Insect Conservation and Diversity

Insect conservation - finding the way forward

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Relatively speaking, the conservation of mammals, birds and other large terrestrial vertebrates is a simple task. The bulk of species are described, their ecologies are reasonably well known, the threats to their habitat or breeding systems are often documented, and the funding to implement recovery programmes readily available; e.g. mammals and birds are charismatic and the general public are fairly easily persuaded to identify with flagship species such as elephants, lions and snow leopards and financially support their conservation (Wilson, 1987; Clark & May, 2002). The major problems facing large vertebrate conservation are habitat loss/destruction and genetic bottlenecks. There is no shortage of volunteers to count, survey and protect these species; e.g. turtle watch, bird counts in Britain and North America, etc.

Things are different with invertebrates - how do we conserve species when we have very limited knowledge of which species are endangered or even how many species there are? Estimates of the number of insect species thought to exist globally vary widely (Stork, 1988), but there are probably 4-6 million (Novotny *et* al., 2002). We have perhaps named only 23-35% of these (Hammond, 1992). As for their ecology and habitat requirements, the chances of elucidating even a small fraction of the myriad life histories and species interactions that exist within the invertebrate world are remote, especially in the hyperdiverse tropics. This is despite the widely appreciated importance of arthropods to the diversity and function of terrestrial and freshwater ecosystems, at least among entomologists. The limitations associated with invertebrate conservation efforts are clearly manifested in the literature. Clark and May (2002) found deep taxonomic bias in conservation research, with vertebrate studies dominating (69% of papers versus 3% of described species) over plants (20% of papers versus 18% of species), and with invertebrates lagging far behind (11% of papers versus 79% of species).

In a move to redress this inappropriate state of affairs and promote arthropod conservation, the Royal Entomological Society has launched *Insect Conservation and Diversity*. Our new journal explicitly associates the two concepts of insect diversity and insect conservation for the benefit of invertebrate conservation. The subject is vast – nearly as vast as global biodiversity – and there is ample opportunity to disseminate research that may also be published in excellent journals such as *Ecological Entomology*, *Journal of Insect Conservation* or *Environmental Entomology*, to name a few. But despite the existence of several entomologically oriented journals in which conservation related issues are addressed to varying degrees, insect conservation needs to be promoted further to rally the general scientific community to the viewpoints already held by many entomologists. In other words, we are in pressing need of a critical mass of arthropod conservation studies of high quality. Further, fast dissemination of conservation research is essential in view of rapid anthropogenic loss and modification of habitats world-wide.

With *Insect Conservation and Diversity*, the Royal Entomological Society expands its series of international journals: *Agricultural and Forest Entomology, Ecological Entomology, Insect Molecular Biology*, *Medical and Veterinary Entomology, Physiological Entomology* and *Systematic Entomolo*gy. The new journal has an emphasis on wild arthropods (as opposed to agricultural or pest insects treated in *Agricultural and Forest Entomology*) and on explicit relations between arthropod conservation and diversity (as opposed to the general ecological emphasis found in *Ecological Entomology*).

Efficient biodiversity conservation cannot proceed without addressing the five following concerns:

(1) Knowing biodiversity.

(2) Understanding the past and present distribution of biodiversity.

(3) Implementing suitable monitoring systems for arthropod populations to disentangle stochastic and natural variation from that resulting from anthropogenic action.

(4) Identifying harmful factors influencing arthropod populations and their cascading effects on ecosystem services.

(5) Seeking strategies to alleviate the action of harmful factors and restoring ecosystem services.

The importance of item (1) cannot be overemphasized. Given the huge number of species that remain to be discovered, the rehabilitation of taxonomy is essential to research in insect biodiversity and the development of insect conservation (Wilson, 2000; Godfray, 2002).

Item (2) derives from the problem of taxonomy. May (2004) has stressed that cataloguing life on Earth is far from complete, and that the rate-limiting step remains the craft of collecting specimens in the field. Further, the inability of the scientific community to document species diversity, and hence its decline, is hugely detrimental to the credibility of the conservation movement (Mann, 1991). New strategies, such as parataxonomist training coupled with DNA barcoding (Janzen *et al.*, 2005) may greatly help to refine the extent of arthropod biodiversity. In particular, arthropod studies should be targeted in key geographical locations, ecosystems and habitats, such as in biodiversity hotspots and the soil and canopies of tropical rainforests (Basset, 2001; André *et al.*, 2002; Brooks *et al.*, 2002; Odling-Smee, 2005). Analyses of arthropod distributions at the community and population levels may benefit from recent advances and syntheses addressing concepts such as ecological and evolutionary factors influencing diversity at local and regional scales; additive partitioning of diversity; relation between soil diversity and above-ground diversity; metapopulation dynamics; and gene flow, inbreeding and introgression, to cite a few examples (Cornell & Lawton, 1992; Hanski & Gyllenberg, 1997; Hooper *et al.*, 2000; Hawkins, 2001; Gering *et al.*, 2003; Zeh *et al.*, 2003).

Item (3) has been reasonably well implemented for aquatic systems (Karr, 1991). The challenge is rather to develop suitable monitoring systems for terrestrial arthropods. Parataxonomists can help with most aspects of field monitoring and powerful statistical models can filter arthropod data.

The list of factors influencing adversely arthropod assemblages and communities is rather long: habitat loss and fragmentation, pollution effects, climate change, effects of agricultural and forestry practices, invasive species, etc. The challenge for research item (4) is also to be able to relate alterations of arthropod communities to modifications of ecosystem services. Processes similar to the 'extinction debt' (Tilman *et al.*, 1994) may often alter ecosystem function in subtle ways.

We are slowly moving towards developing strategies related to item (5): biodiversity action plans (and particularly scaling up from insects), comparison of restored and natural habitats, enhancing urban environments for insects, captive breeding programmes, etc. But much remains to be done in this aspect (Leather & Helden, 2005)

Insect Conservation and Diversity may be viewed as a platform to share and develop these and other ideas. Our new journal is particularly keen to welcome submissions related to items (2)-(5) of the above research agenda. More generally, the journal is open to submissions within the area of interest of insect (and other arthropod) conservation and diversity, covering topics ranging from ecological theory to practical management. We look forward to seeing the development of these topics in the pages of this journal. Indeed, insect diversity may provide ample opportunities for biological conservation, but this is up to us – the entomologists – to drum this important message.

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