UK TEPoP 2023: TEPoP and Climate Change: Challenges, Risks and Solutions

Workshop: Climate change opportunities and challenges
Monday 6th November 2023

What challenges does climate change bring to biodiversity monitoring, and how can TEPoP schemes best prepare for these challenges?	
Challenges	How can TEPoP schemes best prepare for these challenges?
• **Changes to species distribution:** surveys that target core areas can miss an increasing proportion of populations; range shifts can make automatic classifiers harder to verify; new cryptic species might get misidentified (e.g. Kuhl's pipistrelle vs. Nathusius' pipistrelle); do we need different ways of communicating population changes (at UK and country level), given likely range shifts?; range shifts in places that are typically unsampled may not be detected. • **Separating climate change pressures from other pressures**: climate change pressures acting at large scales may mask pressures working at smaller scales; challenges in separating climate effects from other pressures (e.g. impacts of nutrification). • **Ensuring good scheme coverage:** consider the range of intensity of climate change exposure across the landscape; ensure schemes are monitoring the most vulnerable species and habitats. • Use of indicator species are more likely to show losses than gains. • **We need to better understand impacts**: there is a need for a better understanding of ecological processes and interactions, as well as changes in pattern (distribution, abundances etc.); we need an improved understanding of the range and complexity of climate change impacts on species; there are difficulties with using multi-species indicators due to varying impacts of climate change on species; there are unanticipated/non-linear responses of organisms to extreme weather (e.g. pollinator behaviour stops in extreme heat). • What is the scope to change monitoring while maintaining long term data sets?	• **Monitor habitat change:** make use of EO data; though labour intensive, more ground truthing may be necessary. • **Consider the design of surveys and what additional data is needed**: including indicators of ecological function and resilience; consider ultimate objectives of the monitoring schemes – does the design enable impacts of climate change to be properly understood?; develop localised (adaptive) sampling methods; gain greater statistical understanding of impacts; include monitoring of effects of climate change and climate change risk analysis in survey design; adapt and regularly review and update monitoring protocols to account for changing climate conditions and shifting distribution of species. • **Adjust our advice for volunteers**, for example, regarding heat exposure. • Build resilience in volunteer base for schemes and squares (e.g. some volunteers may no longer have access to vehicles once transition to electric is made). • **Improve site location**: look at the distribution of sites compared to climate exposure maps; ensure that samples are representative of habitats and species. • Build space in workplans to look at what needs to happen in the coming years. • **Reassess assumptions**: most of our trend models assume a constant phenological pattern through time – this is probably not going to be a realistic assumption; being careful with simply relying on stats and assuming linearity of relationships.

• **Phenology changes:** phenology changes may cause mismatches between volunteer visit timing and when species are best detected; seasonal climate affects people's participation timing (might hide effects/confound them with season effects). • How do we reach the right people to make sure there's awareness of evidence and it's used in the right way? • Challenges surrounding reducing the carbon emissions impact of schemes. • **Impacts on detectability:** e.g. heatwaves lead to plants drying out – so detectability depends on idiosyncratic effects earlier in the year. • **Volunteer access and health and safety**: challenges for volunteers accessing sites during extreme weather events (fire risk, flooding, extreme heat); consider the impact on the health and safety of volunteers, and then the impacts of survey coverage per habitat/species. • Sampling bias towards warmer regions. • Challenging for SSSI monitoring as we are monitoring geographical regions compared to a set of species/habitats that should be there but have/will move due to climate change. • Harder to find species affected by climate change. • Coastal erosion may change the area of some sites. • Defining what good looks like and what we are monitoring against at different scales (e.g., Protected Sites).	• Account for weather dependant detectability. • **Alter/extend sampling season** to account for phenology changes and timings of 'expected' events; allow guidance of time of year to visit sites to differ between regions of the UK.

What are the priority evidence needs to be able to address climate change questions, and how can we make sure that TEPoP data can answer these questions?	
Priority evidence needs	How can we make sure that our data can answer these questions?
• **Develop ways to improve our understanding of ecosystem impacts and species interactions**: develop measures or indicators of ecosystem; understand the complexities of climate change impacts (e.g., apparently positive impact of horseshoe for over-winter survival vs. possible negative impact of changes in insect prey annual cycles); predict future species assemblages change including the impacts of range expanding species. • **Increase the ability to inform decision making** at different scales; what is the best way to prioritise which are the habitat types to be restored and/or created in compensatory habitat, and where?; identify zones of action in the UK for species management plans – "safe" zones, "support required" zones "likely to be lost even with conservation action" zones; how will habitat definitions change over time considering they are formed by their constituent species which will change; use scheme data to inform climate change adaption/mitigation (e.g. tree planting, wind and solar planning, identify climate refugia). • **Collect habitat data** on national scheme survey squares at regular intervals to monitor change. • **Collect data on rarer species and habitats** as these may be the ones where climate impact can be seen more readily. • **Understand species range and abundance changes**: measure species' dispersal distances; understand complexities (e.g. many butterflies and moths are expanding their distribution but declining in abundance); use data to show and communicate climate change effects and likely future distributions; create a new bird atlas to assess range changes. • **Collect and include environmental data** with the biological records (e.g. weather, habitat changes etc). • Ultimately, how is climate change affecting biodiversity? What does it mean? And how can we mitigate negative impacts? Note, "what does it mean" is a societal values question, not a scientific one (e.g., ecosystem services, but also conservation ethics of declining/expanding species). • Think in a European futures climate viewpoint, not just UK.	• Understand how TEPoP data is being used by government in relation to reporting/targets etc., and particularly in relation to climate change - can it be used more? • Understand evidence and data needs beyond government, business, finance, insurance. • Understand evidence priorities regarding land use planning, effectiveness of nature-based solutions and indicators, and how to link to the right end-users. • Decide on a consistent way across schemes to include environmental data with biological records, such as what environmental data is being included. • Link structured surveys (e.g. BBS) with unstructured ones (e.g. RBBP) to take rarer species into consideration. • Increase access to where climate change adaption is occurring. • Need open access data. • Consider all effects of climate change on the outputs of schemes – for example not just abundance or occupancy, but also activity levels and phenology. • Co-locate data to assess the broader impacts of the loss or arrival of species on other species in the ecosystem. • Be adaptable in our schemes (e.g. opportunities for 'add on' experiments and individual focused design to increase coverage or address questions in the short term). • Use our existing methods in new places/ways to address specific questions. • Develop and use new statistical methods to help compensate for driven changes. • Analyse weather dependant detectability. • Understand what the most effective options for reducing climate change impacts are for particular species.

• **<u>Contribute to climate change indicators.</u>** • **<u>Understand impacts of extreme events</u>** (flooding, fire, droughts etc). • Understand direct effects vs. indirect via habitat change. • Collect more data.	