Institution: University of Stirling

Unit of Assessment: B7 Earth Systems and Environmental Sciences

Title of case study: Conservation of Bumblebees

1. Summary of the impact

The Bumblebee Conservation Trust (BBCT), a conservation charity launched at the University of Stirling in 2006, was aimed at bridging the gap between research findings and conservation practice. BBCT now has 11 staff, offices and staff based in England, Wales and Scotland, 8,000 paying members, and has involved >12,000 people in bumblebee recording or conservation. Other impacts include awareness raising through extensive media coverage for bumblebee conservation, creation of an education pack for primary schools, joint initiatives with a nationwide Garden Centre chain (Wyevale) and a supermarket (Morrisons), helping to create >2,000 ha of flower rich habitat, involvement in a reintroduction attempt for the locally extinct short-haired bumblebee, political lobbying and influencing national and international policy.

2. Underpinning research

Research on bumblebees at Stirling has been increasingly focused on explaining why many species are declining, and in developing techniques to conserve them. We discovered much about the basic ecology, foraging range and dietary requirements of both rare and common bumblebees (e.g. Goulson et al. 2008). Some of this work has developed island populations in the Hebrides as a model system in which to understand the population biology of bumblebees (e.g. Whitehorn et al. 2011); islands have the advantage that the size and isolation of populations are more easily defined. The Hebrides also support significant populations of endangered bumblebees. Knowledge gleaned from this work was then applied to understanding how best to conserve small, declining populations of bumblebees in habitat fragments on the mainland (e.g. Somerset levels, Salisbury Plain) and in Europe (e.g. Goulson et al. 2010). Molecular studies by the group have revealed the impacts of inbreeding on bumblebees and allowed estimation of minimum viable population sizes (Darvill et al. 2010). Parallel studies have sought to understand how lowland farm management and agri-environment schemes affect population size and pollination service provision by common bumblebee species (Lye et al. 2009). The group have also become involved in understanding the effects that bees can have on biodiversity when released outside their native range. Finally, studies of the sublethal effects of pesticides on bumblebee colony growth have revealed that use of systemic pesticides on flowering crops is likely to be having a major impact on bumblebee populations (Whitehorn et al. 2012).

In combination with studies of bumblebees conducted by other research groups elsewhere, we now have a clear idea how to conserve bumblebees; they simply need enough of the right flowers, at the right times of year, provided in patches distributed at an appropriate spatial scale. For some species, action is urgently needed as current populations are too small to persist in the long term; unless population size is increased they will probably go extinct. This action needs to be integrated with farming practices, including alterations to pesticide usage on flowering crops, to produce a sustainable system whereby pollination services for crops and wildflowers are secured. However, farmers, nature reserve wardens and politicians do not read scientific journals. Much of the research that goes on into how best to conserve declining species is never translated into action, so the Bumblebee Conservation Trust was founded to bridge this gap between research findings and conservation practice.

Goulson left Stirling in 2013, but BBCT remains based within Biological and Environmental Sciences at Stirling and the work continues under Whitehorn, Park and Tinsley who have retained a collaborative link with Goulson. Another researcher within the group, Darvill, took up the position of CEO within BBCT between 2009 and 2012.

3. References to the research (staff at University of Stirling between 2008 and 2013 in bold)

2012 **Whitehorn** PR, O'Connor S, Wackers FL & **Goulson** D. Neonicotinoid pesticide reduces bumblebee colony growth and queen production. *Science* 336: 351-352. IF = 31.03

2011 Whitehorn, P.R., **Tinsley**, M.C., Brown, M.J.F., **Darvill**, B. & **Goulson**, D. Genetic diversity, parasite prevalence and immunity in wild bumblebees. *Proceedings of the Royal Society B* 278: 1195-1202. IF = 5.68

2010 **Goulson** D, **Lepais** O, O'Connor S, Osborne JL, Sanderson RA, Cussans J, Goffe L & **Darvill** B. Effects of land use at a landscape scale on bumblebee nest density and survival. *Journal of Applied Ecology* 46: 1207-1215. IF = 4.74

2010 **Darvill**, B., O'Connor, S., Lye, G.C., **Lepais**, O. & **Goulson**, D. Cryptic differences in dispersal lead to differential sensitivity to habitat fragmentation in two bumblebee species. *Molecular Ecology* 19: 53-63. IF = 6.28

2009 Lye GC, **Park** K, Osborne JL, Holland J and **Goulson** D. Assessing the value of Rural Stewardship schemes for providing foraging resources and nesting habitat for bumblebee queens (Hymenoptera: Apidae). *Biological Conservation* 142: 2023-2032. IF = 3.79

2008 **Goulson**, D, Lye, GC, **Darvill**, B. Decline and conservation of bumblebees. *Annual Review of Entymology* 53: 191-208. IF = 11.45

Key grants:

- BBSRC, 2006, Effects of mass-flowering crops on bumblebee populations in arable farmland, £263K
- Leverhulme, 2007, Use of a sniffer dog to detect bumblebee nests, £116K
- Natural England, 2009, Reintroduction of the extinct short-haired bumblebee to the UK, £115K
- BBSRC, 2012, An integrated model for predicting bumblebee population success and pollination services in agro-ecosystems, £402K

Evidence of the quality of the research; the papers arising from the research group are published in high impact journals and widely cited (e.g. Whitehorn et al. was published in 2012 but has already been cited 47 times). This work has attracted much media interest, with articles in national newspapers, radio and television.

4. Details of the impact

The Bumblebee Conservation Trust (BBCT) was founded in 2006 at the University of Stirling by Dave Goulson. BBCT is a registered charity and limited company devoted to translating what we have learned about bumblebee biology into practical measures to conserve this declining group of pollinators. The impacts outlined in this case study have all occurred during the period 2008 – 2013 with the relevant underpinning research outputs including; detailed knowledge of bumblebee foraging and nesting needs, understanding of their distributions, population density and dispersal abilities, and knowledge on the scale at which habitat manipulations are required to influence bumblebee population size.

The charity has grown from a starting point of no paid staff, no members and no funds to have 8,000 members (plus 13,000 followers on Twitter) and provide employment for 12 staff (Feb 2013). It has main offices in Stirling and Eastleigh (Hants), and further staff based in Kent and South Wales. All members receive wildflower seeds, an identification poster and a quarterly newsletter. They are strongly encouraged to get involved in trust activities which include bumblebee identification training days and three different bumblebee recording schemes. Between them these schemes have so far generated >100,000 individual bee records sent in by >12,000 recorders.

Impacts arising from this work:

- Lobbying: Our activities have led to a number of invitations to meet with politicians, including members of the Scottish and European Parliaments, Ministers, and even an invitation to visit to No.10. We had input to the recent "Postnote" (Parliamentary briefing notes) on Pollination. Following the publication of two landmark papers in *Science* on bees and neonicotinoid pesticides (Whitehorn et al. 2012, and one from a French research group, Henry et al. 2012), Goulson has been invited to give evidence to the Environmental Audit Committee investigation into Insects and Insecticides, an enquiry which was launched in part as a result of the publication of Whitehorn et al. He was also asked to give a talk to the All Party Parliamentary Group on Agroecology (both in Westminster). Goulson was asked by EFSA to input into the development of new protocols for evaluating plant protection products, and was invited to the Pesticide Safety Directorate in York to discuss the safety of neonicotinoids. In April 2013 the EU announced a two year moratorium on use of neonicotinoid insecticides on flowering crops, an outcome which can be clearly traced back to the publication of Whitehorn et al. and Henry et al (see section 5; Environmental Audit Committee 2013).
- Awareness: Since the launch of BBCT was featured in the front three pages of *The Independent*, we have had much media coverage, including substantial articles about bumblebees and their decline in *The Sunday Times, The Guardian, The Telegraph, The Daily Mail,* television coverage on BBC "The One Show" and BBC Breakfast News (Sept, 2008), and a 30 minute programme "The Plight of the Bumblebee" on Radio 4 (Oct, 2009). This media coverage has substantially raised awareness of bumblebee declines and how they may be reversed in the public consciousness. The publication of Whitehorn et al. (2012) was covered by major national newspapers across the world (e.g. *Washington Post, Le Monde, Stern, New York Times*), greatly increasing public and political interest in the role of pesticides in bee declines.
- Children: we have a mission to raise awareness in children (the land managers of tomorrow), and to this end we obtained funding from Scottish Natural Heritage to develop an education pack for primary schools. This had input from educational specialists and was trialled in several primary schools; it has since been requested and sent out to over 260 schools. Trust staff have visited many schools to talk about bumblebees and advise on creating school wildlife gardens.
- Wildlife gardening: In 2009 we teamed up with Wyevale Garden Centres to run an "Insect Weekend" with displays illustrating the best plants for bumblebees in 122 garden centres across the country. The trust has distributed >15,000 packs of wildflower seeds. Through an initiative with Morrison's supermarkets, 200,000 packets of wildflower seed and information on bumblebees were given away with bouquets of flowers in 2010.
- Practical Conservation: The Trust set up the first "Bumblebee nature reserve", an 8 ha grassland restoration project at Royal Society for the Protection of Birds' (RSPB) Vane Farm, Loch Leven. We obtained funding for a major (80 ha) grassland restoration project in Carmarthenshire with the Grasslands Trust. With funding from Natural England and working with various partners including RSPB, we co-ordinated a project to reintroduce the extinct short-haired bumblebee to the UK: results from summer 2013 have shown that at least some of these bees have now bred successfully as new queens and workers have been observed. More than 1,000 ha of suitable bumblebee habitat have been created in SE Kent in advance of the reintroduction attempt. Working with Farming & Wildlife Advisory Group and National Farmers Union, each spring and summer our two conservation officers organise numerous "farmers days", on-farm social gatherings at which farmers meet to discuss bumblebee conservation and how best to manage bumblebee-friendly agri-environment prescriptions. Farmers very readily grasp the importance of bumblebees as pollinators of crops and wildflowers, and we have found that this grass-roots approach to conservation is paying great dividends in terms of delivering bee-friendly farming. Many more projects are in the pipeline. Overall, so far the trust has played a role in the creation of >2,000 ha of habitat.

5. Sources to corroborate the impact

1. Evidence of the range of impacts the trust has had can be obtained from simply typing *bumblebee conservation* into Google – the first >100 webpages all refer to the work of the trust, and include diverse sources from the BBC to local government to sock manufacturers.
2. Details of BBCT's activities can be found on their website http://www.bumblebeeconservation.org/. The Charities Commission hold details of the financial organisation and aims of the trust.
3. Partner organisations on various conservation projects who could be contacted to confirm conservation outputs include Swift Ecology, Wyevale Garden Centres, Co-op, Hymettus Ltd and RSPB. Funders who could be contacted include Natural England, Scottish Natural Heritage, the Heritage Lottery, Esmée Fairbairn Foundation, the Mackintosh Foundation, the Foxglove Trust and the Naturesave Trust.
4. Goulson was awarded BBSRC's "Social Innovator of the year" in 2010 for his work founding BBCT, and was given the PraxisUnico Impact Award for Environmental Research in 2010. He was elected a Fellow of the Royal Society of Edinburgh in 2013.
5. Reintroduction of short haired bumblebee: information on the successful introduction can be found on the following websites:
   - http://www.bumblebeereintroduction.org/
   - http://bumblebeeconservation.org/about-us/case-study/short-haired-bumblebee-reintroduction/
6. Examples of media coverage and debate arising from Stirling research on the effects of pesticides on bumblebees (Whitehorn et al. 2012):
   - "*Insecticide regulators ignoring risk to bees, say MPs*". Guardian 12th December 2012. Available at: http://www.theguardian.com/environment/2012/dec/12/mps-insecticide-regulators-bees.
   - "*2 Studies Point to Common Pesticide as a Culprit in Declining Bee Colonies*". New York Times 29th March 2012. Available at: http://www.nytimes.com/2012/03/30/science/neocotinoid-pesticides-play-a-role-in-bees-decline-2-studies-find.html?_r=0
   - "*Pesticides hit queen bee numbers*". BBC News Online. Available at: http://www.bbc.co.uk/news/science-environment-17535769
   - "*Pesticides harming bee populations, researchers suggest*". Telegraph 30th March 2012. Available at: http://www.telegraph.co.uk/earth/wildlife/9173586/Pesticides-harming-bee-populations-researchers-suggest.html
7. Impact of pesticide research at Stirling on policy at UK and European level:
   - Environmental Audit Committee (2013) Pollinators and pesticides. UK Government. Seventh report of the Environmental Audit Committee. Available at: http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/668/66802.htm. *This report makes specific reference to Whitehorn et al. 2012 being important, and called for an introduction of a moratorium in the UK on the use of several pesticides.*
   - The committee meetings held in the process of compiling this report are available to watch on Parliament TV e.g. http://www.parliamentlive.tv/Main/Player.aspx?meetingId=11852 (at which Goulson was a witness)
   - European Food Safety Authority (2012). "Conclusion on the peer review of the pesticide risk assessment for bees for the active substance imidacloprid". Available at: http://www.efsa.europa.eu/en/efsajournal/doc/3068.pdf. *This report led directly to the proposal and adoption of Regulation (EU) No 485/2013 as announced on the following website*: http://ec.europa.eu/food/animal/liveanimals/bees/neonicotinoids_en.htm *which restricts the use of three neonicotinoid (including the one investigated in Whitehorn et al. 2012) for a period of two years from 1st December 2013.*