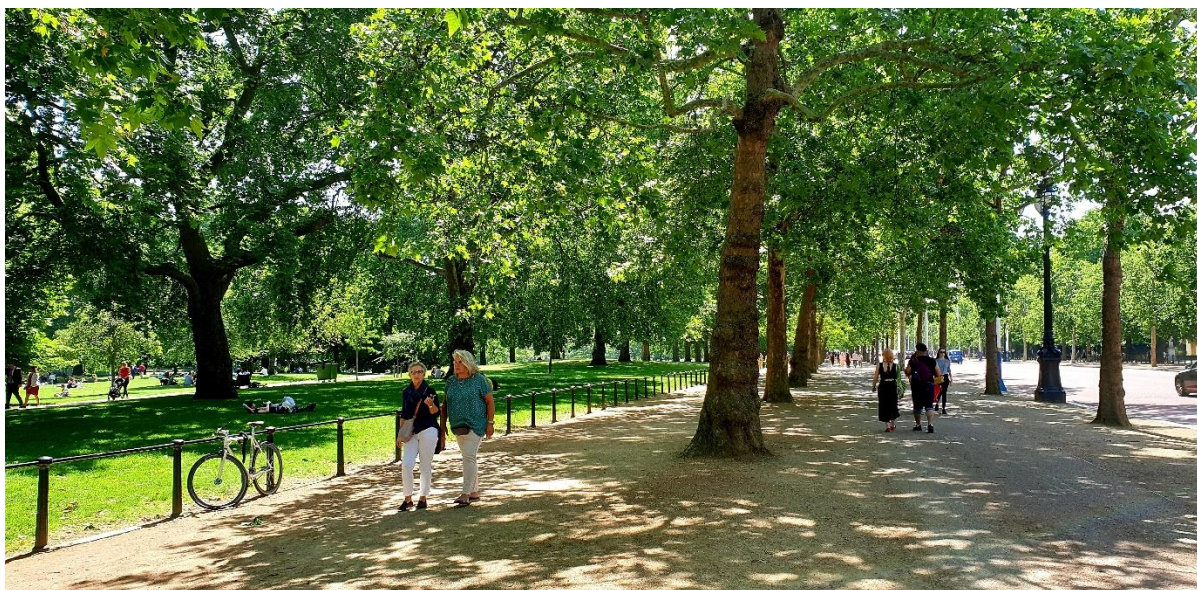# Using causal loop diagrams to develop complexity-informed hypotheses on the link between street trees and mental health

By Dr. Cornelia Guell, Senior Lecturer, University of Exeter, European Center for Environment and Human Health. REGREEN 3rd Newsletter, Dec. 2021

Many cities have ambitions to significantly increase the number of street trees. Paris, for example, plans to plant trees on a number of key sites across the city. The English government has a new Urban Tree Challenge Fund and Barcelona has a comprehensive plan for it's network of street trees that aims for a 'tree population that forms a real green infrastructure, achieving the maximum value and connectivity...'

The reasons to plant trees in urban areas are numerous; to potentially mitigate the impacts of a changing environment, improve air quality, address heat island effects and to improve the quality of the living environment for both residents and visitors. Each of these processes has impacts to human health. Epidemiological studies have linked street trees to mental health, typically (though not always) demonstrating that the more street trees in a neighborhood typically the better the health of local people.

However, we know little about how those health benefits come about, how to ensure equity of benefit and, crucially, how to plan the street tree planting and maintenance strategies for maximum benefit. There have been numerous calls to better understand the complex systems that link street trees to mental health.

A key driver for a better understanding is that the burden of mental ill-health is high and projected to increase. Poor mental health costs societies billions each year. Finding strategies to avoid, reduce and mitigate poor mental health is a key priority globally. Street trees, appropriately sited and sufficiently cared for, might be one of the contributory steps we can take to help tackle poor mental health.

A team from the University of Exeter, working with partners from across REGREEN, used a complexity-informed approach to consider the interconnections between street trees and mental health.
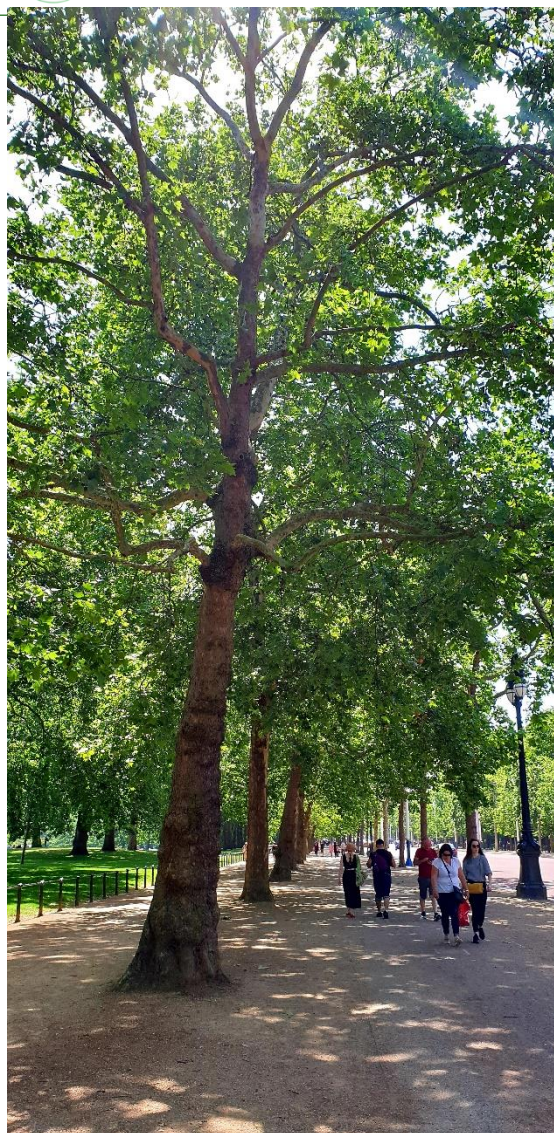
Complexity informed approaches consider multiple outcomes, non-linearity, feedback loops and unexpected consequences of actions or exposures. They can offer new insights around the structures of systems - for example, conceptualising 'mental health' as a system rather than as an 'outcome'.

Using a review of published literature to build a model of the complex interactions between street trees and mental health outcomes, the team showed that many direct and indirect pathways exist through which street trees may impact mental health. These include reductions in temperature and noise which can exacerbate stress, through to a range of calming and restorative effects including improvements in cognitive performance and reductions in mental fatigue. It's important to note that street trees may also negatively impact mental health such as through allergic responses to pollen or through tree vandalism resulting in reduced area attractiveness and anxiety. The literature showed that tree health is critical to delivery of many health benefits. Some benefits, such as cooling effects, are linked to canopy size and canopy size is linked to tree health.

Street trees, and other green infrastructure, face competition for scarce resources. If inadequately resourced and poorly planned, the potential benefits of street trees can fail to materialize. This can result in the perception that grey infrastructure is a better investment. Further, over time, cycles of investment or underinvestment can produce and then entrench inequities in tree coverage and benefits. Historical differences in coverage can result in vicious cycles in which street tree benefits are not realised and tree health deteriorates.

The review showed that these factors, such as competition for resources within systems and historical patterns of inequitable coverage, need to be taken into account when considering the implementation of street tree programmes; both to avoid failure, as well as to maximise equitable benefits.

The deliverable D4.2 'Benefit valuation of Nature Based Solutions: using Causal Loop Diagrams to develop our understanding of the complex systems linking NBS and human health & wellbeing' has been submitted to the EC.