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### White-Tailed Deer Overpopulation

When we think of the word, 'deer', what is the first thing that comes to mind? It would have to be Disney's beloved white-tailed deer, Bambi. In the original work, Bambi was initially introduced as a roe deer. So why did Disney decide to change it? Firstly, roe deers do not populate the North American terrain. Secondly, the white-tailed deer is notable for being one of North America's most widespread species. However, their population may be too dense for the ecosystem to handle. How does one species's population affect the biodiversity within an ecological community. With research, I will be able to give an explanation on how the overpopulation of the white-tailed deer can greatly affect the biodiversity within a community, mainly the plant species. Along with this research, I will also be covering the basic facts about the white-tailed deer and their social and adaptive behaviors in order to gain a better understanding of how they are so widely spread within the North American terrain. To add on, I will also touch upon certain solutions to control the deer overpopulation and whether or not they are effective; one being the introduction of predators within the deer populated area as well as certain proposals that can contribute to the management of the population.

The majority of the white-tailed deer population usually inhabit forests, brush areas and farmlands located within the eastern regions of North America [2]. They are known to be abundant during the winter season, as they tend to over browse a forest by feeding off of tree bark and twigs [1]. When eating, they rip away vegetation rather than snipping due to their lack of upper incisors, which can cause difficulty for regeneration for many plants [2]. According to the research from David H. Hirth, the number of adult doe groups within a year is most abundant over the summer and fall season whereas June being the least abundant, when the majority of the fawns are born [7]. Such information can lead to the conclusion that more does result to more births which can cause an increase in population density, as one doe can give birth to at most two, or even three, fawns depending on the abundance of food [2]. Because of the excessive amount of deer hunting that occurred back in the years, wildlife managers made sure to enforce rules in order to prevent the endangerment of the species such as shortening hunting seasons and limiting the hunting to bucks in order to aid the herds' recovery. Bucks were also hunted mostly because of their antlers, which may explain why there are fewer numbers of them in comparison. They also tried to make a more favorable habitat for the deer herds by creating grassy, open regions [7]. However, such plan backlashed as there is a great abundance of does which result to a great abundance of offspring in the later years.

The white-tailed deer is a notable herbivore, so it is understandable that the majority of the damage that the white-tailed deer population makes is inflicted on many forest ecosystems in

North America. The deer population density can cause a great decrease in the regeneration of many valuable plant species within those forests. One of those victims being the Allegheny hardwood forests of northwestern Pennsylvania. Nancy G. Tilghman examined the impact of deer on seedlings, shrubs, and herbaceous plants. She had 5 groups of different deer population densities. It is concluded that the group with the highest deer density reduced the diversity of herbaceous plants, but increased the regeneration of ferns and black cherries. They also stunt the growth of many tree seedlings as well as consuming them, causing only the regeneration of ferns [4]. Such information can indicate the great effect the deer population density has on forest compositions. As they rip away the tree seedlings and other common plant species, the plant's height and reproduction can be greatly affected. The seedling would take a much longer time regrowing to the height previous to the deer's consumption. To add on, more than one deer will take their share from that very same plant. As a result, there will be difficulty in regeneration of tree composition as well as other common species [8]. Such alteration within the forest ecosystem and composition can also greatly affect other species within those regions.

The forest can only give so much for the deer population to consume, thus results the number native plant species to decrease. As the white-tailed deer take in those native species, the abundance of exotic, invasive plant species will grow in abundance. As the white-tailed deer are browsing, they also play the role as seed-dispersal agents since the seeds hitch a little ride on the deer until they eventually fall off. Though it may sound very helpful for the ecosystem, it is a double-edge sword as it can also distribute seeds of invasive species. Because of such distribution, more invasive plants will grow and take over more area within the biome. Due to the invasion of these exotic species, the ecosystem will go through some changes in order to sustain its life. Such factor would be the change in soil pH, as invasive species can elevate the nitrate uptake [3]. These changes can greatly affect the native plant species as they are not accustomed to the change in the soil pH, which may end up costing their lifespan. This change can possibly greatly affect the functionality of an ecosystem as it slowly affects plants and animals altogether.

As white-tailed deer are known to roam through not only forests, but also farmland, it is highly likely that their population can be a great concern for the human community. Deer not only consume forest plant species, but may also devour crops from farmlands. Such loss equates to the lost of money for the farmers. There are also deer-vehicle incidents that occur within the human populated areas, causing many to find the deer a nuisance (especially in the suburban areas) [5]. In 1991, it was reported that 538,000 deer-vehicle collisions have occurred in 35 states. These collisions also cost money as an estimation of the values of repairment bills total to almost \$1.1 billion [9]. As the population is getting out of hand, wildlife managers try to find solutions regarding the management of the population. It is best that the does are to be gamed as there is an abundance within the wilderness. Though game production, otherwise known as hunting, is an effective choice of regulation, there are many areas which prohibit hunting activities. To add on, hunters tend to hunt in favor of tradition and satisfaction rather than

regulating a population [5]. If the hunters were to game in favor for the latter, it would greatly help control the overpopulation of the white-tailed deer as well as the overfeeding of plant species which can greatly benefit the community. To find ways to manage the population, gathering research is a must. Wildlife managers must expand their research in order to find the main factors that contribute to the growth of the deer population, allowing them to alter any changes within the area. Such information can spread to the community, as people will find ways to contribute to such cause.

Though hunting is seen in a negative light by human society, one other possible solution for regulating the size of the white-tailed deer would be introducing more predators within the vicinity. One of the white-tailed deers predators is the coyote. In 2015, the coyote population slowly reached into the eastern region of North America. This caused a great decline within the white-tailed deer population [6]. The coyotes are more likely to prey on the deer neonates as they are much easier and vulnerable targets in comparison to the adults. As one doe can bear twins (sometimes three), the amount of food source is tempting to that of the coyote. Although the solution is efficient towards the issue, such solution may not be a dependable for various of reasons. Being carnivores, coyotes have the variety to consume different prey, so the relation between the coyote and the consumption of deer may fluctuate within time. There may also be another rising issue involving human interaction as well as the people not only have to interact with the deer, but with the coyotes as well. More incidents may possibly occur. However, by maintaining regulation and close monitoring, these solutions so far seem plausible.

With this research, I plan to illustrate a short storybook, preferably a children's book. The production will either be illustrated digitally or by hand, and will be printed into a book. Initially, I wanted to have the story center around a baby deer and show the changes revolving around the baby deer's home. However, such changes may be difficult to show as they have already happened way before the baby deer would even be born. Instead, the story would revolve around an elderly deer and her family. She'll tell stories of the "good ol' days" to her grandchildren, describing how things were way different back then. With this idea, I will try to incorporate the research that I've gathered such as when the elder deer discovered the first invasive plant species, or when she noticed the changes in her surroundings. I want to convey how the deer population can greatly affect the environment that it inhabits, and how it can affect other species as well. I would also like to incorporate the distribution and growth of exotic invasive plant species within the ecosystems as the deer play a significant role regarding the distribution. Although it may not be suitable for a children's book, I would like to include some solutions that can help regulate the deer population such as "doe harvesting" or predatory introduction in a non-grotesque fashion. There would also be some human interaction in order to show how the deer population affects the lives of humans. By creating a children's book, all the research can be easily digested and the story will be simple and easy to understand.

### Annotated Bibliography:

1. Peterson, Roger Tory, editor. 1988. *A Field Guide to Ecology of Eastern Forests North America*. First Edition. Boston (MA). Houghton Mifflin Harcourt Publishing Company

This book source is a guide that provides information on all the eastern forests of North America. It gives an enormous amount of information on animals and plants which inhabit those areas, that including the white-tailed deer. They inform on animal behavior, animal diet, population, and so forth.

2. Brown, Lauren. 1985. *National Audubon Society Regional Guide to Grasslands (Audubon Society Nature Guides)*. First Edition. New York: Knopf

This guidebook includes illustrations and photographs of various plants, mammals, and other living organisms. Each organisms is accompanied with information relating to where they inhabit, their behaviors, and appearance. One of these organisms mentioned is the white-tailed deer. The guidebook provided information on the area range which the inhabitat, appearance, breeding, and the author's comments on the species which are interesting facts about the animal's behavior.

3. Shen, Xiaolin, Bourg Norman A., McShea William J., Turner, Benjamin L. 2016. *Long-Term Effects of White-Tailed Deer Exclusion on the Invasion of Exotic Plants: A Case Study in a Mid-Atlantic Temperate Forest: A Case Study in a Mid-Atlantic Temperate Forest*. *PLOS ONE* 11(3): e0151825. <https://doi.org/10.1371/journal.pone.0151825>

This source focuses on the role the white-tailed deer plays on exotic invasive plant species. They chose to use four different exotic species in a temperate forest ecosystem in Virginia and applied it within a 4-ha deer exclusion site and a 4-ha reference site. The results indicate the significant role the deer density has on the abundance of exotic invasive plant species. They infer that in order to limit the number of these invasive species, there must be a limitation on the deer population.

4. Tilghman, N. (1989). Impacts of White-Tailed Deer on Forest Regeneration in Northwestern Pennsylvania. *The Journal of Wildlife Management*, 53(3), 524-532. doi:10.2307/3809172 [www.jstor.org/stable/3809172](http://www.jstor.org/stable/3809172)

This journal article covers the effects of white-tailed deer overpopulation in Allegheny hardwoods forests located in Northwestern Pennsylvania. Tilghman observes 3 silvicultural treatments with different amounts of deer density. Such observations have concluded information of how deer overpopulation can greatly affect forest regeneration and biodiversity. The deers caused a stunt growth for many tree seedlings, even consuming some of these seedlings, which can cause an issue regarding forest composition.

5. Waller, D., & Alverson, W. (1997). The White-Tailed Deer: A Keystone Herbivore. *Wildlife Society Bulletin*, 25(2), 217-226. [www.jstor.org/stable/3783435](http://www.jstor.org/stable/3783435)

This article, like the rest of the articles, touches upon the problematic white-tailed deer overpopulation. However, it also proposes different approaches to tackle this issue. In order to do so, biological research on the ecosystem is needed in order for managers to have a better understanding as to what contributes to the growth of deer population. There is also an option of hunting, though it is found to be unfavorable for those who do not understand the issue of the abundance of deer roaming within the ecosystem.

6. Chitwood MC, Lashley MA, Kilgo JC, Pollock KH, Moorman CE, et al. (2015) *Do Biological and Bedsite Characteristics Influence Survival of Neonatal White-Tailed Deer?*. PLOS ONE 10(3): e0119070. <https://doi.org/10.1371/journal.pone.0119070>

This source discusses the survival of neonatal white-tailed deer and their survival of predation of the coyote. This source explores the rate of survival for deer offspring and the amount of predation amongst them which may come in handy for explaining the deer overpopulation or maybe a solution to the deer overpopulation. It also explores the role of bedsites and how they can help in a neonate's survival. However, the survival of the neonates was not due to the visual obstruction of the bedsite, though it had slight relations to the diversity of plant species near the bedsites.

7. Hirth, D. (1977). Social Behavior of White-Tailed Deer in Relation to Habitat. *Wildlife Monographs*, (53), 3-55. Retrieved from <http://www.jstor.org/stable/3830446>

This article discusses the social behavior of white-tailed deer and how much reproduction that may occur within. Data such as the amount of doe in comparison to buck is provided. It also provides the behavior of fawns and the amount of time which it takes for them to adapt to their surroundings and follow their parent's footsteps. Such information can be beneficial as it has data regarding the rate of birth of the white-tailed deer as well as their behavior within a social group in different habitats.

8. Frerker K, Sabo A, Waller D (2014) Long-Term Regional Shifts in Plant Community Composition Are Largely Explained by Local Deer Impact Experiments. *PLOS ONE* 9(12): e115843. <https://doi.org/10.1371/journal.pone.0115843>

Like many sources, this source also touches on the effects of deer overpopulation on the plant community composition. It explores the long term effects on the communities and plant reproduction within the Midwest area of North America. The results show how deer consumption can lead to a decrease in abundance of various plant species, such as shrubs, and an increase in exotic plants and ferns. Their consumption can also cause future difficulty in plant regeneration.

9. Conover, Michael R., William C. Pitt, Kimberly K. Kessler, Tami J. DuBow, and Wendy A. Sanborn. "Review of Human Injuries, Illnesses, and Economic Losses Caused by Wildlife in the United States." *Wildlife Society Bulletin (1973-2006)* 23, no. 3 (1995): 407-14. [http://www.jstor.org/stable/3782947?seq=1#page\\_scan\\_tab\\_contents](http://www.jstor.org/stable/3782947?seq=1#page_scan_tab_contents)

This source is about the occurring problems between wildlife and the human population. It also includes reports of economic losses that were caused by these wildlife problems, one being deer-vehicle collision. This source provides information as to how many collisions occurred during the 1990s and how much it costs for repairment of these collisions. This information can help further explain how the deer overpopulation can cause a negative impact to

human society. These accidents are very dangerous for both the deer and the people in their vehicles.