Plant phenology is the transition of plants through phenophases, or observable stages of their life cycle that have a defined starting and ending point. Plant phenology has many critical applications, including: the management of invasive species and forest pests; predictions of human health-related events like the timing and severity of allergies, and when mosquitos are most abundant; optimization of when to plant, fertilize, and harvest crops; understanding the timing of ecosystem processes, such as carbon-cycling; and assessing the vulnerability of species, populations, and ecological communities to ongoing climate change (USA NPN). When phenological transitions occur earlier or later than average, the timing and impacts of allergies changes, crop production may suffer because of poorly timed application of fertilizers and pesticides, and the phenology of the varying trophic levels of animals won’t be in sync with plant development anymore (USA NPN). Without plant phenophases occurring around the same time each year, catastrophic effects throughout the food chain may follow.

Forces that affect plant phenology include temperature, timing and duration of pest infestations and disease outbreaks, water fluxes, nutrient budgets, carbon dynamics, and food availability. One of the most obvious factors in relation to climate change is changing temperature. High temperatures, for example, may cause non-perennial crops to development more quickly and have a shorter life cycle, resulting in smaller plants, shorter reproductive duration, and lower yield potential (Hatfield, Prueger 2015). Perennial crops may also be affected, if temperature shifts affect the chilling requirements fruit or nut production (Hatfield, Prueger 2015).

Along with temperature as a factor of phenological change, accumulated growing degree days are also important to look at. Growing degree days are the number of degrees the average daily temperature exceeds the temperature below which the organism will remain developmentally inactive. For many plants, a specific number of growing degree days must accumulate to trigger a change in phenological status, such as budburst. This minimum number of GDDs is referred to as a plant’s growing degree threshold. If a growing degree threshold for a phenological transition is known for a particular organism, it is possible to investigate how soon that transition is likely to be reached by calculating aggregated growing degree days over the course of a season.

This project focuses on the phenology of deciduous broadleaf trees, a perennial plant, within several NEON domains throughout the United States. Specifically, deciduous broadleaf “green-up” will be compared to temperatures throughout a season… (to do/look at what exactly?). Deciduous trees are among the USA-NPN regional species list to monitor due to their dominance in their habitat, their conservation value, association with health issues such as allergens, and their importance to ecosystem services such as food supply. According to the EPA, two phenology derived variables as climate change indicators are length of the growing season of plants and leaf and bloom dates. By using data collected by NEON, deciduous tree leaf growth throughout time at a field site within one season will be graphed along with the temperature over the season, so that the implications of climate change can be explored. The accumulated growing degree days for the sites will also be displayed so that the changes in phenophases can be compared to the heat accumulation at the site, further allowing for the exploration of plant phenology and its relation to climate change.

References:

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Hatfield, J. L. & Prueger, J. H. Temperature extremes: Effect on plant growth and development. *Weather and Climate Extremes* **10,** 4–10 (2015).