A Step to Becoming a Less "Carbonated" World: Sequestering Carbon From the Furry Creatures Around Us

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Abstract

Wildlife has co-existed on this planet with humans for thousands of years. While industrialization and urbanization are on the rise, so is the level of carbon dioxide, significantly affecting wildlife in numerous ways. Yet, as we humans are doing our best to devise the most efficient and appropriate ways to fight against climate change–through strategies like sequestering carbon and focusing on renewable energies–animals are also fighting climate change in their own unique ways. While solutions to fight climate change are mostly innovated by humans, being able to realize and value the role of nature and wildlife is an inseparable key to making our world closer to carbon neutral. This paper explores the details into how wildlife plays a role in carbon sequestration, focusing on two critical animals to the environment: deer and forest elephants. Research was gathered from sources worldwide on the relationship between wild animals and carbon sequestration, featuring studies on specific species of Scotland deer and African Forest elephants. It was found that these wild animals not only benefit the local vegetation's growth, but also reflect a wider regional impact on increasing their ability to sequester carbon into the atmosphere. Though there exist negative impacts of these animals, it is still essential to recognize their role in our nature and make use of all that can be done.

Introduction

Ever since industrialization, emissions of carbon dioxide have only been heading upwards in one direction, to the point where the world and climate have been significantly impacted. Yet, is that the irrevocable consequence of human action and the end of this clean world? The answer is no, and the focus of this paper will be to discuss one of the strategies to combat climate change: carbon sequestration through wild animals.

So what is carbon sequestration? It refers to the process of storing and capturing atmospheric carbon. By doing so, carbon dioxide in the atmosphere can be decreased, reducing the greenhouse effect. The main two approaches are through biological and geological carbon sequestration ("The Role of Wild Animals in Carbon Sequestration", n.d.).

Geological carbon sequestration focuses on carbon captured and stored by geological formations and rocks, whereas biological carbon sequestration is done by animals, plants, and the soil. Wild animals, in this case, fall under biological carbon sequestration.

As humans, we have inevitably played a significant role in both producing and sequestering carbon. Because animals also breathe and live on this planet, the same likely happens for wildlife. And some wildlife are more or less beneficial/detrimental than others to climate change's cause. Many animals have a significant role in carbon sequestration. Deers and forest elephants are two species that are closely tied to our environment. They live in the forests, which act as one of the most important carbon-sequestering sources. Thus, they play a critical role in the steps of sequestering carbon from our atmosphere.

This paper will take a deep dive into the specifics of how and why animals can contribute or harm carbon sequestration–specifically elaborating on the impact and role of deer and forest elephants on our atmospheric carbon.

The Correlation Between Wildlife in Woods/Grasslands and the Environment

Wildlife makes up a major part of our environment on earth, inseparable from the natural carbon cycle of the earth. Without the existence of forests and grasslands, there would be no oxygen production in our world, nor would there be carbon capture and conversion–through the critical process of photosynthesis in plants. Animals in the wild live off of nature to survive, depending heavily on a clean and functioning environment; simultaneously, a clean and healthy environment relies on the role of living animals. Thus, the tie goes both ways

The ocean, soil, and forests are the world's largest natural carbon sinks, acting as an essential foundation for reducing carbon in our atmosphere (Willige, 2023). Among those, the forest is one of the most direct, with the gathered trees and vegetation being the key to it. By maintaining their lives through photosynthesis–capturing CO2 from the atmosphere for energy and oxygen release, trees are able to sequester great amounts of carbon, ultimately bringing breathable oxygen to our atmosphere. Hence, without forests, a major source of oxygen and carbon sequestration will disappear, further deteriorating the current climate change due to greenhouse effects.

However, apart from human intervention, animals that inhabit forest areas can also affect their life or function to different degrees. Different animal actions could benefit or harm their local forest, like helping with seed dispersal and increasing vegetation or trampling over plants and other deforestation acts. Ultimately, no matter in what way, animals have a strong correlation with their environment, influencing it just as significantly as humans except in a different way–even though many people aren't aware of it.

Wildlife on Land: Carbon Footprint

As mentioned above, animals are closely tied to our environment as inhabitants of this land, and undoubtedly affect and are affected by changes in the climate. Thus, carbon levels in our atmosphere today have a strong correlation with wild animals, as well. Because they are living organisms on the planet, there are many ways they also leave a carbon footprint–like necessary respiration and excrement production.

Deers are a species that inhabit forests. They affect the environment and atmospheric carbon in numerous ways, from entire populations to individual actions. Firstly, in terms of the species as a whole, population density is an essential factor in the trails that they leave behind. To elaborate, population growth is usually followed by large declines in aboveground woody biomass and vegetation–decreasing the opportunities for carbon sequestration among those plants. From studies conducted on deer populations in Scotland, the population of deer has increased significantly due to the decline of predators in the region; thus, competition for

resource consumption often damages local fauna, decreasing the diversity and abundance of plant species that are able to sequester carbon (Hirst, 2021).

By consuming plant biomass, herbivores like deer are removing vegetation that originally served as carbon storage through photosynthesis. Instead, that biomass is consumed by such animals, turning into animal biomass like excrement which releases carbon to the soil, as well as into the atmosphere through respiration (Hirst, 2021). Deer also can negatively affect tree regeneration by eating up and damaging young seedlings or saplings; they do this through simple habits of rubbing their antlers on adult trees, potentially causing the damage or death of those plants (Journal of Applied Ecology, 2019).

Additionally, another deer behavior–deer browsing, which is them eating leaves, buds, and twigs of woody plants–also has quite an effect on the environment. By doing so, they could alter plant community composition as well as plant and ecosystem productivity, and shift the flow of nutrients within an ecosystem. Browsing also results in less plant biomass available for photosynthesis. The potential loss in plant diversity and abundance can alter its capability for carbon capture and the density of carbon storage in standing biomass (Hirst, 2021).

Apart from deer, there are many other animals that reflect a deep impact on our environment, one of them being the forest elephants. Similar to the deer, forest elephants inhabit forest areas, as they leave carbon footprints in the woods and vegetation through multiple facets. As large vertebrates, elephant tramples are strong and impactful to the forest, causing soil compaction, change in structure, and change in infiltration capacity. Trampling also destroys aggregates, decreasing the carbon storage capacity within soil–and making it vulnerable to degradation (Hofman, Linstadter, Kindermann, Angombe, Amelung, 2021).

On top of the carbon footprints of individual members, the population as a whole creates a more profound impact on limiting carbon sequestration. With the density of their population as a major influencer for above-ground carbon density (ACD) in their ecosystem, a larger population is closely associated with an increase in ACD (Davies, Asner, 2019). This is because more carbon is accumulated and released from the respiration and excrement of elephants. Ultimately, elephants inevitably leave a carbon footprint on their environment and atmosphere. Yet, these are only the downsides of the wild animals; they also benefit carbon sequestration in various ways, which are explored below.

Carbon Sequestration among wild animals

Other non-human animals have lived on this planet for a long time prior to the existence of human and human-constructed infrastructure. Before humans intervened into the natural world, wild animal and their environment established their state of harmony with organized interactions, both good and bad ones. Therefore, apart from the negatives, there exist numerous benefits wild animals can bring to the environment. The paper goes on to explore those effects, specifically how they help with carbon sequestration.

To begin, natural behaviors among wildlife could increase ecosystems' carbon storage capacity, or the ecosystems' ability to sequester more carbon. As an example, many large vertebrates aid ecosystems in carbon sequestration through their day-to-day acts like trampling,

burrowing, and foraging–which can increase its ecosystem's carbon storage capacity by up to 250% ("The Role of Wild Animals in Carbon Sequestration", n.d.).

Through actions like these, animals can support the growth of carbon-sequestering vegetation, emphasizing the role and effect of such plants on our atmosphere. In addition, wild animal balance and conservation are also key to maintaining a functioning ecosystem, and thus a functioning carbon-sequestering system. Every ecosystem requires balance; there is a critical predator-prey relationship that affects the ecosystem's vegetation. If the predation of prey becomes out of order, it will likely reflect an impact on the fauna that could be essential to the atmosphere's oxygen regulation ("The Role of Wild Animals in Carbon Sequestration", n.d.). Keeping a balanced and organized ecosystem can ensure that the carbon-sequestering vegetation can thrive at the level necessary to maintain natural carbon cycles

Simultaneously, biodiversity exists as a critical aspect of enhancing ecosystems that act as a large carbon sink. Protecting certain animals and maintaining biodiversity in an ecosystem can bring a greater diversity of animals that carry various functional roles, significantly increasing carbon absorption. The wildlife works together to disperse the seeds of trees with carbon-dense wood, enhance the nutrient supply of the soil, and control the competition between different plants (Willige, 2023). These results all add up to help sequester carbon, which is necessary as many wild populations of animals have dropped, decreasing all the behaviors benefitting carbon capture and storage.

Yes, animals do have a tight relationship with ecosystems sequestering carbon. But specifically how, and what animals are capable of making a critical effect?

Deers are a species that can help with such goals. These animals can do much that benefits the environment, from local to regional scales. They can help mitigate severe wildfires through their daily consumption of woody shrubs, hence reducing the amount of fuel load and the severity of such events (Journal of Applied Ecology, 2019). Through this, they decrease the likelihood of surface wildfires transitioning into severe canopy wildfires, which can be a big release of carbon into the atmosphere if not controlled. While protecting the survival of trees and similar vegetation, deers are indirectly contributing to the ecosystem's carbon storage.

Researchers in Scotland have taken a deep dive into the effects of deer on carbon sequestration, where the following will be results drawn from their research. Density is a critical issue, as the deer numbers in Scotland today are too high; a reduction of the population is needed to encourage regeneration of vulnerable plant species, while also increasing the health, productivity, and potential of carbon sequestration. Moreover, deer directly impact their environment by grazing, browsing, bark stripping, trampling, and fraying, which is beneficial to the environment if the deer population is at a balanced number. Both above and below-ground biomass in a forest ecosystem are capable of carbon sequestration, as deer lifestyle correlates tightly with both aspects through their respiration, excrement, and actions.

We see elephants living on grasslands and prairies most often, yet there is also a population of them living in densely vegetated areas like forests: these are the African forest elephants. These animals assist in the carbon sequestration process through their daily foraging for food, spending about 20 hours a day munching ("The Role of Wild Animals in Carbon Sequestration", n.d.). By trampling around forests and consuming plants, they free up space and

nutrients for the growth of larger, more mature trees that sequester more carbon than the low-level foliage they consume.

Just through these everyday actions, an African forest elephant can sequester up to 9000 tonnes of carbon in their lifetimes accumulated together ("The Role of Wild Animals in Carbon Sequestration", n.d.).

In addition, by combining repeat airborne Light Detection and Ranging with measurements of elephant densities, abiotic factors, and exclusion experiments, scientists determined the importance of motivators in aboveground woody vegetation carbon stocks in Kruger National Park, South Africa (Hofman et al., 2021). The regulation of terrestrial carbon stocks is relatively important, greatly depending on the behavior of the elephant population. Population density has close ties to such carbon-regulating vegetation, where a decline in population could free up consumption and damage to the forest biomass and vegetation–increasing opportunities for carbon sequestration (Hofman, Linstadter, Kindermann, Angombe, Amelung, 2021).

Furthermore, through their actions, elephants trample or eat the vegetation that could exist as competition to those trees of space and nutrients. This frees up room for carbon-sequestering vegetation to grow, no longer having other foliage in their way. As mentioned before, elephants are an important driver of change for ACD in their habitats, though many may think that abiotic features take on a more significant role (Davies, Asner, 2019).

Discussion

Although wildlife and animals are not always able to conscientiously innovate carbon sequestration solutions the way humans can, they do exist as a natural tool for carbon sequestration that is closely intertwined with the environment. Because every animal's actions have two sides, it's important to consider both the positives and negatives of all species on carbon sequestration and not to consider any animal for inhumane research studies. On top of knowing their effects on carbon sequestration, being able to learn about their unique behaviors–and valuing them–is what this paper's ultimately trying to convey.

Deers and elephants, though minimal in effect on the human population, are vital to forests through their frequent interaction with the vegetation. From simply trampling around to plant consumption and browsing, these wild animals leave behind small trails of enhancement to their habitat, which ultimately come together as a big carbon sequestration source method. On the other hand, if their population grows out of proportion, the results can be extremely negative to forest health and carbon capture potential.

Furthermore, rewilding animal species is one of the keys to increasing carbon sequestration, but over-conservation of a single species with no predators, like with elephants, does conflict with carbon sequestration efforts due to density reasons. As discussed before, higher densities of animal populations lead to numerous negatives like increased competition for resources, faster consumption of vegetation, and further damage to the habitat. Yes, the conservation of wild species by rewilding them is a good solution, but ecosystem balance stands as a more critical aspect. Without the right predator-prey ratio or relationship, too much

abundance of one species–like the deer or elephant–would not reflect a positive impact on the local fauna–thus decreasing the ability to regulate atmospheric carbon.

Conclusion

In conclusion, wildlife plays an essential and complex role in carbon sequestration. Despite increased atmospheric CO2 levels due to industrialization and human activities, wild animals like deer and forest elephants continue to contribute to carbon sequestration through their natural behaviors and interactions with their habitats. However, it is crucial to recognize that these contributions come with challenges and imperfections. Therefore, a balanced and comprehensive approach is one that values the role of wildlife and maintains ecosystem harmony, appreciating how it is the key to enhancing carbon sequestration efforts and creating a greener world.

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