Institution: University of Reading

Unit of Assessment: 6 (Agriculture, Food and Veterinary Sciences)

Title of case study: Driving a step change in international policy to protect pollinators.

Period when the underpinning research was undertaken: Between 2002 and 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:
Simon Potts	Professor of Biodiversity and Ecosystem Services, Senior Research Fellow	Between March 2002 and present
Deepa Senapathi	Senior Research Fellow, Research Fellow	Between April 2010 and present
Mike Garratt	Principal Research Fellow, Senior Research Fellow, Research Fellow	Between January 2011 and present
Tom Breeze	Research Fellow	Between May 2012 and present

Period when the claimed impact occurred: Between 2016 and 2020

Is this case study continued from a case study submitted in 2014? No

1. Summary of the impact

International commitments to protect pollinators have been catalysed by University of Reading research to understand the status, trends and values of bees and other pollinating insects within the context of the UN Sustainable Development Goals. This substantial and sustained body of research made a major contribution to the first comprehensive global assessment of pollinators, itself co-chaired by Professor Simon Potts. The assessment report, which clearly demonstrated pollinators' critical role in crop production and causes of their loss, was endorsed by all 124 signatory governments of the United Nations (UN)'s Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and was subsequently adopted into the UN Convention on Biological Diversity together with recommendations for national government action to prevent these losses. The intellectual leadership of Potts and the quality of the IPBES assessment have been cited by leading international policymakers as having played a vital role in ensuring the direct and rapid implementation of recommendations – to help safeguard the sustainability of global food production – into the international policy agenda at all scales.

2. Underpinning research

Since 2000, Potts has published 181 peer-reviewed publications as outputs of major national and international projects he has led. These papers include many highly cited (mean 95 citations/paper, h-index 62), high impact factor studies covering a wide range of taxa, spatial and temporal scales, including **the first**:

- Comprehensive assessment of the status and trends of pollinators in Europe [1,2]
- Quantification of the impacts of climate change on bumblebees across two continents [3]
- Demonstration that insecticides not only impact pollinators but also crop pollination services [4]
- Quantification of the relative contribution of different pollinating species to crop production across two continents [5]
- Evaluation of the effectiveness of a range of management responses to protect pollinators across Europe [6].

Between 2010 and 2015, Potts co-coordinated the Pan-European research project the '**Status and Trends of European Pollinators**' (STEP, http://step-project.net/), which combined the expertise of 22 research institutions from 17 European countries with more than 120 researchers. The project delivered >160 peer-reviewed publications, of which 28 are from Potts. Notably, STEP,

in partnership with the International Union for Conservation of Nature (IUCN) produced the first ever regional Red List for Threatened Species of bees for the whole of Europe [2].

The UN **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services** (IPBES) is the intergovernmental body which assesses the state of biodiversity and of the ecosystem services it provides to society. In 2014, IPBES was mandated to critically assess current knowledge on pollinators and pollination – a large body of complex scientific evidence requiring systematic review – as an urgent policy issue. The assessment took two years to critically assess and analyse evidence sources from more than 27,000 published papers (Web of Knowledge, search "pollinat*" up to 2016) and involved 74 global experts from academia and industry. The assessment was co-chaired by Potts, using a standardised analytical framework to analyse the quantity, quality and balance of evidence. This intensive review process ensured that the inclusion of publications, interpretation of the evidence, and the conclusions drawn in the technical report were non-biased, transparent and objective (see the IPBES Assessment Guide).

The main IBPES technical report, 'Pollinators, Pollination and Food Production' [7], contained 3,625 references and 5,505 citations, of which 119 and 330 respectively are from Potts' team. The related 'Summary for Policy Makers' (SPM) [E1] highlighted 23 key messages which are directly traceable back to the technical report [7] and the underpinning literature. To assess Potts' relative contribution to these key messages, the University of Reading has benchmarked his work against that of six other leading pollinator researchers, who were independently selected in a pollinator researcher workshop as being widely recognised international leaders in the areas of research covered by the SPM key messages. The University used a qualitative text analysis (QDA Miner and WordStat) which coded text within the technical report to key messages comparing Potts' papers with other authors' papers, and found that his publications were the highest, or joint highest, contributors to more than half (12 out of 23) of the key messages. This underlines the considerable contribution of the research of Potts and his team to this globally important issue.

The IPBES technical report [7] and Summary for Policy Makers [E1] provided the first critical assessment of the global evidence base, highlighting pollinator declines and deficits in pollinations as well as demonstrating how an essential ecosystem service contributes to the 2030 Agenda for Sustainable Development. Both reports were fully endorsed by the 124 signatory governments of IPBES in 2016, which is testament to the strength of the two-year-long critical review process and quality of its underpinning evidence base.

3. References to the research

The research in this case study resulted from competitive, peer-reviewed funding applications, including the EUR 4,800,000 EU Framework 7 STEP project (Grant ID: 244090), and the GBP 405,000 UK Sustainable pollination services for UP crops project, LWEC Insect Pollinators Initiative BB/I000348/1, with notable outputs published in *Nature* and *Science*.

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2. Nieto A., **Roberts S.P.M**., Kemp J., Rasmont P., Kuhlmann M., Biesmeijer J.C., Bogusch P., Dathe H.H., De la Rúa P., De Meulemeester T., Dehon M., Dewulf A., García Criado M., Ortiz-Sánchez F.J., Lhomme P., Pauly A., **Potts S.G.**, Praz C., Quaranta M., Radchenko V.G., Scheuchl E., Smit J., Straka J., Terzo M., Tomozii B., Window J., Michez D. (2014). **'***European Red List of Bees'*. Luxembourg: Publication Office of the European Union. DOI: https://doi.org/10.2779/77003
3. Kerr J.T., Pindar A., Galpern P., Packer L., **Potts S.G.**, **Roberts S.P.M.**, Rasmont P., Schweiger O., Colla S.R., Richardson L.L., Wagner D.L., Gall L.F., Sikes D.S., Pantoja A. (2015). 'Climate change impacts on bumblebees converge across continents'. *Science,* **349,**177-180. DOI: https://doi.org/10.1126/science.aaa7031
4. Stanley D.A., **Garratt M.P.D.**, **Wickens J.B.**, **Wickens V.J.**, **Potts S.G.**, Raine N.E. (2015). 'Neonicotinoid pesticide exposure impairs crop pollination services delivered by bumblebees'. *Nature,* **528**, 548–550. DOI: https://doi.org/10.1038/nature16167

5. Kleijn D., Winfree R., Bartomeus I., Carvalheiro L.G., Henry M., Isaacs R., Klein A-M, Kremen C., M'Gonigle L.K., Rader R., Ricketts T., Williams N.M, Adamson N.L., Ascher J.S., Báldi A., Batáry P., Benjamin F., Biesmeijer J.C., Blitzer E.J., Bommarco R., Brand M.R., Bretagnolle V., Button L., Cariveau D.P., Chifflet R., Colville J.F., Danforth B.N., Elle E., **Garratt M.P.D.**, Herzog F., Holzschuh A., Howlett B.G., Jauker F., Jha S., Knop E., Krewenka K.M., Le Féon V., Mandelik Y., May E.A., Park M.G., Pisanty G., Reemer M., Riedinger V., Rollin O., Rundlöf M., Sardiñas H.S., Scheper J., Sciligo A.R., Smith H.G., Steffan-Dewenter I., Thorp R., Tscharntke T., Verhulst J., Viana B.F., Vaissière B.E., Veldtman R., Westphal C., **Potts S.G.** (2015).'Delivery of crop pollination services is an insufficient argument for wild pollinator conservation'. *Nature Communications*, **6**, 7414. DOI: https://doi.org/10.1038/ncomms8414
6. **Potts S.G.**, Biesmeijer K., Bommarco R., **Breeze T.**, Carvalheiro L., Franzén M., González-Varo J.P., Holzschuh A., Kleijn D., Klein A.-M., Kunin, B., Lecocq T., Lundin O., Michez D., Neumann P., Nieto A., Penev L., Rasmont P., Ratamäki O., Riedinger V., **Roberts S.P.M.**, Rundlöf M., Scheper J., Sørensen P., Steffan-Dewenter I., Stoev P., Vilà M., Schweiger O. (2015). 'Status and trends of European pollinators. Key findings of the STEP project'. Pensoft Publishers, Sofia, 72. ISBN: 978-954-642-762-5
7. IPBES (2016). 'The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production'. **S.G. Potts**, V. L. Imperatriz-Fonseca, and H. T. Ngo, (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. DOI: https://doi.org/10.5281/zenodo.3402856

4. Details of the impact

"The pollination assessment was the first IPBES assessment, setting a standard for excellence and scientific credibility for all future IPBES assessments. It addressed an issue of critical scientific and societal importance brilliantly. It demonstrated the important role of pollinators, the current causes of the loss of pollinators, which undermine agricultural productivity, but it also showed that there are response options to stem this loss. The assessment has already had a profound influence on national and international policy, including the development of national pollinator strategies, and providing the framework for the work programme of the Convention on Biological Diversity (CBD) on pollinators," [E2]. Sir Robert Watson, Chair of IPBES during the assessment.

While the 2016 IPBES report [7] and summary for policymakers [E1] were highly policy-relevant, by design they did not directly provide recommendations. Specific recommendations for government actions were co-developed by Potts with policymakers, informed by evidence from the two reports, with additional post-2016 Potts publications, the STEP project and the IUCN European Red List of Bees. Recommendations for policy development included: promoting pollinator-friendly habitats; improving the management of pollinators; reducing risk from pests, pathogens and invasive species; reducing risk from pesticides, including insecticides, herbicides and fungicides; enabling policies and activities; and research, monitoring and assessment. Furthermore, Potts played a central role in the development of policy initiatives from these recommendations using established mechanisms (see Figure 1), including: drafting and reviewing technical documents (e.g. CBD, Food and Agriculture Organisation (FAO)), and presenting the findings of the IPBES report to policymakers (e.g. CBD Conference of Parties, Cancun, 2016; UN Environment Assembly, Nairobi, 2016; EPI, Brussels, 2018). Detailed examples are provided below.

(1) UN Convention on Biological Diversity (CBD): In a rare move, according to IPBES Chair Sir Robert Watson, the IPBES report [7] and recommendations for action were formally endorsed in 2016 by the 196 signatory governments of the CBD at the 13th Conference of the Parties (CoP-13, 2016) in Mexico. Sir Robert explained: "*Normal practice for a body like the CBD is to 'welcome' a report. The report did exactly what was needed – impeccable quality, policy-relevant but not policy-prescriptive – providing information to assist governments and other stakeholders around the world stem the loss of pollinators, critical for biodiversity and agricultural productivity."*

Decision XIII/15 [E3] specifically pertained to the implications of the IPBES assessment for the work of the Convention, and subsequent CBD documents state: *"Many of the activities identified in the IPBES assessment and reflected in decision XIII/15, will contribute to the conservation and*

sustainable use of pollinators and their habitats and thereby help to sustain pollination functions in ecosystems beyond agricultural systems and food production"… "[The CBD] *encourages parties, other governments, relevant United Nations and other organizations, as well as multilateral environment agreements, and stakeholders to use, as appropriate, the* [IPBES] *assessment, in particular the examples of responses outlined in the SPM, to help guide their efforts to improve conservation and management of pollinators, address drivers of pollinator declines, and work towards sustainable food production systems and agriculture".*

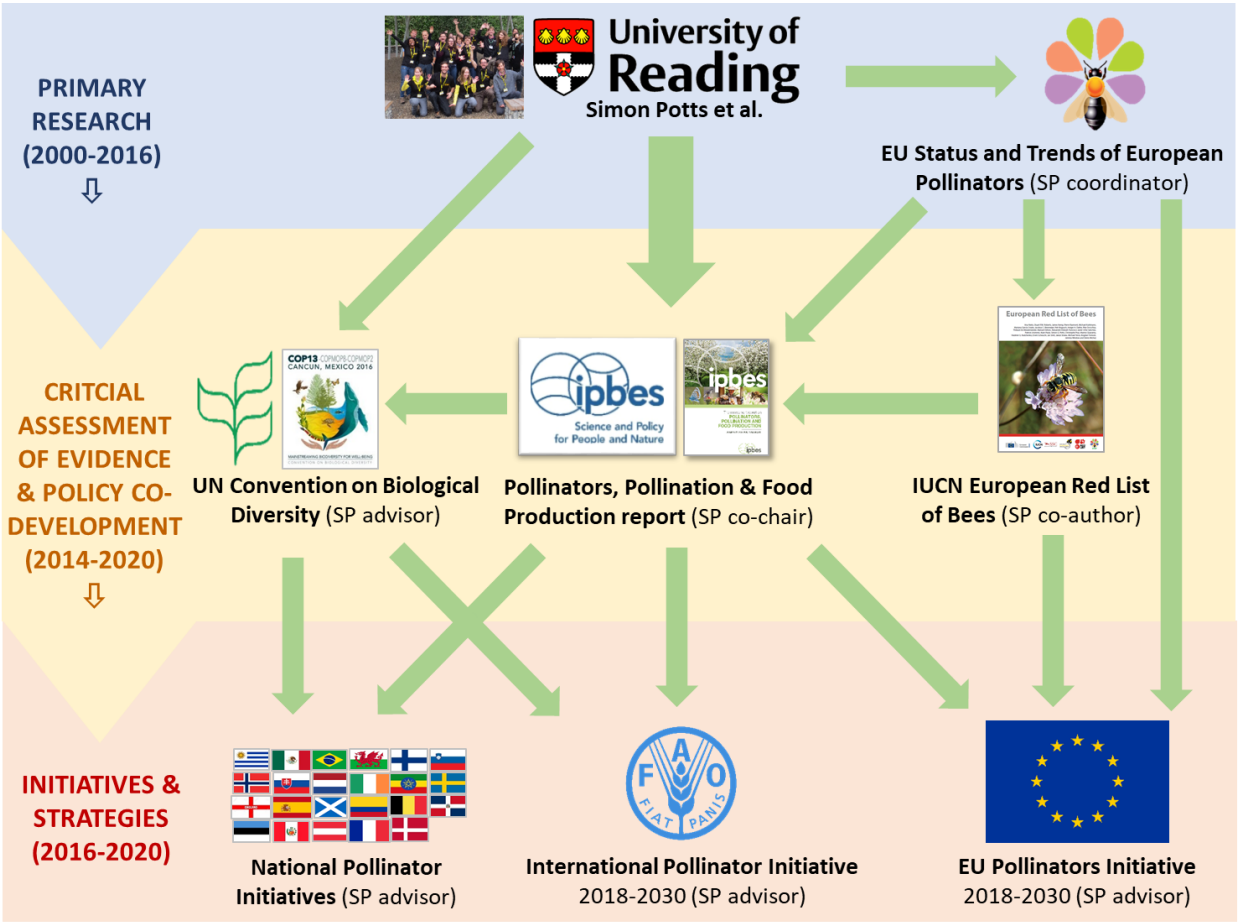

Figure 1: *Charting the development of international policy and the influence of University of Reading research led by Professor Simon Potts (SP).*

(2) National Pollinator Initiatives: Many countries around the world now have national pollinator strategies which are all based, at least in part, on the IPBES publications [7, E1] and CBD CoP-13 recommendations. Of these, 13 are established (Belgium, Brazil, Canada, Colombia, Denmark, England, France, Ireland, Netherlands, Norway, Scotland, Switzerland, and Wales), one is in active development (the Oceanic Pollinator Initiative) and two others are planned (Germany and Slovenia) [E4]. Furthermore, 30 countries have formed **Promote Pollinators**, a Coalition of the Willing, committing to: "*take action to protect pollinators and their habitats in order to stop and reverse their decline*"; "*avoid or reduce the use of pesticides harmful to wild and domestic pollinators*" and "*report in this respect our results to the meetings of the Conference of the Parties to the Convention on Biological Diversity*" [E5].

The secretary of Promote Pollinators stated: "*Without the IPBES pollinator report, there would be no coalition*". He emphasised that the IPBES assessment was an essential part of the decision of several countries to start working together for pollinators: "*It led to direct implementation of its recommendations in the (international) policy agenda. That is not seen very often*," [E2].

(3) FAO International Pollinator Initiative (IPI): In 2018, at the 22nd meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA-22, 2018), ahead of CoP-14, the CBD requested that "*the FAO, in collaboration with other partners, to review the*

implementation of the International Pollinators Initiative and prepare an updated plan of action based on the IPBES assessment" [E6]. The FAO's Agricultural officer leading the IPI, stated: "*In the context of decisions made at CoP-14 and the framework for FAO's IPI 2.0, I found the IPBES report indispensable in helping my understanding in what are the knowns, the unknowns, the knowledge gaps but also the technical but very practical advice and strategic responses to sustainable use of pollinators… We are able to use [the IPBES report] at multiple levels with the FAO using it at a science and policy advisory level and CoW using it more at the political level*" [E2].

The revised plan of action (2018-2030) sets out how IPI will: "promote coordinated action worldwide to safeguard wild and managed pollinators and promote the sustainable use of pollination services"; and "help governments implement Decision XIII/15, in alignment with the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets and the 2050 Vision for Biodiversity, and the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs)". The specific objectives are "to support parties, other governments, relevant organizations and initiatives to: enable policy coherence and strategies within and across sectors; implement pollinator-friendly practices at field level; increase awareness, knowledge sharing and improve valuation tools for decision making; and foster research, assessment and monitoring".

(4) The EU Pollinators Initiative was formally launched in 2018 and draws heavily upon the IPBES report (and related CBD recommendations), STEP and the IUCN Red List. The underpinning evidence document for the EPI [E7], of which 18% of the publications cited are from Potts, goes on to state: "*The European Red List is currently the key tool providing information on the status and trends of pollinators at the EU level (and in Europe as a whole*)". Specific actions of the EPI include: development of a Pan-European Pollinator Monitoring Scheme (expert group chaired by Potts); action plans for the most threatened pollinator species and habitats; revised national action plans under Directive 2009/128/EC to reduce the risks and impacts of pesticide use on pollinators; and a pollinator indicator for the post-2020 Common Agricultural Policy [E8]. The Policy Officer leading EPI at the European Commission, stated: "*The IPBES pollinator report was the primary reference and provided scientific clarity for the initial road map for the EPI.* ***Other than the IPBES report we did not have any other reference with the same weight to actually cite as a big review of scientific evidence at the global level***" [E2].

By securing the commitment of governments around the globe to protect pollinators, research and expertise at the University of Reading has underpinned the development of international and national initiatives, which in turn is driving policies regulating for or enabling multiple actions by multiple actors (e.g. growers, land managers, beekeepers, government agencies, NGOs and the public) helping to safeguard the sustainability of global food production.

5. Sources to corroborate the impact

[E1] IPBES (2016) 'Summary for Policy Makers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production'. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany

[E2] Signed testimonials from former Chair of IPBES, Head of Technical Support for the Global IPBES assessment, Secretary of Promote Pollinators, FAO's Agricultural Officer and Policy Officer leading the EU's European Pollinator Initiative

[E3] CBD/COP/DEC/XIII/15 Conference of the parties to the convention on Biological Diversity 2016

[E4] Table of national pollinator initiatives, confirmed by Promote Pollinators

[E5] Declaration of Promote Pollinators (2019)

[E6] Revised IPI plan of action (2018-2030), CBD SBSTTA 22 (2018)

[E7] EPI evidence document, SWD (2018) 302 final

[E8] EPI strategy, COM (2018) 395 final.