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## Roles of Forests

Forestry was commonly a misunderstood topic in which it was thought to be the study of trees alone, yet in actuality is much more. Forestry, in short, is known to be the science and understanding of managing forest trees and other natural resources that result from forested lands. Therefore, in addition to studying forest trees, forestry embraces studies in wildlife, soil, timber, and more. (The University of British Columbia, 2017) The importance of forestry in the United States became evident in the late 1800s. From 1876 to the early 1900s, the United States government made efforts towards creating forest reserves through the Forest Reserve Act of 1891 and eventually the responsibility for these reserves fell into the hands of the U.S. Forest Service in which Gifford Pinchot became the first Chief. (U.S Forest Service, n.d.) More recently, the United States in addition to many other countries continue to protect its forests through established proper regulations.

Forests have a major impact in different environmental aspects. A tree's environment integrates its abiotic factors including soil and climate to its biological elements like animals, insects, and microorganisms that depend on the plants. Since trees may not permanently reside in their native environment, certain trees may struggle to thrive in their current habitat to reach their maximum potential. This will determine the success of that tree species in its current environment and may cause some species to dominate while others die off. (The University of British Columbia, 2017) This project studies whether or not there is a relationship between the dominant tree in an area and the biomass of trees in that same area in order to further understanding tree growth patterns.

### American Broadleaf Forests

American broadleaf forests are widespread throughout the United States. These forests consist of mainly deciduous trees, which have been known to have broad leaves instead of pine needles like coniferous trees. Although most of these trees had lost their leaves seasonally, there is still biodiversity amongst these types of forests. Biodiversity has been classified into either phylogenetic (evolutionary) and/or functional (ecological) criteria. Biodiversity occurs due to genetic variation among each individual organism through phylogenetic and functional history and the means of future adaptive evolution. In terms of diversity, species that do not have much genetic variation become more susceptible to extinction due to nature or human interactions. (Colwell, n.d.) More specifically, ecologists and biologists have described the biodiversity of forests in terms of species. Species richness is the amount of species of a specific life form that characterize a community, habitat, or ecosystem. (Colwell, n.d.) Biodiversity and ecosystem functioning (BEF) studies manipulated the species richness of plants during experiments and

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suggested that ecosystem functions, like biomass production and nutrient cycling, respond strongly to changes in biological diversity. (Cardinale, 2012)

In addition to biodiversity, carbon sequestration is an important factor in American broadleaf forests. These deciduous forests have been recognized to be large carbon sinks. Many of these forests trees balance out the carbon in the atmosphere by extracting it (carbon sequestration) and storing it in their leaves or in the soil. This makes the amount of carbon stored in the forests twice the amount of carbon stored in the atmosphere. (Hui, 2016) Another important aspect that has made up American Broadleaf Forests is succession, which may also influence the carbon levels. Succession occurs after a disturbance cleared a land area and plant species grow in that area over time afterward. In order for an ecosystem to completely grow back, it takes time, which is why succession is occurs in stages. As noted in a recent study, during some of the middle succession stages, the net ecosystem production (the difference between the amount of carbon produced by photosynthesis and the amount used by respiration) and net primary production (the amount of carbon uptake after plant respiration) may decline or increase, depending on the frequency of the disturbance. (Gough, 2016) Due to this and other factors, succession is the process that keeps many forests functional today. Greenbelt Park One of Maryland's known forested areas that has resulted from succession is Greenbelt Park. Greenbelt Park is one of Maryland's National Parks, and has been one since 1950 under Public Law 643. Originally, the land flourished with trees, wildlife, and water.

Once colonists arrived on the Native American territory, they cleared the land over the next 150 years for farming and other convenient uses, and those factors along with erosion left the remaining land bare. The land slowly began to replenish itself over time and has recently flourished into the vast array of trees, wildlife, bacteria, and more. (National Park Service, n.d.) Greenbelt Park is important in Maryland because it now stands as a National Park and is devoted to being protected and preserved. It contains some common tree species such as the red maple tree and the flowering dogwood tree. Red maples are one of the most abundant and widespread trees in North America. (U.S. Forest Service, n.d.) The flowering dogwood tree is also found in Greenbelt Park and tends to be found in areas with improved drainage and soils with lighter textures. (Viña, 2010) These tree species along with the others found in the park contribute to the animals, bacteria, fungi, and lichen that interact with them and may help the trees grow or use their resources.

## Tree Dominance

Although there can be many tree species in a forest, including Greenbelt Park, an important factor that can determine the fate of a forest are the dominant trees. A dominant tree is known as one that appears the most in a specific area or range. A dominant tree may emerge due to different circumstances, but commonly due to disturbances, which may determine the success

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or failure of a plant. One example of a disturbance is human interaction, or anthropogenic disturbances. These may include forest clearing for building houses or roads or even “wave of intensive harvesting and clearing for agriculture in which harvesters select economically valuable species.” (Hanberry, 2013) These types of disturbances can destroy the balance of a forest ecosystem, and can cause new species to be grown in the area surrounding the disturbance, since the human interaction with that forested area could ruin the seed production of plants that were initially there or cause mutualistic relationships between that tree species and animals to suffer. This eventually could cause another type of tree to flourish, and create a different environment in which the new tree species could better disperse their seeds and thrive until it eventually takes dominance.

Another type of disturbance is natural disasters which could affect which tree becomes dominant in a plot. Natural disasters such as tornadoes, earthquakes, and hurricanes which can easily remove tree species that were not strong enough to withstand them, and could cause some gains that were made by forest species to be offset. (Viña, 2010) This can also include droughts in which many tree species have suffered mortality from them. (Fensham, 2015) This would eventually leave the stronger tree species to survive and dominate. Invasive species can also be another way for a tree species to dominate in an area. According to research, seed dispersal plays a vital role in plant invasions. As long as seeds can be transported to different environments, exotic species will remain a threat to native species in an environment, and have the potential to kill native species which may dominate. Studies have redirected their focus from diversity and how that may enhance invasion resistance to instead study dispersal and how the characteristics of introduced species mainly determine the success of invasive species. Other factors, such as disease, seed predation, herbivory and resource availability affect the recruitment of an invasive species and whether or not it will survive in its new environment. (Lichstein, 2017) Species richness must generally be estimated based on samples due to detection difficulty, behavioral factors, and more. Relative abundance is the most important influence on the effort required to record a species. As the more species grow and develop, the rate of discovery of new species declines steadily, as rarer and rarer kinds remain to be found. (Colwell, n.d.)

Biomass In forest ecosystems, tree biomass refers to the measure of tree biological matter in the forest. This includes all parts of the tree, in which most parts are from the ground up, however some parts, such as the roots, need to be taken into account. Forest inventories usually consist of quantifying below ground biomass in addition to above ground biomass. The most common measurements used to determine forest tree biomass include DBH which is known as diameter at breast height, tree heights at distinct levels, and tree type are related to measured timber volume. (Price, 2017) In order to understand the contribution of forest biomass changes to other important forestall factors like the global carbon cycle, climate change, and the relationship between tree diversity and productivity, environmentalists need to make proper estimates of the

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changes in forest demographic rates. Permanent sample plots (PSPs) have been used for estimating forest demographic rates as well as mapping forest biomass distribution, yet it only includes large trees. (Searle, 2017) This can be a problem when properly mapping the biomass of a forest. In the United States, the requirement in order for a woody plant to be considered a tree is for the DBH to be 12.7 cm and higher as of 2017. (Searle, 2017) This has caused experiments to take place in which tree biomass was only accounted for the larger trees, which was not an accurate measurement of the forest biomass.

## Summary

A forest ecosystem needs has many determining factors in order to make it unique. Forestry is known for its trees, which contribute to many factors in the ecosystem and affect the environment as a whole. Trees can take on many different shapes and forms, and may have different niches depending on the species and their ecosystems.

The importance of tree dominance and biomass has been stressed. The dominance of a specific tree species may hold an environment together, yet if disturbed may give leeway for another species to take over. This could ruin the soil, drive away other native tree species, and make it more likely for the supporting organisms to be driven away to find newer, stable environments that could support them. Just as important as tree dominance, tree biomass can affect different parts of the ecosystem. It can affect the carbon levels in the air and the forest itself, and deserves to be accounted for properly. These factors need to be understood in order to retain a better understanding of tree growth patterns, the survival rates of certain tree species, winning and losing tree species, and many other.

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