also been called the zombie deer disease. CWD specifically affects members of the deer family. While transmission from deer to humans isn't proven the science on this is still fairly inconclusive. Discovered in the US in the 60s and correctly identified as a TSE in 1978, the disease has now been confirmed in 30 US states and four Canadian provinces. The Wisconsin DNR began testing for CWD in 1999 and got its first positive test in 2002. Since then, hunters have been encouraged to get their deer tested for CWD, and most of the positive cases have been in the southwestern portion of the state. In addition to suggesting hunters get their deer tested, the DNR published a report in 2014, which was revised in 2019. This report gives tons of recommendations to the public about how they can reduce the spread of CWD. Avoiding unnatural concentrations of deer is of the utmost importance to reduce spreading CWD. Artificial water structures such as a trough or guzzler which are not properly cleaned and maintained have been shown to drastically increase the ability of CWD to spread in a local deer population. Urine based scents (UBS) also have the ability to increase spread of CWD depending on the source of the UBS. The Wisconsin DNR highly recommends using alternatives to UBS. Hunter harvested deer carcasses are often moved across geographic barriers, and this human assisted movement can spread CWD to areas which naturally would not contain CWD. Staying informed and up to date on regulations and knowing areas affected by CWD is extremely important, especially if you are a hunter. The damaging effects of CWD spread such as decreased herd size and lack of herd structure can be slow to progress, making it difficult to monitor management success, however continuing efforts to control the spread are currently our best option.

References:

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