Increasing functional diversity of the urban canopy for climate tolerance: Potential tradeoffs with ecosystem service provision?

Sylvia Wood, Postdoctoral Researcher, Eco2Urb

ABSTRACT

Cities are home to an increasing number of people who depend on both natural and built infrastructure to provide livable spaces. Urban forests contribute to air quality improvement, stormwater and urban temperature reduction, carbon storage, and other ecosystem services. Climate change may challenge the capacity of urban forest to provide these services through intensification of heat waves, droughts and damaging storms. In Quebec City, previous work has suggested the urban canopy composition is vulnerable to projected climate extremes, i.e. hotter and drier summers. Compounding this threat, the emerald ash borer, which arrived in 2017, is expected to kill the 11% of the municipal canopy over the next decade. Together these pressures could lead to a significant loss of ecosystem service provision.

To mitigate these impacts, the species composition must shift towards climate-tolerant species, especially conifer species. However, it is not clear if these canopies will provide similar levels of ecosystem services. We develop three alternative replanting approaches for lost ash trees in Quebec City and compare their capacity to deliver ecosystem services using the iTree Eco model. The three scenarios apply a: i) 'business-as-usual', ii) 'stratified' or iii) 'conifer-targeted' selection of species according to a functional group classification. Simulations were run over a 20-year time horizon with a 2% background mortality rate.

We find trade-offs in ecosystem service provision both within and between scenarios. The 'conifer-targeted' replanting of trees provided the highest level of air quality improvement, storm water abatement and reduced energy demands after 20-yrs. The BAU scenario achieved greater carbon storage and sequestration, as well as summer shading due to the dominance of broadleaf deciduous species. Stratified replanting resulted in the greatest reduction in the vulnerability of the canopy to regional pest threats. Our results suggest there maybe long-term tradeoffs in ecosystem service provision when planning a climate-tolerant canopy.

BIOGRAPHY

Dr. Sylvia Wood is a landscape ecologist and geographer. She currently works with the Ecological Economics lab at the University of Quebec in Gatineau as a postdoctoral research and as a consultant with the start-up firm Eco2Urb in Montreal. Sylvia has a background in Biology and Forest Sciences with a doctorate in Geography on agroforestry systems from McGill University. In her previous positions she has worked with Bioversity International – the global research center on crop biodiversity– to understand how ecosystem services contribute to meeting targets under the UN Sustainable Development Goals. Her work focuses on assessing ecosystem service benefits and trade-offs in both agricultural and urban contexts for sustainable landscape planning.