Newsletter
January 2001

[This newsletter is essentially the same as that issued to participants in the project in early 2001, with minor changes to remove requests for information etc.. relevant only to those involved. If you are involved in the project and need further copies of the full newsletter, then please email us.]

We have now completed the first year of the BUGS project. This offers an opportunity to review our work, and to look forward to developments of the project over the next year. Above all, this is an occasion for us to thank all our participants for their co-operation, forbearance, and encouragement.

BUGS gardens

In January we began the daunting task of seeking gardens for the project. How on Earth do you find garden owners willing to host pots of stinging nettles or homes for bees and wasps? The mere suggestion of a black and white "tent" on the lawn was likely to evoke bemused or uneasy expressions. Yet within Sheffield there are a good number of people either sympathetic or committed to encouraging wildlife in gardens. This has provided the base to the BUGS project.

So far we have received more than 160 expressions of interest in participating in BUGS. Sixty-one gardens have been used for detailed surveys of fauna and flora, and another thirty-five for trials of wildlife gardening techniques. Participants were attracted from articles advertising the project in the University of Sheffield newsletter, Sheffield Wildlife Trust's 'Kingfisher' magazine, and the Sorby Natural History Society's newsletter. Others were found via personal contacts in the Animal and Plant Sciences Department, and following a talk at the Sorby's biodiversity symposium in February.

Our garden sample

Clearly, our selection of survey gardens was not random. We only approached a restricted sample of garden owners. Nevertheless, our study sites include a broad spectrum of housing types and ages, and they are not biased towards particular districts of Sheffield. There is more than a tenfold difference in size between the largest and smallest gardens; one or two resemble an arboretum, whilst others are simply a walled yard. They range from the diligently tended to those that receive no management whatsoever. Thus we are confident that we have captured much of the variety of gardens in our sample. In measuring the response of biodiversity to such variability, we hope to be able to pinpoint some of the key factors that are important for wildlife in gardens.

Describing gardens

This summer we made detailed plans and descriptions of our survey gardens, accompanied by a photograph. We quantified the availability of different habitats and resources, ranging from the amount of border, lawn and hedges to the presence of ponds and compost heaps. We also estimated the structure of vegetation in gardens by recording its vertical and horizontal cover. This is an important aspect of the resources in a garden because vegetation 'architecture' strongly influences the number of available micro-habitats.

Sampling biodiversity

We have selected a wide range of fauna and flora to survey in gardens, ranging from poorly-studied species, such as ichneumon wasps, to the gardener's favourite: birds. One important consequence of having information on many different groups is that we can determine whether the diversity of one group can be used to predict that of others in gardens. We were keen to investigate as many habitats within gardens as possible, although it has been necessary to balance the specificity of our sampling with techniques that could be repeated by other surveys.

Pitfall trapping

Pitfall trapping was conducted for two weeks each month, from June to October. Three pots were placed in borders, and distributed so as to sample areas of the garden with different characteristics. The method sampled many ground-active invertebrates: principally ground beetles, springtails, woodlice, millipedes and centipedes. It was rather *too effective* for slugs and snails, as in some gardens they literally filled the pots. The 50% alcohol, sufficient as a preservative for most samples, was all but reduced to a putrefying sludge in those cases. We commiserate with all involved for the stench! Currently the c.900 pitfall samples are being sorted prior to being identified.

Litter sampling

Litter samples were made in triplicate from each garden, on one visit during the summer. This method collected animals from the layer of dead leaves and woody debris found under vegetation in borders. We aimed to find the relatively immobile organisms that tended not to fall into pitfall traps. We used 'Tullgren funnels' to recover the inhabitants of the litter efficiently and intact.

Malaise trapping

The arrival of black and white terylene 'tents', in roughly a third of survey gardens, did not herald our intent to camp out - rather a very effective means of sampling insects, known as a malaise trap.

This method is very useful because, as for pitfall traps, sampling can run unattended. The aerial fauna was sampled for two weeks every month, and is continuing now, over winter. At the height of the summer, a single collection could result in thousands of insects per trap, comprising mainly small flies. The groups of real interest were ichneumon wasps, hover-flies, crane-flies, moths, bees, and wasps. However, the aspect of the malaise trapping that left us most puzzled was the theft of one of the traps. Evidently criminals are seeking to exploit the insatiable demand for net curtains in some parts of the city…

Inventory of the garden flora

We made a complete record of the plants growing in our survey gardens, during a single visit between late July and mid-September. We considered grasses, herbs, shrubs, trees, ferns and mosses. One of the most interesting aspects of the inventory was to record whether plants were native or alien to the Sheffield region. This provides an insight to how gardens serve as a refuge for populations of native plants, and what kind of resource they offer to native fauna. There is a long-running debate as to what role non-native garden plants can play for wildlife.

The challenge of British gardens is that they potentially contain representatives from the entire global temperate flora, with a vast range of varieties and hybrids. We are confident of having accurately identified plant genera, and distinguished morphological types within these genera. We were ably helped by garden owners on many occasions. A minority of plants remained unnamed, and so samples were taken for later examination. Lawns were not inspected closely in this years sampling; we aim to cover them in 2001 with expert botanical assistance.

Leaf-mining insects

Whilst undertaking the floral inventory, plants were also inspected for leaf-miners. These are the larvae of flies, or caterpillars of tiny moths, that actually feed under the surface of a leaf. They create characteristic blotches and galleries on the host plant that can even be used to identify the species involved. Leaf-miners are one set of organisms in which you can directly measure the use of resources in a garden. We found that out of 70 host plants with mines, 27 were non-native species. Clearly alien plants can support herbivores, although the proportion that do is likely to be less than that of natives.

Ponds

Aquatic habitats are another discrete resource, used by a particular wildlife assemblage. In gardens they are represented by butyl- or concrete- lined ponds, barrels and butts, and even old porcelain sinks! Lee Bates, an undergraduate working with BUGS over the summer, made a detailed survey of 37 ponds. Having described their physical and chemical features (such as size, age, pH and conductivity), Lee went on to sample aquatic vegetation and animals. The patterns of richness of these inhabitants will now be analysed in relation to pond characteristics.

Fungi

Fungi play a critical role in ecosystems, but they are a relatively difficult group to study or survey. The fruiting bodies occur both unpredictably and temporarily, thus detecting them requires more effort than for other groups. Opportunistic collections over the year have recorded 28 species. Another 13 were sampled from garden lawns, across 54 gardens, during one week towards the end of October. No fungi were found on 40 of the lawns, and the largest number of species from any one site was six. It would be interesting to see how this picture changes with greater sampling effort, and it may be an area where garden owners could provide 'on site' assistance.

Trials of wildlife gardening techniques

The second component of the BUGS project has investigated the efficacy of methods that manipulate biodiversity. 'Wildlife gardening' has the potential to increase the population sizes of certain animals and plants, through the provision of nesting sites, food plants or new habitats. We replicated the following trials in each of 20 gardens (some of which were used for more than one trial). They were different from those used for surveys, so as not to confound the results from the two components of the project.

Artificial nest sites for bees and wasps

Three types of nest were used to attract solitary bees and wasps. These insects normally breed in hollow plant stems or old borings in wood, neither of which are thought to be abundant in gardens. Nest chambers were created by drilling tunnels, 4-10mm in diameter, in wooden blocks; by placing paper straws in painted tin cans; and by filling sections of 11cm diameter drainage pipe with lengths of bamboo. Eight wooden blocks, one can, and two pipes were hung from a wooden stake in each garden, during the spring. They were retrieved in

October, and are now housed in an unheated out-building, awaiting the emergence of any insects next spring. Mud caps or seals of wood fragments betray the presence of nests. Nest uptake was widespread: at least one type of nesting site was occupied in 15 out of 20 gardens. However, the number of utilised tunnels was low, just a few in each case.

Bumblebee nesting sites were tested in the form of a terracotta plant pot, upturned on a tile, and raised off the ground by a brick. Upholsterer's cotton was provided to mimic the old nest material of birds or rodents that bumblebees use in genuine nests. Although the pots were put out in time to be found by nesting queens, none were used! They have therefore been left out for another trial next spring.

Nettles

Tubs of stinging nettle rhizomes were set up in early summer. Over the following three months, we aimed to discover whether the new growth was attractive to four butterfly species for egg-laying (the small tortoiseshell, comma, peacock, and red admiral). Although the nettles grew well, only one pot out of 19 was colonised- we found a single comma caterpillar. As the numbers of adults observed in gardens this summer was very low, the result may be due to butterflies not finding the nettles. We will be repeating the trial next year; the tubs are ready and waiting…

Experimental ponds

Many gardens contain ponds in the form of sinks. Even the small amount of water they contain offers a potential aquatic resource for species not otherwise occurring in gardens. This was our reasoning behind establishing simple ponds in planter troughs, and we will examine natural colonisation over the course of the project. A sand and gravel substrate was created in the troughs, and they were stocked with cleaned Canadian pondweed. The ponds were inoculated with the freshwater crustacean, *Daphnia*, for two purposes: to slow algal growth and to provide a food source for predatory bugs and beetles. The troughs were not sunk into the ground, as this would probably have been asking too much of our garden owners! Therefore, a length of plastic mesh was trained out of the trough to allow animals to enter or exit, but clearly the troughs are not as accessible as conventional ponds. Nevertheless, aerial insects are not restricted, and within a week that chironomid midges and mosquitoes had laid eggs in the ponds.

Birch log piles

By mid-November we had deposited small log piles in gardens. Birch was used because it is widely available around Sheffield, being cleared as a 'weed' from heaths and moors as a part of their management. The birch was obtained from Loxley Common, with the kind assistance of the Sheffield Ranger Service and BTCV. We intend to study the role of logs as a refuge for hibernating wildlife, and as a resource for wood-feeding insects and decaying fungi. Log piles are an overwintering habitat for invertebrates, and the amphibians that are supported by local ponds. Within the time scale of the current project, it will not be possible to explore the logs' full potential for wildlife, as decay occurs over a decade or more. Dying trees or dead wood tend to be removed in the wider countryside, so their presence in gardens could be significant for certain fungi and insects.

The BUGS workshop

In mid-December, we held a one-day workshop with representatives of end-users for the outputs of the BUGS project and representatives of other interested organisations. Here the progress of the project was summarised and much valuable discussion took place about how to develop things further, the interpretation of some of the findings, and how best to disseminate the results. Many of the suggestions that were made will shape how we take the project forward.

Plans for the next two years

There is a full season in 2001, and a partial one in 2002, to continue survey and experimental work in gardens. We intend to continue malaise trap sampling into 2001, and would like to obtain more extensive collections of fungi from gardens. At the moment we are deciding what kind of sampling will help us to build up a more detailed picture of specific garden habitats, for example a survey of compost heaps, and more detailed work on lawns.

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