



Newsletter 3 March 2004

Much later than intended, for which our apologies, here is the last newsletter of the original BUGS project, summarising the main findings, the ways in which the information is being used, and the developments and publications which the project has led to.

What has been happening?

Since the funded part of the project finished at the start of 2003, we have been working at the final collation of the data sets and seeing the huge amount of information collected through to final analysis and publication which, as many of you will be aware, is a lengthy task. Richard Smith continues to be involved with this task, although his employment on the project ended with the conclusion of the funding period, and he has been coping with looking after a young family, and a new job at the Central Science Laboratory, near York, at the same time! The analyses of the data, although lengthy, are of course the only way in which we can turn the specimens, observations and measurements made from the study gardens into answers to the questions we set out to look at.

The data

The most obvious outcome from the work are the data the project has generated. We have several thousands of records of organisms in gardens, ranging from woodlice to wood anemones, and from bees to beech trees. The data for invertebrates, plants, and garden characteristics have been collated and accepted into the data archive of the Natural Environment Research Council (who funded the work), where they will in due course be available for (non-commercial) research work by others. [N.B. the data are of course in a totally anonymous form – individual gardens cannot be identified from the data sets.]

Gardens and their features

Part of the project has been concerned with taking stock of exactly what sort of a resource gardens are in an urban area. How much of a city is gardens? What sizes are they? What sort of features do they contain? As we outlined in the previous newsletter, we have used a mixture of digital mapping information, aerial photography, and telephone surveys to sample various features of garden resources across the city as a whole. For Sheffield, we now know that approximately 23% of the city is domestic gardens – an area of some 33 km². This area is, of course rather unevenly distributed across the city, and the bulk of the area is made up of small gardens which, as might be expected, vastly outnumber large ones. This of course emphasises that what people do with small gardens is very important in the city as a whole. Other numbers, such as the proportion of gardens with ponds (about 15%), nestboxes (26%) and trees (48%) begin to enable us to get a picture of how these components of gardens add up across the city as a whole and what effect changes in people's garden management, or design, decisions will

have. This work is the first time that a quantitative assessment of the resources provided by domestic gardens has been made on this scale. More detailed studies of our 61 study gardens have also enabled us to show how features such as house age, location and garden size affect the range of features in individual gardens.

This work is in the process of being revised for publication in *Biodiversity and Conservation* and *Landscape Ecology*, and we hope these papers will be available later this year.

Biodiversity

Plants

In our 61 survey gardens we found 1166 vascular plant species. A little over 30 % of these were native species, though this does not mean that the natives were there by accident – many were planted deliberately.

The average number of plant species in individual gardens was 119, with larger gardens tending to have more species, but as might be expected, there was considerable variation, the most species poor garden having a respectable 48, while the record holder had an impressive 268. Another interesting feature of garden floras is that most species are very rare: 490 species occurred only once, and only 35 species occurred in more than half the gardens. Comparisons of garden floras with patterns of plant diversity in urban waste ground showed that gardens contribute to urban plant diversity in quite different ways from derelict green space.

We also made a detailed comparison of lawn floras, again finding a surprisingly high diversity of plants in the humble garden lawn (possibly not always at the desire of the garden owner!)

Some of this work has been published in: *Journal of Vegetation Science* (2003) 14: 71-78; and *Journal of Vegetation Science* (2004) 15: 371-376), and a further publication is in preparation.

Invertebrates

Of the approximately 40000 invertebrates recovered from our various sampling programmes, our identification efforts, which depended heavily on a dedicated group of taxonomic experts from around the country, focused on 13 major groups: molluscs, millipedes, centipedes, woodlice, hoverflies, bumblebees, craneflies, sawflies, true bugs, solitary bees and wasps, beetles and spiders.

At a very general level, the patterns of occurrence for the invertebrates echoed some of those in the plants – there was a great deal of variation in the species found in different gardens, though unlike with the plants it is not because garden owners exert deliberate control over which spiders, hoverflies, or woodlice they have! In fact what emerges strongly from the invertebrate results is that the occurrence of different groups appears to be affected by different features of gardens, or features of the surrounding environment. For example, increased bumblebee diversity seems to relate to increased diversity of different habitat features in a garden, and increased amounts of greenspace in the neighbourhood, which seems quite logical, but other groups don't seem to be responding to any aspects of the environment that we managed to measure. So the invertebrate story looks like it is quite a complex one, but if there is a general message it is probably that increasing amounts of vegetation, at different heights, are one garden feature which the gardener has influence over and which will tend to enhance invertebrate diversity. Interestingly, there is little support for common ideas such as larger gardens being better, or gardens in more urban areas being less good than those in the suburbs.

The invertebrate survey work is currently submitted for publication, but it may be a while yet before it is available.

Wildlife gardening

Of the experiments we carried out to see how quickly and effectively simple wildlife gardening measures worked to encourage diversity in gardens, there were contrasting results. The most successful measures were nest site provision for solitary bees and wasps – which were successful in many gardens. The same could not be said of nettle patches, which were rather ineffective, and bumblebee nests which were entirely unsuccessful. Dead wood showed promise – though probably needs several years to develop its real value - while the key to getting a good wildlife pond seems to be that you need to introduce some appropriate species to get it started.

The experimental work is currently in the process of publication in the journal *Biodiversity and Conservation*

Other groups

In addition to the plants and invertebrates, we also looked at lichens, bryophytes (mosses and liverworts) and lawn fungi. Although often inconspicuous, the two former groups often occur in surprising numbers and diversity in gardens, nearly 80 species of lichens (including the species mentioned in a previous newsletter which really does appear to be a new species) and 63 species of bryophytes were found in the study gardens. Despite many people's wishes to the contrary, many of these species do rather well in lawns! Fungi, provided a less impressive number of species, though of course they were sampled from lawns only.

Outputs

Obviously the primary aim of the project is to try to provide quantitative results to a number of questions about the biodiversity value of gardens, and much of our effort has to go into publication of that work in the scientific literature. However, we are also concerned to

try and extract the main messages from that detailed reporting in more accessible forms for a wider audience. To this end we have prepared an article which provides a more detailed, though non-technical, overview of the results from the project, which we are hoping to see published soon.

An article on the project by Ken Thompson will also shortly be appearing in *The Garden* magazine, and various mentions of the work crop up in the gardening and general media from time to time.

We presented a talk on the project at the Royal Horticultural Society meeting *Gardens: Heaven or Hell for Wildlife?* late in 2002; a report of the meeting, and transcript of the talk is available on the RHS website (linked from the BUGS web pages).

The future

Although the main work on the BUGS project has finished, obviously analysis and publication of the results will continue for a while yet. We are also just about to start work on a survey, based on the protocols developed with BUGS, looking at plant biodiversity, and garden features in other urban areas in the U.K. (funded by English Nature, The Countryside Council for Wales, the Environment and Heritage Service and DEFRA).

We feel that a great deal of useful scientific information has come out of the BUGS project, and it has demonstrated that a better understanding of the role of gardens in urban ecosystems is both possible, and worthwhile. We hope this, and other studies which take the ideas further, will provide a sound base from which to incorporate gardens into both urban ecology, and ecology into gardening.

And finally ...

We must express our deep gratitude to the many people who provided us with access to their gardens (and all sorts of favours and assistance once we got there) which made the BUGS project possible. We are also indebted to the taxonomic experts whose time and skill made it possible to examine the diversity of many groups that we could not otherwise have documented. And to everyone else who has participated in any way, our thanks.

We will continue to post information about outputs from the project, including copies of publications whenever possible, on the BUGS website (www.shef.ac.uk/uni/projects/bugs/index.html)

Kevin Gaston, Richard Smith, Ken Thompson, Phil Warren

Dept Animal and Plant Sciences, University of Sheffield, Western Bank, SHEFFIELD, S10 2TN, UK

Email: k.j.gaston@sheffield.ac.uk Tel: 0114 2220030