Science for Environment Policy

Quantifying the ecosystem services provided by urban green spaces

Urban green spaces provide important ecosystem services in cities, from recreation to the mitigation of noise and air pollution. This study quantified the ecosystem services (ES) provided by green spaces in Rotterdam, the Netherlands, using new methods to evaluate high-resolution land-cover data. The findings show that different types of green space provide different ES, highlighting the importance of careful design during city planning. The authors say their method to map ES supply will aid the design of healthy, climate-resilient cities.

**8 October 2015
Issue 430**

Read more about:
Environment and health, Green infrastructure, Land use, Sustainable development and policy assessment, Urban environment

Urban green spaces, which include parks and playing fields, have important benefits. They provide a range of ecosystem services (ES) and can help to mitigate problems that are particularly prevalent in cities, such as air and noise pollution. Despite their importance in urban areas, most studies of ES focus on rural or natural landscapes. This may be because existing methods to quantify ES struggle to cope with the high-resolution land-cover data necessary to assess ES in a city context.

To improve understanding of urban ES, this study derived new methods to quantify and map ES supplied by urban green spaces. The methods, based on land-cover data and a literature review, were applied to Rotterdam. The second largest city in the Netherlands, Rotterdam faces challenges common to many European cities, including heat stress, flooding and air pollution.

The researchers, supported by the European Commission via projects TURAS[1] and OPERAs[2], selected six urban ES: air purification (defined as the lowering of background air pollution concentrations), carbon storage (gross aboveground carbon storage), noise reduction (the capacity of vegetation to attenuate environmental noise), run-off retention (the combined effect of rainfall interception, infiltration and storage), cooling (temperature reduction by vegetation) and recreation (the potential of green spaces for everyday outdoor recreation). These ES were chosen due to their relevance for human well-being.

To determine the spatial distribution of each ES, the researchers mapped them onto the city landscape using data on the locations of eight different types of urban green space (trees, woodland, tall shrubs, short shrubs, herbaceous, garden, water, and others, such as allotment gardens and sports fields). This data was compiled from a combination of green maintenance maps, cadastral maps and land-use maps.

Indicators for each ES were obtained from a literature review and applied to the green space data within the geographic information services platform ArcGIS 10.1. The researchers calculated the ES supplied by each individual green space and at the neighbourhood and district levels. For each urban green space they multiplied the area by the ES supply rate per square metre. The ES supplied by individual green spaces was then aggregated to the neighbourhood and district levels.

Analysis showed that different green spaces have different capacities for ES delivery. The spatial arrangements of green spaces are also a key determinant of ES supply. For example, trees can be more effective in filtering pollutants from the air when they are close to the source of pollution.

Continued on next page.

Science for Environment Policy

Quantifying the ecosystem services provided by urban green spaces
(continued)

Read more about:
[Environment and health](#), [Green infrastructure](#), [Land use](#), [Sustainable development and policy assessment](#), [Urban environment](#)

Differences in the availability of green spaces can lead to significant spatial variation in ES supply across a city. In general, supply increases with distance from the city centre. The researchers say this is because central neighbourhoods tend to be more developed and are therefore less green. In Rotterdam, there were clear spatial discrepancies in ES supply; some districts completely lacked green spaces and therefore received low levels of ES, while others received high levels of numerous or even all ES.

This study shows that not only the amount but also the composition and arrangement of urban green spaces influence the type and level of ES provided to neighbourhoods. The methodology used here to map ES shows which services are supplied, where, in what quantity and by which green spaces. The authors say this approach will help urban planners to ensure that the ES needs of neighbourhoods are met, and ultimately to design more sustainable cities.