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The benefits of turf to the environment and human health have long been appreciated by those in the sector, but now a US study has brought together the evidence from peer-reviewed journals over the past decade.

"It became a priority when we found that there had been no major review of the literature in more than 10 years despite the importance of issues such as water run-off prevention, carbon emissions and obesity," says the author of Benefits of Green Space - Recent Research Dr John Heinze, executive director of the Environmental Health Research Foundation. The report makes a compelling case for turf's role in what are nowadays called "ecosystem services" in urban areas.

### **Run-off prevention**

The role of green space and particularly grass in alleviating rainwater run-off is increasingly understood. A 2010 study by the State of Michigan department of agriculture found that a lawn is four times more effective than a hayfield and six times better than a wheat field at absorbing rainfall.

A 2003 study by Colorado State University calculated that an average 60ha golf course can absorb 18 million litres of water in a rain shower of 2.5cm. Turf quality was important, it found: "A dense turf can reduce run-off to almost zero."

Explaining this, a 2002 summary report by the turfgrass research programme at the University of California, Riverside stated: "Turfgrass ecosystems support abundant earthworm populations, which contribute to increased macropore space in soil, resulting in higher water-holding capacity and improved soil structure." It concluded: "The reduction in run-off linked to turf can lead to a decrease in storm water management expenses."

### **Water purification**

Cornell University researcher Zachary Easton also discovered that healthy turf was a much better absorber of nutrients. He found weedy, unhealthy lawns gave rise to three times more nitrogen run-off than healthy, dense turf. A further study for the Journal of Environmental Quality comparing turf with cultivated tobacco grown at the same Maryland site found that not only were surface water run-off losses for the tobacco 11 times greater, it also contained 195 times more nitrogen and 240 times more phosphorus than run-off from the turf.

Several studies have pointed to the role of microbes in the root zone in breaking down chemicals into harmless materials, suggesting these have a role in "scrubbing" polluted run-off waters from impermeable surfaces. The Maryland study found that rainfall is as much as 10 times more acidic than the same water filtered through a healthy lawn.

### **Air purification**

During China's Cultural Revolution many lawns and green spaces, considered vestiges of capitalism, were removed. This brought huge atmospheric and health problems that were only rectified in recent years by huge expenditure on green space, including seeding areas with grass.

According to the Michigan department of agriculture and rural development, turfgrasses trap much of the estimated 12 million tonnes of dust and dirt released annually into the US atmosphere, which bears a range of toxins.

Researchers at the University of Aveiro in Portugal also found that turfgrass removes hydrogen fluoride, ozone, peroxyacetyl nitrate and sulphur dioxide, which can cause breathing difficulties. As well as its role in absorption, a 225sq m lawn produces enough oxygen for four people.

### **Temperature control**

Turf's role in cooling the air has long been known. Back in 1990, Pennsylvania State University emeritus professor of turfgrass science Thomas Watschke wrote: "Turfgrasses efficiently intercept solar radiation. As a result, when the sidewalk or street is well over 100 degsF (38 degsC), the temperature of the lawn areas will remain around 75 degsF (24 degsC)."

Not only does turf feel cooler to the touch, earlier studies from the University of Minnesota concluded that lawns, along with trees and shrubs, can reduce air temperatures by up to 10 degsC through evapotranspiration and shading. It concludes: "Planting lawns and other landscape vegetation could reduce total US air conditioning energy requirements by 25 per cent."

In the UK, Dr Roland Ennos of the University of Manchester has long advocated greater use of planting including turf to combat projected rises in urban temperatures over the coming decades. He claimed in 2007 that 10 per cent more green cover in urban centres would be enough to compensate for the temperature rises anticipated by 2080.

### **Carbon sequestration**

A 2002 article in Agronomy Journal calculated from analysis of golf courses that well-maintained turfgrass was able to sequester atmospheric carbon at a rate of 450kg per hectare per year, comparable to conservation-grade grasslands. The absorption rate was found to be greater in the first 30 years after establishment of turfgrass, levelling off as the soil becomes saturated. The authors calculated that turf in the USA was responsible for removing 20 million tonnes of carbon from the atmosphere each year.

Dale Bremer, associate professor in the department of horticulture, forestry and recreation resources at Kansas State University, reckons that returning grass clippings to the turf increases carbon sequestration by as much as 59 per cent. He even speculates: "If global warming were to accelerate or become a more imminent and widely accepted threat, the Government could provide incentives or even enforce management practices that result in increased carbon sequestration in turfgrasses."

However, the Agronomy Journal authors caution that such benefits need to be weighed up against the use of fuel, fertiliser and pesticide in maintaining turf to calculate an overall "carbon budget".

### **- The role of green space in human health**

"The most impressive findings are the clear links to health benefits," Environmental Health Research Foundation (EHRF) executive director Dr John Heinze says of his report Benefits of Green Space - Recent Research. Indeed, studies have revealed a relationship between physical health and recreational green space.

A study reported in the American Journal of Preventive Medicine found that children living close to parks and green spaces are more likely to be of normal weight due to greater outdoor physical activity.

A 2005 study in the British Medical Journal found that adult residents of areas with the highest levels of greenery are 40 per cent less likely to be overweight or obese.

A study in The Lancet, meanwhile, found health disparities between rich and poor in England are much narrower in overall mortality and incidence of circulatory diseases in areas with ample green space. And a five-year study of senior citizens in Japan found that readily-available space for walks is a significant predictor of increased longevity.

Robert Ulrich, fellow at Texas A&M University Center for Health Systems & Design, has championed the role of green space in hospital patients' recovery.

- Benefits of Green Space - Recent Research can be downloaded from the EHRF website at [www.ehrf.info](http://www.ehrf.info).

#### **- Association highlights benefits of turf areas**

Dr Heinze's report was welcomed by the UK Turfgrass Growers Association (TGA), which has consistently stressed the important role turf plays in the landscape.

The TGA Council has participated in projects on the issue. For example, working as part of the Greening the Games group, the TGA lobbied that turf in the Olympic Park will provide a cooler environment because grassed areas reduce the temperature of landscaped areas in the summer as well as helping trap dust and purifying the air.

The turf will remain as a legacy to the Games and provide recreational and environmental benefits to north London for many years to come.

Defra, the Environment Agency and the water companies incorporated the TGA's recommendations in the code of practice issued with the latest Water Bill. They acknowledged how important turf is when considering the replenishment of aquifers and preventing rainwater run-off.

The TGA also highlights the role turf plays in carbon sequestration. By locking carbon into the soil throughout the lifetime of a lawn, turf plays an important part in the overall capture of carbon.

According to association figures, 12,000 ha of turf are supplied every year for landscaping, adding up to a major contribution to the quality of people's lives.