



Royal  
Horticultural  
Society

Sharing the best in Gardening

# Gardening in a changing climate





# Introduction

Climate change is likely to be one of the defining challenges of the 21st century and how we respond will not only determine our future prosperity, health and wellbeing, but also the sustainability of Earth's natural environment. Our gardens can help in so many ways, from reducing our emissions and storing carbon to providing safe havens for our wildlife and contributing to our health and wellbeing.

As a result, our perspectives on what a garden should be and what we might like to grow in it will have to change. We now have a clearer idea, thanks to climate science, of what our future weather and climate might be like. This means we can now plan for the changes that we will need to introduce in our gardens. This summary provides guidance and demonstrates how climate change need not be an insurmountable problem for our gardens as it provides opportunities as well as challenges.

Right. The 2002 'Gardening in the Global Greenhouse' report predicted rising temperatures and warmer summers, with a longer season for visiting gardens. More variable weather patterns are now anticipated.







## Background

The RHS has long been concerned about how climate change will affect gardens. It will change what gardeners can grow and how we need to grow it. These challenges were originally examined and published in 2002 in the 'Gardening in the Global Greenhouse' report.

Since then, a great deal of climate and horticultural science research has been carried out. The 2017 report 'Gardening in a Changing Climate', of which this is the summary, shows which of the conclusions are still valid and where our understanding has moved on.

The 'Gardening in a Changing Climate' report was commissioned by the RHS, but has been written in collaboration with the University of Sheffield and the University of Reading.

## Finding the facts

The information used in this summary is taken from the 'Gardening in a Changing Climate' report (2017), which is available as a free download on the RHS website ([rhs.org.uk/climate-change](https://rhs.org.uk/climate-change)). The report is supported by an extensive reference list, including government reports and publications peer-reviewed by impartial specialists. Authors and reviewers of the report have published novel research within their respective fields in peer-reviewed publications.

The climate predictions used are based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2013)\*. This report underpins the work of scientists, governments and policymakers throughout the world.

This summary also includes information from an extensive survey of the gardening public and interviews with horticultural professionals, shedding light on how climate change is already being experienced by gardeners. The survey underwent a rigorous review process, including consideration by the ethics committee at the University of Reading.

## Climate predictions

When the 2002 report was released, climate models suggested rising temperatures and, consequently, warmer summers. While there is still expected to be an underlying trend of rising temperatures, more variable weather patterns are now anticipated, including extreme rainfall events. The predictions that are likely to most affect our gardens are as follows.

### Rainfall

- ◆ An increase in the occurrence of prolonged periods without rain, most pronounced in summer in southern England.
- ◆ An increased frequency of very wet days, most pronounced in winter in northern areas of the UK.
- ◆ A continuing high year-to-year variability in rainfall.

### Temperature

- ◆ Average temperature is projected to increase in all seasons and across all regions of the UK.
- ◆ Much of the UK could theoretically be frost-free in the future.
- ◆ Global temperature may rise by 1.5 to 2.0°C over the next century, even when based on scenarios where there is strict legislation on greenhouse gas emissions.

### Wind and storms

- ◆ More extreme, more intense windy spells and storms.

\* IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

# Findings from the Gardening in a Changing Climate report

## The importance of gardens in the future

All green areas, from large formal gardens and parks to school, community and domestic gardens, are multifunctional spaces. They are vital for our physical and mental health and for our social wellbeing. Gardens sustain wildlife and provide important functions in the urban environment, such as alleviating flooding, locking up carbon, cooling our towns and cities and capturing pollutants.

With populations rising and housing development set to continue into the future, the role of gardens in delivering the functions formerly fulfilled by the natural environment will become increasingly important. Over half of UK adults are engaged in gardening, so there is great potential for gardeners to make a major contribution to this process.

## Applying the findings

The authors of the report set out to understand what the predicted changes in climate mean for gardeners and how they will affect UK gardens. The findings present a mixed picture, with some strong regional differences (see pp.6–11). This summary shares the key messages about what is likely to happen and how we as gardeners can adapt and help.

## Challenges and opportunities: how gardeners can adapt

### Longer growing season

**Warmer springs and autumns** will extend the growing season and, therefore, some species will flower earlier and some will experience delayed leaf colouring or leaf fall in autumn. Maintenance tasks such as weeding and mowing will also be extended into these periods.

**Get Greening Grey Britain** by growing a wider range of plants, especially tender ornamentals and edible plants, to take advantage of the longer growing season.

### Extremes of wet weather

**Extreme rainfall events** will increase waterlogging and flooding, and also the rate at which nutrients, particularly nitrogen, are washed out of the soil. Combined with heat stress, this could lead to a reduction in plant growth.

Incorporate design features such as **rain gardens or dry gardens** with suitable plants to cope with the predicted change in conditions.

### Coping with shortages of water

**Hot and dry spells** are projected to increase, which could result in less water being freely available in the growing season to support optimum growth.

**Capture and store rainwater** in water butts and larger storage tanks to ensure a sufficient water supply over the summer.

### Effects on pests and diseases

**Warmer and damper conditions** are expected to allow some existing pests and diseases to extend their range to additional areas of the UK.

These conditions also increase the likelihood that **introduced pests and diseases will become established in the UK.**

**Look out for pests and diseases**, particularly new threats, and control them as soon as you see them. Non-chemical methods, such as pruning and biological controls, have the least negative impact on the environment.

### Effects on pollinators

Evidence suggests that **the flowering time of plants** will be affected, and this may no longer coincide with the active feeding period of an associated pollinator.

To increase the number of pollen and nectar sources, **plant a diverse variety of pollinator-friendly native and non-native plants** with different flowering times, for example by using plants from the RHS Perfect for Pollinators lists (see p.12).



## What else can you do?

- ◆ Reduce your use of petrol-powered tools and, instead, **use energy-efficient technologies** such as solar-powered garden products and automatic irrigation and light timers.
- ◆ **Plant trees and shrubs**, as these help lock up carbon from the atmosphere over a long period of time, and release less from the soil due to low requirements for soil cultivation.
- ◆ **Install green roofs and walls**. These result in energy savings in the region of 15% (particularly for old buildings) due to a cooling effect in summer and an insulating effect in winter.
- ◆ Ask for and **use peat-free composts**. Peat bogs store considerable amounts of carbon and support wildlife.
- ◆ **Compost your garden and kitchen waste**. This provides nutrients for the garden, but thrown away as household waste, it ends up on landfill and produces methane – a potent greenhouse gas.
- ◆ Minimise the negative **environmental impact** of gardening by:
  - ▶ **Reducing** the use of resources in your garden wherever possible.
  - ▶ **Reusing** household materials and seasonal items year on year.
  - ▶ **Recycling** your garden waste, plastic, glass and metals.
  - ▶ **Reinvesting** – stimulate demand for recycled products by buying recycled items.
- ◆ **Avoid using chemicals** with a high carbon cost, such as some pesticides and fertilisers.
- ◆ Minimise the possible spread of **invasive species** into the wider environment by ensuring that cultivated plants remain in the garden, and that legislation is adhered to during plant disposal.

\* This specifically relates to gardens, rather than wild areas or countryside. Care should be taken when planting non-natives close to wild areas that garden plants do not escape.

Clockwise from top right. A bee house for solitary bees; rosemary beetle (*Chrysolina americana*) and heuchera powdery mildew, both new to the UK.

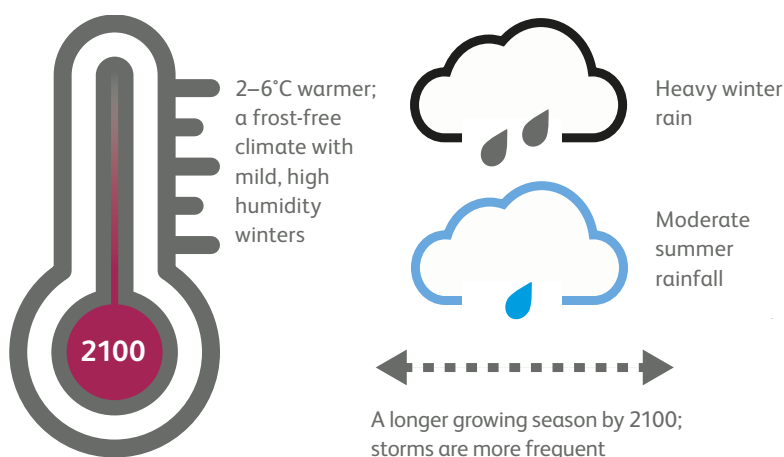


# Changing gardens

With increased scientific confidence about the predictions for climate change comes a better understanding of how gardens will need to adapt over the next century.

In 2002, the more limited understanding indicated that the UK climate would be closer to that of the Mediterranean. While that remains a useful indicator for East Anglia, the picture across the rest of the country is more complex. So in the following examples, we have illustrated gardens in three different UK regions to show the likely conditions gardeners will be growing in and the plants and design features that will be successful.

The climate projections used here are taken from Intergovernmental Panel on Climate Change report 'Climate Change 2013: The Physical Science Basis'.



**1** Traditional favourite garden plants, e.g. alliums, asters, pelargoniums and tulips, are being grown in raised beds to lift their roots clear of the water table.

**2** Large trees on wet soils are more prone to wind-toppling, so smaller trees have been chosen.

**3** Lawns have been converted into shrub borders, reducing the need to mow grass all year round.

**4** A rain garden has been introduced to help deal with heavy rainfall events.

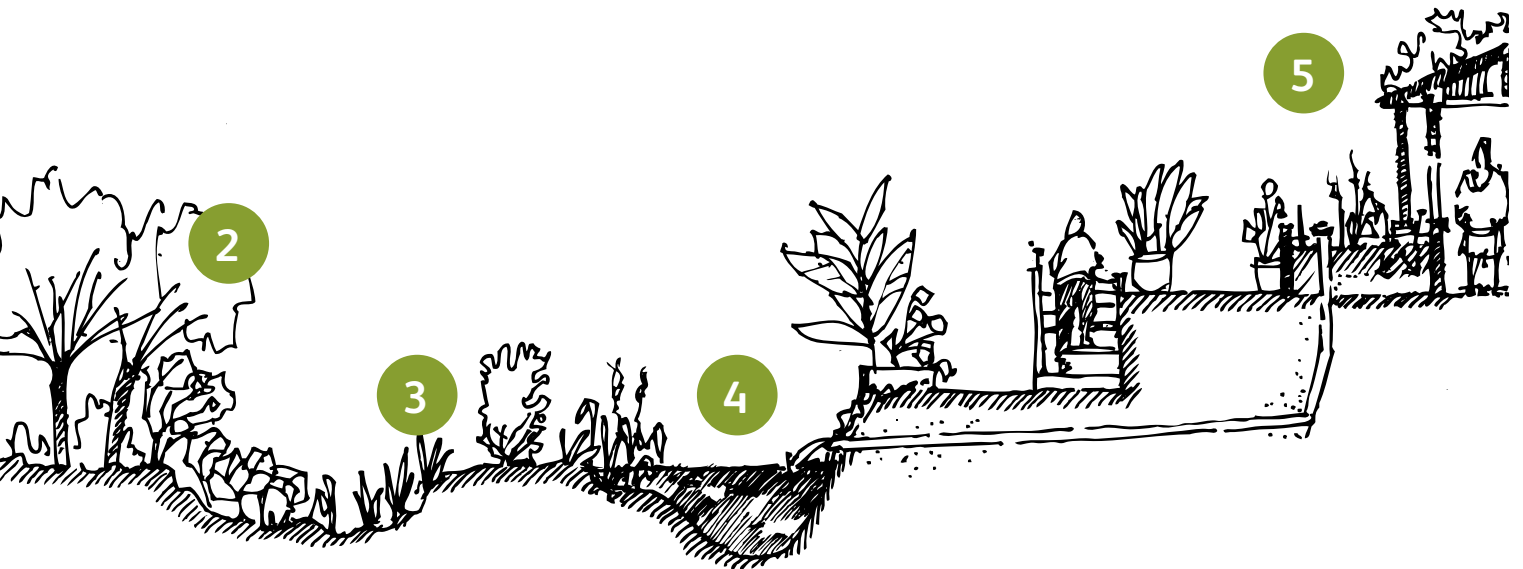
**5** Green roofs are being used to minimise run-off rates from built structures.



Above. Rain gardens are likely to become more common as gardeners adopt features that are more compatible with the climate. Right. *Acacia baileyana*. Higher temperatures will increase the range of plants that can be grown.



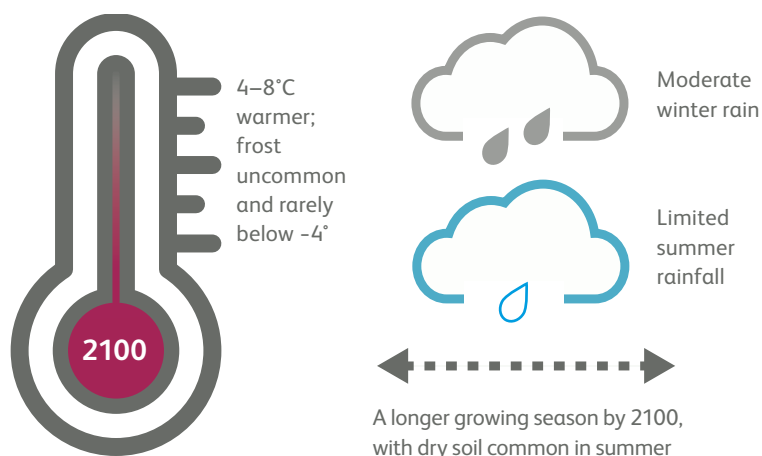
# Garden adaptations: West Country



## What plants will we be growing?

- ◆ Camellias, escallonias, fuchsias and other 'temperate' species have become dominant hedge and boundary plants.
- ◆ Groves of wattle (*Acacia*), Chilean fire bush (*Embothrium*) and gum (*Eucalyptus*) have become commonplace.
- ◆ Shelter belts are needed to protect large-leaved semi-tropical species from wind tear. This includes angel's trumpet (*Brugmansia*), *Canna* and Japanese banana (*Musa basjoo*).
- ◆ Ornamental cherries (*Prunus*) and crab apples (*Malus*) have lost some of their popularity due to disease and wind damage to blossom.

# Garden adaptations: East Anglia



## What plants will we be growing?

◆ Higher temperatures have increased the range of plants that can be grown, although choices are constrained by dry soil in summer.

◆ Evergreen plants, e.g. strawberry tree (*Arbutus*), gum (*Eucalyptus*; right), silk tassel bush (*Garrya elliptica*), bay (*Laurus nobilis*), holm oak (*Quercus ilex*) and palms, e.g. Canary Island date palm (*Phoenix canariensis*) and Chinese windmill palm (*Trachycarpus fortunei*), have become more common.

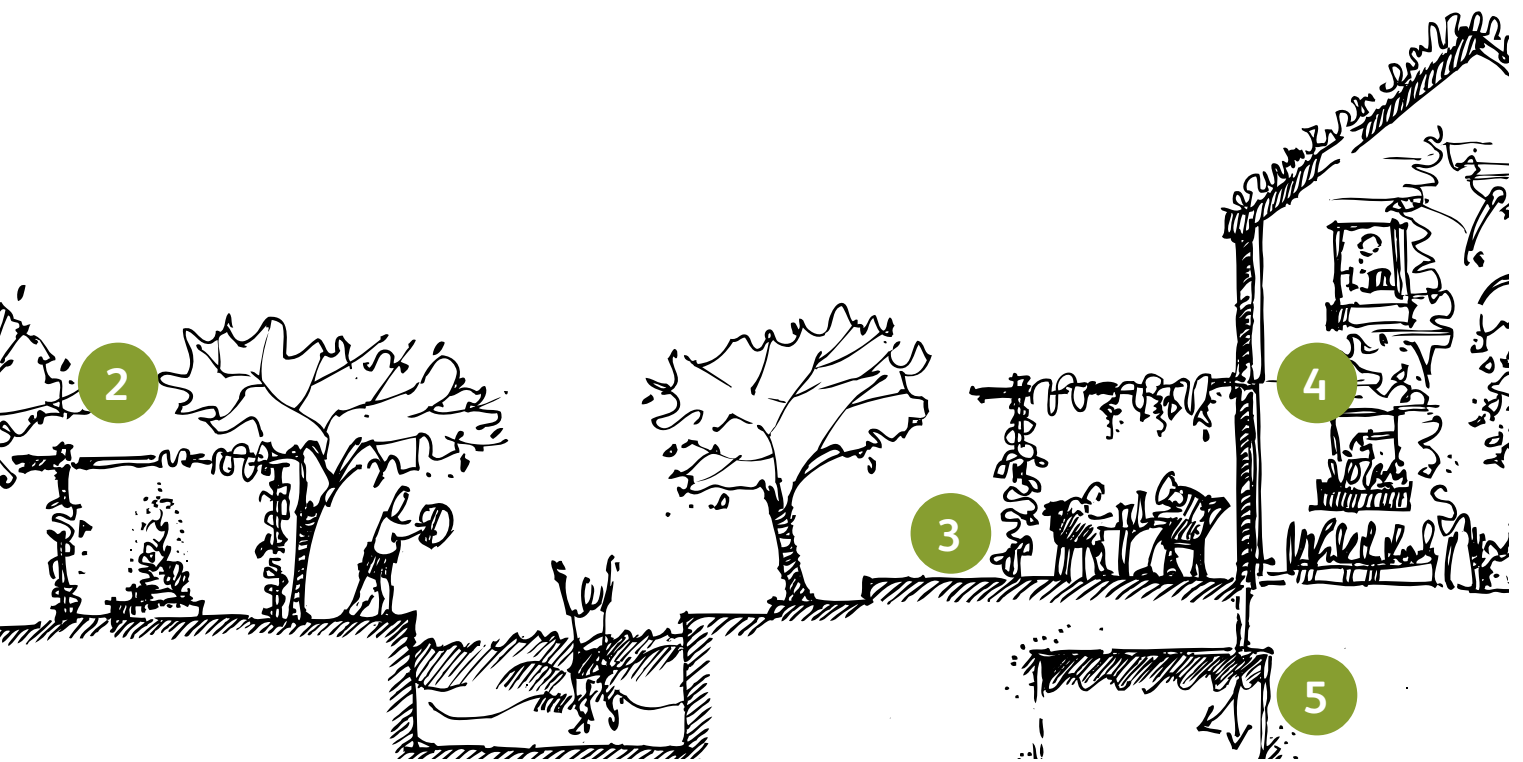
◆ On light soils, mixed borders have lost their hybrid tea roses in favour of species roses and drought-tolerant climbers such as *Rosa* 'Veilchenblau' and 'American Pillar' (inset).



**1** Lawns have mainly been converted to dry meadows, with naturalised bulbs used to extend the flowering period, as watering the lawn to keep it green has become a chore.

Above. Warmer summers may mean the garden becomes an extra room. Opposite. Clumps of *Kniphofia* may be naturalised in dry meadows.





**2** Gardens are screened to the south and west to provide midday shade to prevent leaf scorch and reduce the amount the soil dries out.

**3** Shady patios have become extensions of the family home and important social spaces, taking advantage of the warmer temperatures.



**4** Wall climbers such as *Campsis* (above) have been planted around the air conditioning units of houses to improve their cooling efficiency further.

**5** Downpipes from the roof are connected to an underground tank to store rainwater for summer watering.



# Garden adaptations: Northern England



**1** More plants are being grown in containers to allow movement between frost-protected areas (e.g. greenhouses and polytunnels) and unprotected areas in the garden.

**2** Gardening under protection in greenhouses, polythene tunnels (right) and conservatories has become more common.

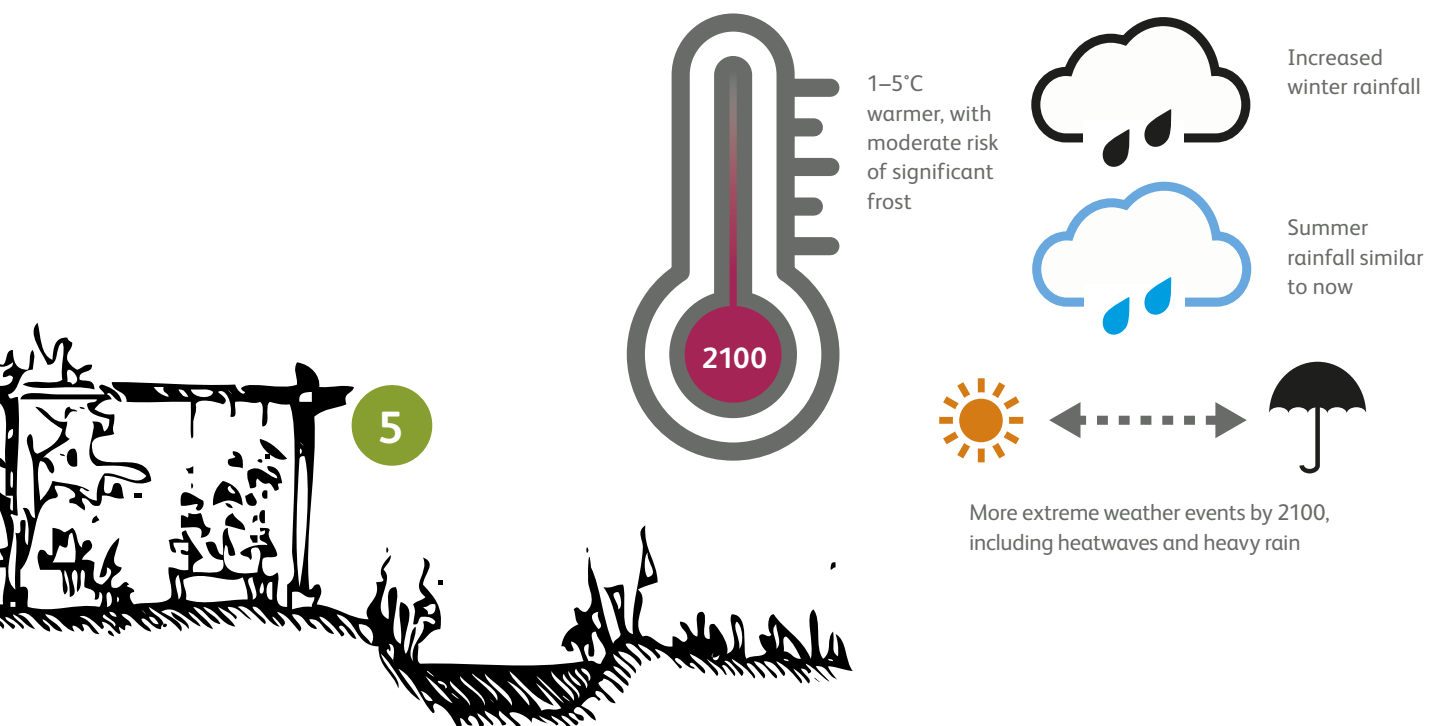
**3** Raised beds with free-draining soil and a network of seep irrigation hoses allow garden favourites to be lifted clear of the water table in winter and have sufficient water in summer.

**4** Drains and catchment areas are being used to divert water away from buildings during heavy rain.

**5** For shelter from storms, fruit and vegetables are being grown by walls and along sheltered paths and alleyways.







## What plants will we be growing?

◆ Plants are chosen for their resilience to a range of factors including wind, waterlogging and drought. Robust garden stalwarts such as serviceberry (*Amelanchier*), barberry (*Berberis*), smoke tree (*Cotinus*, far left), golden bell tree (*Forsythia*), tree mallow (*Lavatera*), mock orange (*Philadelphus*), flowering currant (*Ribes*), elderberry (*Sambucus*), bridewort (*Spiraea*), as well as climbers such as *Clematis montana* and honeysuckle (*Lonicera*) have become more common.

◆ Garden trees with both cold and heat tolerance, e.g. spruce (*Abies*), Norway maple (*Acer platanoides*), bean tree (*Laburnum*, left), Scots pine (*Pinus sylvestris*) and lime (*Tilia*) are preferred.



# Supporting the future of gardens and gardeners

Understanding how to grow and make great gardens has been the role of the RHS for more than 200 years. Over the next century, climate change will provide new challenges and opportunities for gardeners, and the RHS Science team continues to explore these changes. Our research will support gardeners in the years to come.

## Green roofs and walls research

Green roofs and walls can be used to create year-round energy savings thanks to a cooling effect in summer and an insulating effect in winter. The RHS has investigated which green roof plants cool the air most, finding that hairy-leaved plants such as lamb's ears (*Stachys byzantina*) are more effective than traditional *Sedum* choices. Likewise, ivy is known to make a good wall covering, but how do we stop it penetrating gutters and lofts? Our research (right) has shown that using a copper mesh border and anti-intruder paint are good prevention measures.

## Insect diversity research

The flowering time of plants will be affected by climate change, and this may no longer coincide with the active period of an associated pollinator. The **RHS Plants for Bugs** research project has shown that non-native plants have an important role to play in gardens by extending the season and providing a diversity of nectar sources for pollinators. Our **RHS Perfect for Pollinators** plant lists ([rhs.org.uk/perfectforpollinators](https://rhs.org.uk/perfectforpollinators)) can help gardeners encourage pollinating insects.



## Pest and disease research

The Defra Climate Change Risk Assessment report identified invasive organisms, including garden pests and diseases, as key risks. The RHS is carrying out research to understand current problems such as box blight and slugs, both of which are likely to be more of an issue where the climate is warm and damp for significant / longer periods. New garden pest and disease problems are often identified through the RHS Gardening Advice service. The RHS is the only organisation monitoring UK garden pests and diseases. This informs our scientific research and our advice for gardeners, and is the basis for our input into the UK plant health risk register.

## Getting the benefits

Gardens will become increasingly important for flood protection, pollution mitigation, moderating local temperature and providing green space for wildlife and our health and social wellbeing. The RHS encourages everyone to garden and grow through the **RHS Greening Grey Britain** campaign ([www.rhs.org.uk/ggb](https://www.rhs.org.uk/ggb)). The more plants we grow, the more benefits they will provide to people in the places where they live.



[rhs.org.uk/science](https://rhs.org.uk/science)

Royal Horticultural Society, RHS Garden Wisley, Woking, Surrey GU23 6QB  
Email: [science@rhs.org.uk](mailto:science@rhs.org.uk) Registered charity no. 222879 / SC038262

All images © RHS except iStock 8 (terrace), 10; Dorling Kindersley 9 (*Campsis*, *Kniphofia*); Faye Thomsit-Ireland 12 (copper mesh). Garden schematics 6–11 courtesy of Dr Ross Cameron, University of Sheffield.

