Monitoring ecosystem services of urban forests in São Paulo, Brazil

Trees offer various ecosystem services that can significantly cool down and improve livability in cities. Through a deeper understanding of these contributions by studying native tree species in São Paulo, we aim to provide the municipality guidelines on vegetation structure and species composition to maximize the benefits of urban forests for the city.

in 2020
the monitoring studies started

The two parks cover
600 ha
of mixed vegetation and remnants of Atlantic Rainforest

The parks receive more than
14 million visitors every year

Nature-based Solutions Benefits

Background

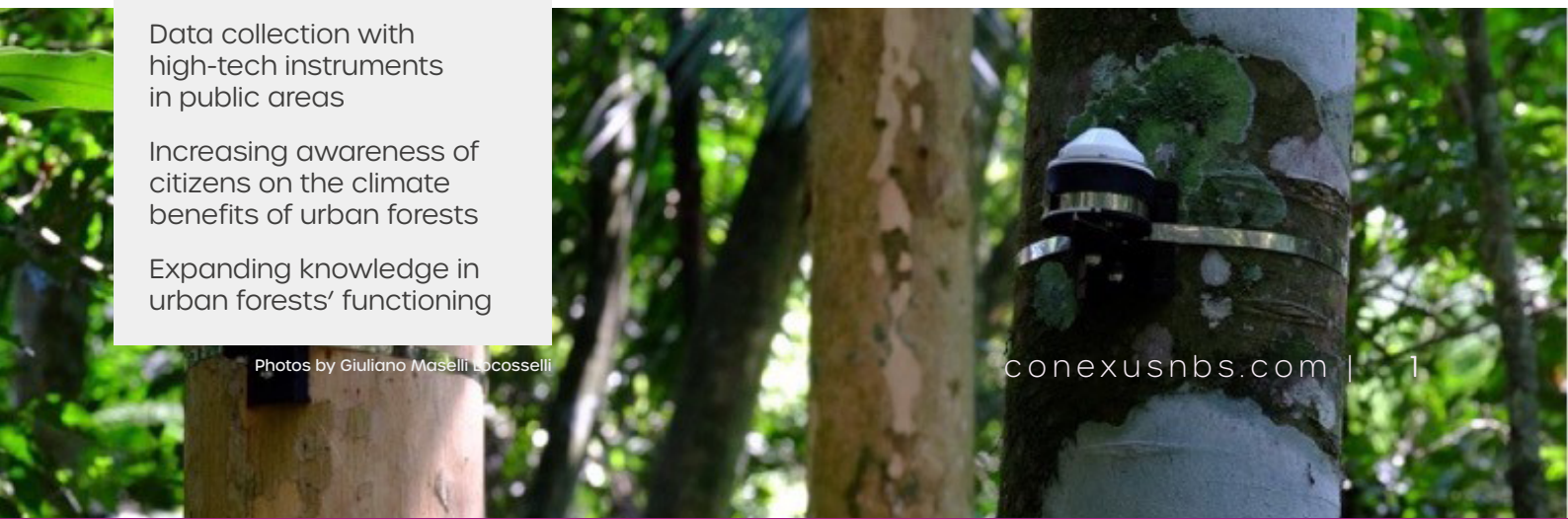
Enhancing the urban environment conditions is crucial to addressing the impacts of climate change and urban heat islands in the city of São Paulo. Urban forests provide ecosystem services that are essential for climate change adaptation and mitigation in the urban environment. In São Paulo, a pilot takes place in two well-visited extensive urban parks: the Fontes do Ipiranga State Park and Ibirapuera Park. These parks represent well the vegetation found in the parks of São Paulo. This pilot aims at I) understanding the ecosystem services urban forests provide; II) understanding the impact of the urban environment on forests' functioning; and III) creating outreach about the importance of urban forests for citizens' well-being.

Challenges

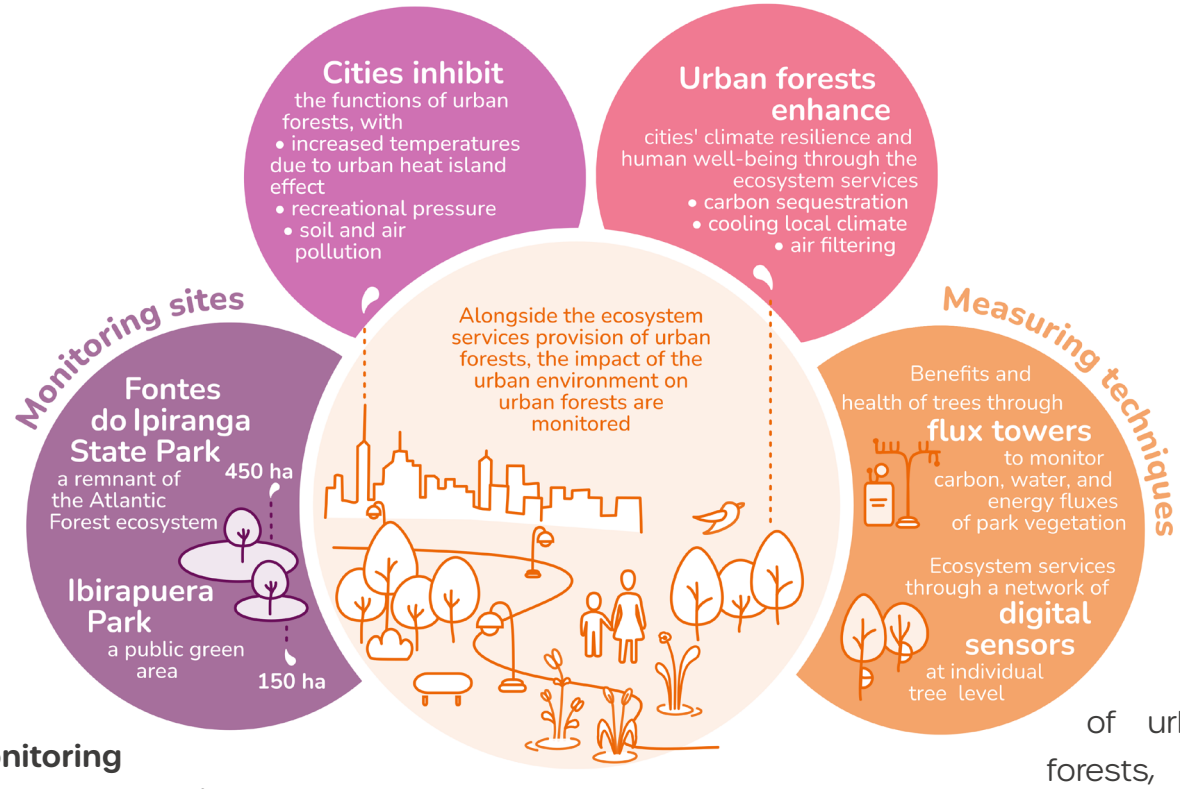
Data collection with high-tech instruments in public areas

Increasing awareness of citizens on the climate benefits of urban forests

Expanding knowledge in urban forests' functioning



Photos by Giuliano Maselli Locosselli



Monitoring ecosystem services and health of urban forests

Urban forests' ecosystem services enhance human well-being and increase cities' resilience to ongoing and future climate extremes. Whereas carbon sequestration mitigates climate change, trees' evapotranspiration helps cities adapt to climate change by cooling the atmosphere and improving thermal comfort. Likewise, trees provide cleaner air through air filtering. However, cities also bring challenges to urban forests, such as increased temperatures due to the urban heat island effect, recreational pressure, and soil and air pollution from industrial and vehicle emissions. These challenges inhibit the functions of urban forests to provide ecosystem services now or in the future. Especially when future climate conditions become more extreme, ensuring and planning resilient urban forests becomes essential. For this reason, alongside the ecosystem services provision of urban forests, the impact of the urban environment on urban forests was monitored.

The Fontes do Ipiranga State Park, a remnant of the Atlantic Forest ecosystem covering 450 hectares, and Ibirapuera Park, a public green area covering 150 hectares, were selected as monitoring sites. These large parks receive millions of visitors yearly while harboring significant biodiversity representing the vegetation in São Paulo, predominantly Atlantic Rainforests. To measure the benefits and health of trees, the carbon, water, and energy fluxes of park vegetation are monitored using flux towers. Flux towers are advanced equipment that provide real-time data on carbon dioxide, water vapor, and energy flux. This equipment are typically used to monitor forests in the Amazon and other natural areas worldwide but are rarely used in cities. Related

ecosystem services are also measured at the individual tree level through a network of digital sensors installed in native trees.

With their unique vegetation structures, both parks contribute significantly to carbon sequestration in the city while also providing substantial evaporative cooling, thereby improving thermal comfort and air pollution mitigation. These benefits are sustained even during extreme climate events like heat waves. On the other hand, drought can limit the growth and provision of ecosystem services for some species. However, the services provided by public parks are not yet at their maximum and have room for optimization by combining tree species and adequately designing the vegetation structure. These services can be further enhanced by using the knowledge emerging from this pilot project and developing practice guidelines based on it.

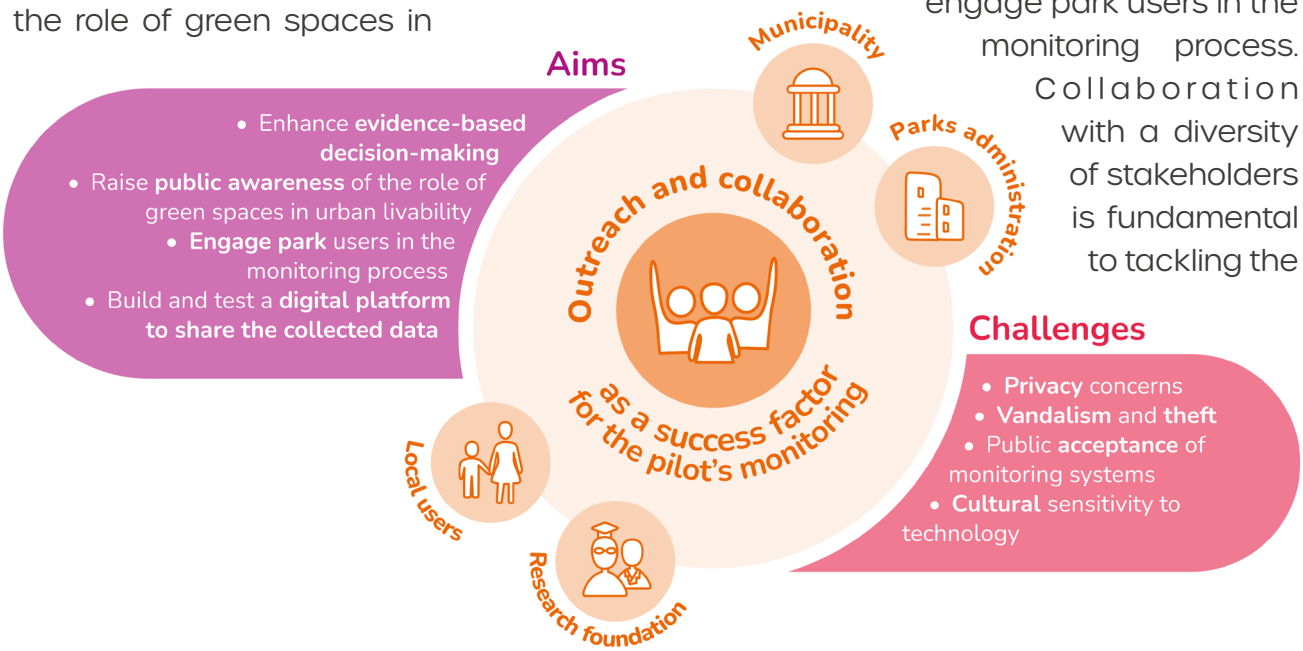
The potential of outreach and collaboration for monitoring

Effective communication is crucial to inform evidence-based decision-making and enhance public awareness of the role of green spaces in urban livability. Alongside their environmental conditions, the selected parks were chosen for their potential for public outreach. With the information collected through the monitoring network, park users, policy- and decision-makers can be informed about the value of trees and parks to the city.

"The future of cities' resilience relies on the well-informed green decisions we make today."

It also offers the opportunity to raise awareness about the importance of scientific interventions in public spaces.

Yet, setting up complex monitoring systems in public parks can be challenging. There are technical issues associated with high-tech equipment. Yet, there are also social issues such as privacy concerns, vandalism and theft, public acceptance of monitoring systems, and cultural sensitivity to technology. Due to the complexity of the monitoring, the outreach has yet to reach its full potential. The vision is to build and test a digital platform to share the collected data and engage park users in the monitoring process. Collaboration with a diversity of stakeholders is fundamental to tackling the



challenges and making the pilot successful. This pilot initiative was made possible thanks to the invaluable support of key local stakeholders, such as the São Paulo Municipality, Parks Administration, and local users, alongside financial backing from the São Paulo Research Foundation. Communication with local stakeholders has to be transparent and effective to gain their trust and support. Having a straightforward narrative on the importance of the pilot and its benefit to all stakeholders is vital to bringing stakeholders together. Collaboration was promoted by inviting stakeholders to the process, sharing common interests, and presenting the initial plans, interventions, assessments, and reports. Having a diversity of involved actors allows for feedback, exchange of ideas, and more support, but it also requires being open to suggestions and criticisms. Sharing knowledge with all stakeholders and sustaining this engagement over the years is paramount for a long-term monitoring program.

Related Projects

CUT - Climate and Urban Trees
link

Ecosystem Services of Urban Green at Public Squares in Munich
link

Learn more at
conexusnbs.com

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key messages

1. Urban forests provide different benefits, yet their functioning can be optimized.
2. Monitoring experiments of urban forests need strong partnerships between the government, academia, and organized society.
3. Stakeholders' diversity is key for a successful pilot intervention that will lead to future innovations in NbS.

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City Partners

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