Institution: University of Bristol		
Unit of Assessment: 5) Biological Sciences		
Title of case study: Informing national and international policy to support pollinators		
Period when the underpinning research was undertaken: 2004 - 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Jane Memmott Katherine Baldock	Professor of Ecology Senior Research Associate	02/1999 - present 02/2011 - 11/2019
Period when the claimed impact occurred: 2015 – 2020		
Is this case study continued from a case study submitted in 2014? No		

1. Summary of the impact

University of Bristol research identified the value of urban habitats for pollinators and provided data for evidence-based conservation management strategies. These were put into practice in the Greater Bristol Pollinator Strategy which has become an exemplar for developing local strategies for UK cities and informed the approach taken by the city of Stockholm. The research has informed implementation and updates to the National Pollinator Strategy for England as well as EU, Commonwealth and international conservation policy. Engagement with national policy makers and the public has raised awareness of the importance of pollinators and the role of urban habitats for conservation in the UK.

2. Underpinning research

Insect pollinators provide a crucial ecosystem service but are under threat both nationally and globally with a suite of factors causing population declines. The UK Insect Pollinators Initiative, established in 2009, and funded by Defra, BBSRC, NERC, the Scottish Government, and the Wellcome Trust, aimed to provide an evidence base to inform pollinator conservation management and reduce species declines. An initial review undertaken by collaborators from across the Insect Pollinators Initiative, identified urbanisation as a key driver of pollinator decline [2]. Urban Pollinators: their ecology and conservation [i] was one of nine projects funded as part of this initiative. Under the overall lead of Prof Memmott at the University of Bristol (UoB), the project took place in collaboration with the Universities of Edinburgh, Leeds and Reading, across twelve UK towns and cities.

Using methods developed by Prof Memmott for sampling whole communities of plants and pollinators (1999), the project first considered the value of urban habitats for pollinators relative to farmland and nature reserves. The data revealed that urban areas can be surprisingly good for pollinators and, in particular, that bee species richness was higher in urban areas compared to nearby farmland [3]. A further multi-city assessment of all major urban land uses showed residential gardens and allotments (community gardens) to be ‘hotspots’ for plants and pollinators, with a small increase in their area predicted to provide a large benefit for urban pollinator communities compared with other urban land uses [5].

To assess the potential benefits of adapting urban greenspace management strategies for pollinators, the project also expanded a modelling approach developed at UoB which predicts how whole communities respond to species loss [1]. This was the first time that “robustness” to

species loss had been used as a response variable when considering the effect of conservation management strategies. Simulating the effects of increasing abundance of three common amenity grassland plant species (common daisy, dandelion and white clover) demonstrated an associated increase in plant-pollinator community robustness [5]. This would be straightforward to implement by simply mowing the grass less frequently, also saving public money.

Flower plantings ('urban meadows') have been increasingly used to improve the biodiversity and aesthetic amenity value of urban areas. However, the floral resources these provide to flower-visiting insects, and how these change through time, were largely unknown. UoB-led research designed a multi-city experiment planting 60 large urban meadows using two commercial flower-rich seed mixes. Nectar and pollen rewards provided per plant species varied among the 65 species surveyed, with perennial seed mixes and native British weed species providing large quantities of these floral resources [4].

The Urban Pollinators Project demonstrated significant opportunities for pollinator conservation in urban areas. Urban areas are growing worldwide and improving their value for pollinators should be part of national and international strategies to conserve and restore pollinators at a landscape level.

3. References to the research

1) **Memmott J,** Waser NM & Price MV. (2004). Tolerance of pollination networks to species extinctions. *Proceedings of the Royal Society B-Biological Sciences,* **271,** 2605. DOI:10.1098/rspb.2004.2909

2) Vanbergen AJ and The Insect Pollinators Initiative (**Memmott J** co-author). (2013). Threats to an ecosystem service: pressures on pollinators. *Frontiers in Ecology and the Environment*, 11, 251–259. DOI:10.1890/120126

3) **Baldock KCR**, Goddard MA, Hicks D, Kunin WE, Mitschunas N, Osgathorpe LM, Potts SG, Robertson K, Scott AV, Stone GN, Vaughan I, **Memmott J**. (2015). Where is the UK's pollinator biodiversity? The importance of urban areas for flower-visiting insects. *Proceedings of the Royal Society B*, 282 (1803). DOI:10.1098/rspb.2014.2849

4) Hicks DM, Ouvrard P, **Baldock KCR**, Baude M, Goddard MA, Kunin WE, Mitschunas N, **Memmott J**, Morse H, Nikolitsi M, Osgathorpe LM, Potts SG, Robertson KM, Scott AV, Sinclair F, Westbury DB & Stone GN. (2016). Food for Pollinators: Quantifying the Nectar and Pollen Resources of Urban Flower Meadows. *Plos One,* 11(6): e0158117. DOI:10.1371/journal.pone.0158117

5) **Baldock KCR**, Goddard MA, Hicks DM, Kunin W, Mitschunas N, Osgathorpe LM, Potts SG, Scott AV, Staniczenko PPA, Stone GN, Vaugham IP & **Memmott J**. (2019). A systems approach reveals urban pollinator hotspots and conservation opportunities, *Nature Ecology & Evolution*, 3(3), 363-373. DOI:10.1038/s41559-018-0769-y

Key Funding:

[i] **Memmott J** (PI). Urban pollinators: their ecology and conservation, The Insect Pollinator Initiative (BBSRC, NERC, Defra & Scottish Government), 2011-2014, GBP1,239,000 (GBP614,000 to Bristol)

[ii] **Baldock KCR** (PI). Improving urban habitat management for insect pollinators and people, NERC KE Fellowship, 2014-2019, GBP172,035

4. Details of the impact

Pollinators are essential for 75% crop species worldwide and 35% of global food supplies. Pollinator conservation is a high-profile global issue with national strategy documents being published for multiple countries and regions. The Urban Pollinators Project provided data [3-5] for evidence-based conservation management of pollinators in urban habitats.

Shaping conservation policy and practice in the West of England

Practitioner partners, representing Local Authorities and local Wildlife Trusts, were involved at each of the four city hubs of the Urban Pollinators Project. In Bristol, Memmott and Baldock (funded through a NERC KE Fellowship [ii]), led a collaboration of local stakeholders; Bristol City Council, South Gloucestershire Council, University of the West of England, Avon Wildlife Trust, Buglife and Bristol Friends of the Earth, in the 'Get Bristol Buzzing' project to develop the Greater Bristol Pollinator Strategy (2015-2020) [Ai]. The strategy informed greenspace management strategies in Bristol and surrounding urban areas, including changing mowing regimes to increase flower abundance and planting pollinator friendly flowers. The strategy was replicated in the city of Bath and scaled up as the West of England Pollinator Strategy incorporating Bristol City, South Gloucestershire, Bath & North East Somerset and North Somerset councils [Aii]. A Parks Co-ordinator at Bristol City Council noted that her team no longer follow the traditional horticultural 'gold standard' of increasing use of bedding plants to improve parks, as a result of UoB research which '*confirmed this annual planting was not only resource heavy but has limited benefits for urban pollinators and has since informed changes in the way my team and I manage Bristol's urban areas for insect pollinators'* [Bi]. The Get Bristol Buzzing initiative established a 'Pollinator Forum' as well as organising a one-day 'Urban Pollinator Summit' attended by 100 city council ecologists, planners, parks and greenspaces managers and Wildlife Trust conservationists for sharing knowledge and best practice. The Biodiversity Officer for South Gloucestershire stated the importance of UoB research in *'providing a framework of understanding and the tools to change behaviours which have been and continue to be important for pollinator conservation in South Gloucestershire'* [C].

Partner organisation Buglife explained that not only had the Urban Pollinators Project *'laid the foundations for urban green space regeneration'* in Bristol, but that the impact *'goes beyond Bristol however, providing the tools and knowledge to help create more valuable and connected urban landscapes for biodiversity across the UK'* [Di]. The Greater Bristol Pollinator Strategy [A] is cited in UK national advice to local authorities co-created by Buglife and Friends of the Earth [Dii]. The research evidence [3-5], *'provided a portfolio of best practice examples on how to create flower-rich green spaces, which Buglife's Urban Buzz project continued to build on'* as well as supporting Buglife to gain *'successful bids for additional grant funding'* for their own 'Urban Buzz' project [Di].

The Urban Pollinators Project [3-5] continues to influence local authority policy. The Biodiversity Officer for South Gloucestershire explained that *'Adopting the Greater Bristol Pollinator Strategy has enabled other policies such as the biodiversity supplementary planning document and the emerging Green Space Strategy, all with the effect of allowing better management of urban areas for insect pollinators'* [Ci]. Most recently (September 2020) Bristol City Council launched the 'One City Ecological Emergency Strategy' which referred to data gathered during the Urban Pollinator Project [5]; *'evidence shows that allotments and small holdings are some of the most biodiverse habitats in cities'*, to encourage regenerative approaches to food growing to restore habitats across the city [Bii].

Informing national policy

The evidence review carried out by the Insect Pollinators Initiative [2] underpinned Defra's 2014 National Pollinator Strategy [Fi]. The strategy delivers across five key areas including '2. Supporting pollinators in towns, cities and the countryside'. Policy actions listed within this key area included the publication of a Policy and Practice Note on urban pollinators, as well as workshops on managing urban pollinators for landowners and managers (p.17.) [Fi]. Baldock led the development of this Policy and Practice Note (2015) outlining management strategies to benefit insect pollinators in urban areas, as part of the Living With Environmental Change Partnership, bringing together 22 public sector organisations including government departments, devolved administrations and government agencies [E]. In addition, Baldock led a knowledge exchange event attended by 50 representatives from Defra, local government, NGOs, industry and highways sectors [Fii]. Both activities were recognised in the 2016 National Pollinator Strategy progress report [Fii]. A 2019 evidence review [Fiii], co-authored by Baldock, will underpin the ongoing update to the National Pollinator Strategy (planned for 2020 but delayed by the COVID-19 pandemic). The updated strategy will follow the original five key themes, with updates to 'Supporting pollinators across towns, cities and the countryside' underpinned by UoB research [1, 3].

Memmott presented findings from the Urban Pollinators Project at the Houses of Parliament and UoB research [2-5] is cited in two UK parliamentary briefing notes (September 2013, 2020) discussing specific threats to insect populations declines [G]. These briefings are used by parliamentarians to advance knowledge of key issues rising on the political agenda. UoB research [3] is also cited in the Pollinator Strategy for Scotland 2017-2027 Technical Annex with the Urban Pollinators Project noted as a '*source of much information*'.

Informing international policy and practice

Building on the success of the Greater Bristol Pollinator Strategy [A], Baldock advised the city of Stockholm, Sweden, on pollinator-friendly management practices, doing this via a link to the British Embassy who described the document as *'proving a very useful tool with which to galvanise various bodies into action!'* [H]. The city is now officially *"changing its public flower planting regime and how it spends its budget to make sure it actively includes pollinator-friendly plants and will integrate a pollinator-perspective into its new Biodiversity policy"* [H]. Stockholm Loves Pollinators (SLP) has been granted funding to co-develop various 'demonstration sites' in the national park to showcase good pollinator practice to the public and to work with local residents to raise awareness about supporting pollinators. Grassroots work has encouraged local residents and embassies in the city to make their properties more pollinator-friendly and a wildflower meadow was planted by the diplomatic community on UN Biological Biodiversity Day [H].

The importance of urban areas as habitat, particularly in intensively managed landscapes as outlined by UoB research [3], has been recognised in international conservation management policy documents. In 2016, Memmott and Baldock were contributing authors for, as well as cited [3] in, 'The assessment report on Pollinators, Pollination and Food Production' produced by IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) [J]. This report is the blueprint for several national pollinator strategies and also the EU and FAO global initiatives. Baldock also co-authored a report for the Commonwealth Human Ecology Council [I] which looks to find solutions for the declines of pollinators, and the impact on food security, across the Commonwealth. The report was launched at the Commonwealth Heads of

Government Meeting in Malta (2015), attended by over 100 participants including international delegates representing governments of the Commonwealth nations [I]. Most recently, European Commission guidance for 'pollinator-friendly cities' (2020) [Iii] cited evidence from the Urban Pollinators Project [3, 5].

Increased public awareness

Memmott and Baldock have raised public awareness of the importance of urban habitats for pollinators through local, national and international engagement activities including: talks for garden and wildlife groups; pollination festivals (seven) each attended by more than 1,000 members of the public; freely available podcasts and videos for The Wellcome Trust, Royal Entomological Society, British Ecological Society and the journal Nature Ecology & Evolution ('How to help pollinators in cities' (10,567 views 01/10/20)); as well as interviews for BBC Radio 4's PM Programme, Farming Today, Shared Planet and Natural Histories. The Urban Pollinators Project featured in an article by Baldock for The Conversation (2019), and national newspapers such as The Guardian, The Daily Mail, and The Telegraph, which named it one of ten ground-breaking research projects in the UK (2015).

5. Sources to corroborate the impact

A) i) **Baldock** *et al.* (2015). Get Bristol Buzzing - Greater Bristol Pollinator Strategy 2015-2020
ii) West of England Nature Partnership (2018). West of England Pollinator Strategy

B i) Bristol City Council (2020). Corroborating statement – Nature Conservation Officer
ii) Bristol City Council (2020). One City Ecological Emergency Strategy *(p.11)*

C) South Gloucestershire Council (2020). Corroborating statement – Biodiversity Officer

D) i) Buglife (2020). Corroborating statement – Conservation Officer
ii) Buglife and Friends of the Earth (2019). Helping Pollinators Locally: developing a local pollinator action plan or strategy

E) **Baldock K**, Goddard MA, Kunin WE, Potts SG, Stone GN & **Memmott J**. (2015). Managing urban areas for insect pollinators: As town and cities continue to grow how can land managers help insect pollinators in urban areas. Policy and Practice Note No. 20

F) i) Defra (2014). The National Pollinator Strategy for bees and other pollinators in England
Research [2] cited p.9. and urban pollinator actions listed p.17.
ii) Defra (2016). National Pollinator Strategy Progress Report 2016
iii) Defra (2019). Management and drivers of change of pollinating insects and pollination services. National Pollinator Strategy: for bees and other pollinators in England, Evidence statements and Summary of Evidence

G) Parliamentary Office of Science and Technology (POST)
i) (Sept 2013). POSTNOTE 442 - Reversing Insect Pollinator Decline
ii) (2020). POSTNOTE 169 - UK Insect Decline and Extinctions

H) British Embassy - Stockholm (2020). Corroborating statement

I) i) Commonwealth Human Ecology Council (2017). Report: Bees and Pollinators: A Commonwealth Concern and Launch Meeting
ii) European Commission (2020). A guide for pollinator-friendly cities
iii) European Commission (2020). Future Brief: Pollinators: importance for nature and human well-being, drivers of decline and the need for monitoring

J) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (2017). The Assessment Report on Pollinators, Pollination and Food Production