Examining the Response of Urban Trees in Canada to Variations in Climate

https://www.e-ir.info/2020/04/29/examining-the-response-of-urban-trees-in-canada-to-variations-in-climate/

ISABELLA BOUSHEY, APR 29 2020

Urban populations are rising at alarming rates worldwide. Currently, 55% of the global population lives in urban areas, and that number is projected to increase to 68% by 2050. This raises the question whether urban environments are equipped to sustain and support healthy living conditions for the growing human population. Greater increases in urban populations demand further urban development, essential resources, and ecosystem services. Ecosystem services are the benefits humans receive from the natural environment, including temperature regulation, air quality, carbon sequestration, sense of well-being, and flood reduction. The increases in human populations and demand for resources in urban areas also puts further strain on the natural environment and vegetative zones within these areas. Some of this stress is produced by higher temperatures as a result of the Urban Heat Island (UHI) effect and reduced air quality. A reduction in the survival of the urban forest is detrimental to not only the provision of ecosystem services; but it can also exacerbate negative effects that cities impose on global climate change.

Urban trees are one of the most important natural resources we have and provide many benefits to society and the environment. They are important assets which mitigate the effects of the UHI and excess rainwater. Urban trees create important wildlife habitats, are sinks for carbon sequestration, and improve public health. With the current and projected increase in the frequency and intensity of heat waves, cities also generally record average annual temperatures of 3°C to 12°C higher than their surrounding rural and suburban areas. This increased temperature level in urban areas can affect the vitality and resilience of urban forests; which are known to prevent impermeable surfaces from absorbing energy from incoming solar radiation and improve air quality. Thus, the maintenance of urban trees is a key tool for ensuring the quality of life in cities. Trees growing in urban conditions experience many stressors at their growth sites, including limited water availability, higher temperatures, and limited space for growth. Consequently, increasingly frequent and intense heat waves and droughts will negatively affect tree growth and survival, as they become increasingly important for the regulation (i.e. cooling) of the urban climate.

The effects of temperature and precipitation variation on tree growth have been increasingly studied in recent years, with droughts being one of the main abiotic factors affecting the vitality of trees worldwide. There are many studies regarding drought tolerance and the resilience of vegetation in natural or managed forests, but the responses of urban trees to drought are much less studied. Only a few studies have addressed the problems of the resilience of urban trees to extreme climatic phenomena and these are generally limited to one or two cities and a few species. Efforts at the regional and international scale are even rarer. Thus, in order to fully understand whether the effects of climate change on humans is dependant on the health of the trees within our communities, urban trees must be incorporated into future studies.

Trees have a unique way of telling stories through the growth rings found in their woody structure. The study of tree rings is referred to as dendrochronology and this scientific practice has been applied to a vast field of studies. Dendrochronology can tell us about changes in climate over time and help us develop future projections of environmental responses to climate. There is a significant lack of literature and research using dendrochronology to help us understand how trees have responded to past variations in climate in the urban environment.

Some studies have addressed the effect of drought on urban trees, but none have assessed the performance of species through a climate and urban gradient encompassing some of the most populated and urbanized areas in Canada, from Halifax (NS) to Victoria (BC). Ongoing research at the Université du Québec à Montréal, aims to understand the resilience of common urban tree species to drought in major cities across Canada and how they have historically responded to annual variations in Spring, Summer, and Fall temperature and precipitation. Using dendrochronological analysis focusing on species resilience to summer droughts and climate extremes, we will assess the capacities of different species to face future climate challenges in urban scenarios.

We have collected hundreds of tree cores from each of the downtown cores of major Canadian cities and looked at the trends in annual growth changes of the trees. We can now identify years of significant climatic variation (e.g. drought years) and determine whether the urban trees are resilient to these stresses. We expect trends to vary according to the differing climates across the country; from a mild and wet climate in the east, to a cold and dry climate in the prairies, and a warm climate in the west. Current data reveals that trends appear to be influenced by climate, species, and location within parks and streets. From past trends in urban tree growth with response to climate events, we will also be able to project growth, mortality, and various ecosystem service outputs, such as carbon sequestration and tree resilience, from the urban forest in Canada.

This research is critical to understanding how the urban vegetation in our cities supports our living spaces and how it can help support the rising populations in cities through decreasing temperatures and improving air quality through carbon capture. The diverse environmental and climatic conditions, as well as features within cities that make the urban forest grow and capture carbon, improve its resilience, and reduce environmental exposure, are rarely considered together in urban planning. Therefore, this project will help to not only better characterize the urban forest with richer data on growth, carbon sequestration, and resilience, it will also identify the best practices for developing resilient urban forests that will support ecosystem services now and in the future.

About the author:

Isabella Boushey is a PhD candidate in Biology at the Université du Québec à Montréal. She received her undergraduate degree from Carleton University in Environmental Science (2017) and completed her master's degree in Renewable Resources at McGill University (2019). Her work with various local and national level environmental groups is focused on science communication, outreach, and community engagement.