Justin Bere's roof gardens in Islington, London, photographed in July 2008

The native versus non-native planting debate

In this sustain' exclusive, Justin Bere describes how his rooftop wildflower meadow is providing vital support for the local house sparrow population as well as evidence of how native planting benefits a healthy ecosystem.

May 16th 2009: The local house sparrows have discovered something very interesting about the wild flower meadow on the roof of my house. After the adults have fed themselves on sunflower seeds that they collect from nearby bird feeders, they have taken to flying over to the native wild flower meadow where they collect a beak-full of insects to carry off to their fledgling chicks.

The sparrows are most interested in the Common Vetch native annual which is abundant on the roof due to ecologist and green roof expert, Dusty Gedge's planting advice. Close inspection shows that the Common Vetch is host to an abundant supply of huge juicy aphids; one of the favourite and most important foods for baby sparrows and essential for the survival of the first of the season's brood of chicks.

Further research (below) indicates that Common Vetch is known to be extremely attractive to aphids and that by supporting large aphid populations, the Common Vetch in turn supports the house sparrow population which is perilously in decline.

SUPPORT YOUR LOCAL BIRD POPULATION!

I planted my four green roofs with native plants due to a belief that this would be the best way to build a healthy ecosystem that would support my local bird population, including the house sparrows. However I know from Dusty Gedge that some people have consistently claimed there is no evidence that green roofs do anything for the house sparrow population, so I am particularly pleased to find myself in a position to provide the evidence that was hitherto missing.

A healthy ecosystem contains a rich range of fungi, flowers, trees, insects, birds and mammals living together in immensely complex but reasonably well balanced symbiotic relationships. It seems obvious to me that native species will be more likely to contribute to a balanced ecosystem than non-native species which will, by definition, be misfits. There are many well-known ecological misfit disasters, such as the Japanese knotweed that cause major problems and it is reasonable therefore to suggest that there are many lesser known or less obvious imbalances caused by imported misfits.

According to a scientist that I met at the Natural History Museum, even soil that comes in to the UK with imported plants from as close as Southern Europe poses an environmental hazard in an already stressed ecosystem. Most of the plants sold in commercial garden centres come from places like Italy or even further afield. Even a British plant specialist who supplied my hawthorn had to search for a UK supplier of hawthorn as nowadays most of it is grown in Holland. So I feel content that by choosing entirely native plants grown in the UK I have avoided many environmental risks and promoted the right conditions for a healthy ecosystem to develop.

In this piece, I will describe how a number of bird ►

species have used the same rooftop meadow throughout the spring and summer of its second year of existence to feed their young and themselves. I think that this is evidence of a rapidly developing ecosystem, 17 months after the soil first arrived in February/March 2008. To illustrate the rapid growth of biodiversity, I will also list the range of bees and other insects that I photographed one recent Sunday afternoon in June.

CREATING A BUZZ ABOUT THE GREEN ROOF

A variety of different types of bumble bees (*bombus*) covered my wildflower meadows last summer and again this summer. It is a pleasure to see the numbers grow over the weeks and months and to see how the bees got bigger and stronger as the season went on. Each time I worried that one nectar supply was coming to an end, another wild flower took over the job of supplying food for the bumble bees. I noticed that they were particularly fond of cornflowers and poppies. This spring another roof area gave early support to bumble bees with Solomon's Seal beneath a Hazel coppice and following this another smaller roof was thickly covered with Foxgloves and Verbascum under a Hawthorn thicket.

Honey bees (*apis mellifera*) are also now present on the various green roofs of my London home due to my new beehive and colony that was installed on 1 July 2009. Britain's native honey bees (dark brown or black in colour) were almost wiped out in 1921 by disease. Following this, bees from all over Europe were imported to rebuild stocks. However another threat, the Varroa mite, has now spread throughout the world due to man's interference and bad practices, finally arriving in England in 1992. Now queen bees are transported all around the world to satisfy the passion of many beekeepers for experimental breeding or to improve the temperament of bees destined for an urban location. Like many people, I am worried about the risks that might be posed by importing queen bees from around the globe. As well as the continuous risk of spreading disease, and of reducing biodiversity, my fear is that losing a bee population's regional characteristics may upset symbiotic relationships between those bees and their native habitats. I suspect that much damage has already been done and that honey bee plant preferences in the UK are less finely tuned to their environment than 100 years ago when the majority of UK bee colonies were still of a native or at least European origin.

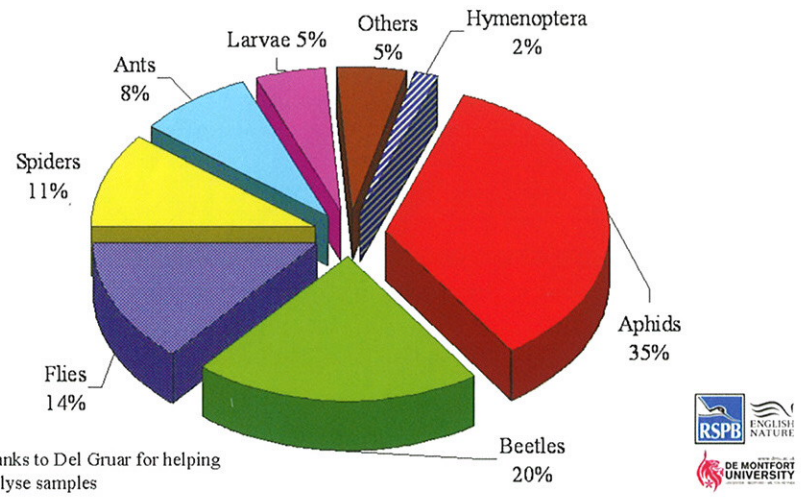
Some imported plants are very popular with honey bees. For example, the Echium is imported from the Canary Islands and is very popular as a garden plant to support honey bees. I would be interested to know if plants like the Echium would have been of such interest to the native honey bee. Whatever the answer to this question, I cannot help wondering if the bees that flock to the nectar of the Echium aren't at the same time ignoring some other important but less attractive native plants, such as native wild flowers that might need pollination in order to support the wider ecosystem?

One such native wild flower might be the Common Vetch, although I don't know how much this particular plant relies on the honey bee as opposed to the bumble bee or other flying insects for pollination. Like other flowers, this hardy annual relies on bees for pollination and reproduction. Experience on my green roof suggests that the Common Vetch may in turn provide critically important support for the dwindling house sparrow population.

LOOKING AFTER DIETARY REQUIREMENTS

Research by Alexander Mitschke, Hilmar Rathjen and Sven Baumung in Hamburg provides convincing evidence that the drastic decline in house sparrows is largely caused by a failure in the supply of suitable insect food for the chicks. Michael McCarthy in *The Independent* reported that the Hamburg study shows that for the first brood in April, the house sparrow is almost entirely dependent on aphids to feed the

Diet Composition: *(175 samples from 2001, 2002 & 2003)*



Thanks to Del Gruar for helping analyse samples

young. For the second brood, the birds use ants which feed on the secretions the aphids produce. These honeydew secretions are a source of food for both ants and bees in a healthy ecosystem. For the third brood at the end of the summer, the birds use flies to feed their young. Apparently sparrows do not like to travel more than about 50m from their nests to find feed for their young, so they require appropriate local food supplies for their chicks. If there is a failure in aphids, the Hamburg study shows that the first brood of sparrows will suffer or fail.

Likewise, Kate Vincent's research in Leicester suggests that aphids are an important part of the UK house sparrow chick's diet. Kate's research shows that aphids contribute more than any other food supply; a total of 35% of the diet of the birds surveyed. Furthermore, Kate has discovered that fledglings with up to 20% plant material in their diet generally manage to survive. However, when there is a severe shortage of insects in the local environment, adults are forced to provide their chicks with a larger proportion of plant material and where this proportion increases to 70% it leads to almost certain chick death.

The reason that Common Vetch is of so much interest to aphids is that Common Vetch has 'extrafloral nectaries' on its leaf stipules that provide an easy source of food for aphids. Plants have a defence mechanism that prevents fluids leaking out of the plant when they are damaged, but aphids overcome this by injecting special saliva into the plant. As a result, Common Vetch is often infested by aphids which in turn serve as prey for sparrows, wrens and various beneficial food-chain insects such as ladybirds and ants. The aphids feed on plant phloem and have exploited this niche by evolving a symbiosis with various bacteria that they carry in their bodies to supplement the nutrients in phloem fluid and also improve the aphid's resistance to parasitoids and fungi.

So strong is the relationship of the Common Vetch and aphids, that in America, the California Lettuce Research Board uses its own native common vetch in lettuce fields to provide aphid feed for hover-fly larvae that maintain hover-fly populations ready to destroy aphids as soon as they appear on the lettuces.

Knowing that specific bacteria are present in the guts of animals to aid digestion (it is thought that the human appendix may act as a store of ►

BELOW: Bee bombus pascuorum

bacteria to restore the gut quickly to full health after illness), I cannot help wondering about how the young sparrow cannot eat much vegetable matter and older sparrows can. Perhaps some of the bacteria that exists in symbiosis with the aphid to help it digest the secretions of plants might one day be found to provide a useful role in the gut of the fledgling house sparrow enabling it, like aphids, to derive sufficient nutrition from plant food as it becomes an adult? Perhaps, in an inter-dependent life cycle, adult sparrow droppings act to inter-seasonally replenish the same bacteria in aphids that are so essential for them?

A WIDE RANGE OF RESIDENTS

The debate about biodiversity often centres around bees and pays less attention to the vast numbers of other indicators of a healthy ecology. To avoid being guilty here of ignoring the vital role of bees in a healthy ecology, I recently took my camera on to the same roof meadows and photographed the bees and wasps that I found foraging there. The photos on the previous page illustrate just some of these bees and wasps. Additionally on 1 July this year, I obtained a beehive and a young colony of bees and these are now located in the middle of the wild flower meadow. The *apis mellifera* is an important part of any ecosystem.

The roofs are also being studied by Dr Kadas, whose recent PhD on green roofs and biodiversity in London shows that green roofs can provide an important refuge for rare invertebrates associated with brownfield sites in SE England. Dusty Gedge of Livingroofs.org who pioneered green roof and biodiversity design in the UK has been a regular visitor and helped provide the design imperatives for the roof. All too often, he suggests, we take a homogenous and visual approach to green roofs, which pays scant regard for the micro habitat benefits of green roofs. Bees are one element of a healthy ecosystem but a green roof should ensure that a range of invertebrates can take up residence. Such integrated design will ensure that any green roof provides a range of benefits both for fauna and flora but also across the range of services that ecosystems can provide.

LESSONS LEARNED

In the construction industry we are familiar with risk assessments. The purpose of these is to consider every possible risk to health and safety of workers and the public. Each perceived risk is rated for its 'likelihood' and its 'severity'. The most serious risk is one that has both a 'high likelihood' and a 'high severity'. One of the main lessons that I would like to draw out of this little study is that the 'likelihood' of symbiotic relationships existing in a local native ecosystem is most certainly 'high'. The studies that I highlighted above, linking the Sparrow, the Common Vetch and the Aphid illustrate that the 'severity' of upsetting such symbiotic relationships in a local native ecosystem can also be 'high'. I believe therefore, that we would be at best unwise and at worst foolish if we dismissed the broader implications of such a risk assessment concerning the maintenance of natural, local and above all, native eco-systems ▢

For more information on green roofs and biodiversity
www.livingroofs.org/livingpages/researchbiodiv.html

Some of the many visitors to the garden

1. The common vetch attracts huge numbers of aphids which are in turn very attractive to birds feeding their young
2. House sparrows eating common vetch seeds
3. Gold finches eating seeds from viper's bugloss
4. Pigeons eating common vetch seeds
5. Dragonfly – broad bodied chaser