



# A GARDEN FOR ALL CLIMATES

Accustomed to adapting to nature's whims, gardeners are more prepared than most to take on the challenge of climate change. **Emma Marris** asks them what to grow in a greenhouse world.

"This concept that gardening puts you in harmony with nature is a big lie," says Peter Del Tredici, a botanist at Harvard University in Cambridge, Massachusetts. "Gardening is really about preventing nature from doing what it wants to do, which is to destroy your landscape, and gardeners know this at their core. Climate change is just another challenge."

At The Royal Botanic Gardens in Kew, London, the English oaks are ailing. High temperatures and dry conditions over consecutive years have stressed the trees, and wood borer beetles have been taking advantage. "A number of oaks are looking very sad. The weakening of the tree means that beetles come and finish them off," says Nigel Taylor, Kew Gardens' curator of living collections. The leaves, too, are eaten, by the caterpillars of the oak processionary moth, *Thaumetopoea processionea*. To add irritation to injury, these invaders from southern Europe shed hairs that can cause severe allergic reactions in park visitors. "If we get to the stage of a major epidemic, I can see us having to close substantial parts of the park," says Taylor. In ten

years, he says, all of London could be affected as the caterpillars become established in northern climates.

Meanwhile, a stroll through Kew Gardens reveals many tender plants and Mediterranean species that would not have been grown outdoors a few decades ago. "The last great winter was 1963," says Taylor. "I remember it from when I was a boy. These days, about a quarter of the plants we grow outdoors would not have survived that winter."

In many places a warmer and less predictable climate seems to be remaking the context in which gardeners sow and reap. Blooming, sprouting and frost times are shifting unexpectedly. Traditional plants are suffering, whereas exotic species are thriving, and unfamiliar pests and weeds are showing up. Gardeners have no choice but to respond to the challenges — and opportunities — offered by their climate-changed gardens.

You can see their responses in the latest

trends in British urban gardens: subtropical and vegetable gardening. Olive trees and even tropical avocados have been seen growing in London. In 2006, sales of vegetable seeds in the United Kingdom overtook sales of flower seeds

for the first time since the Second World War, according to the Royal Horticultural Society. One reason could be that, for the eco-conscious gardener, home-grown vegetables avoid the carbon emissions associated with importing produce from overseas.

**"Gardening is really about preventing nature from doing what it wants to do."**

— Peter Del Tredici

## Breaking with tradition

Yet the growth of the new brings with it reasonable fears for the old. Some gardeners worry that much-loved traditional species are being adversely affected by the changing climate. And the timing of seasonal events does seem to be shifting. In the Shanghai Botanic Garden, cherries and gardenias reportedly bloomed 15–20 days early this year. Del Tredici notes that the annual lilac festival at Harvard's

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Arnold Arboretum has been brought forward a week after a couple of Lilac Sundays (as the festival is known) nearly missed the peak bloom. And some of the famous cherries in Washington DC bloomed in January rather than their usual April this year. And one startled man on the street stopped me, saying, "Do you see this? It's not natural!"

It's not easy to say whether these shifts are caused by global warming or are just the result of natural climate variability. According to Simon Brown, head of climate extremes research at Britain's Met Office Hadley Centre, all that scientists can say for sure about climate change in the United Kingdom is that it increases the probability of extreme events, such as hot, dry summers and mild winters. Events such as the 2003 summer heat wave in Europe, he says, are now at least three times more likely. He adds that most climate models also predict fewer frost days across the country.

### Redrawing the map

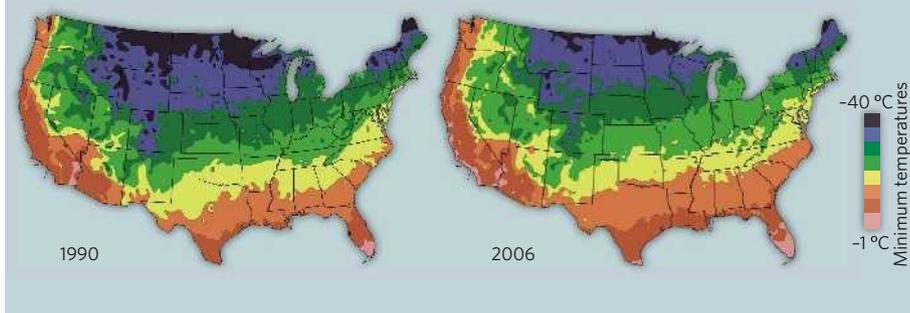
Changes in the plant hardiness zones used by gardeners to choose what plants to grow are seen by some as evidence of systematic change (see 'US Plant Hardiness Zones'). These zones map the possible growing areas for different plants as defined by regional average annual minimum temperatures. In the United States, the best known map is produced by the Department of Agriculture (USDA). The current map, released in 1990, is based on 15 years of temperature data, and an eagerly awaited revision will be based on 30 years. But impatient with the USDA's progress, in 2006, the national Arbor Day Foundation produced its own update of the 1990 map, based on the 15 years prior to 2006. In it, the zones were shifted noticeably northward, and many chalked that up to climate change.

But USDA spokesperson Kim Kaplan insists that data sets of just 15–30 years are not good enough to diagnose climate change. "Call back in 50 years and I'll let you know," she says. And she points out that temperature is not the only important variable, especially in the activity that is the USDA's main focus: farming. "It is not the temperatures that tend to change what farmers grow, but their effect on moisture," she explains. "One or two degrees isn't enough to affect most plants, but where we are seeing shifting patterns of rainfall, that has a major impact on what farmers can grow." Climate change is expected to increase rainfall in some parts of the world and decrease it in others — with potentially disastrous results for agriculture.

The challenge faced by farmers is much more serious than that faced by gardeners. But precisely because less rides on gardening,

## US PLANT HARDINESS ZONES

Do shifting zones of possible growing temperatures for plants hint at climate change?



horticulture can be seen as a way to experiment with strategies to adapt to changes in the climate, some of which might then have broader relevance.

"Home gardeners tend to be kind of adventurous," says Peter Raven, director of the Missouri Botanical Garden in St Louis, "so they will continuously be pointing the way to what can be grown." They have the luxury, not available to other land managers, from farmers to city planners, of changing what they do each season. "It is a lot easier in gardening than it is in many other spheres," Raven says, "You can adapt with new plants every year."

And some are already adapting to a warmer and less-predictable climate. "The professional gardening community is beginning to think carefully about what it is going to plant," says Taylor. "Some have even written contingency plans."

Used to suffering from the vagaries of the weather, gardeners might be better prepared than many for the changes that will occur as



Caterpillars of southern European moths are eating the leaves of English oaks.

humanity fills its atmosphere chock-full of heat-trapping carbon dioxide and other gases. "As any gardener knows, the weather was engineered to make us miserable," says Todd Forest, vice-president for horticulture and living collections at the New York Botanical Garden, which recently held a symposium on gardening and climate change. But he adds, "Gardeners love to experiment. They love to try new things. You might be able to grow things in New York that you couldn't grow before. We will look at those opportunities."

Not everyone is so positive. Scott Aker, a horticulturist at the US National Arboretum in Washington DC says that climate change is likely to be mostly bad for gardeners. "I don't believe that global warming is going to allow us to grow things that were previously not hardy enough here," he says. In fact, Aker, explains, because plants go into a state of dormancy for the winter, which is triggered by gradually lowering temperatures, a warm winter and then a cold snap will be much more damaging than the same cold snap after the rigours of a cold autumn and early winter. "We can dispense with the idea that we are going to be growing coconut palms in Washington any time soon," he says.

And some of the knock-on effects of climate change will be too complex to predict. At Kew, they have been watering more in the rash of dry summers they've seen, and all that London tap water is turning their soil alkaline. Changes in precipitation and microclimate will vary, and perhaps the only firm certainty is that the weather will be less predictable.

According to Aker, the uncertain weather wrought by climate change may narrow rather than broaden the range of plants that can be grown in any one place. At least until plant breeders are able to produce tougher varieties. "That is going to be the focus of breeding," says Aker. "The plants that we put in our gardens 20 years from now are going to have to be able to withstand a lot more extremes of

## The green gardener

Gardening seems like the ultimate green activity, but it, too, can contribute to greenhouse-gas emissions. Gardens can be incredibly energy- and input-intensive. Trees and other plants capture carbon, but watering, mowing, leaf blowing and using fossil-fuel-derived fertilizers can easily offset this.

"If you are using synthetic nitrogen fertilizers, just purchasing the bag is making a contribution to greenhouse-gas emissions," says David Wolfe, a plant ecologist at Cornell University, in Ithaca, New York. And using too much fertilizer that has a high nitrogen content will release trace amounts of nitrogen oxides. Even tilling may

be problematic. "Over-tillage is a big problem — a bad habit that farmers and gardeners get into," says Wolfe. "It over-oxygenates the soil and releases a lot of carbon."

Douglas Kent, an environmental horticulturist and landscape designer in California, offers carbon-neutral and even carbon-negative garden designs. He suggests using ground covers that require low or no inputs of water and fertilizer. Creeping red fescue and sedges are among his favourite lawn alternatives.

Some of his ideas are counter-intuitive. For example, he says that most gardens produce more waste than they can use

as compost. Excess wood can be used for borders, and entombing other waste in a landfill makes more sense than letting it decompose, thereby releasing its carbon. And he suggests that, in theory, a lawn that requires heavy inputs might be better for the environment if it were simply paved over. That way you can avoid all the emissions associated with its upkeep.

Climate change may see the end of the 'native garden', a popular trend with many gardeners. As microclimates change, so too will the plants that can survive with few inputs. So gardeners who prefer native plants because they are more environmentally friendly

might have to think again. "One of the great myths of gardening is that a native plant is always best adapted to your site," says Todd Forest, vice-president for horticulture and living collections at the New York Botanical Garden.

But Kent says that gardening for low emissions, like gardening for unpredictable weather, encourages a beautiful new aesthetic experience. "There is more whimsy, more nature. It is not that apollonian concept of real heavy structure. You kind of usher nature back a little more into your garden." Butterflies and birds prefer these kinds of gardens, he says. "It is exceptionally satisfying, and there is, frankly, less work." **E.M.**

temperature and drought." Apart from changing temperatures and moisture patterns, climate change also expands the ranges for many pests and pathogens. "I would say that perhaps the most significant things affecting horticulture are the new pests and diseases," says Taylor. At Kew they are seeing one or two new pests every year.

Scott Ogden and Lauren Springer Ogden are landscape gardeners who, by virtue of maintaining gardens in two unpredictable climates — Colorado and Texas — are now advising gardeners in heretofore meek and mild climes such as the northeast and northwest. Their advice for handling climate change? Plant more species, so even if some fail others will flourish. They say that if gardeners try to hold on to species they've always grown, they may have to water, fertilize, and generally manage them more. "It's a much more mixed bed," says Ogden. "Instead of maintaining the plants artificially, find the plants that are going to work."

Other advice: forget about relying on long springs to bring out your show-stopping flowering trees — they might bloom in February and then get zapped by a cold snap in March. And watch those formal gardens that rely on broadleaf evergreen hedges. They don't like erratic freezes. Instead, go layered and diverse. Then, "when things ebb and flow there is always something looking good," says Springer Ogden.

The message is to take control by not being too controlling; to worry less about traditional species and to embrace well-adapted species whatever their source (as long as they aren't



Scott Ogden and Lauren Springer Ogden run a consultancy for green gardening in Texas.

destructively invasive). The new look in the climate-adapted garden is rambunctious, diverse and more like wild spaces.

### Up to date

No matter what their local climate does, gardeners will notice. "If you ask a gardener what the ten-day forecast is or whether it has been a wet or dry fall, chances are that they will know," says Forest. In a sense, every year is a new mini-experiment in each garden. And in some regions gardeners are being asked to put their famous attention to detail to scientific use

by recording and reporting data. Phenologists, who study seasonal phenomena, are enlisting citizens to record data in projects such as the US-based Project Budburst, the United Kingdom's Nature's Calendar, the Netherlands' De Natuurkalender and Canada's NatureWatch.

Kayri Havens, a conservation biologist at the Chicago Botanic Garden in Illinois, helps run Project Budburst. She says that in its pilot year, about two-thirds of their 1,800 observations of blooming times were from children under 12. Havens hopes that the data will be used to predict where plants may need to migrate so that their blooming coincides with their pollinators' cycles. Data from an older volunteer project run by the University of Wisconsin, Milwaukee, which monitors lilac bloom times, have already been used in more than two dozen scientific papers.

Gardeners are moving into a space where many others are still loath to go. When it comes to climate change, says Raven, gardeners can afford to experiment. They accept climate change as fact, and they work with it (see 'The green gardener'), some even do so cheerfully.

"I call this a brave new ecology," says Del Tredici, "The reality is that climate change is already happening, so we have to learn how to live with it." This approach might be a model for managing other activities, beyond the backyard. After all, says Stephen Hopper, head of Kew, "Some people argue that the world is managed so much that we are all gardeners." ■

Emma Marris is keeping an eye on when the rebuds bloom in Columbia, Missouri.

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