

# Can horticulturists save the world? A reflection on the curation of plant collections

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## Abstract

The author has worked with plant collections for over 30 years and notes that perspectives have changed in this period, particularly as environmental challenges have increased. Here he provides a personal perspective, drawing on this time spent working with plants, on the role that such collections can play to counteract some of the challenges faced by environmental degradation, biodiversity loss and the impacts of these on human health. Plant collections in botanic and public gardens celebrate plant diversity, whether they are grown for science, conservation, education or simply for joy. These are all strong and valid reasons for maintaining collections, whilst the increasing awareness of environmental issues, and notably the challenges of a changing climate, bring a new emphasis to the value of cultivated plants in society. Horticulturists have been at the forefront of recognising these impacts, adapting the way they manage landscapes and noting the changing behaviour of plants. In garden collections, cultivated plants are increasingly important as horticulturists adapt to and mitigate the effects of climate change, placing an emphasis on their conservation and use. Connected to this increased desire to preserve plants and landscapes is a growing recognition of the value of plants and green spaces to human wellbeing. The challenges to urban and rural environments created by climate change raise the importance and relevance to society of plant diversity and horticulture. Can horticulturists save the world? The author argues that they certainly have a major contribution to make.

## Introduction

I would like to share some reflections on my career in horticulture and how my thoughts have evolved, and on some key foci today. Ultimately, I am interested in plant diversity, whether this involves growing plants, understanding their identity and relationships, conserving them or how we can and must utilise this key resource in facing today's many challenges, particularly that of climate change. Since joining the Royal Horticultural Society (RHS), whilst my interests remain the same, my perspectives

have changed. So, can horticulturists save the world? This is quite a bold statement, and deliberately so, as the contributions that horticulturists and the plants we grow can make is often underestimated.

## A personal perspective

I have always had an interest in collections; being able to explore and compare diversity within a collection is always a joy and a great learning experience. Research work on the genera *Lavandula* (Upson & Andrews, 2004) and *Rosmarinus* (Harley *et al.*, 2004) – now

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*Salvia* (Will & Claßen-Bockhoff, 2017) – was enriched by access to living collections. Understanding the variation in *Rosmarinus* was unlocked by growing out wild seed in cultivation. This revealed a wide range of variation, exemplified by habit, from prostrate to mound-forming, spreading to erect variants. This variation is very obvious in the cultivated plants, and demonstrated by a trial hosted at RHS Wisley, Surrey, and which ran from 2016 to 2020. It is rarely encountered in the wild, but is most often seen as prostrate and mounded variants on exposed coastal cliffs. Most populations are a typical component of the Mediterranean maquis, the spreading and erect forms persisting as they are able to compete and survive as the vegetation recovers in these fire-dominated communities, with low-growing forms soon shaded out.

The RHS *Colchicum* trials hosted at Hyde Hall, an RHS Garden near Chelmsford in the south-east of England, until 2019 brought together both wild and cultivated taxa to enable their correct identification and sort out the many misnamings; these were also assessed for their performance in the garden, with the best-performing receiving the RHS Award of Garden Merit. *Colchicum* produces flowers and leaves in different seasons, which is inconvenient for herbarium sampling as both are often key for identification, but the trial allowed complete specimens to be collected. The trial and associated work has resulted in a new and much-needed monograph on the genus (Grey-Wilson *et al.*, 2020).

### *The shift from comparative to molecular studies*

My career started in horticulture and the fascination of growing a range of plants subsequently brought me to plant conservation and systematics during the

1990s. Research methods moved from the study of morphology and non-molecular characters to the introduction of molecular techniques, which has since been transformed by our capacity to sequence DNA and ultimately genomics. This all catalysed an exciting transformation in our understanding of plant evolution and relationships, one outcome of which was the Angiosperm Phylogeny Group, a collaboration to establish a consensus on the taxonomy of flowering plants. The resulting changes to names, especially in commercially and culturally popular genera such as *Salvia* and *Rosmarinus*, are not always welcomed by all, but for me represent advancement in science and our knowledge of plant diversity. Working in botanic garden collections we have adapted our displays, particularly systematic or order beds, and associated teaching to reflect these advances. They provide a fantastic resource to illustrate morphological patterns that link genera to families and also demonstrate that without molecular markers the true relationships between those plants that have adapted to certain habitats or pollination syndromes are unclear.

Some of the results of reclassification due to molecular studies, as has happened with genera in Scrophulariaceae, a number of which are now in Plantaginaceae, can be a revelation and a cause of some disbelief. This work has enabled us to understand that an insect-pollinated flower such as *Antirrhinum* (snapdragon) shares a common ancestor with the aquatic and water-pollinated *Hippuris vulgaris* (mare's tail), despite the latter's highly reduced flowers (a single anther and stigma).

### *Conserving all plant diversity*

Conserving plant genetic diversity has become ever more important, whether through seed banking or *ex situ* living

collections. It has prevented island species from becoming extinct, the flora of the island of Saint Helena in the South Atlantic being an extreme example (Maunder *et al.*, 1995). The value of our cultivated flora has long been acknowledged; Brickell (1977) described it as ‘a unique gene pool of accumulated variation from centuries of selection and breeding’, and it was later recognised in the Aichi Biodiversity Targets developed to help measure progress in preventing the loss of biodiversity, with Target 13 specifically referencing the genetic diversity of cultivated plants. The network of National Plant Collections, managed by Plant Heritage, conserves our heritage of plants and provides a potential resource to meet future challenges (Upson, 2013). The value of such collections, especially large, diverse plantings that require space and resources to maintain, such as *Malus domestica* (orchard apple), has been questioned by some, as diversity can be quickly and easily generated – shown by discarded apple cores and the pips contained within that give rise to new variants. Regenerating such diversity is, of course, perfectly possible but perhaps misses the associated heritage and stories that reflect the rich gardening culture of the UK, as well as the selection process to identify superior forms that has taken place.

## Communicating key issues – climate change

Horticulturists need to be advocates for all the reasons we have collections and have cultivated plant diversity. In my role as Director of Horticulture, Education and Communities at the RHS, there are frequent opportunities to meet some quite influential people, including politicians. The Chelsea Flower Show is a particularly high-profile event, providing an opportunity to emphasise

the importance of gardens and gardening in all their many and varied aspects. It has been a very interesting learning curve for me to understand how best to engage with people who are not so aware of the importance of the world of plants. When you start talking about environmental and social sustainability, and the key role that horticulture plays in this, they often then begin to understand and start to engage.

As ever, the weather always provides a common starting point for such conversations. Often a reference to recent weather patterns or how an extreme event has impacted our everyday lives and our gardening efforts can provide a relatable example. This is one way to introduce the subject of climate change and its importance to us, and to discuss the role that plants can play in helping us to adapt to and mitigate its effects (Webster *et al.*, 2017). I realise that I have been working with climate change throughout my career, especially as Curator of Cambridge University Botanic Garden (CUBG) over the period 1997 to 2014. Climate data from CUBG showed an increase of more than 1.1 °C in mean annual temperature over the previous 100 years (Carroll *et al.*, 2008), and the garden currently holds the record for the highest temperature recorded in the UK: 38.7 °C on 25 July 2019. Data have proven the existence of climate change, but it is through curating collections and noting how plants in our care respond that we gain a very personal and close-up view of its effects. A plant I first got to know when training at Royal Botanic Gardens, Kew was *Chimonanthus praecox* (winter sweet), which flowered mid- to late February in the 1980s. This flowering event coincided with Chinese New Year, and had strong cultural associations because the plant originates from China. Over time, with extending

autumns and milder winters, I have noted flowering shifting to January, then to before Christmas, and most recently there have been reports of flowers in November. The enigmatic Chinese tree *Emmenopterys henryi* had rarely flowered in the UK until recently. My interest was piqued when it flowered at CUBG in 2013, having only previously done so on a few occasions at Wakehurst Place and Borde Hill, both in Sussex. It is known that flowering is not age-related, as it will flower after four or five years in climates such as that of California, so a more likely explanation is that the changing climate means the specific conditions required are becoming more usual. The climatic pattern triggering flowering is associated with a hot summer, a period of cold temperatures in the winter and then a particularly warm spring. Since 2013, it has flowered more frequently in the UK, and especially spectacularly in 2018, which suggests the exacting climatic conditions needed to trigger flowering are becoming more common (Upson, 2014).

## Horticulture and science – resilience in a changing climate

As we consider the plants we have grown that have thrived in the past, we also need to look forward to the plants we will grow in the future. One example is *Lagerstroemia indica* (crape myrtle), traditionally a relatively rare plant in cultivation in the UK, an unusual find on a south-facing wall and not often seen flowering in late summer. It is now becoming a more frequent feature in the south of the UK, and can be seen in new plantings at RHS Wisley, where new selections flower regularly. Horticulturists need to adapt the collections and gardens in their care in light of new or increased climate challenges, and the knowledge they bring is recognised.

## Plant health – pests, disease and pollinators

Managing pests and diseases has always been high on gardeners' agendas, now made more urgent with the ever-increasing frequency of novel pests and diseases appearing from abroad. This is due to the volumes of plants imported and changes in climate, especially warmer winters, enabling more pests and diseases to become established in our gardens. Even against the background of a decreasing use of chemicals, encouraging good stewardship of nature is ever more important for environmental benefit, leading to enhanced biodiversity and natural balance within our gardens.

The RHS Gardens are very much about experimenting with ways to reduce pests and diseases sustainably. The walled garden at Wisley used to be planted with annual displays of bedding plants, with the beds enclosed with *Buxus* (box). As in so many gardens, the box hedges have suffered with box moth and box blight. This problem provided an opportunity to change the display to showcase alternative hedging plants that could serve the same purpose and draw on the diversity of the RHS collections (Fig. 1). The development of integrated pest management methods (Ardle, 2021), together with the demonstration of alternative species, provides an example of how we can use our plant diversity in a different way, allowing us to adapt to the presence of new pests and diseases.

## Wildlife

Gardens are becoming an increasingly important refuge for wildlife. Not only is this in the context of spreading urban environments where gardens provide welcome green spaces, but, well managed in an environmentally sensitive way, they

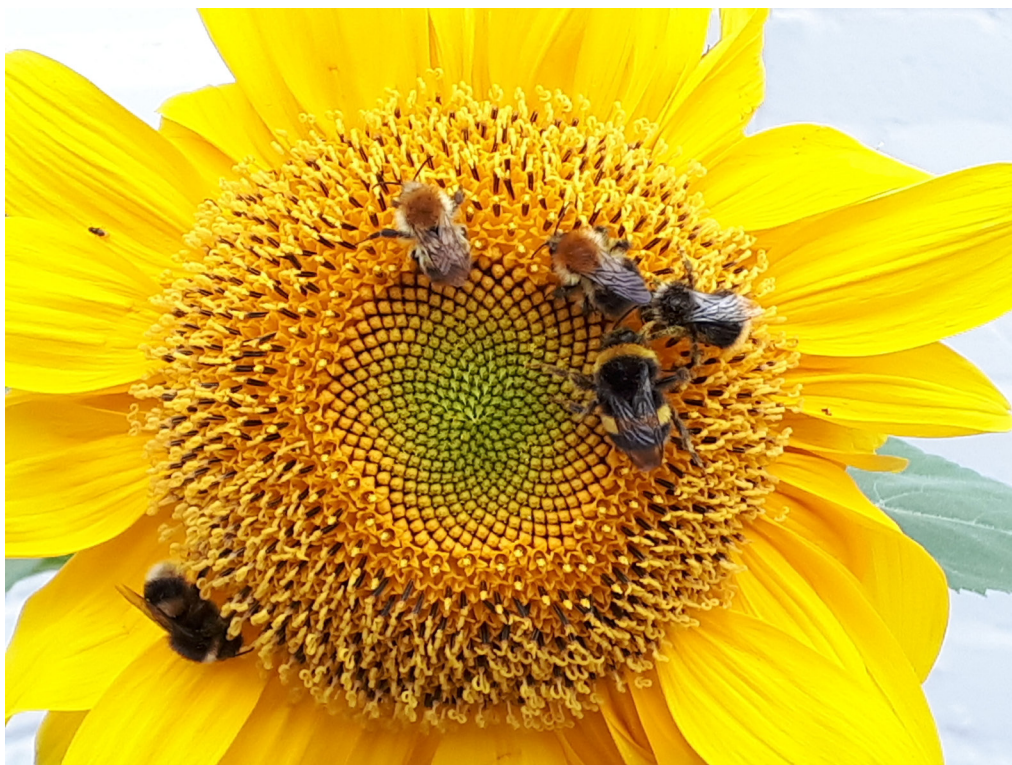


**Fig. 1** Hedging plants that have a similar growth habit to box and so provide an alternative. These include *Taxus baccata* 'Repandens' (replacing low box hedges), *Pittosporum tenuifolium* cvs, *Podocarpus nivalis* 'Bronze', *Lonicera ligustrina* var. *yunnanensis* 'Maigrün' and *Berberis thunbergii* 'Red Pillar'. Photo: RHS/Chris Gorman/Big Ladder.

can provide a variety of habitats, contain layers of planting and retain organic matter. They are also important sources of nectar, not just for bees, but for a wide range of insects. Lists of good plants for pollinators are widely available, and studies such as Plants for Bugs provide evidence of just how important cultivated plants are as nectar sources (Salisbury *et al.*, 2015). A mix of flower types is important to provide a prolonged nectar supply – the sequential opening of the individual flowers within the inflorescence of members of the Asteraceae is one such example (Fig. 2). Many garden plants owe their origin to hybridisation, either deliberate or naturally occurring. Hybrids can bring vigour and increased flower production to the species; some are also naturally sterile, meaning that nectar production is extended because no seed is set. One such example is *Lavandula x intermedia* (the Lavandins), a cross between *L. angustifolia* and *L. latifolia* that has

occurred both in the wild and in cultivation and has many named cultivars. Whilst all lavenders are beneficial for pollinators the Lavandins are particularly so, as their sterility ensures continued production of nectar. Delving further, there is also important variation at the cultivar level. This is easy to observe from insect behaviour when growing a number of cultivars together. *L. x intermedia* 'Sussex' is particularly beneficial, with plants often seen covered with pollinators. This is probably due to its flared corolla tube which makes the nectar readily accessible to many species of bees and hoverflies, as well as a range of butterflies and day-flying moths.

Seasonality can also be important, and cultivated flora can play a particularly important role in late winter now that above-average temperatures are more common and insects can be active before native flowers begin to bloom. I remember standing in the Winter Garden at CUBG



**Fig. 2** The single inflorescence of a sunflower. Numerous individual flowers provide nectar over a long period of time, illustrated by the bees. The arrangement of the single flowers in a Fibonacci pattern is clearly visible. Photo: Tim Upson.

being interviewed about unseasonable warm temperatures in the middle of January, with the temperature reaching 11–12 °C and the honeybees active. Fortunately, the early-flowering *Lonicera x purpusii* (winter honeysuckle) provided a much-needed nectar source, the strongly scented flowers an attractant to both visitors and pollinators.

### *Gardens and plants for the environment*

The importance of plants and the services they provide to the ecosystem has been well documented; their value in gardens and urban ecosystems is no less, and arguably more, important for many people in mitigating the impacts of climate change. An example of where this has been recognised is

the IGNITION project in Greater Manchester which aims to use nature-based solutions to form a new green infrastructure (Greater Manchester Combined Authority, 2020). The project uses evidence-based methods that cover green walls, street trees, urban green space, green roofs and sustainable drainage systems. It demonstrates plants' wide range of uses – from trees to help reduce the effects of flooding and as carbon stores, to vegetation to absorb pollutants. Blanusca (2020) highlights how specific cultivars with key characteristics can be more effective in delivering ecosystem services than species, and the rich value that lies within the cultivated flora.

We can also demonstrate some of these ecosystem services in our own gardens. One example is the Cool Garden, which opened



**Fig. 3** The Cool Garden at RHS Rosemoor. Photo: RHS/Chris Gorman.

at Rosemoor, an RHS Garden in North Devon, in the south-west of England, in 2019 (Fig. 3). Much of the garden's design is based around, and makes a virtue of, water. The site is on a slope and was previously prone to frequent flooding. In essence, the design shows how we can use the issue of flooding positively rather than seeing it as a problem to be solved. The gently flowing rills and bodies of water combine with the colour palette of green foliage and pastel flowers to make this a quiet and calming space that is already enjoyed by many visitors. The Cool Garden demonstrates some of the principles that make gardens pleasant places to be. This effect is emphasised by the adjacent and contrasting Hot Garden that features flowers in yellows, oranges and reds, colours known to be more stimulating to the human eye.

## Gardens, gardening and wellbeing

Horticulturists understand the value of gardens, gardening and plants for all aspects of our wellbeing. The evidence for this has been furthered by many recent studies, such as Chalmin-Pui *et al.* (2020, 2021a) and De Bell *et al.* (2020), with the subject also summarised in Griffiths & Keightley (2020). Such benefits have also been highlighted as part of the significant contribution that horticulture makes to the UK economy and society (Oxford Economics, 2018). These benefits have become even more apparent during the COVID pandemic, with many people rediscovering nature and accessing it through their local gardens and other green spaces. This is illustrated by Chalmin-Pui *et al.* (2021b) and through feedback from Britain in Bloom groups via the RHS Community team

which summarises the power of gardening: in their words, 'local people have told us how the garden has given them a place to enjoy the outside during lockdown, and a reason to get up in the morning during their most challenging days' (Ainsdale Village Church Community Garden, South Port, North West in Bloom).

The Big Soup Share (RHS, 2020), an initiative that celebrates the growing and cooking of food and is run annually in October, was undertaken in a COVID-safe way in 2020, and so the groups were not able to come together as usual. Yet the simple process of harvesting and cooking home-grown vegetables, and this year delivering to people's homes rather than sharing communally, was still an effective way to tackle loneliness and create friendship. It is humbling to read how valuable horticulture is in bringing people together in difficult situations.

Equally, we know that education is a real strength of many public and botanic gardens. It is a core activity, perhaps more today than ever. Again, during the COVID pandemic at the RHS we have seen a rise in interest from schools and other community groups who really want to garden and to start growing plants for themselves. It is revealing that in multiple surveys undertaken of young people and schools, the wellbeing of young people was always cited as a priority. And what better way to create wellbeing than through horticulture?

### *New gardens for wellbeing*

How do these social roles and educational functions translate into the RHS Gardens? RHS Bridgewater, a new RHS Garden and the fifth of its public display gardens, was due to open in July 2020, but the impact of COVID meant opening was delayed until May 2021.

Located in Salford, on the western side of the Greater Manchester region of England, it is on the site of Worsley New Hall, covering 154 acres (62.3 ha), with a combination of meadows, lakes, terraces and woodland. At its horticultural heart is the 11 acre (4.5 ha) walled garden (Fig. 4), at the centre of which is the Paradise Garden, where planting is intended to have the greatest intensity. The design intent here is inspired by the earliest gardens in Persia: enclosed spaces with pools, planted with fruit trees – a place to escape the outside world, and creating a kind of wellbeing by any other name. The Paradise Garden is a place we hope will provide a wonderful space to sit, linger in and enjoy. The richness of the planting makes it a special place, with plants from the Mediterranean, North America and Asia.

The outer areas of the walled garden are more overtly designed to enhance wellbeing. The Community Grow space will allow new gardeners to learn, mentored by the garden team. The beds take their inspiration from the hexagonal shapes of honeycomb, a departure from the more usual rectangles. By grouping two or three of these beds together we hope to encourage people to learn from each other too.

Adjacent to the Community Grow space is the Wellbeing or Therapeutic Garden. This has been designed as a quiet space, a social space and an area where people can cultivate plants. It is full of plant diversity, making it an interesting and stimulating place. Plants such as lavenders and roses are used to evoke memories and elicit responses, especially for those suffering from dementia. The garden provides an opportunity for their memories to be stimulated through sights and smells. The use of different leaf textures and shades of green creates a quiet, contemplative space where people can feel safe and calm.





**Fig. 4** The walled garden at RHS Bridgewater showing the Paradise Garden and Kitchen Gardens on the left and centre, and the Wellbeing Garden and Community Grow space on the far right. Photo: RHS/Kestrel Cam.

This area will be a ‘working’ garden and we have partnered with the local NHS trust to offer gardening as part of a social prescription. To date, 30 people who have persistent or chronic health problems have been referred to the programme as an alternative to medication or talking treatments (Howarth *et al.*, 2020). Some very human stories have emerged: people who have previously struggled to leave their own home now have the confidence to catch a bus and come to the garden each week for their course. Such examples demonstrate the power of gardening for wellbeing.

A wellbeing garden has now been completed at RHS Wisley. It is one of three new gardens constructed around RHS Hilltop – The Home of Gardening Science, RHS Wisley’s centre for horticultural excellence (Fig. 5). The building itself will house RHS Science and Collections, new interpretation

and learning spaces, and visitor facilities. The three surrounding gardens all reflect important aspects of gardens and gardening and each has a positive focus on wellbeing. The Wildlife Garden explores different ideas of habitat creation to encourage wildlife not just to visit but to be an integral part of the garden. The design encourages visitors to explore and closely observe any wildlife. The World Food Garden demonstrates various ways to grow edible plants, a healthy activity in its own right, and also highlights the importance of plants in our diet to keep us healthy. The Wellbeing Garden to the front of the building explores the diverse elements that make gardens good for our wellbeing. A number of quiet, enclosed areas contrast with larger, more open, busier spaces.

On approach to the building, the ribbons and drifts of plants, highlighting different



**Fig. 5** RHS Wisley's Hilltop Building – The Home of Gardening Science is surrounded by three new gardens. The Wellbeing Garden is to the front, the Wildlife Garden on the left and the World Food Garden on the right. Photo: RHS/ Chris Gorman.

greens and textures with pines, rosemary and grasses, create a calming effect. Within these various spaces, colour palettes have been selected with great care to explore how subtle changes of shade and hue can influence us. These are all examples of how the RHS is exploring the use of the diversity of the collections and cultivated plants for wellbeing.

## Conclusion

Can horticulturists save the world? Well, perhaps not in the literal sense, but we do have a very big role to play in helping to tackle some of the environmental and social issues that society faces today. Horticulture can help us mitigate and adapt to climate change, and can contribute to our wellbeing, as so vividly demonstrated throughout the ongoing COVID pandemic. Key to all this is the diversity of plants, both wild and

cultivated, and we should not underestimate their value and the key role horticulturists have to play in the future.

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