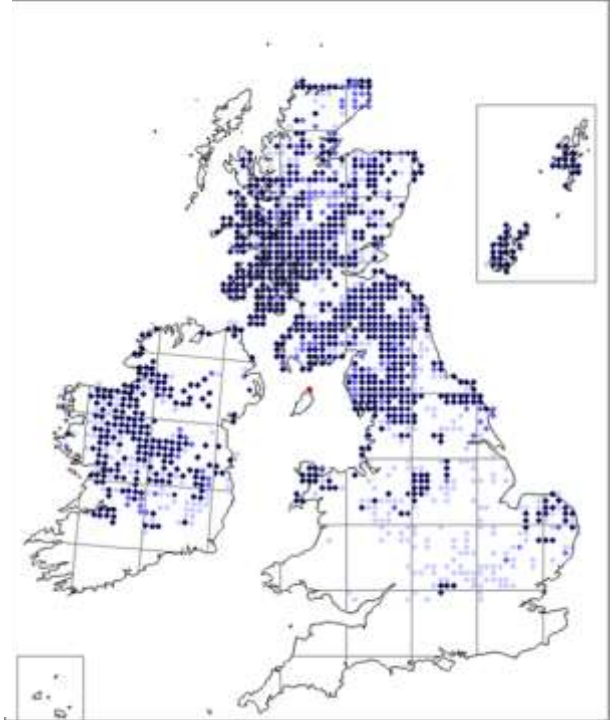


Biological Recording – filling evidence gaps – the UK (and Europe) perspective

David Roy

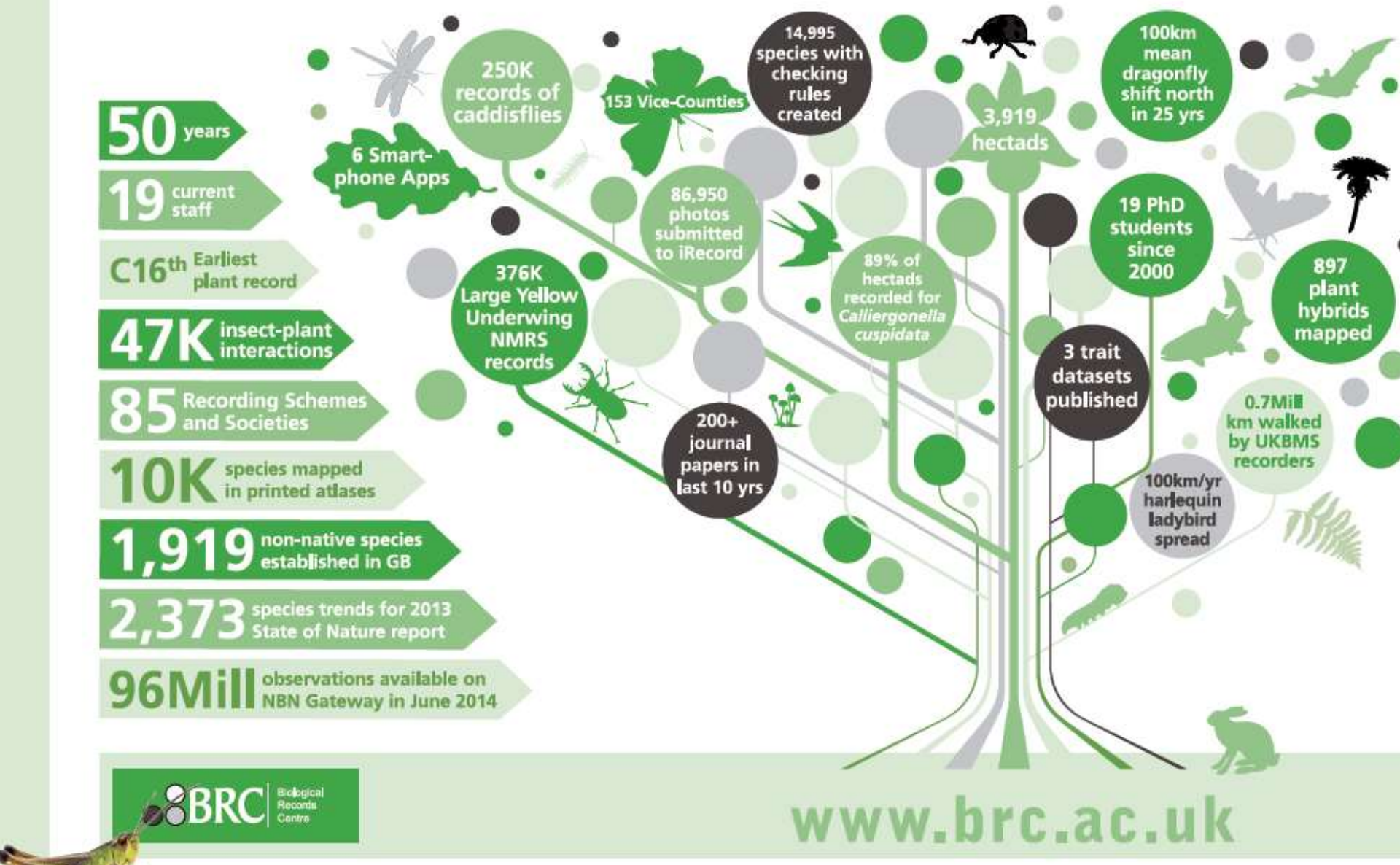
Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

BRC Biological Records Centre

The challenge

- Species & ecosystems increasingly threatened by multiple man-made pressures
- Policy makers need sound evidence to protect the environment, mitigate impacts, regulate use of resources etc
- .....but monitoring is expensive and budgets are reducing
- Can biological recording by volunteers deliver useful data in a cost effective manner?

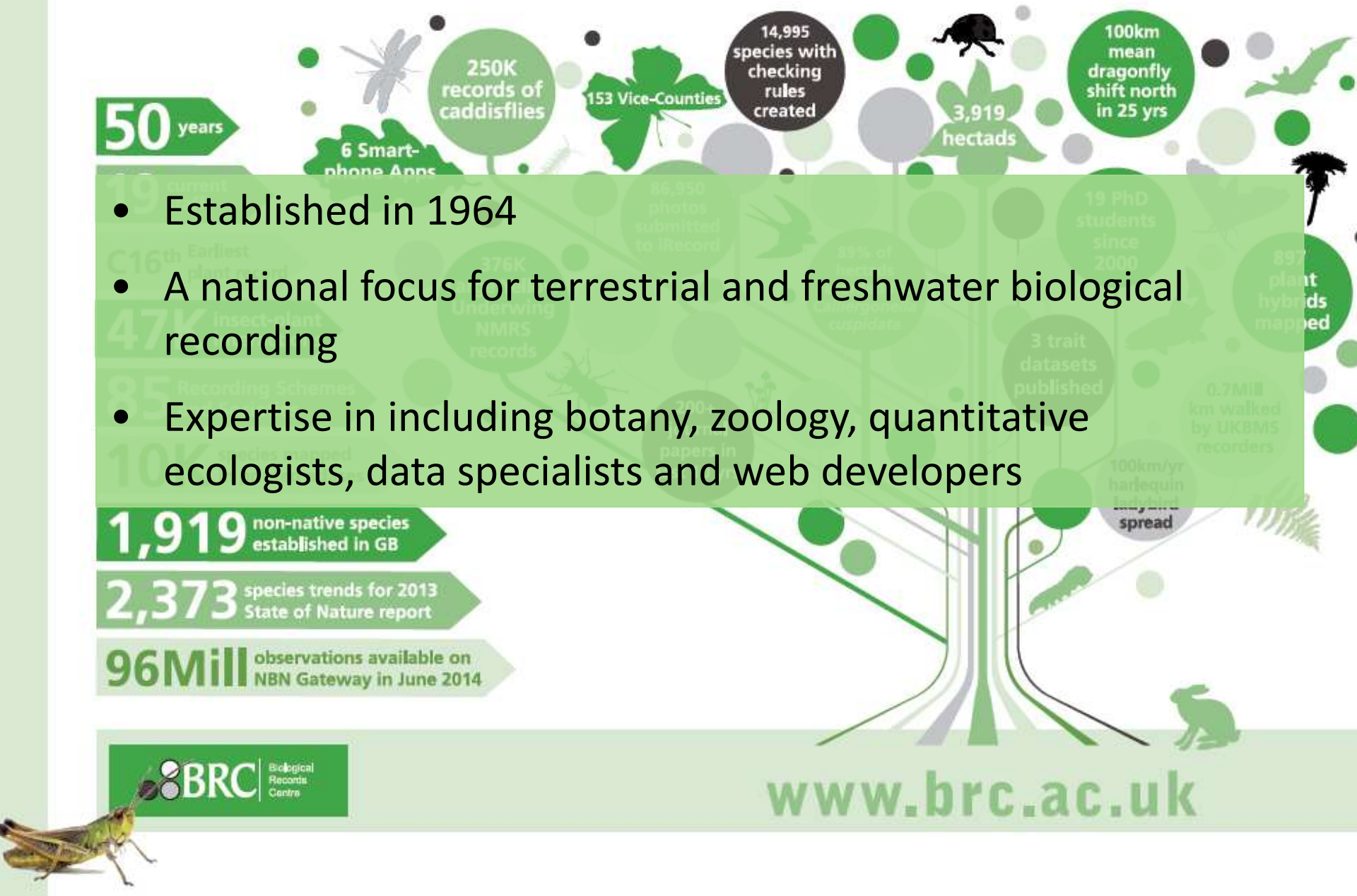
BIOLOGICAL RECORDS CENTRE



BRC Biological Records Centre

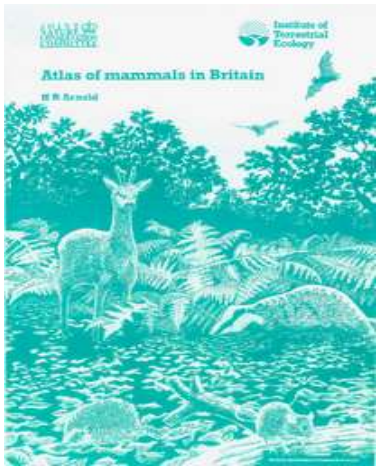
www.brc.ac.uk

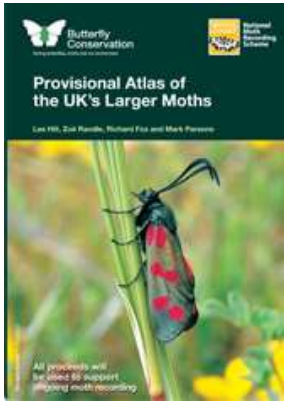
BIOLOGICAL RECORDS CENTRE

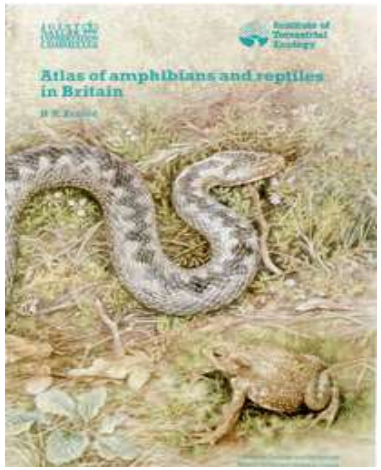


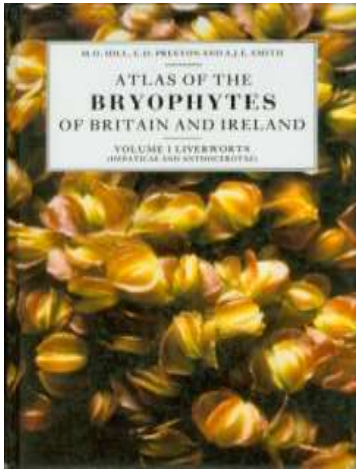
- Established in 1964
- A national focus for terrestrial and freshwater biological recording
- Expertise in including botany, zoology, quantitative ecologists, data specialists and web developers

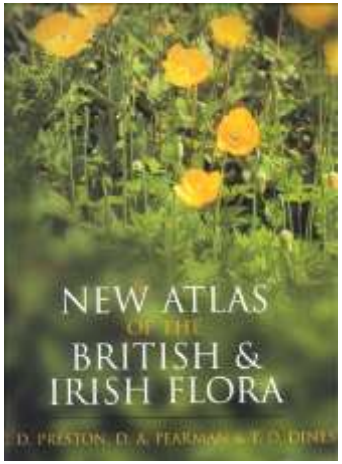
Traditional outputs











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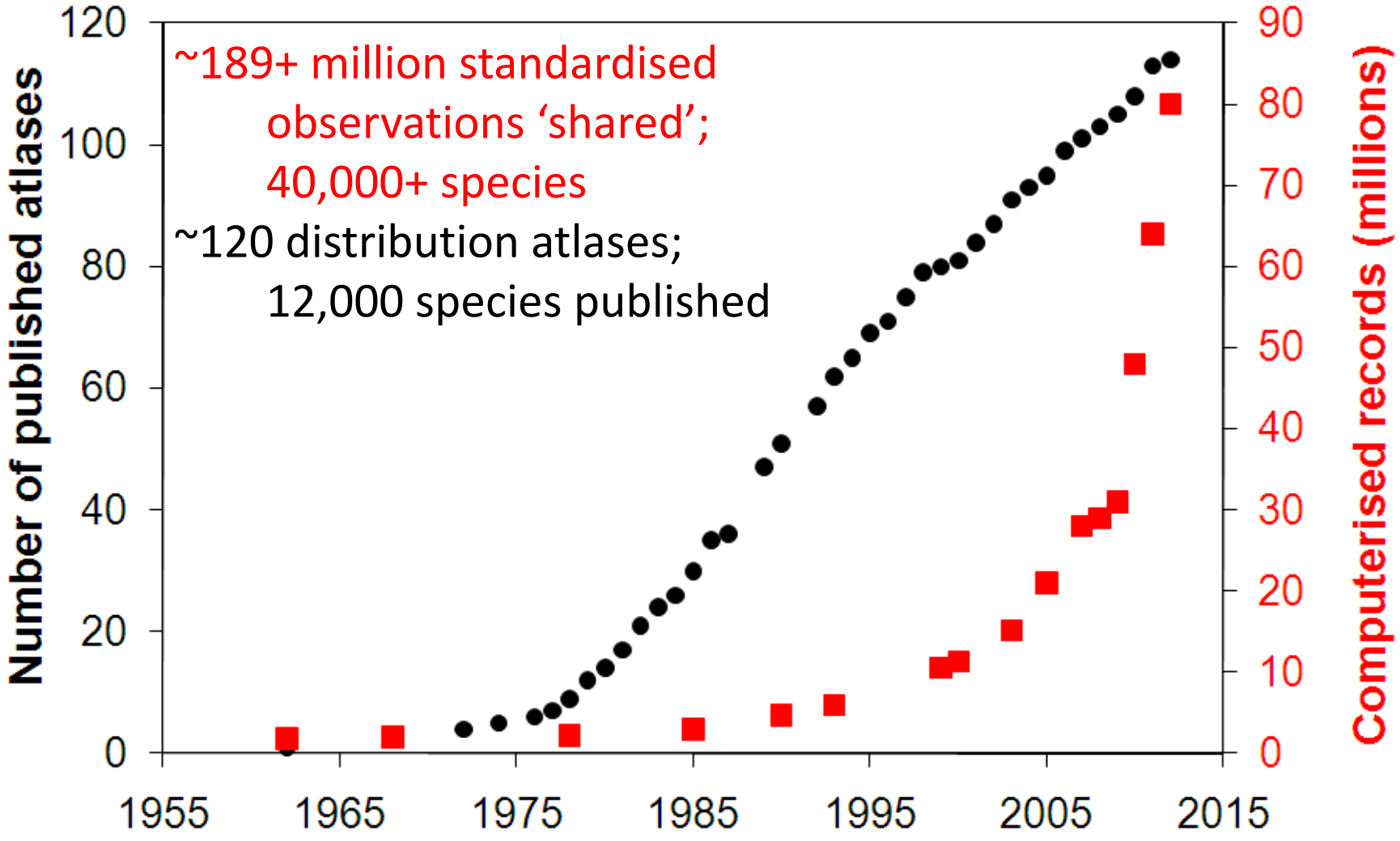
Growth in data and outputs



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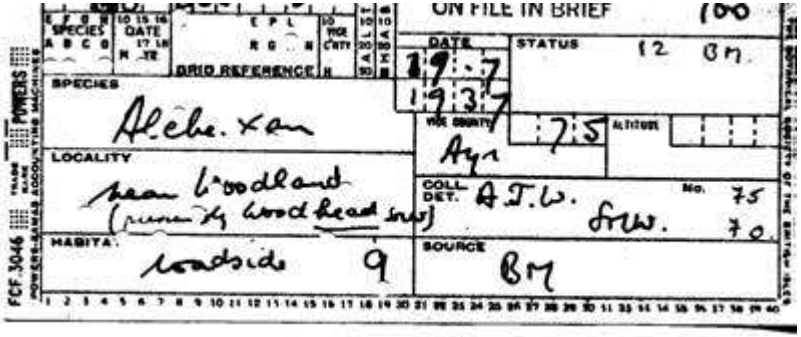
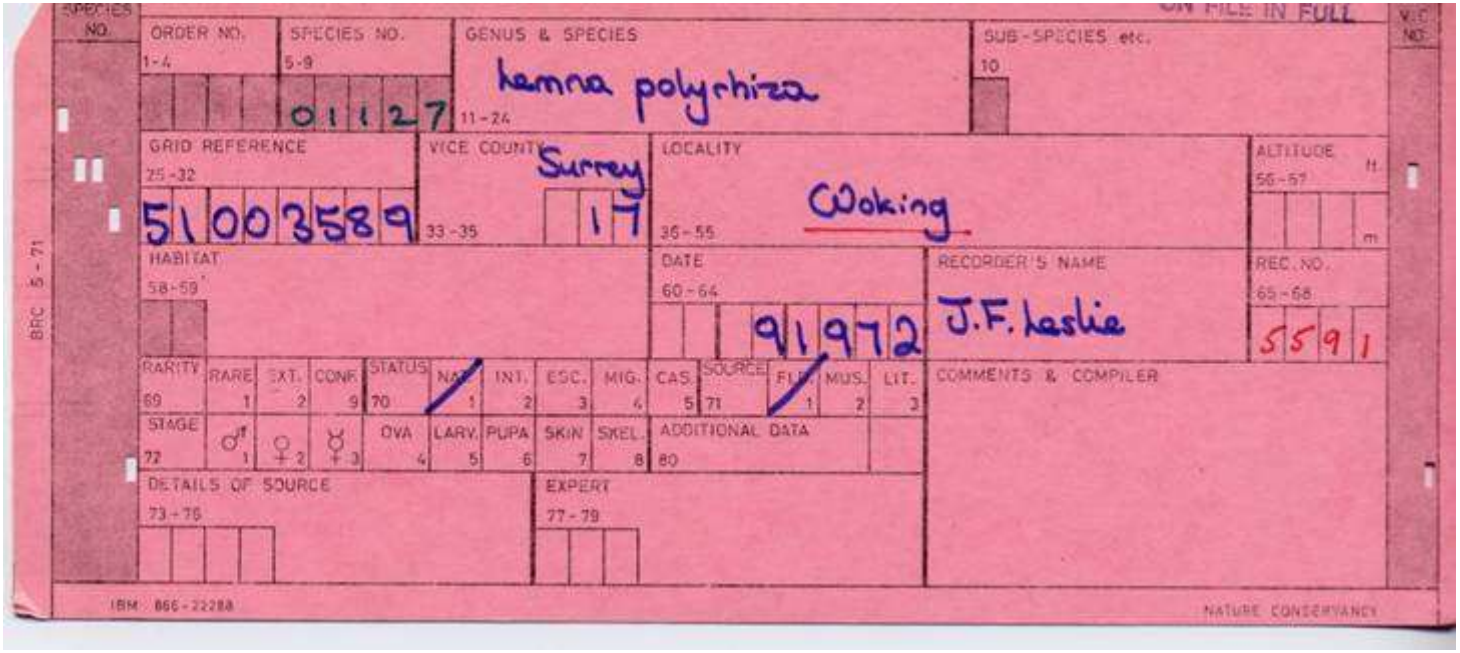
Some biological recorders

Photo: Richard Comont


Another biological recorder

Historical data collection





TECHNOLOGY

iSpot

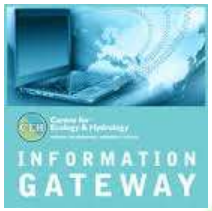
Indicia

iRecord

Collect

Review

Expert review
Automated rule-checks
Image recognition

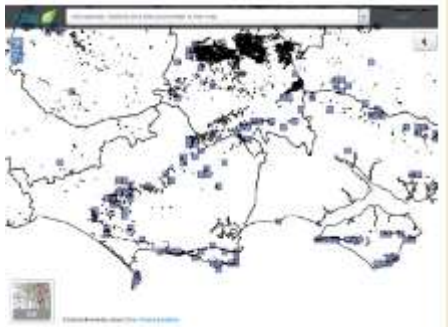


NBN
National Biodiversity Network

NBN Gateway

Integrate

Share



Publish

Botanical Society of Britain & Ireland

BWARS

Butterfly Conservation
Saving butterflies, moths and their habitats

85 Recording Schemes and Societies
















Pros & cons of biological recording data

- Broad taxonomic scope (incl. functionally important, ‘non-charismatic’ taxa)
- Wide geographic coverage across gradients
- Early warning and long-term perspective
- Provides wider engagement (citizen science)

- .....but recording is often biased in time, space, detectability & effort per visit

- However, we have developed statistical techniques to account for these

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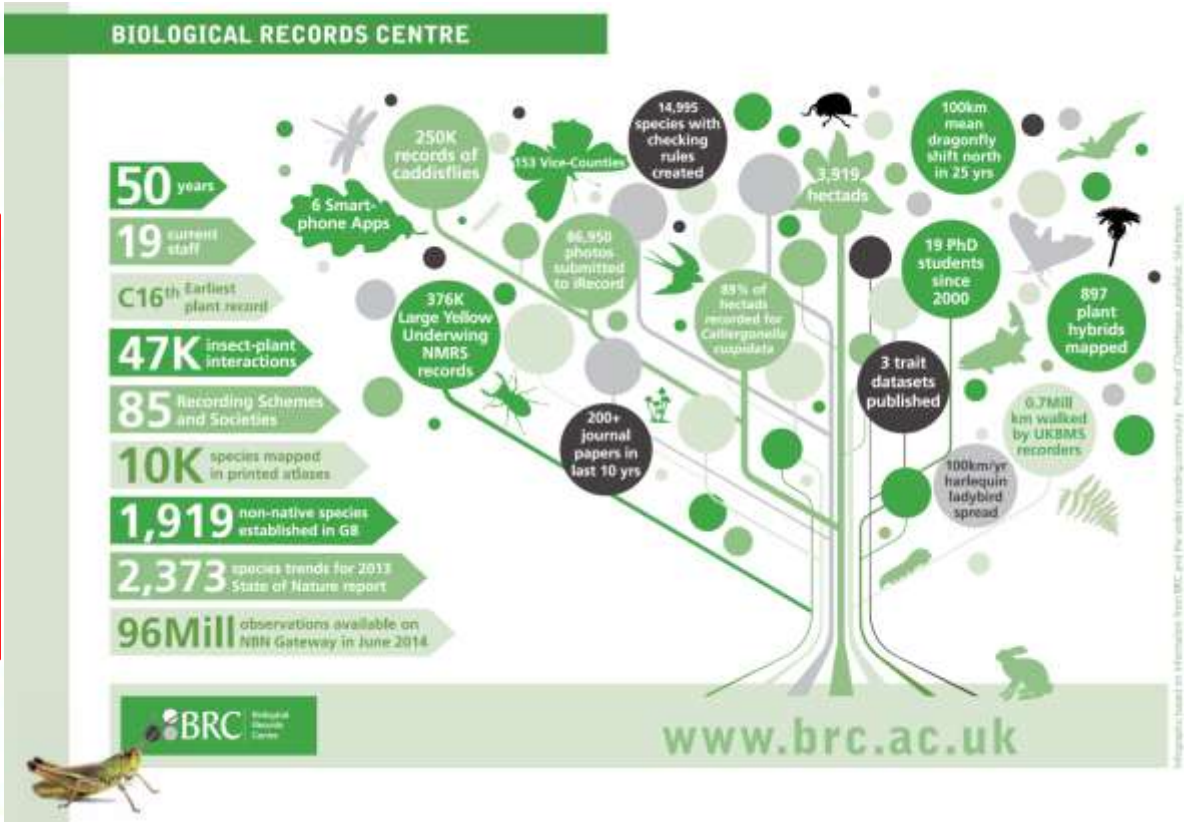
Photo: Carabid beetles of Ireland

Examples of applying biological recording data



http://www.brc.ac.uk/article/brc-50th-anniversary-brochure-published

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What might happen to species with climate change?

Die

- ➢ extinction

Move

- ➢ range shift

Respond *in situ*

- ➢ population change
- ➢ phenological change

• Adapt

- ➢ ecological change
- ➢ evolutionary change

CLIMATE CHANGE ECOLOGY

Comma

● 1970-1982

Butterfly Conservation

CLIMATE CHANGE ECOLOGY

Comma

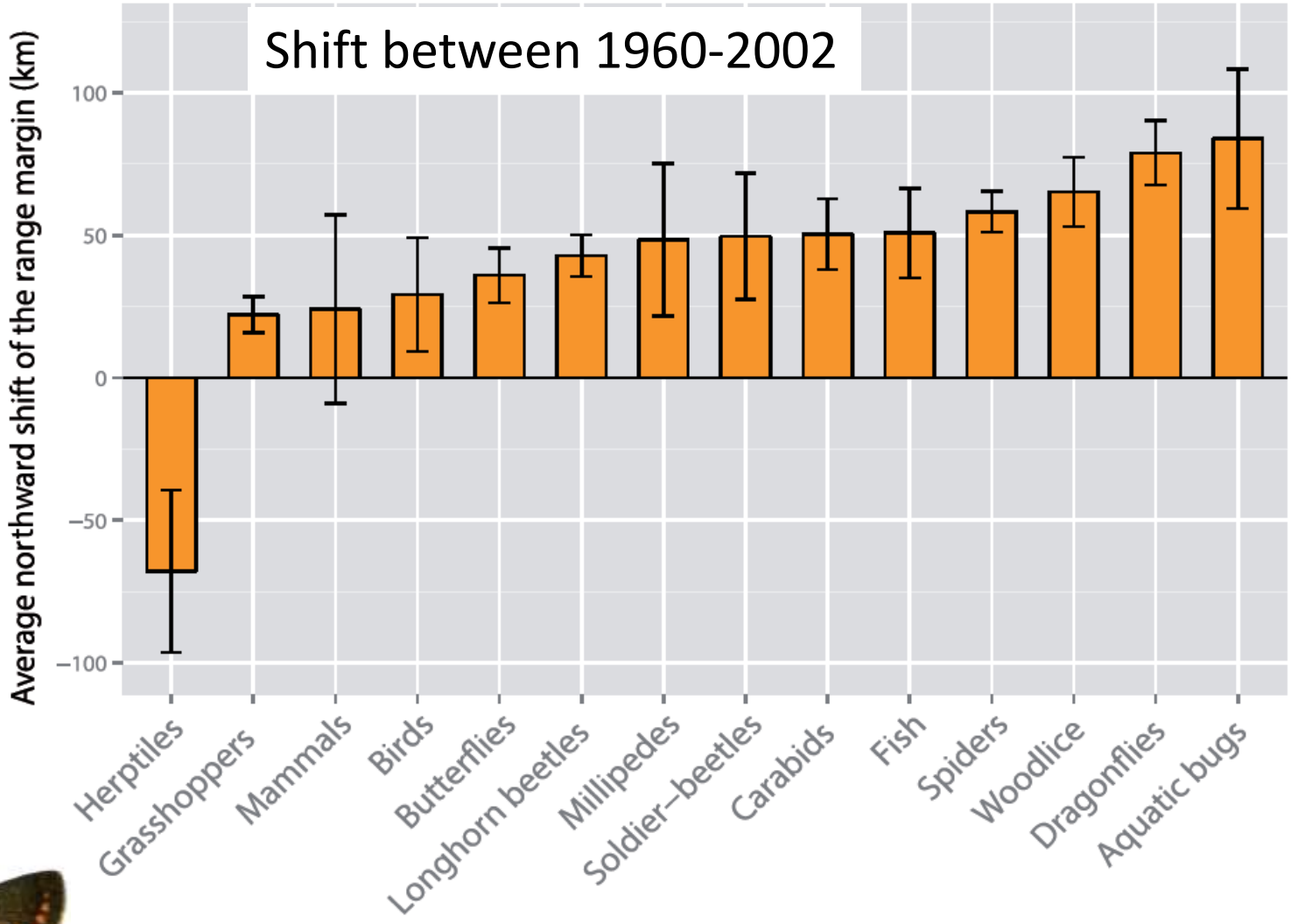
Butterfly Conservation

New squares

- 1995-2012
- 1970-1982

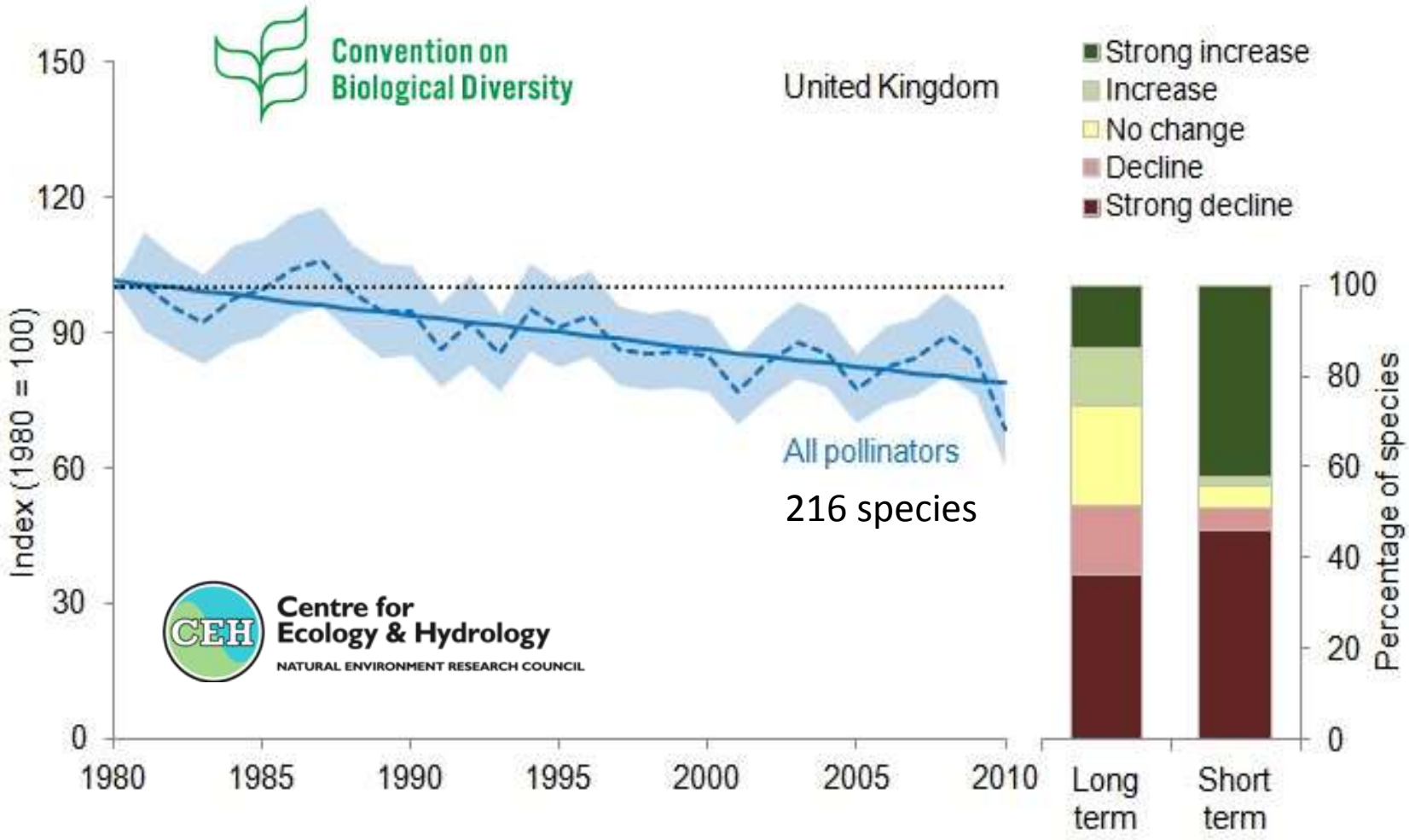
CLIMATE CHANGE ECOLOGY

General patterns of northward range shift across many different taxonomic groups



Key Publications: Hickling *et al.* 2006 *Global Change Biology*; Chen *et al.* 2011 *Science*

Declines in wild bees



Department for Environment Food & Rural Affairs

JNCC
Joint Nature Conservation Committee

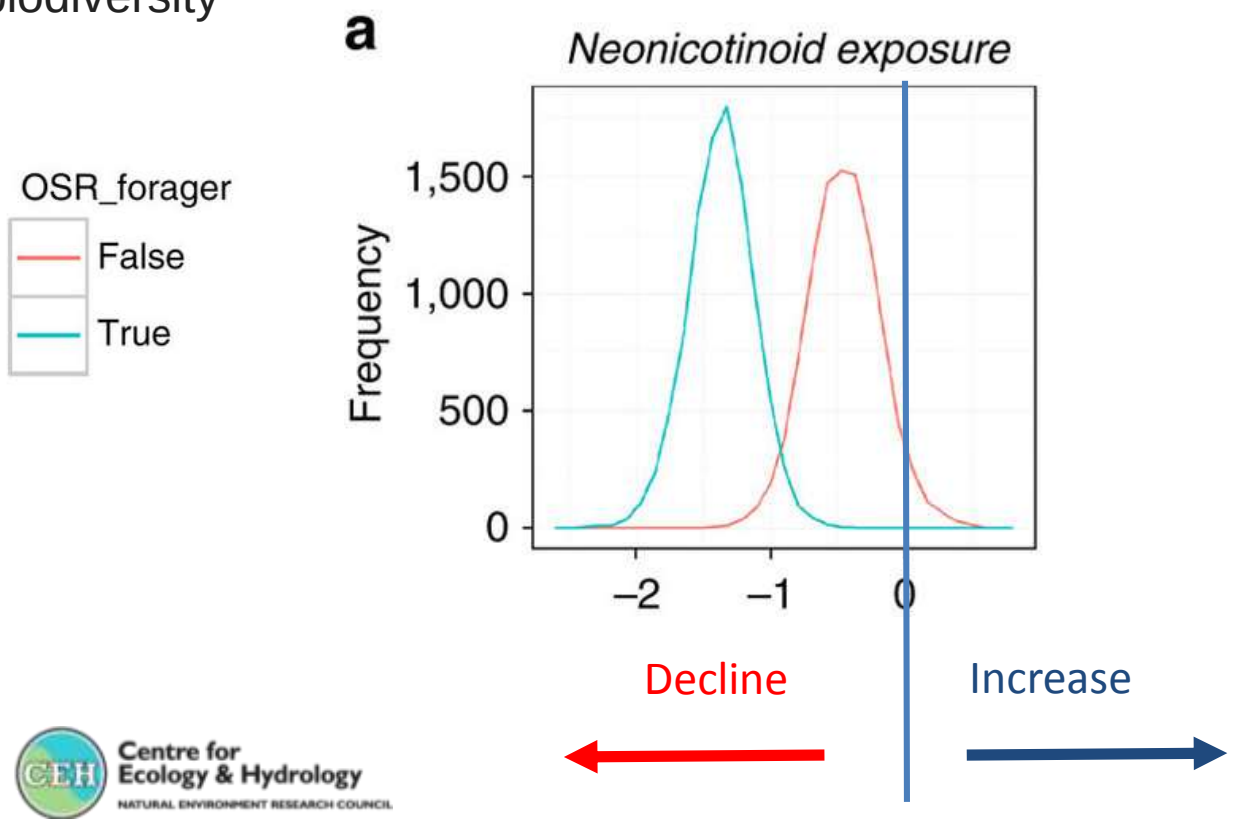
NERC SCIENCE OF THE ENVIRONMENT

Attributable to neonicotinoid usage?

Oilseed rape has benefited wild bees

But, oilseed rape foragers were ~3x more negatively affected by exposure to neonicotinoids than non-crop foragers.

Sub-lethal effects of neonicotinoids could scale up to cause losses of bee biodiversity



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Woodcock et al. (2016) *Nature Communications.*DOI: **10.1038/NCOMMS12459**

Photo: Vita (Europe) Ltd

Biological invasions

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Global Change Biology

Global Change Biology (2014) 20, 3859–3871, doi: 10.1111/gcb.12603

Horizon scanning for invasive alien species with the potential to threaten biodiversity in Great Britain

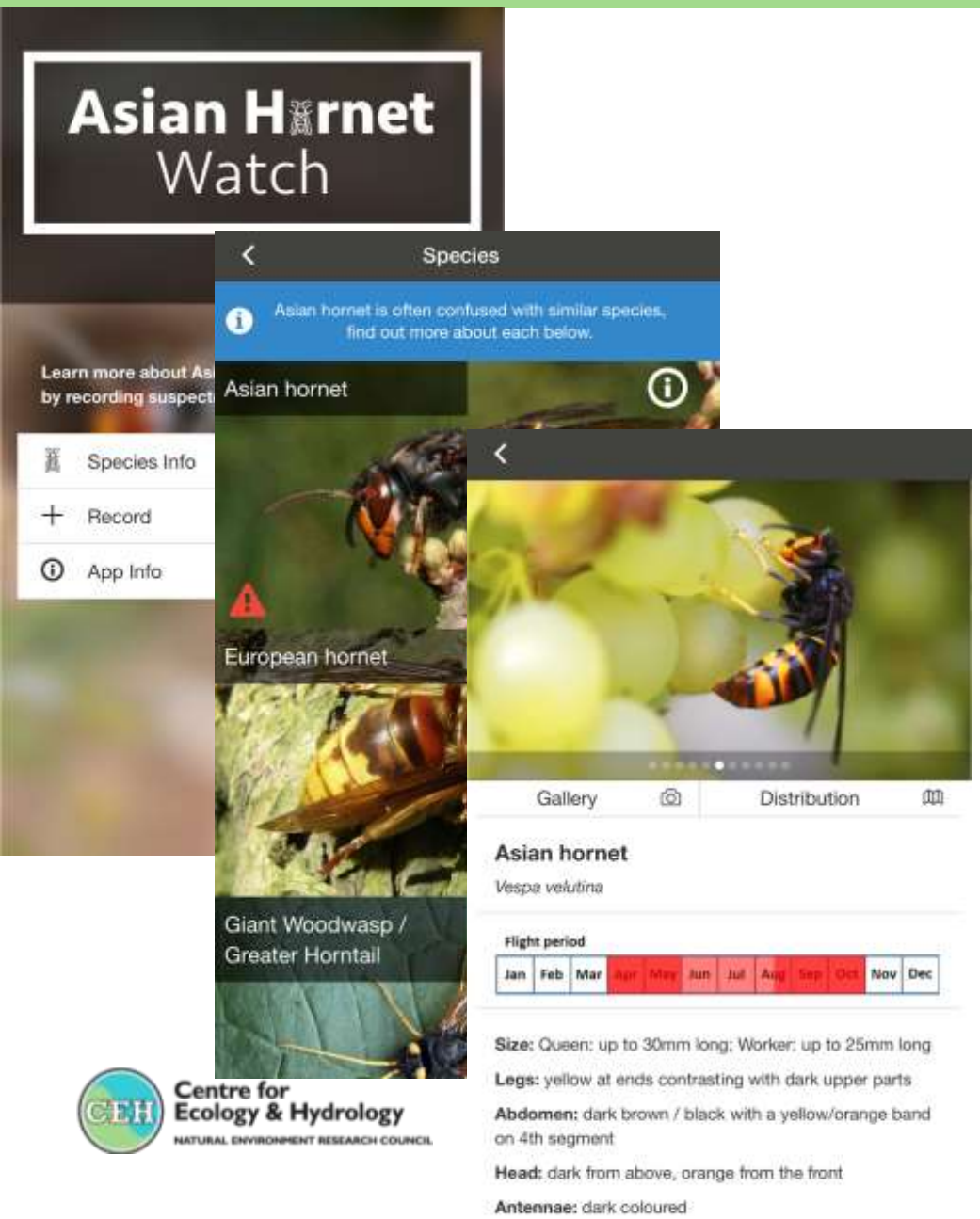
HELEN E. ROY[1], JODEY PEYTON[1], DAVID C. ALDRIDGE[2], TRISTAN BANTOCK[3], TIM M. BLACKBURN[4,5], ROBERT BRITTON[6], PAUL CLARK[7], ELIZABETH COOK[8], KATHARINA DEHNEN-SCHMUTZ[9], TREVOR DINES[10], MICHAEL DOBSON[11], FRANÇOIS EDWARDS[1], COLIN HARROWER[1], MARTIN C. HARVEY[12], DAN MINCHIN[13], DAVID G. NOBLE[14], DAVE PARROTT[15], MICHAEL J. O. POCOCK[1], CHRIS D. PRESTON[1], SUGOTO ROY[15], ANDREW SALISBURY[16], KARSTEN SCHÖNROGGE[1], JACK SEWELL[17], RICHARD H. SHAW[18], PAUL STEBBING[19], ALAN J. A. STEWART[20] and KEVIN J. WALKER[21]

[1]Centre for Ecology & Hydrology, Wallingford OX10 8BB, UK, [2]Aquatic Ecology Group, Department of Zoology, University of Cambridge, Cambridge CB2 3EJ, UK, [3]British Bugs, 101 Crouch Hill, London N8 9RD, UK, [4]Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK, [5]Centre for Biodiversity Theory and Modelling, Stellenbosch University, Stellenbosch, South Africa, [6]University of Bournemouth, Poole BH12 5BB, UK, [7]Aquatic Invertebrates Division, Department of Life Sciences, The Natural History Museum, Cromwell Road, London SW7 5BD, UK, [8]Scottish Marine Institute, Oban, Argyll, PA37 1QA, UK, [9]Centre for Agroecology and Food Security, Coventry University, Priory St, Coventry CV1 5FB, UK, [10]PlantLife, Uned 14, Llys Castan, Parc Menai, Bangor LL57 4FD, UK, [11]APEM Ltd., The Technopole Centre, Midlothian EH26 0PJ, UK, [12]Department of Environment, Earth and Ecosystems, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK, [13]Marine Organism Investigations Killaloe, Co Clare, Ireland, [14]British Trust for Ornithology, Thetford

7 out of top 10 species have arrived




Early warning of invasion



- Further key role of volunteer community
- New technology
- Recording apps to alert of new invasions & record spread

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BRC Biological Records Centre

iRecord

One future for monitoring – BRC priorities

- Wider ‘citizen’ participation: expert and non-expert volunteers
  - Different biases to deal with, requiring data of *known* quality

One future for monitoring – BRC priorities

- Wider ‘citizen’ participation: expert and non-expert volunteers
  - Different biases to deal with, of data of *known* quality
- Structured/designed volunteer monitoring
  - Asks more of contributors
  - More power to detect change

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Systematic monitoring – BRC priorities

United Kingdom
Butterfly Monitoring Scheme

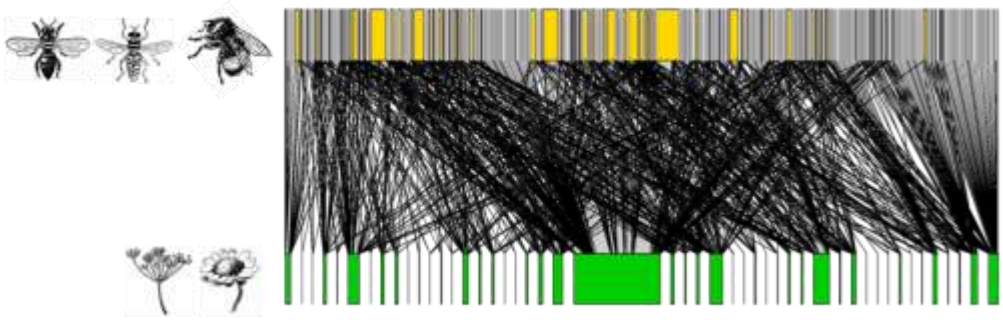
(From 1976)
(with Butterfly Conservation/JNCC)

National Plant Monitoring Scheme (for 2015)
(developed by BRC/BSBI/Plantlife/JNCC)

+ **Pollinator Monitoring Scheme** (started in 2017)

One future for monitoring – BRC priorities

- Wider ‘citizen’ participation: expert and non-expert volunteers
  - Different biases to deal with data of *known* quality
- Structured/designed volunteer monitoring
  - Asks more of contributors
  - More power to detect change
- Use of technology
  - Modelling; Field capture (+sensors); Integration with other data types (i.e. EO); eDNA; image recognition
- Different (more important?) measures of change
  - Ecosystem function & resilience ← interactions



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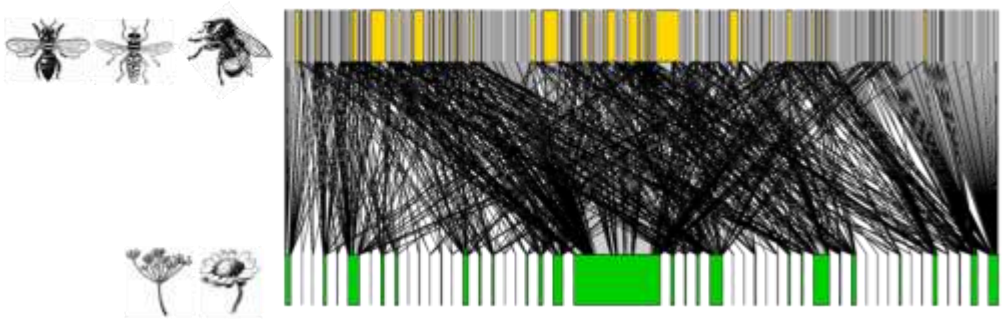
One future for monitoring – BRC priorities

- Wider ‘citizen’ participation: expert and non-expert volunteers
  - Different biases to deal with data of *known* quality
- Structured/designed volunteer monitoring
  - Asks more of contributors

But will it resonate with people?

- Use of technology
  - Modelling; Field capture (+sensors); Integration of data; EO; eDNA
- Different (more important?) measures of change
  - Ecosystem function & resilience ← interactions



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In conclusion

- We are fortunate to have an amazing legacy of biological recording in Great Britain
- Recent growth in Citizen Science has increased interest in wildlife recording worldwide
- Technology makes biological recording more accessible and available
- Novel statistical techniques enhance our capacity for measuring and interpreting change
- Great potential in extensive biodiversity recording for understanding environmental change

» **If there is support (funded) for co-ordination activities**

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Acknowledgements

All volunteer recorders &
co-ordinating organisations

JNCC
Joint Nature Conservation Committee

BRC
Biological
Records
Centre

NBN
National Biodiversity Network

CEH
Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

For presentation material:

Michael Pocock, Nick Isaac, Helen Roy,
Tom August, Richard Fox

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Habitat loss

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Butterfly Conservation

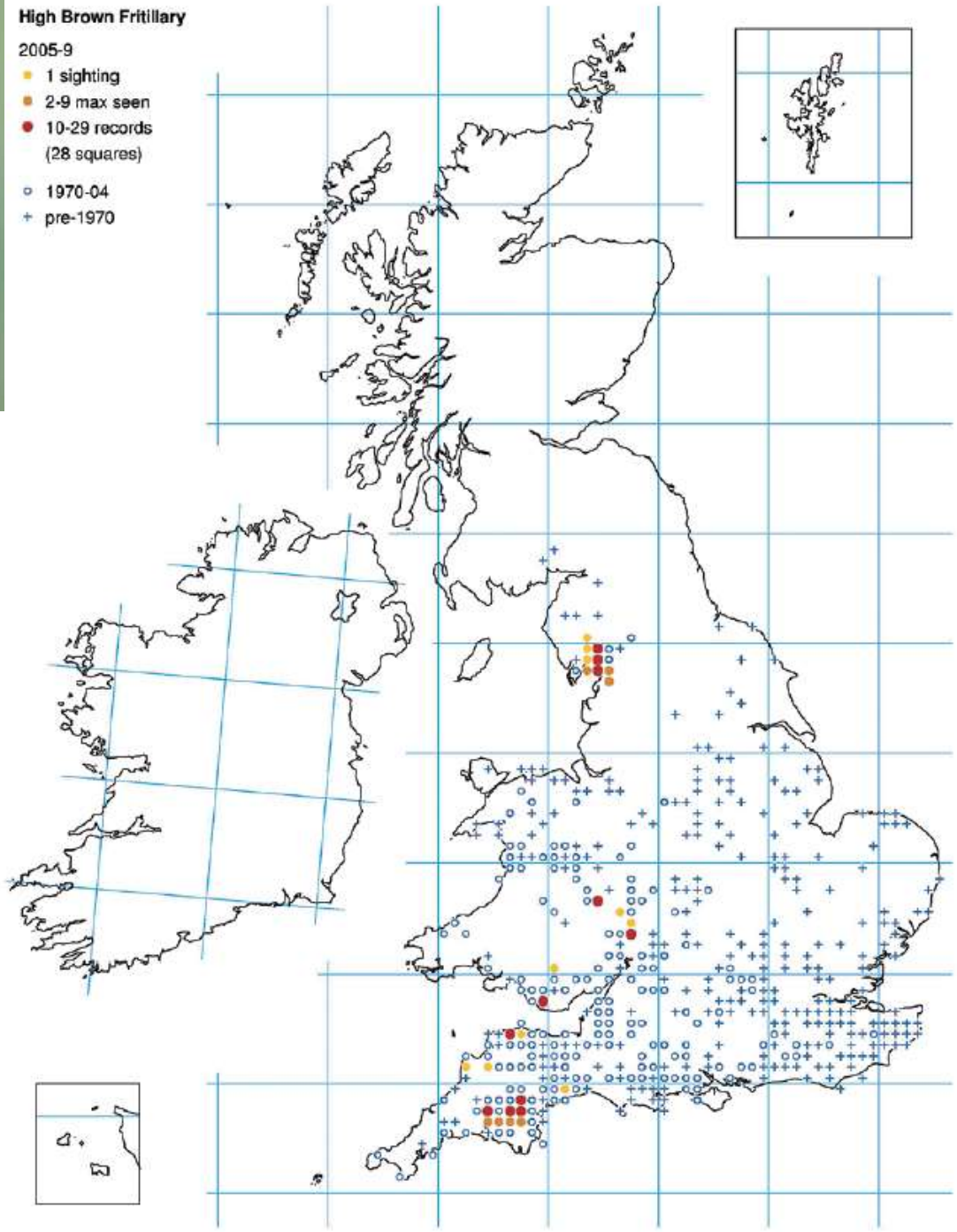
Saving butterflies, moths and their habitats

High Brown Fritillary

2005-9
- 1 sighting
- 2-9 max seen
- 10-29 records (28 squares)

1970-04

pre-1970



Air pollution

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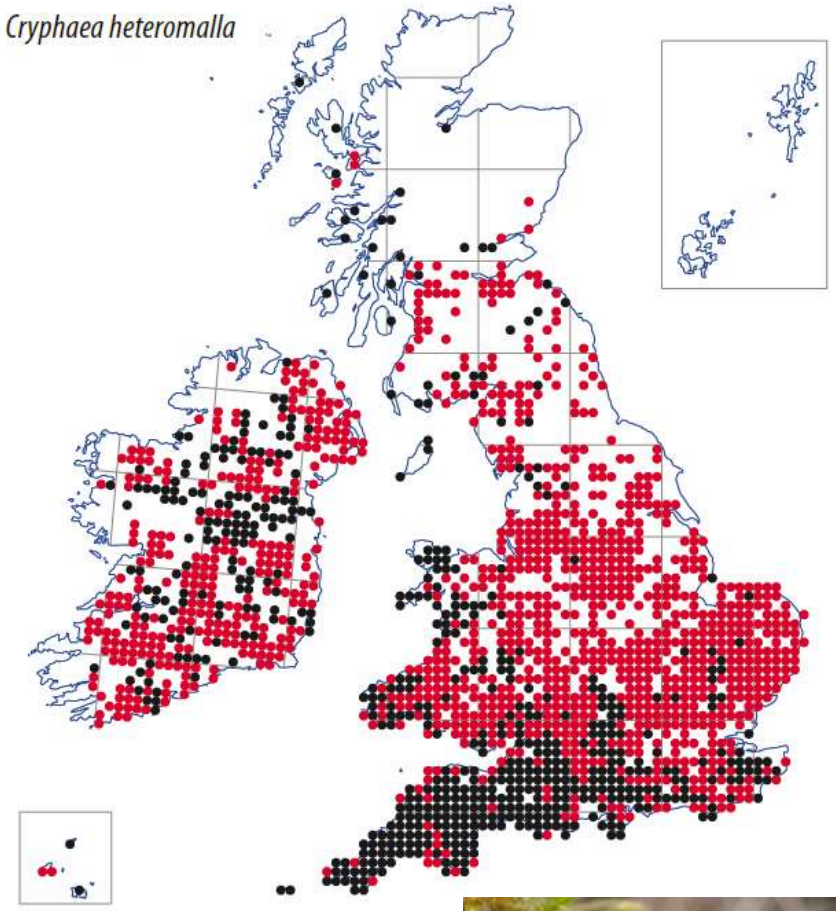
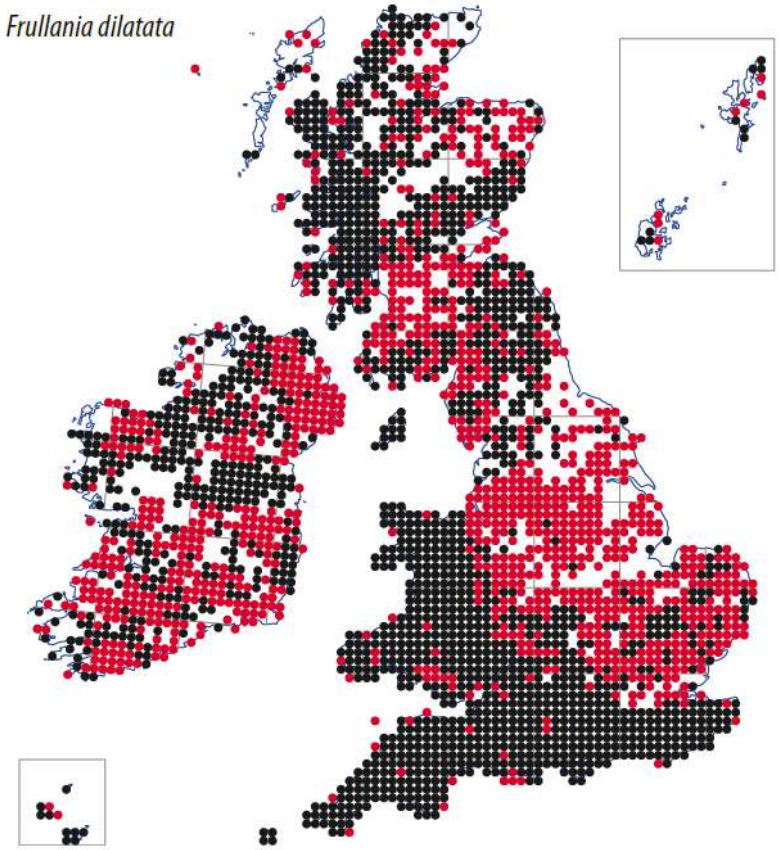
Improving air quality: bryophyte response





Hill (2014)

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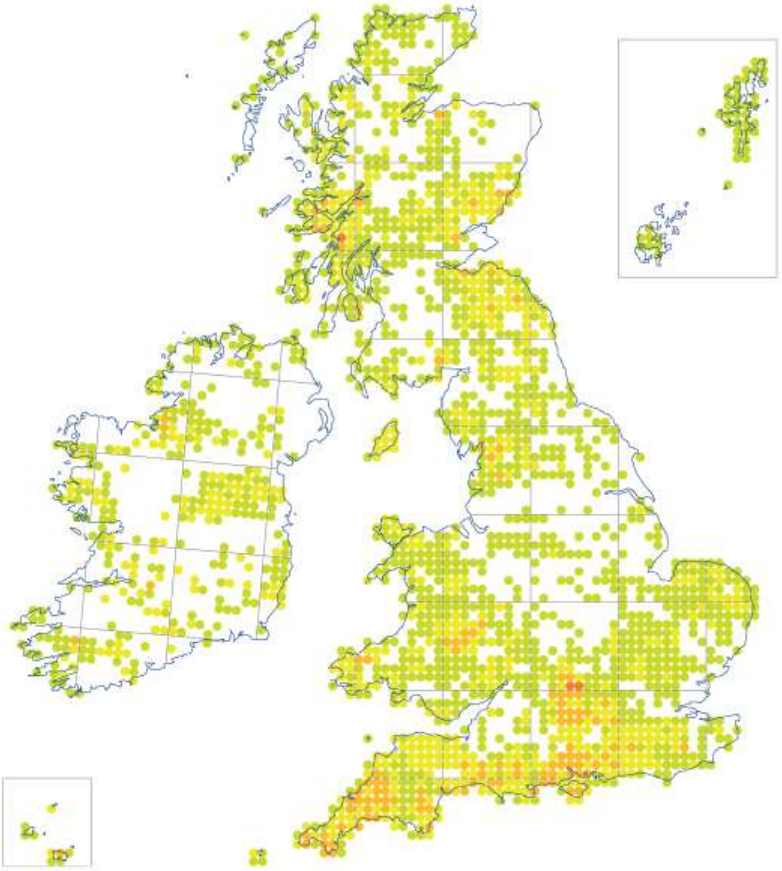
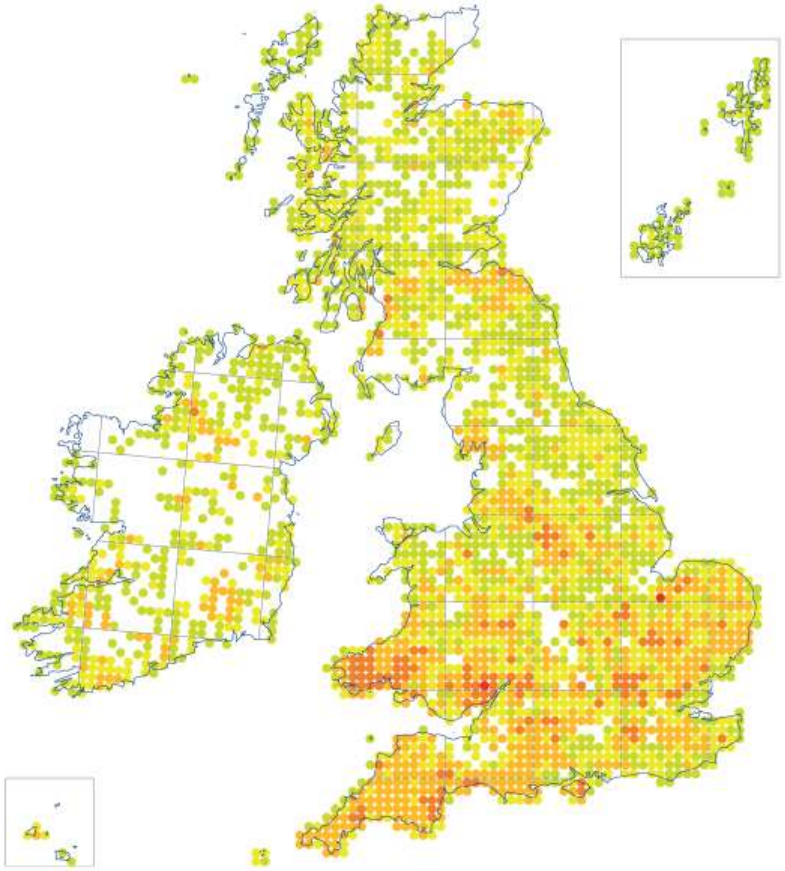
Changes in the distributions of moss and liverwort epiphytes for the periods 1960-1980 and 1990-2010



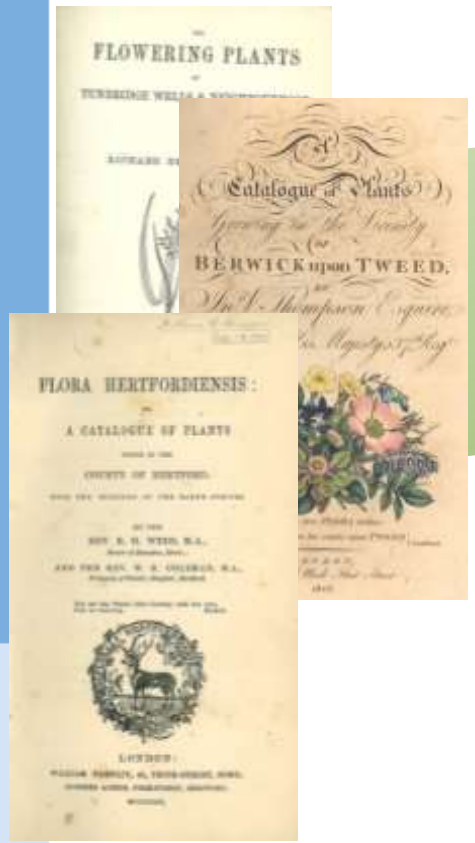
1960-1980

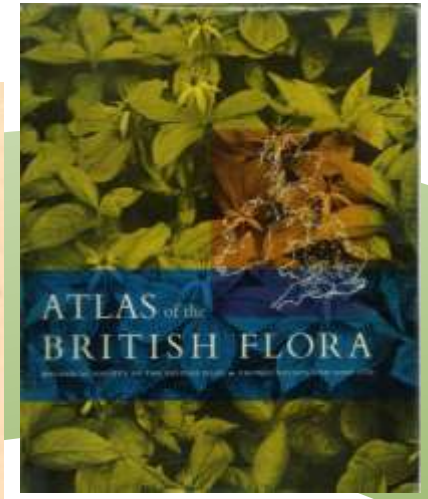


1990-2010

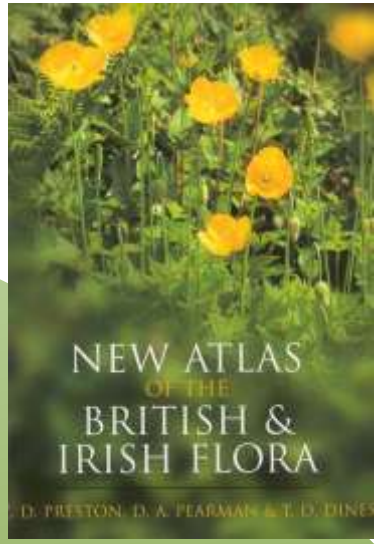
ATLASES AND DATASETS

Pre 1940





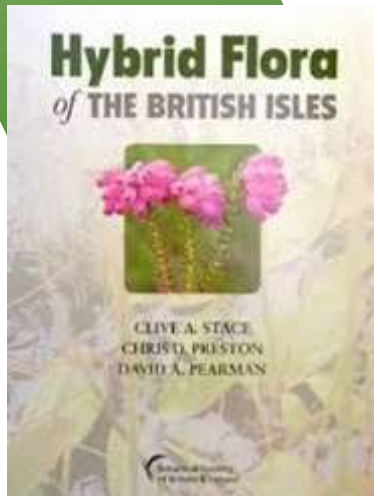
1962



2002

2012

2015



2016-2017

NPMS NYPH

Atlas 2020