

The Bosco Verticale in Milan could be one solution to the urban climate change problem

Plants for changing times



Cities are on the front line of climate change, with rising temperatures and levels of pollution. **Arit Anderson** investigates how plants can help gardens - and gardeners - thrive in the city

When I got my first proper garden, I was obsessed with how the small city plot was going to look. Like many people, I wanted to escape the whirl of city life around me by filling it with my favoured cottage plants, complete with an immaculate (though tiny), verdant lawn.

In the intervening years, it has become apparent that my roses and peonies are struggling under torrential downpours, and powdery mildew is on the increase through my herbaceous border during periods of drought. Living under the flight path into Heathrow, there is a constant trail of pollution and noise, and while I tell myself I'll get used to it one day, I want to find more positive ways for me and my garden to not just survive, but thrive in the city.

The reality is our climate is changing and population increasing, which are impacting on city living now and into the future. This may seem a daunting problem to tackle, but the good news for gardeners is there are steps we can take at a local level to help ease the effects of these big issues.

Of course, we all instinctively know how much better we feel when surrounded by plants but new academic research and real-world projects, such as the incredible Bosco Verticale in Milan, which I visited earlier this year for the *Gardeners' World* TV series, are starting to confirm the genuine benefits of plants and nature at the heart of our cities and wider environment.

A team at Sheffield University is working on identifying those plant groups that can give us specific benefits beyond purely visual, in the light of our changing climate. Dr Ross Cameron, Senior Lecturer in Landscape Management, Ecology & Design, names such plants FOPs, or Functional Ornamental Plants. "This research is in its infancy," he told me, "but we are beginning to identify the environmental, psychological and social benefits of key plants."

Forest in the sky

The Bosco Verticale, or Vertical Forest, in Milan comprises two tower blocks with trees and shrubs built into the structure on every floor. Giant planters around the perimeters contain 21,000 plants, including 30 species of tree and over 100 shrub and perennial species.

Planted into a soil-based compost mix, fertilised only by CO₂ in the air, and irrigated by water run-off from Milan's streets, the buildings' plants are estimated to transform 44,000lb of CO₂ into oxygen annually. The towers opened in 2014 and are home to 480 people and an estimated 1,600 birds.

Milanese architect Stefano Boeri, who conceived the design, is now rolling out the concept across the world. Find out more at stefanoboeriarchitetti.net

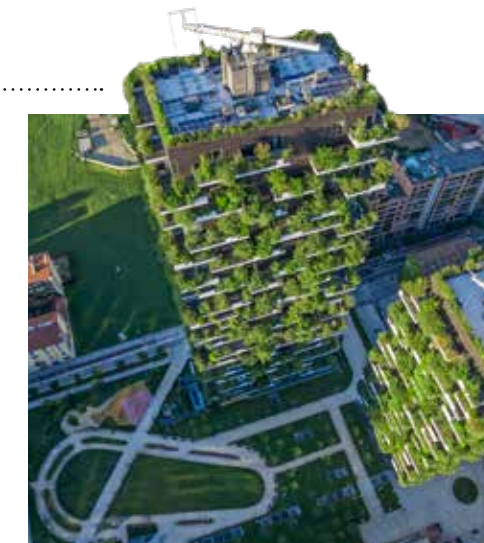
Ross states, "Not all plants provide the same level of benefits. For example, we know plants are useful for insulating our houses during cold or windy weather, potentially reducing our heating bills by 30 per cent. On a north-facing wall plants with a dense evergreen foliage, like cherry laurel or ivy, maximise the insulation effect. On a south-facing wall though, we might want to optimise insulation at night, but also let sunlight in during the winter day, so a plant with an open lattice framework works best here, such as a semi-evergreen cotoneaster or even a deciduous wisteria."

Weathering the storm

The symptoms of climate change include extreme weather incidents – such as bouts of hot, dry conditions followed by extreme rainfall. On 27 May this year, for example, the West Midlands saw one month's rainfall in just one hour! This is putting immense pressure on our drains and waterways, when that rain has nowhere to permeate. And with an estimated one in four gardens paved over, it's perhaps time to reconsider this design trend? Ross reveals there are plants to help counter flood risk.

"Species such as pine, spruce, fir, cedar and privet have lots of small leaves which increase their surface area. This gives them the ability to capture, store and reduce the force of rainwater, thereby avoiding flash-flooding. Lawns, left a little longer, can also help in this, and filter what's entering our water courses."

But what about when the temperatures rise, as they are now noticeably doing? In the journal *Nature Climate Change*, the researchers, from Sussex University, Mexico and The Netherlands, found that from 1950-2015, 27 per cent of cities and 65 per cent of the urban population warmed more than the world average (about 0.6°C). They also found that during this period, 60 per cent of the urban population experienced warming twice that of the



The Bosco Verticale uses water run-off from Milan's streets to irrigate the 21,000 plants

world. Cities and built-up urban areas experience what's known as the Urban Heat Island effect (UHI). This is due to the roads and buildings absorbing more heat from the sun, and the build-up of high pollution levels that can cause higher temperatures. While we can use drought-tolerant plants to cope in raised temperatures, the long-term solution lies in reducing the heat.

Some plants have been proven to actively improve the microclimate of a garden and surrounding buildings, confirms Dr Cameron. His team has been identifying those that are most effective at keeping a building cool in summer. "We have shown on thermal cameras that fuchsia, jasmine, ivy, Virginia creeper, Russian vine and viburnum are able to cool a building by between 7°C and 14°C. Using these plants effectively could reduce the need for, and use of, air-conditioning."

Something in the air

The quality of city air has been an area of concern and study since the Industrial Revolution, but recent work by The Centre for Ecology and Hydrology has focused on how plants can play a part in cleaning up the air we breathe.

Professor David Fowler, a former fellow at the centre, has been studying the impact of plants on pollution, and told me: "Reduction of pollution in our cities has to be down to us, but trees and plants can play a role in helping. Our studies show that what we plant in a city, and where, is key. Certain large, broad-leaved trees along a road can trap pollution, for instance, while large trees planted in parklands can be better at absorbing the pollution. And conifers have been found to be better at trapping particulate matter, due to their smaller leaf size and shape."

Both scientists shared the striking statistic that wide or dense hedges can significantly reduce particulate matter pollution, when used as a barrier along roadsides. With careful placing of the right plant combinations, for instance, beech, *Viburnum tinus*, cedar, holly, privet or spindle, and providing a continuous hedge, the pollution entering our homes could be reduced by 30 to 50 per cent. So if hedges offer us protection from road pollution, as well as filtering street noise, this is surely reason enough to favour them over fences.

The Bosco Verticale planting converts harmful carbon dioxide into life-giving oxygen

“Some plants can cool a building by between 7°C and 14°C”

While choosing plants for their functional benefits makes pragmatic sense, the latest research into our need for an emotional connection with nature suggests that the look of what's around us has value, too.

Ross confirms this: "At the heart of our research we are looking to validate the importance for humans to get back in touch with nature and the seasons. We need to ensure that while we're building ecological resilience into our cities, we're also improving our mental well-being."

His research indicates that to relax more and reduce stress, you should use predominantly blue-green hues in your planting – lavender, rosemary, nepeta and veronica – and include water features. Create a sense of enclosure, or garden rooms, with hedging such as beech and hornbeam. And while plants can not always be the single solution in terms of helping our environmental issues, Dr Cameron confirms they bring huge value by delivering benefits beyond the purely practical. Calculating the mental benefits of horticulture is a burgeoning area of study, with current research aiming at measuring how gardening can improve attention span, create a sense of achievement and self-worth, and increase confidence whilst keeping us physically fit.

As Dr Cameron concludes, "It all leads to the fact that we need to encourage people to engage more with nature in cities."

Whatever the bigger picture, for us all to benefit, it means reconsidering what each of us does at the local level. For me, I need to make new plant choices to better suit my garden's changing microclimate. Given the bigger issues facing us, it's clear that in future the look of any garden I design will become a by-product of what is demanded environmentally by each site. As scientific experts gather evidence on the plants that should become an integral part of our urban spaces, what can we be getting on with?

Firstly, assess your garden. Where are the hot spots? Is there a risk of flooding? How near are you to heavy pollution sites, such as a main road?

Then explore the benefits that a plant has to offer. Above all, experiment. A plant may tempt you by fabulous flowers or luscious leaves, but put first the issues *you* face in *your* garden. There's no better way to find your newest planting partners – plants that could not only be with you for life, but also improve it. □



Key plants for a climate-change garden



For pollution

Box, *Elaeagnus*, spindle, beech, privet, bamboo, holly, *Rosa rugosa*, *Viburnum*, *Camellia*



For flooding

Pine, spruce, fir, cedar and privet, grasses, pinks and lawn grasses left a little longer



For water-logged soil

Forsythia, *Spiraea*, *Eucalyptus*, hydrangea, willow, blue fescue, lamb's ear



For cooling walls

Fuchsia, jasmine, ivy, Virginia creeper, Russian vine, *Viburnum*



For insulation

Ivy, cherry laurel, *Viburnum*



For filtering noise

Berberis, box, spindle, hebe (at pavement level), beech, *Photinia*, firethorn



For contaminated soil

Box, *Photinia*, beech, spindle, hornbeam, laurel, firethorn

Catch up with Arit

On TV See more from Arit and the team on *Gardeners' World*, Fridays, 8pm. The show will air at 9pm on 3 and 10 August.

