



Valuing Our Life Support Systems Summit

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Conceptual framework in place

Practical implications understood

Evidence & tools available

Good examples of implementation available

Mainstream adoption of good practice

Importance of cross-disciplinary work

Recognising and understanding the interactions between the five forms of capital - financial, manufactured, human, social and natural - is crucial. This will require cross-disciplinary working, linking the natural sciences with engineering, social science and medical research. Greater access to cross-disciplinary research funding is needed, along with the removal of bureaucratic barriers to joint working.

Research & Innovation Agenda on Nature-Based Solutions and Re-Naturing Cities

Goals	Research & Innovation Actions
Enhancing sustainable urbanisation	<div>  <p>Urban regeneration through nature-based solutions</p> </div> <div>  <p>Nature-based solutions for improving well-being in urban areas</p> </div>
Restoring degraded ecosystems	<div>  <p>Establishing nature-based solutions for coastal resilience</p> </div>
Developing climate change adaptation and mitigation	<div>  <p>Multi-functional nature-based watershed management and ecosystem restoration</p> </div> <div>  <p>Nature-based solutions for increasing the sustainable use of matter and energy</p> </div>
Improving risk management and resilience	<div>  <p>Nature-based solutions for enhancing the insurance value of ecosystems</p> </div> <div>  <p>Increasing carbon sequestration through nature-based solutions</p> </div>

Examples of societal challenge that could benefit from nature-based solutions

- Air pollution
- Noise pollution
- Flood risk
- Coastal erosion
- Landslides and avalanches
- Crime
- Lack of exercise leading to reduced physical and mental health
- Local lack of economic investment

Some options for enhancing urban nature-based solutions

Protect urban green spaces, to absorb gaseous pollutants and trap particulates.

Protect urban green spaces to store carbon.

Plant green roofs to encourage interception of rainfall.

Establish rain gardens (planted depressions or swales allowing runoff from impervious urban areas to be absorbed).

Greater use of balancing ponds to contain surges and release slowly.

Use underground water storage systems.

Use phytoremediation and phytostabilisation on contaminated sites.

Use of permeable surfaces and vegetation where possible in hard landscape construction.

Create ponds and wetlands to collect, store and clean water before gradual release into water courses (Sustainable Urban Drainage Systems).

Reduce output and improve treatment of industrial and municipal effluent through biodegradation and bioconversion.

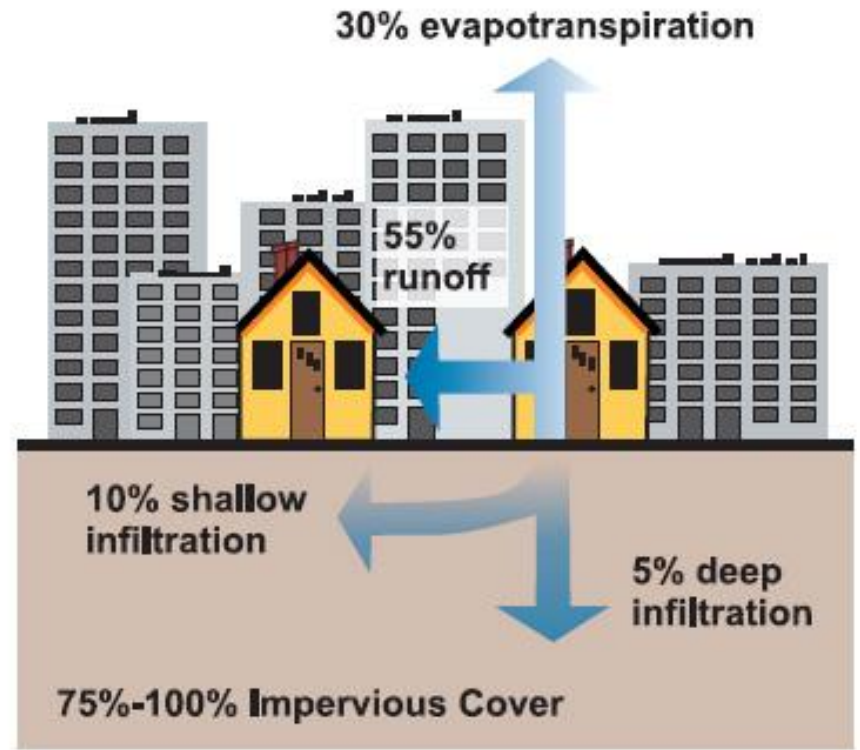
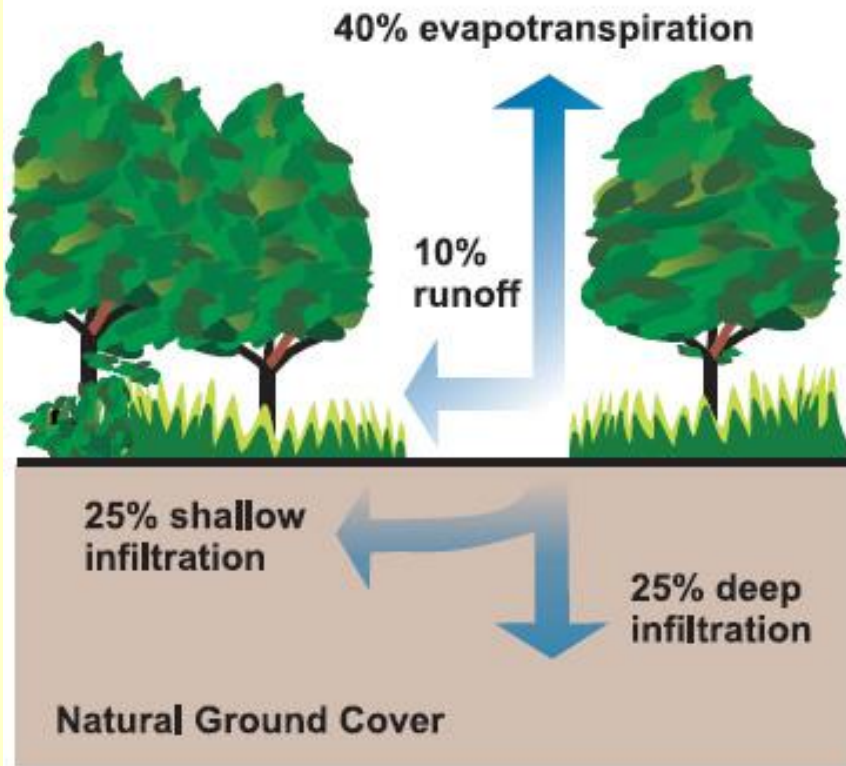
Improve remediation of wastes before disposal in soil or water by greater use of biological, physical and chemical methods.

Improve treatment of contaminated land through phytoremediation.

Reduce output and improve treatment of industrial and municipal effluent through biodegradation and bioconversion.

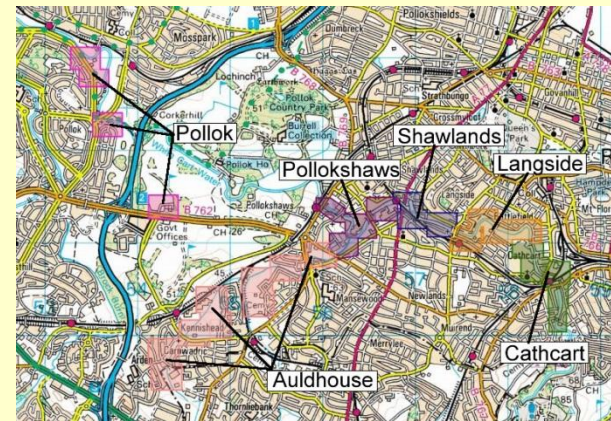
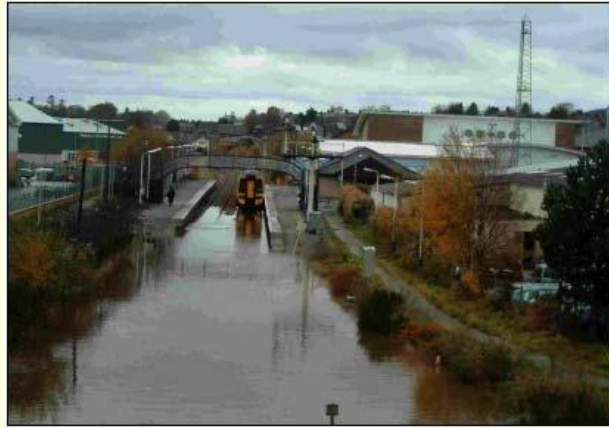
Improve remediation of wastes before disposal in soil or water by greater use of biological, physical and chemical methods.

Encourage planting of appropriate resource plants and caterpillar food plants in gardens and municipal areas



Benefits often combined:
for example aim here is
flood water storage, but
also offering people more
opportunities to exercise,
better quality of life etc

White Cart Water Flood Prevention Scheme



US cities that have avoided construction of filtration plants through watershed protection

Metropolitan area	Population (000s)	Avoided costs through watershed protection
New York City	9,000	\$1.5 billion spent on watershed protection over 10 years to avoid at least \$6 billion in capital costs and \$300 million in annual operating costs
Boston, Massachusetts	2,300	\$180 million (gross) avoided cost
Seattle, Washington	1,300	\$150–200 million (gross) avoided cost.
Portland, Oregon	825	\$920,000 spent annually to protect watershed is avoiding a \$200 million capital cost
Portland, Maine	160	\$729,000 spent annually to protect watershed has avoided \$25 million in capital costs and \$725,000 in operating costs.
Syracuse, New York	150	\$10 million watershed plan is avoiding \$45–60 million in capital costs.

Improving access to knowledge to business

Many businesses have limited understanding of the importance of natural capital in their supply chains. Researchers can improve business knowledge and subsequent action by working in partnership with businesses to improve access to research, data and measurement.

Google images 'economy Wales'



Google images 'economy Scotland'



POLICY

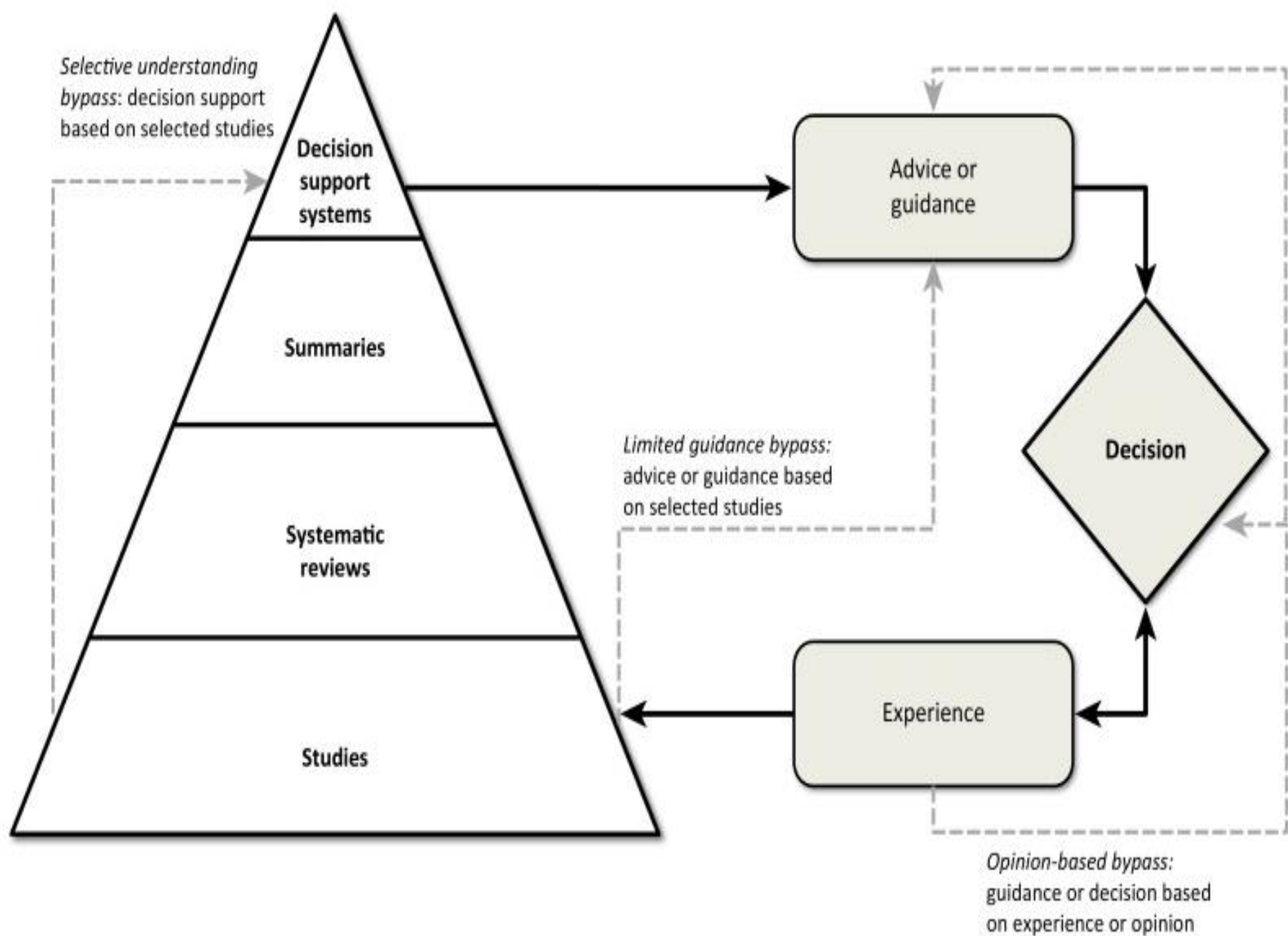
Identifying key knowledge needs for evidence-based conservation of wild insect pollinators: a collaborative cross-sectoral exercise

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Disseminating results

There is a need to express the scientific results of natural capital research in language that is easily understood by businesses and land-users working with green, blue and built infrastructure.



It is vital to get the details right

The success of these projects depends on fitting them to their context and ensuring the details are right.

For example:

Green roofs can have benefits in terms of rainwater management, energy conservation (insulation and cooling) and habitat for biodiversity e.g. city-wide project in Basel, Switzerland

But...



It is vital to get the details right

Green roofs:

- Evidence shows success is highly variable
- Many unsuccessful due to location, creation or management e.g.
- The depth and type of substrate is critical for minimising water runoff.
- Substrate is also vital to ensure long-term survival of biodiversity.
- Planting must be appropriate to the site and substrate.

e.g. Building regulations in Basel have required the use of vegetation on new roofs since 2002. However initially had limited benefits. A second campaign (2005-2006) improved after specifying requirements.

It is vital to get the details right

Planting trees in urban areas can have benefits by reducing pollutant (ozone, nitrogen dioxide, and particulate) exposure.

Ozone effects increase with urban heat island effect

But...

Varies with whether trees are deciduous or evergreen

Varies with species e.g. leaf size, hair density and leaf wax

Varies with height and street structure

Trees vary in production of damaging Volatile organic compounds especially isoprene and the monoterpene

Canopies can reduce mixing (canyon effect)

Varies with location

Planting and maintenance influences success

Information not collated!

Based on collated evidence, what is the effectiveness of interventions on farmland for enhancing natural pest regulation?

Classification	Example
Beneficial	<ul style="list-style-type: none">• Combine trap and repellent crops in a push-pull system
Likely to be beneficial	<ul style="list-style-type: none">• Allow natural regeneration of ground cover beneath perennial crops
Unknown effectiveness	<ul style="list-style-type: none">• Allow natural regeneration of ground cover beneath perennial crops
Trade-off between benefits and harms	<ul style="list-style-type: none">• Combine trap and repellent crops in a push-pull system
Unlikely to be beneficial	<ul style="list-style-type: none">• Create beetle banks
Likely to be ineffective or harmful	<ul style="list-style-type: none">• Incorporate plant remains into the soil that produce weed-controlling chemicals

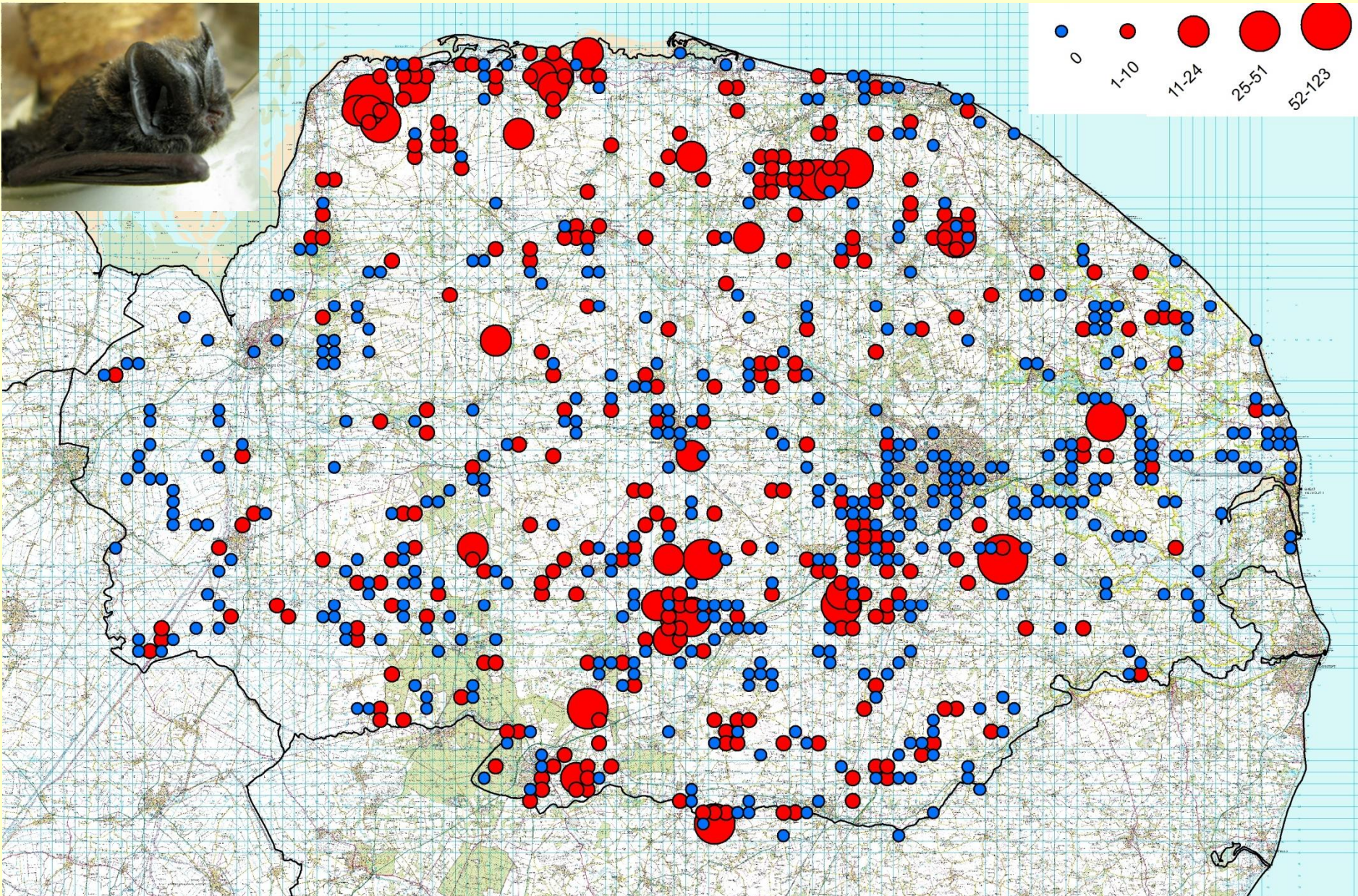
Improved monitoring

The UK is one of the best monitored countries in the world, and can provide considerable data and knowledge about components and functions of natural capital.

Despite this, we do not have an agreed set of metrics, frameworks nor baselines with which to judge the current state, trends and future direction of natural capital in the UK and there is a lack of security of funding for some long-term monitoring programmes.

Greater consistency in monitoring is needed to make the most of our wealth of information and to systematically examine the benefits that natural capital provides.

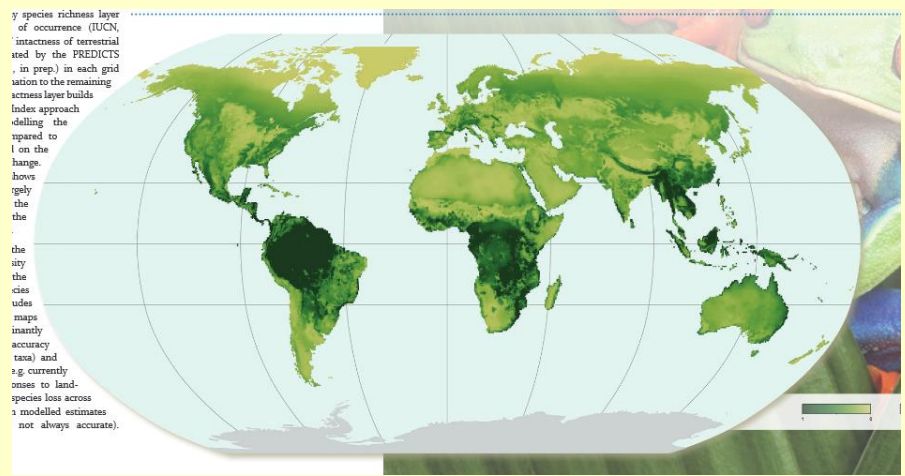
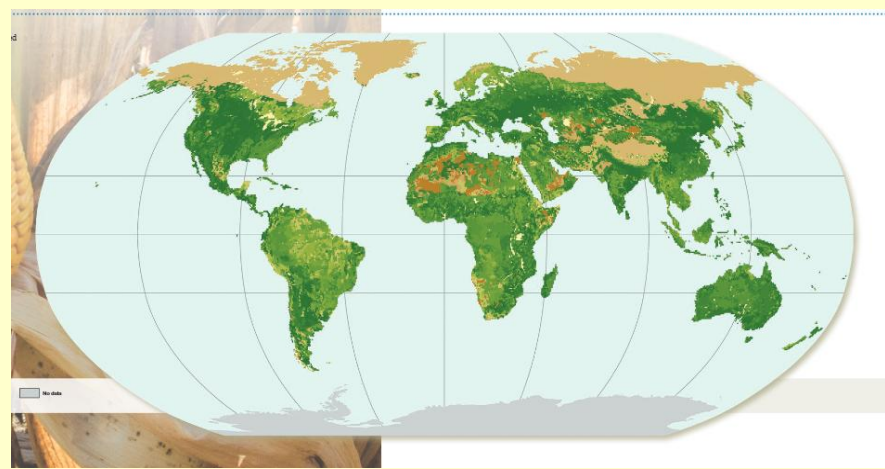
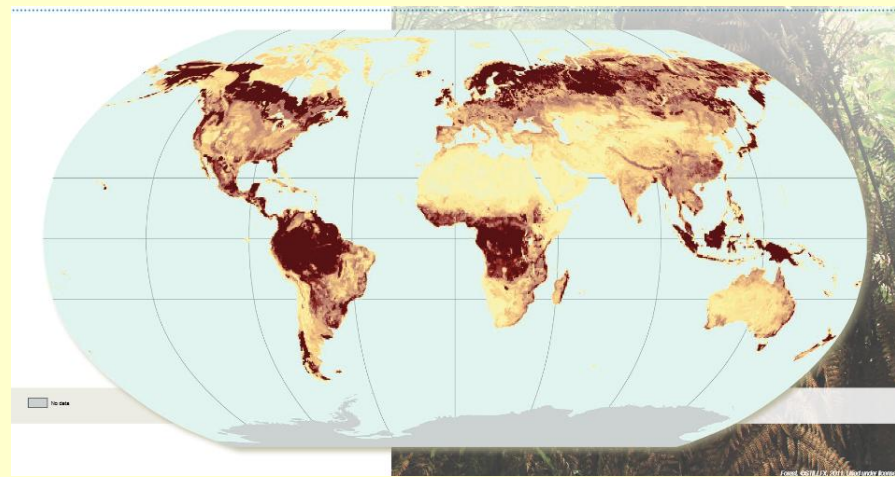
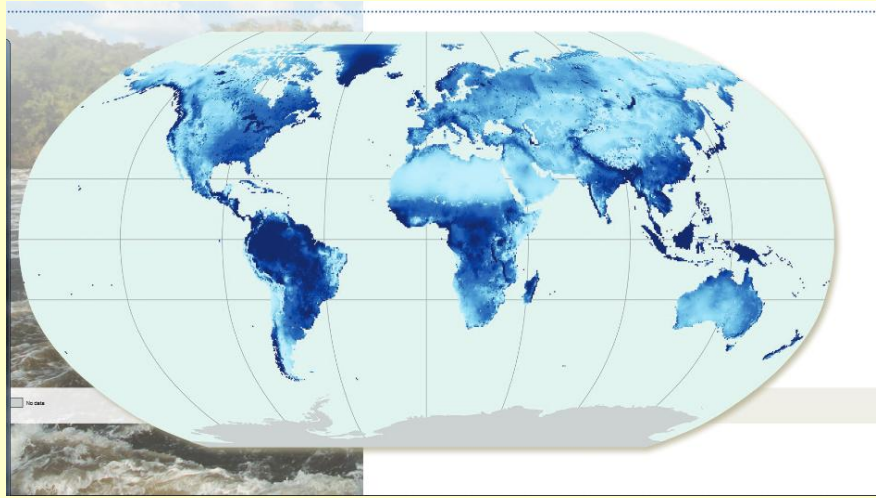
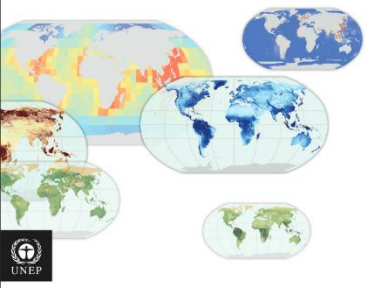
Barbastelle (0.4% of total recordings)



More accurate mapping at appropriate scales

Mapping not only provides effective communication and visualisation, but also assists land managers, environmental practitioners, local authorities and others to take natural capital into account in decision-making. Understanding where natural capital assets are located and who benefits from them enables better outcomes.

Towards a global map
of natural capital:
key ecosystem assets



Measuring cultural services

Measuring cultural services is an intellectual and technical challenge; good outcomes are achievable, but techniques must take into account the differences in value assigned by different groups of people to natural capital and the services it provides.

ECOSYSTEM SERVICES

Supporting

- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

Provisioning

- FOOD
- FRESH WATER
- WOOD AND FIBER
- FUEL
- ...

Regulating

- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

Cultural

- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

Forests

1. Limit use of heavy machinery in forestry operations to avoid soil compaction.
2. Retain forest cover on steep slopes.
3. Avoid felling operations during rainy seasons
4. Switch plantation forests from coniferous to deciduous to reduce acidification.
5. Plant forests at lower densities.
6. Practise alternatives to clearfell, such as continuous cover forestry.

Terrestrial Wetlands

1. Maintain and enhance natural wetlands.
2. Restore wetlands in areas of groundwater recharge.
3. Re-vegetate bare peat to increase surface roughness.
4. Use geo-textiles to arrest peat erosion.
5. Reconnect rivers with floodplains to enhance natural water storage.

Freshwater

1. Encourage re-vegetation of riverbanks (such as through livestock exclusion, and/or direct planting).
2. Increase up-stream structural diversity (such as through the re-introduction of beavers).
3. Reduce canalisation and create channel diversity to reduce speed of flood transmission.
4. Re-meander rivers (where they have been artificially straightened) to help reduce speed and height of flood peaks.
5. Encourage targeted re-vegetation of riverbanks through livestock exclusion and assisted regeneration.
6. Restore riparian vegetation to assist in reconnecting rivers with floodplains and to provide

Conceptual framework in place

Practical implications understood

Evidence & tools available

Good examples of implementation available

Mainstream adoption of good practice