Garden character and responses to climate change

The magnitude of climatic changes to which a garden is likely to be subject, will depend on its regional and local setting. Gardens in the north and west of the UK may be more vulnerable to flooding than those in the south and east. Gardens on hilltops are likely to suffer more from drought, while those in valleys or on flood plains will be susceptible to flooding. Only gardens on the coast or near sea level will feel the impacts of increases in mean sea level.

The significance, or impact, of those climatic changes will depend very much on the particular characteristics of the garden, on the 'genius of the place'. The enormous diversity of gardens, and the reasons for this, has been outlined briefly in section 1.1. Within this great diversity though, and accepting that every categorisation has its misfits, it is possible to distinguish two main types of gardens: the small, private or domestic garden and the heritage garden. There are, of course, also many large private gardens. These have some of the characteristics of domestic gardens (a considerable degree of freedom to determine and modify the form and contents of the garden) and some of heritage gardens (availability of machinery, and usually trained staff to carry out large scale operations). The impacts of climate change on domestic and heritage gardens are examined in this chapter.

5.1 The domestic garden

In the domestic garden, the design and content of the garden result from a complex interplay between what is available and what is considered desirable. The garden layout often evolves and may undergo radical changes from time to time. Change – even complete change on occasions – is usually acceptable and will often be considered desirable.

Supply and demand interact in determining the form and contents of the domestic garden, but in complex ways. Such is the contrariness of the archetypal keen British gardener, that many will seek to grow some plants because they are difficult or not widely available and will reject other plants because they are easy and to be found in every garden centre. In cases where the garden is seen as a room outside rather than as a plot for cultivation, the gardener may be more inclined to follow fashion and to accept what is portrayed on television and readily available at the garden centre.

In both of these types of gardens, climate change will influence the ease of cultivation of some plants and the perception of what gardens are for, but it will be only one of many social, cultural, economic and environmental influences determining the progress of garden fashions. Cultivation of the currently popular *cannas*, tree ferns and other tropical looking plants may be made easier by climate warming, but it is very unlikely that climate change is the primary reason for their popularity.

For keen gardeners and for advocates of an outdoor lifestyle garden, climate change offers exciting opportunities and few threats. The main strategy for dealing with problems in the private garden has always been avoidance of the problem. If one plant fails for any reason, it will cease to be used by all but the most determined enthusiast, and more robust alternatives will be adopted; the range of plants available is so wide that it will not usually be difficult to find alternatives. Difficulties in the growing of particular plants, as a result of climate change or for any other reason, will be more or less indefinitely circumvented by changing to a different plant palette.

Keen gardeners have always enjoyed the challenge of growing marginally hardy plants, seeking sheltered corners of the garden and using a variety of protective covers in winter to increase the chances of success. Their gardens represent the limit of what is possible in that location. Climate change should allow such gardeners to succeed more fre-

quently in growing plants which previously could only be grown in warmer areas. As successes increase, so will the demand. Sought after plants may cease to be the province of specialist nurseries, and may become available in garden centres and adopted by the wider gardening fraternity.

Challenges will arise for the more conservative gardener as a result of climate change. A luxuriant herbaceous border and an immaculate green lawn will be much harder to achieve in a hotter and drier climate. However, for those who insist on retaining such features, the expenditure in time and money to water plants, for example, and to mulch and feed, could be small in absolute terms because of the small size of the garden.

The domestic garden results from personal whim. It often changes from year to year as new ideas are tried. In many gardens the challenge of growing difficult plants is part of the excitement of gardening and the effort required to meet the challenge is focused on a small area.

For the domestic gardener climate change poses few problems and offers several opportunities. Lawns will be more difficult to maintain, but irrigation will often be practical, given their small scale. Plants needing cool, moist conditions could be moved to deeper shade. With warmer weather, climate change offers opportunities of using the garden more often and of growing a whole new range of plants.

5.2 The heritage garden

There are more than 3000 gardens in Britain regularly open to the public. Of these, over 1530 are registered for their special historic importance (English Heritage, 1998). The gardens range from small sites, like Barbara Hepworth's home in St Ives, to great landscaped gardens, like Stourhead, and from privately owned gardens to public parks and properties held in trust. The register includes many other types of designed landscapes and gardens, like allotments, town squares and cemeteries.

A number of gardens and parks, like the magnificent water gardens at Studley Royal along with Fountains Abbey, are of such international importance they have been designated World Heritage Sites. Together, the UK's garden heritage reflects the evolution of garden design spanning the last 500 years, and illustrates the diversity of designed landscapes and gardens and plant collections, and their historic interest.

Gardens may be historically significant because of their design, their planting or their associations, or a combination of these. The garden at Audley End (Essex) for example, has a Victorian parterre, set in a Capability Brown landscape. The garden at Killerton (Devon) contains many plants introduced from Japan and elsewhere in the 19th century by James Veitch. The gardens at Down House and Chartwell (both in Kent) were developed by Charles Darwin and Winston Churchill respectively. Neither of these Kent gardens is outstanding in its design or planting, but each sheds light on the life of an historically important person. Gardens important for their plant collections alone are increasingly being acknowledged for their aesthetic, cultural, botanical and historical significance.

5.2.1 CONSERVING THE HERITAGE GARDEN

Heritage is a fragile and non-renewable resource (Farrar and Vaze, 2000), and the cultural heritage – especially heritage gardens – is disproportionately sensitive to change (Shackley and Wood, 1998) because it necessarily involves long time spans, during which extreme climatic events are likely to occur.

The fragility and uniqueness of the historic environment underpins the Government's own policy (DCMS and DTLR, 2001) on protecting and sustaining historic buildings, monuments, gardens and landscapes. In *A Force for Our Future* (DCMS and DTLR, 2001) the Government says: "If we fail to protect and sustain it [the heritage environment] we risk losing permanently not just the fabric itself, but the history of which it is the visible expression. It is therefore essential that decisions taken at all levels – national, regional and local – have regard

to any potential impact on the physical remains of the past". The aim of conserving historic parks and gardens is to protect and maintain these landscapes, and the investment of resources and the skills that went into their creation over the centuries. The conservation approach is as diverse as the range of gardens, and individual to each one.

As well as sustaining the authenticity of the historic design, garden conservation seeks to sustain the character, qualities, traditions and the plant material of individual gardens. Many gardens have a long history of development and evolution, sometimes with different phases overlaying each other. The historic interest may relate to the designer, design ideas or the progression of designs, its period or rarity, associations with notable events or people, or the botanical interest of plants or plant collections, or a combination of all these factors.

English Heritage's criteria for gardens of special historic interest are:

- sites with a main phase of development before 1750 where at least a proportion of the layout of this date is still evident, even perhaps only as an earthwork;
- sites with a main phase of development laid out between 1750 and 1820 where enough of this landscaping survives to reflect the original design;
- sites with a main phase of development between 1820 and 1880 which is of importance and survives intact or relatively intact;
- sites with a main phase of development between 1880 and 1939 where this of high importance and survives intact;
- sites with a main phase of development laid out postwar, but more than 30 years ago, where the work is of exceptional importance;
- sites which were influential in the development of taste whether through reputation or references in literature;
- sites which are early or representative examples of a style of layout, or a type of site, or the work of a designer (amateur or professional) of national importance;
- sites having an association with significant persons or historical events;
- sites with strong group value (English Heritage, 1998).

In garden conservation, significance is determined by establishing the past history of a garden and its design influences, what survives today and how the garden has developed since first begun. Garden designs, whether formal or informal, rely on a precise relationship between structural features like avenues, hedges and groups of trees, and open spaces like lakes and lawns. Flower displays and plant collections add a rich decorative layer to the landscape designs. The original planting of the garden, the choice of trees, shrubs and flowers would have been governed by species availability, the garden's location and geology, and the skills and interests of the designer, owners and their head gardeners. In all cases, a garden's significance, historical precedent and traditions shape the policies for its conservation and the plants grown, and where they should be grown. Gardens may also be of interest for their artistry or horticultural styles, plant collections and scientific collections. The great tree collections of the 19th century, for example at Killerton (Devon), Westonbirt (Gloucestershire) and Sheffield Park (Sussex) were not simply collections but were arranged for aesthetic effect. Features may be of architectural, archaeological or wildlife importance too, and great educational value. These interests, and other new developments such as opening the gardens to visitors, also need to be embraced in planning the garden's future management.

5.2.2 CLIMATE CHANGE AND HERITAGE GARDENS

Climate change potentially poses an escalating range of threats for heritage gardens, from the impact on choice of plants grown, through to the long term sustainability of historic designs due to changing environmental conditions. The long term

cumulative impact of repeated storm damage, drought, pest and diseases, flooding, lake siltation, sea level rises and so forth is likely to be of greatest significance. Within the next 50 years, some garden features may become vulnerable, and a few gardens may be at risk of complete destruction as a result of climate change, despite the best efforts to counteract its effects on a local level. This will be particularly the case where plants and plant schemes are close to their ecological and physiological limits, for example, moisture loving herbaceous borders grown on the thin gravely soils of the Thames and Chilterns, or ferneries in locations where drought and exposure might be a regular feature in future. However, the majority of plant species that are currently cultivated in historic gardens could be maintained by the use of suitable soil moisture conservation techniques and irrigation in summer, albeit at increasing cost.

Climate change is anticipated to be most marked in the south, and especially the south east, of the UK so clearly it will be most difficult to adapt garden management in these regions. In the north west temperature increases are expected to be less marked and several of the parameters of seasonal precipitation and cloudiness, for example, are not expected to change beyond the limits of present variability. The climate change impacts will be less dramatic, but this is not to say that there will be no concerns. Small changes in temperature and water availability may make the difference between survival and loss of a rare plant or a distinctive plant community, which may be an important factor in the uniqueness and significance of a particular garden.

5.2.3 POTENTIAL EFFECTS OF LONGER TERM EXTREME CLIMATE CHANGE

In the most extreme case, maintaining original, historically authentic trees species and varieties may not be possible. Recent storms in the north have resulted in the loss of many fine specimens and champions of Douglas fir (*Pseudotsuga menziesii*) at Cragside, Northumberland. This damage may have been due as much to the fact that the trees have grown to the limit determined by current gale incidence, as to increases in gales themselves.

Perversely, such events can have beneficial consequences. The 1987 and 1990 storms devastated many landscape gardens, by toppling the mature trees and overgrown features, but it also created opportunities to rejuvenate the gardens through carefully planned repair and restoration programmes. A body of expertise and skills on historic park and garden restoration has developed from the storm damage work. However, the cost implications of the storms for owners and the Government were significant. English Heritage, alone, released £4 million of grants for storm damage related repair programmes to historic parks and gardens (English Heritage, 1997).

Repeated and prolonged summer droughts, as are projected especially for the south, could turn large areas of parkland brown, threatening their aesthetic appeal, grassland flora and fauna, grazing regimes, and agricultural income. Longer-lived tree species may also be threatened, especially the beech (*Fagus sylvatica*), a characteristic and important component of many southern gardens and parks, such as Ashridge (Hertfordshire), on the thin chalky soils of the Chilterns. The serene verdant English parkland we have become used to could disappear.

In the longer term, there may well be situations in which, because of climate change, a whole garden is at risk of being destroyed by inundation as sea levels rise or by increasing incidents of flooding, if the frequency of heavy rainstorms increases. In such circumstances, 'managed retreat' will be the only viable option, and it will only be possible to 'preserve' the garden as an archaeological site, unless the garden is of such importance and the resources so freely available that defensive measures, such as a wall or earth bund are possible. The financial ramifications of such protection, especially if a lengthy stretch of river bank is involved, as is the case at Westbury Court on the River Severn (Gloucestershire), will be considerable; and the context of the historic garden will be altered. Social and economic considerations will also have to be considered, with some gardens in flood plains possibly being 'sacrificed' to ensure the protection of upstream urban communities. Conversely, there will be garden management issues like flood waters washing soil and nutrients into ornamental lakes,

and creating algal blooms which can be damaging to human health or animal life, as well as being unpleasant, difficult and expensive to resolve.

Historically important plant collections, with original introductions from known collectors for example, pose a particular challenge if climate change threatens the survival of unique trees. Exact repetition of a planting scheme may not be possible, and anyway can be argued to be seldom desirable for, for example, plant hygiene reasons. Where accurate replanting is desirable, such as with a formal avenue, and where the tree species or varieties can no longer be grown easily, it will be necessary to rethink the conservation policies for these design elements of the garden.

Where a particular species is considered of the greatest importance, it may be propagated and replanted, if necessary in a more favourable position in the garden or even elsewhere in the UK (requiring coordination between owners and organisations). This is a sensible insurance against accidental loss, regardless of climate change. Where the particular specimen is important because of its age, position or historical associations, good cultivation (aeration of the soil, mulching, removal of competing grass, irrigation) may extend its life.

In very general terms, architectural gardens that rely on terraces, steps, balustrades and fountains for much of their drama will be less obviously affected by climate change, than will plantsman's gardens. Architectural garden features may suffer from settlement problems and cracking of walls and steps on some soils in hotter and drier conditions. Such damage will usually be much more expensive to repair, but the costs could be countered by reduced frost damage in winter. English Heritage has commissioned UCL's Centre for Sustainable Heritage to develop a method for understanding and assessing climate change risk for the historic environment, and to identify further areas of research.

5.2.4 BOTANIC GARDENS

Botanic gardens constitute a particularly interesting group, as most of the major botanic gardens in the UK are simultaneously heritage landscapes and outdoor laboratories, expanding our knowledge of plants – as is the case with the Royal Botanic Gardens, Kew. Many of the most notable plants are of great age and some have important historical associations, so climate change may have impacts on the heritage aspects of the garden. Historically, however, botanic gardens have had to be intensively managed in order to grow the widest possible range of plants in the living collections. The ethos and skills to deal with management challenges (including the potential challenges associated with climate change) already exists within these gardens, although there may be additional costs such as irrigation.

There will also be the advantage, for many botanic gardens, in being able to grow a wider range of plant than hitherto. Several gardens use the most sheltered corners of the garden (eg, narrow south-facing borders against the glasshouse range) – to grow the least hardy plants. With a general warming of the climate, these plants may be able to move into the open garden, releasing their locations for even more tender plants.

The advancement and dissemination of knowledge is another important aspect of the botanic garden, so development of the collections is important to the vitality of the garden. Climate change may offer new opportunities for the collections. After the 1987 storm the Royal Botanic Gardens, Kew extended their tree collection to include more species better suited to increasing temperatures. The botanic garden at the University of Cambridge has developed a dry garden as an example of 'waterwise' gardening.

5.2.5 MANAGING HISTORIC PARKS AND GARDENS THROUGH CLIMATE CHANGE

Garden conservation management plans are already extensively used as practical tools to develop conservation policies and to monitor ongoing management and maintenance. These plans could readily be used to appraise climate change impact risks, adjust conservation policies accordingly, and to measure cumulative effects. Managing the effects of climate change could also impact on the use of surrounding

land, its character and landscape setting for individual gardens. Management agreements could be used to develop cooperative approaches to larger scale land management, to ameliorate climate change impact such as flood prevention schemes which, in turn, could bring benefits for individual gardens through the control of soil and nutrients being washed into lakes and streams. Specific measures, like silt traps for mirror lakes, will be an essential and incur additional costs to build and maintain.

Britain's historic gardens and parks were mostly developed during a climate that itself is becoming historic, therefore adaptation in future will be unavoidable. If anything of the original effects and layouts are to be conserved in perpetuity, changing and/or more intensive maintenance regimes will have to be introduced, accepting the cost implications arising. Greater coordination will be required between organisations and owners, to ensure the conservation of the country's valuable plant collections for future generations. In all cases, managing gardens is about managing natural processes, including the human desire for change. Extreme climate change will make such changes common place and so challenge the way we think about our historic gardens, what we expect of them and what we mean by conservation.