RHS Research into Plants for Biodiversity

Wildlife gardening has only recently gained acceptance as a topic for serious scientific study. This is not before time, since the impact of gardens as a habitat is quite substantial, with the number of domestic gardens in the UK estimated at over 16 million, equating to hundreds of millions of plants.

Frustration at the lack of recognition is expressed by ecologists such as Dr Ken Thompson, a senior research Fellow at the University of Sheffield and lead scientist in the Biodiversity in Urban Gardens Sheffield (BUGS) project. "I know it's a heretical thing to say," he wrote in 2009, "but most farmland would be improved by having a housing estate built on it from a biodiversity point of view. If you're comparing gardens with the equivalent area of modern intensive farmland, gardens are much better." [*The Times*, September 8th 2009].

Certainly, if we are to maximise the potential of gardens for reducing biodiversity loss, we must begin to take the topic a little more seriously. This means asking questions; finding out which practices work and which don't; investigating the impact of one approach over another; offering gardeners, whether professional or amateur, good evidence for the advice on offer rather than relying on assumptions. The world of horticulture has never held back from investing in research. It is now time, therefore, for serious research into biodiversity horticulture.

Over the last 10 years or so, momentum has been gathering with a growing number of projects and studies into all aspects of wildlife gardening being undertaken by universities, conservation bodies and keen individuals such as Jennifer Owen, who in 2010 was awarded the RHS Veitch Memorial Medal for her 30-year study into the wildlife in her Leicester garden. Many of these studies focus on the conservation of individual plant and animal species, though some look at specific habitats such as garden ponds and a number of researchers have taken the bold step of investigating the rich biodiversity of gardens individually or collectively.

I say 'bold step' because of the complex nature of studying gardens. Rarely identified in the UK Government's Local Biodiversity Action Plans (BAPS), gardens tend to be relatively small pockets of privately owned land difficult to access for scientific research (although some work has been done using aerial imagery) and typified by a myriad of styles, features and plant combinations. Studying them is made doubly difficult by the fact that they are subject to regular changes of ownership and management. It is little wonder that they have been under-studied and consequently undervalued in their role in supporting wildlife.

In 2008, the Science team at RHS Wisley recognised that there was a particular gap in horticultural understanding that warranted investigation: does the geographical origin of a plant in a garden have a bearing on its wildlife value?

The plant-focused basis of the work struck a chord with the RHS. Here was something that would be of direct relevance to its members and to gardeners in general but, as with all studies into garden biodiversity, the topic was not going to lend itself easily to investigation. In fact, some in the scientific community were so sure that this topic either couldn't be studied or that the outcome would simply prove them right, that they felt it was a waste of time to undertake it in the first place.

The debate is centred on the role of garden plants in supporting wildlife. The botanical composition of gardens differs significantly from that of more natural habitats. Of plants in an average garden, only around 30%[1] are native (i.e. indigenous to Britain). Since gardens tend to be relatively rich in biodiversity, this leaves a big question mark over the part the 70% non-native plants have to play.

Invertebrates – 'bugs' to most people – are at the heart of garden ecology and much misunderstood. Admittedly, some inflict unsightly damage on a range of garden plants, but the majority are simply getting on with eating and being eaten.

Using in-house entomological expertise, the RHS devised a three-year field trial to investigate the impact of different planting schemes on invertebrate abundance and diversity. As with any project seeking to capture the imagination, a snappy title was required: hence Plants for Bugs.

During 2008/9, work was undertaken at RHS Garden Wisley to construct a trials plot consisting of 18 3×3m beds. The entire plot was replicated at a second site nearby in Wisley Village. Each bed is separated by a 1-m wide path and planted with 14 different species of plants, from bulbs, ferns, grasses and herbaceous perennials to shrubs and a climber.

It would take decades of research to cover every plant in cultivation so, instead of looking at plants as individual species, the approach has been to assess

[1] Loram, A., Thompson, K., Warren, P.H. & Gaston, K.J. 2008. Urban domestic gardens (XII): the richness and composition of the flora in five cities. *Journal of Vegetation Science*, 19, 321–330

how specific groups of plants performed. This involved growing native and non-native plants alongside each other and studying any differences in the fauna associated with them. The hypothesis was that no differences would be found.

To test this hypothesis, plants from one of three different geographical regions were planted in each bed: Britain (i.e. native plants), the rest of the northern hemisphere (i.e. non-native but with some botanical and ecological similarities to British natives) and the southern hemisphere (i.e. non-native plants that are often remote, in botanical and ecological terms, from native British flora). For example, in the native bed one of the 14 plant species is hemp agrimony (*Eupatorium cannabinum*); in the equivalent position in the northern hemisphere bed, the North American Joe-pye weed (*Eupatorium maculatum*) and South American *Verbena bonariensis* in the southern hemisphere bed.

The beds are planted to imitate a mini garden border and, with the exception of zero pesticide use (for obvious reasons), are being managed very much as any gardener would manage an ordinary plot, so weeded, fed and watered when necessary, cut back in spring, etc. A botanist or astute visitor might spot the distinction between the plantings but would the bugs be as discerning?

By the start of 2010 – coincidentally the UN International Year of Biodiversity – the plots were prepared and the scientific team was ready to begin the first of three years of monitoring. Recording protocols, created with the help of consultants and research establishments such as Rothamsted Research in Hertfordshire, were put into practice.

A total of four separate monitoring methods were developed:

1. **Observation of flower-visiting insects**
   During calm, sunny conditions, each bed is observed for flying insects such as bees and butterflies visiting or resting on the flowers. These insects are particularly important as they include some of the pollinators which are vital for the production of many crops. Many species are of conservation concern but, since it is these insects that most gardeners consider attractive, they are usually actively encouraged into their gardens.
2. **Vortis suction sampler**
   One level below the flowers is the foliage layer. Herbivores such as caterpillars, aphids, leaf beetle larvae and leafhoppers abound in this zone. They are captured using a vacuum-style piece of equipment called a Vortis suction sampler. The nozzle is swept slowly over each plant; the insect matter captured by this method is then identified in the laboratory. The survival of such herbivores is directly dependent on suitable plant availability and, although not generally regarded as "the gardener's friend", they in turn support many organisms higher up the food chain.
3. **Pitfall traps**
   At ground level, pitfall trapping is a standardised method that monitors the activity of insects such as ground beetles. The trap, a plastic cup, is set in the soil in the centre of each plot and left in place for a fortnight. Small creatures crawling over the soil are captured when they tumble into the cup.
4. **Slug and snail (gastropod) traps**
   Although not encouraged in most gardens, slugs and snails are also monitored in this project. The trap consists of chicken feed used as bait, placed under an upturned plastic saucer to provide slugs and snails with shelter. Traps are set during damp weather conditions when molluscs are more likely to be active.

This 'top-to-toe' approach to data collection ensures we maximise the number and diversity of species found using plants or other resources within each bed. This recording method is repeated around five times between the months of March and October.

By the end of the first year (2010), over 14000 invertebrates had been counted and identified. This promising start gives confidence in the recording methods and suggests that by the end of the three year study sufficient data will be available to analyse.

Some figures from 2010 include:

- Over 2300 flying insects were observed visiting the plots, including seven species of bumblebee and twelve species of butterfly.
- From the pitfall traps over 6000 ground-dwelling insects and other invertebrates have been counted and over 160 species identified, including 30 species (630 specimens) of ground beetle and four species of woodlice (437 specimens).
- The Vortis suction sampler has captured over 3000 invertebrates off the foliage and 115 species have been identified.
- A mere 45 slugs and snails were caught, possibly due to the dry summer.

With two years still to run, meaningful conclusions cannot yet be drawn from the data. But that does not prevent us from looking ahead at some of the possibilities opened up by the Plants for Bugs research. We need to be cautious, however. A single study into this complex topic will almost certainly fuel yet more debate and further research. Without a pioneer study such as Plants for Bugs, the debate surrounding planting for wildlife remains scientifically uncharted territory, leaving gardeners floundering for direction. So where might the findings take us?

One potential outcome is that there is a marked richness of invertebrates in the native beds as compared to the non-native beds. This is certainly the expectation of many plant and animal conservationists. It will strengthen the trend towards the increased use of British native plants in gardens and ensure RHS advice to wildlife gardeners has a strong emphasis on incorporating wild flowers into planting schemes.

Another possibility is that results might reveal that the northern hemisphere near-native group of plants performs on a par with the British natives. If this were the case, wildlife gardeners could rely heavily on this plant group without necessarily feeling they have to augment it with many pure natives. Certainly plants originating from Northern Europe, North America, China and Japan are relatively well adapted to the UK climate (e.g. fully hardy) and are already extremely popular with British gardeners.

It is also possible that few tangible differences will be discernible across all three plant groups. This certainly would be a headline story since it would suggest that it really doesn't matter what you plant, so long as you plant as wide a range of plants as possible.

Whatever the outcome, we mustn't lose sight of the fact that wildlife gardening is still gardening.

With the exception of a handful of invasive plants, it would be hard to argue that any plant is actually bad for wildlife but with 70,000 plants listed in the current *RHS Plant Finder* and with the average garden size getting ever smaller, the need for evidence-based advice to help gardeners make well-informed decisions on choosing plants has never been more important.

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To learn more about the project visit www.rhs.org.uk/plants4bugs