Environment and Rural Affairs Monitoring & Modelling Programme

ERAMMP Year 1 Report 23: Options for a Synthetic 'Well-being of Future Generations' Indicator 44 (Biodiversity)

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Contents

Abbreviations and some of the technical terms used in this report are expanded in the project glossary: https://erammp.wales/en/glossary (English) and https://erammp.cymru/geirfa (Welsh)

1 Background

The Well-being of Future Generations (Wales) Act (2015) (WFG) requires an indicator to measure the "status of biological diversity in Wales"[1]. Initially this was expected to be based on the status of priority species (distribution) equivalent to the JNCC C4b indicator[2]. Here we explore further options.

A component of the Glastir Monitoring & Evaluation Program (GMEP) tested the feasibility of producing indicators based on unstructured species records for those section 7 species having enough recorded information within Wales to support robust trends over time. To ensure consistency with the UK approach at that time, the indicator was based on priority invertebrate species only. Toward the end of GMEP, trends were also produced for a wider pool of 1,990 species from 18 poorly studied groups (Annex 14 in Emmett and the GMEP team, 2017). Methods for production of trends from unstructured species observations have developed rapidly in the past five years (van Strein et al 2013; Isaac et al 2014). As a result a much larger number of taxa from a wider range of species groups are now included at the UK level. The method is however, still reliant upon sufficient records to produce robust trends. A question that was not addressed in GMEP is whether these new methods could be applied to the more plentiful species records held and continually updated by the Welsh Local Environmental Record Centres (LERC)? If so this would support a more taxonomically comprehensive priority species indicator. This question is being addressed as part of a wider ranging review of the role of LERC data in supplying evidence needs within Wales.

This briefing note explores the possibility of developing an indicator not based solely on priority species but recognises that there are, in addition to many threatened taxa, a wide range of common species more likely to be seen and heard by people and which, by virtue of being common and often being abundant where present, play a major role in the delivery of ecosystem services (Gaston 2010; Smart et al 2017). This is not to question the value of the rarest species but to suggest merit in exploring an indicator that measures change in the wildlife people are more likely to experience across Wales. At UK level the focus on combined country lists of 'threatened' species to form the UK C4 indicators is partly driven by Aichi Target 12[3]. Since indicator 44 is required by domestic Welsh legislation there is scope for considering a wider pool of schemes and species based on Welsh data only.

Options are considered that focus on the use of species distribution data only. While recognising that biodiversity also includes habitat diversity this is covered by Indicator 43 (Area of healthy ecosystems). Joint analysis of the data contributing to both indicators 44 and 43 could be desirable in future. For example, the relationships between biodiversity and semi-natural habitat extent were quantified during the development and measurement of the High Nature Value Farmland concept in GMEP (Maskell et al 2019). Conveying the changing correlative relationships between habitat extent and diversity would seem to align well as a contribution to measuring SMNR and the components of resilience. This note considers options for Indicator 44 and so focusses on the use of species data only.

[1] https://gweddill.gov.wales/docs/desh/publications/161115-national-indicators-for-wales-technical-document-en.pdf
[2] http://jncc.defra.gov.uk/page-6850
[3] https://www.cbd.int/sp/targets/

2 Criteria for monitoring schemes & species records to contribute to indicator 44

A number of options exist for constructing a cost effective indicator of biodiversity for Wales. Key criteria for selection of contributing data and schemes are likely to include the following:

1. Coverage of a wide range of terrestrial taxa including common and rare species.
2. Scheme has a secure lifespan into the future.
3. Scheme is based on a structured design where lack of spatial bias means that results can be interpreted as representative of Welsh populations.
4. If including unstructured records or a scheme with known spatial and temporal bias then derived data is amenable to analysis so that biases can be quantified and accounted for, either by:
    a. selecting subsets of well-recorded species and their records
    b. joint analysis of multiple data sources using a common analytical framework
    c. introducing appropriate uncertainty, which includes modelling variation in the detectability of each species where possible[4]
    d. carefully managing the aggregation of results across species and species groups so as to avoid global averaging or biased signals due to the overwhelming influence of certain groups[5].

Because of the lack of dependence on funding to support the recruitment and deployment of recorders, structured citizen science surveys that employ volunteer effort are more likely to satisfy the requirement that they will continue into the future albeit dependent on continued interest and uptake. Where the sampling design is based on dispersed representative fixed units then derived species trends are also less likely to be bedevilled by spatial and temporal biases in recording effort.

Structured, volunteer-based schemes that have been proven to deliver species distributional trends in Wales are the Breeding Bird Survey (BBS) (see Figure 7, page 24 in Natural Resources Wales 2016; pages 36 and 43 in Emmett et al 2017; and the Butterfly Monitoring Scheme (BMS[6]).

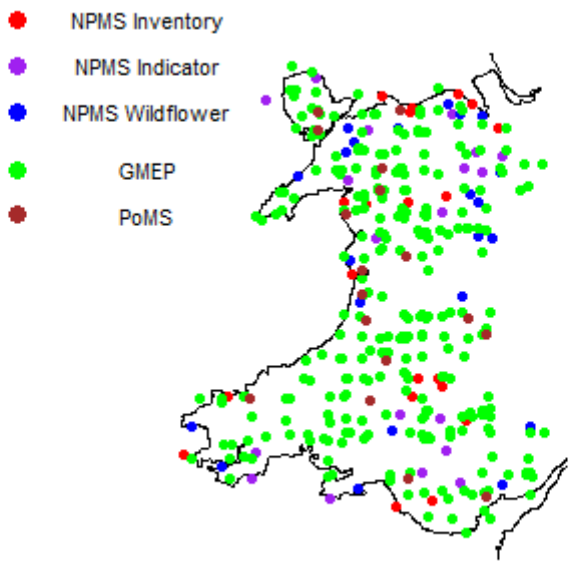
[4] However, no technique exists that can create data where none exists. Therefore presentation of material in supplementary annexes supports transparency when interpreting species trends that maybe derived from spatially highly biased records. Colleagues at the Biological Records Centre, Wallingford have established expertise in supporting the derivation and presentation of indicators based on sparse, unstructured records (Outhwaite et al 2018; Isaac et al 2014).

[5] For example, the current aggregated UK trends indicator for priority species appears to reflect the large number of contributing lichens and bryophytes and their likely response to recovery from atmospheric sulphur deposition since the 70s (Pgs 8-9 in http://jncc.defra.gov.uk/pdf/UKBI2018_TechBG_C4b.pdf).

[6] http://www.ukbms.org/docs/reports/2017/Country-level%20Summary%20Tables%202017.pdf

Two further volunteer-based schemes that are attempting to build capacity in Wales are the Pollinator Monitoring Scheme (PoMS[7]), designed to record pollinating invertebrates and their floral resources and the National Plant Monitoring Scheme[8] (NPMS) that records vascular plants with an emphasis on less common semi-natural habitats. Both PoMS and NPMS currently have low levels of uptake and consequent spatial bias in their coverage in Wales. PoMS currently surveys seventeen 1km squares in Wales. These were also recorded as part of the GMEP baseline from 2013 to 2016. At present all but two are visited by CEH staff contracted by WG but the longer term aim is for them to be adopted by volunteers (Figure 1). NPMS squares are more numerous but exhibit a bias toward lowland Wales and so tend to under-sample upland heathland, acid grasslands and bog. By design, the scheme also explicitly avoids extensive, common habitats that have received substantial agri-environment support for habitat restoration including improved grasslands, upland grasslands, bracken and woodland. However, NPMS aims to cover rarer habitats less well sampled in GMEP. It is hoped that both schemes will grow in popularity over time, recruiting more volunteers and covering more of Wales.

Figure 1: Map showing the locations of sample squares in Wales for CS, GMEP, PoMS and NPMS. Square locations are jittered randomly within the wider 10 km square to obscure their location.



In Wales, Countryside Survey (CS) and GMEP together comprise a structured design based on stratified random sampling. This ensures unbiased representative sampling of Welsh habitats but requires substantial funding to recruit and deploy surveyors to remote and often less 'interesting' areas that are generally not attractive to volunteers. The strength of the survey is its recording of plant species composition and soil in the same fixed quadrats back to 1978. Quadrat locations can be referenced to specific habitats and landscape features.

Constructing trends in individual plant species from CS and GMEP is possible because common sampling methods allow data from the two schemes to be jointly analysed. Moreover the existing CS time series allows a number of common plant species to be analysed as far back as 1978 (Burns et al 2018). Since a sample of CS

[7] https://www.ceh.ac.uk/our-science/projects/pollinator-monitoring
[8] https://www.npms.org.uk/

squares were revisited as part of the final GMEP baseline survey year trends analyses are possible up to 2016 and have been recently published for common plant species associated with linear features in the Welsh countryside (Smart et al 2017). Because of the funding commitment currently needed to repeat GMEP and CS squares, the longevity of these schemes is potentially less secure than volunteer-based schemes that have an established track record such as BMS and BBS. However, since Smart et al (2017) produced meaningful trends based on only a small number of 1km squares (n=21), it would be worth exploring whether a core set of carefully chosen common plant species recorded in a reduced number of squares could provide a secure long-term contribution to indicator 44. The merit of this approach would be the continuation of an established time-series based on robustly representative sampling of the Welsh countryside.

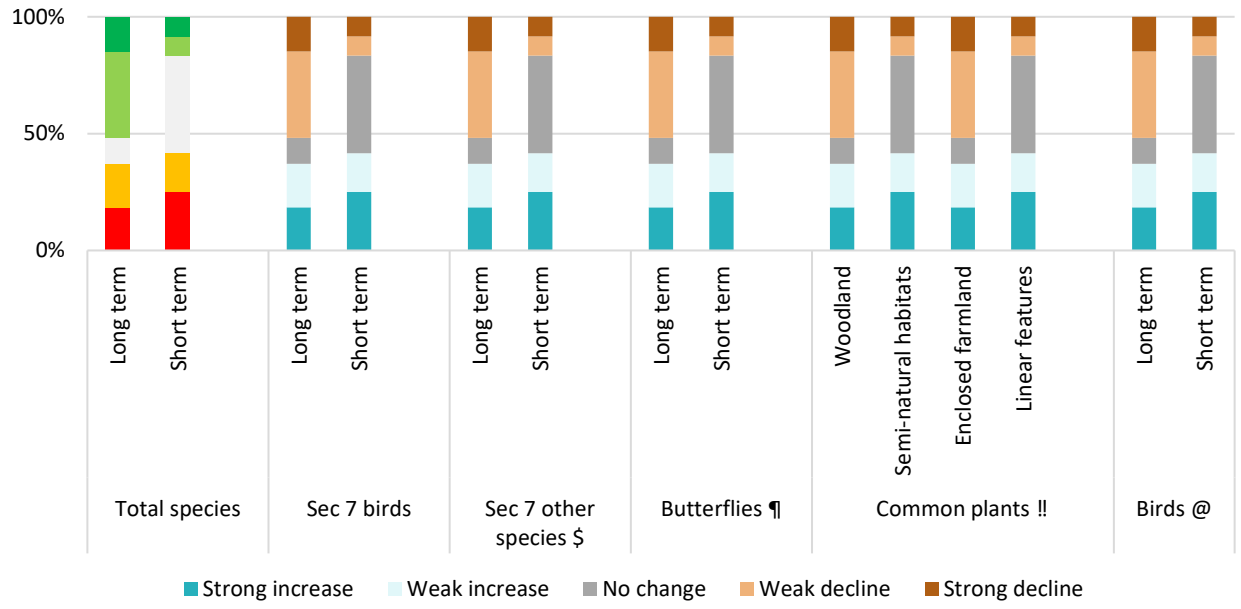
3 Options for assembling indicator 44

The biological scope of the indicator requires discussion and agreement among interested parties, principally NRW and WG. For example, should the focus be solely on section 7 species and if so could it include a more balanced mix of species and species groups by analysis of more plentiful Welsh LERC data using modern occupancy modelling techniques? The WFG Act provides an opportunity to produce a more taxonomically wide-ranging indicator than this.

A more inclusive and informative indicator could include trends in common species while data for a range of species groups could be drawn from multiple structured schemes that have already proved capable of producing trends based on Wales-only data. At its most comprehensive indicator 44 could showcase the ability of multiple schemes to robustly cover rare and common species in Wales. At present, the combined data from Countryside Survey and GMEP provide a unique and representative time series for common plant species but the dependence on continued funding for repeat survey of GMEP squares under ERAMMP make them less secure going forward.

Two well-established, structured, volunteer-based schemes – BBS and BMS – have a proven capacity to contribute Welsh trends for birds and butterflies while the role of the two new volunteer-based schemes - PoMS for pollinators and NPMS for common plants - may increase in the future. These multiple sources of data are brought together below to produce a simple ‘straw man’ for comment and criticism (Figure 2). The graph style is deliberately based on that used already for the UK C4 indicators. Therefore each bar chart summarises many individual species trends over different periods of time.

Figure 2 Proportion of species in each trend category.



$ Estimating the number of species that could be potentially analysed will be aided by an ongoing review of the contribution of Wales LERC species records to evidence needs in Wales.

¶ Presumably further subdivision into generalists and specialists could be explored.

‼ Categories are based on broad and priority habitat locations of fixed quadrats in CS/GMEP squares. Joint analysis and presentation with NPMS is also possible. The identity of the group of common plants would need agreement; candidates include the CSM indicator list compiled by BSBI for NPMS and further subdivision into plants grouped by their contribution to ecosystem services and functions. Examples could include Injurious Weeds, Nectar Plants, Nitrogen Fixers and Crop Wild Relatives.

@ Could be further split into upland/lowland or farmland woodland presumably, if there were enough data.

4 Example presentation

The UK indicators (C4a and C4b) summarise trends among priority species in terms of magnitudes of apparent change over time. For Wales, the results from different contributing schemes plus new analyses of section 7 species could be reduced to a usefully simple tally of increases, decreases and no detected change based on summarising modelled trends in a wide range of species. There are however dangers in this approach: Aggregating spatially and ecologically discrete trends can support simplistic and highly misleading narratives (e.g. Smart et al 2012) hence caution and transparency are required. For example, provision of supporting information that details all results at the most disaggregated level will aid interpretation of the species-group-specific and species-specific trends contributing to the aggregated indicator (see for example JNCC Defra UK Biodiversity Indicators 2018[9]).

[9] http://jncc.defra.gov.uk/pdf/UKBI2018_TechBG_C4b.pdf

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