

Environment and Rural Affairs Monitoring & Modelling Programme

ERAMMP Year 1 Report 16: NRW & ERAMMP Monitoring Activities Review

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Centre for Ecology & Hydrology

Client Ref: Welsh Government / Contract C210/2016/2017

Version 1.0

Date 30/09/2019



Funded by:



Llywodraeth Cymru
Welsh Government



Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

**Programme/
Project** Environment and Rural Affairs Monitoring & Modelling Programme
(ERAMMP)

Title ERAMMP Year 1 Report 16: NRW & ERAMMP Monitoring Activities Review

Client Welsh Government

Reference C210/2016/2017 NEC06297 Task 8.1

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How to cite (long) Emmett, B.A., Maskell, L., Read, D., Robinson, D.A., Smart, S.M., Garbutt, R.A., Williams, B. (2019) Environment and Rural Affairs Monitoring & Modelling Programme – **ERAMMP Year 1 Report 16: NRW & ERAMMP Monitoring Activities Review**. Report to Welsh Government (Contract C210/2016/2017). Centre for Ecology & Hydrology Project NEC06297.

How to cite (short) Emmett, B.A. et al. (2019) **ERAMMP Report 16: NRW & ERAMMP Monitoring Activities Review**. Report to Welsh Government (Contract C210/2016/2017)(CEH NEC06297)

Approved by James Skates

Signed

This document is also available in Welsh / Mae'r ddogfen yma hefyd ar gael yn Gymraeg

Version History

Version	Updated By	Date	Changes
0.1	PMO	30/4/19	Initial draft.
0.11	PMO	8/5/19	Mainly formatting edits – draft for SG
0.12-0.13	PMO	17/9/19	Formatting edits
0.14	PMO	27/9/19	Approved for publication
1.0	PMO	30/9/2019	As published

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To be reviewed in conjunction with corresponding Technical Annexes (16TA1).

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 Introduction

The aim of the Natural Resources Wales (NRW) and other monitoring activities review is to recommend where the key opportunities exist to address evidence gaps, better align activities and reduce duplication.

This should not duplicate the intensive work involving more than 40 organisations and over 100 individuals which resulted in the '[Options for a New Integrated Natural Resource Monitoring Framework for Wales](https://erammp.wales/sites/default/files/Options-for-a-New-Integrated-Natural-Resource-Monitoring-Framework-for-Wales)'¹ review which identified more than 180 monitoring schemes and provided 6 independent reviews of new opportunities for the monitoring community.

¹ https://erammp.wales/sites/default/files/Options-for-Integrated-NRMF-for-Wales-Report-Phase-1-Report-2016-11-30_0.pdf

2 Approach

A structure to frame the review was provided by NRW based on the likely structure of the next State of Natural Resources Report (SoNaRR). This structure was in the format of a table which was populated by both organisations with the aim of capturing monitoring activities likely to meet national reporting requirements by their own organisations, and also other key sources. A workshop then reviewed the combined tables to identify gaps and priorities going forward.

A series of reviews on specific topics were also commissioned by the ERAMMP team for Woodland, Soil erosion and the Land Sea Interface. NRW separately commissioned a review on freshwater monitoring.

Other sources of information concerning monitoring gaps and new opportunities included:

- Bilateral meetings between ERAMMP and different departments within NRW and the Welsh Government (WG)
- Briefing papers developed by the ERAMMP team
- Options for a New Integrated Natural Resource Monitoring Framework for Wales
- Aligned funding from CEH

3 Monitoring scope and purpose

At the workshop the following priorities were clarified:

- NRW monitoring focus is on site level monitoring to improve management with the addition of monitoring to report on the wider national picture for: freshwaters, fish stocks and distribution and extent of habitats
- The scope for ERAMMP is for fundamental evidence which can be used to inform national policy

It was also noted by NRW that SoNaRR does not cover all monitoring, for example it missed site level monitoring.

Marine was excluded from the review as it was not the specialism of the NRW-ERAMMP group convened and was not within scope for ERAMMP with the exception of the land-sea interface for which a separate review has been commissioned by WG as part of ERAMMP.

WG also confirmed freshwater should not be considered beyond the scope of ERAMMP (i.e. headwaters and ponds) as NRW had commissioned a separate review.

Specific comments raised by NRW concerned monitoring of protected sites. NRW currently only have data on Special Areas of Conservation (SACs) for which there has been recent comprehensive programme of work. Monitoring of Sites of Special Scientific Interest (SSSIs) is currently ad hoc which could not provide a coherent national picture. For Special Protection Areas (SPAs), BTO monitoring activities are relied on for reporting. In the past, country agencies in England and Scotland (not Wales) have carried out comprehensive assessment of SSSIs but for Wales the UK indicator has been used. All countries are now having to downgrade monitoring activities due to cost constraints. Environmental Observation (EO) is being assessed for habitat monitoring.

Drivers of change include a wide range of current concerns including Brexit; social structures in the farming community (e.g. aging nature of farmer population); economic issues (e.g. levels of deprivation in the rural community) etc. It was agreed these would not be included in the review.

4 Current Monitoring Activities

Technical Annex 1 provides a structured list of all current monitoring activities set against the SoNaRR likely reporting framework. Technical Annex 2 defines the 'What, Why, How and When' of these data sources. A high level summary table of the gaps, overlaps and synergies and opportunities identified with NRW is provided in Section 4.2. They are a mix of:

- exploitation of new technologies;
- more collaborative working and reporting;
- data integration;
- developing new shared protocols for emerging new priorities
- citizen science

Suggested actions / next steps were agreed at the NRW/ERAMMP workshop and are summarised in 4.2.

Note that a detailed analysis of current gaps, overlaps and synergies and opportunities for Woodlands is provided in the ERAMMP Review of Woodland Monitoring and these are not considered further here. A brief review of freshwater opportunities limited to headwaters and ponds which is the focus of ERAMMP monitoring is provided in Section 4.1.

4.1 Freshwater review

The ERAMMP freshwater review was limited to opportunities relating to headwaters and ponds as NRW had separately commissioned a review on freshwater monitoring activities which captures larger water bodies. The findings of this report are not considered further here. The advantages and disadvantages of both opportunities are summarised in reviews for the 'Options for a New Integrated Natural Resource Monitoring Framework for Wales' report and many other sources. In brief these opportunities are a realization that key opportunities for application in headwaters and ponds are a move to eDNA approaches (i.e. metabarcoding) for the assessment of ecological condition and a greater exploitation of citizen science data.

4.1.1 eDNA

Current methods are ready for field application within a national survey for diatoms, fish, bacteria and fungi but the eDNA library of UK macroinvertebrate is still incomplete. Analysis for rare and invasive species is also available. As macroinvertebrates are currently a key indicator for condition, there could be concern about a move to this approach if findings are to be linked to past surveys. One compromise could be to collect samples and carry out eDNA for parameters of interest (e.g. benthic diatoms and fish) and store homogenised macroinvertebrate kick samples (as currently collected) at -20°C (some suggest -80°C may be required) for future eDNA analysis when methods are fully developed. This approach is already taken for soils where methodologies are changing so fast, samples have to be stored so that links to past surveys are possible.

4.1.2 Citizen science

Citizen Science with respect to ponds and other water bodies is led by The Freshwater Habitats Trust. For ponds, a variety of indicators including physical structure, various taxa and also eDNA for the Great Crested Newt through their PondNet initiative (<https://freshwaterhabitats.org.uk/projects/pondnet/survey-options/>²). It is unlikely the data has sufficient coverage to enable any national metric to be provided in itself. But, the data integration approaches within ERAMMP enables combining from national structured surveys such as the ERAMMP survey with more opportunistic data to increase spatial granularity and improve confidence in trends observed. The Freshwater Habitat Trust has contacted ERAMMP and is interested in exploring future potential for collaboration, although it is likely some financial support would have to be provided for their data.

4.1.3 Opportunities identified

New technologies: To consider a move to eDNA (metabarcoding) analysis for the headwaters and ponds for diatoms and fish storing macroinvertebrate kick-samples for future analysis for macroinvertebrates (and bacteria and fungi if there is concern in e.g. particular pathogens).

Citizen science and data integration: To explore opportunities of combining data with citizen science sources. For NRW to consider opportunities for larger water bodies.

4.2 Summary of gaps, synergies and opportunities and actions

Information from these various reviews have been brought together in Table 1. A total of 27 potential activities were identified.

Table 1 Gaps, synergies/overlaps and opportunities with respect to current monitoring activities in Wales and proposed actions

No.		Gap	Opportunity	Action
Pressure				
1	Gap	On-farm GHG emissions		WG to consider overlaps and options to ensure no duplication of effort with other initiatives ongoing in WG. Any requirement to be passed to ERAMMP if considered appropriate or highlighted as suitable for others to fill.
2	Gap	Ozone damage to vegetation	Field survey approaches	WG /NRW to consider option of using ozone risk map. Citizen science option using the ozone damage app to capture damage but would need promoting by an organisation. WG to consider potential for establishing protocol to be shared by any monitoring organisation and embed in the ERAMMP survey. Decision required if option and costs should be explored.
3	Gap	Pests and disease	Field survey approaches; EO approaches; Shared new protocols for	WG to consider including tree disease reporting into ERAMMP field survey (data captured in GMEP but not reported); WG to consider commissioning the development of a simple field-based metrics for other vegetation

² <https://freshwaterhabitats.org.uk/projects/pondnet/survey-options/>

No.		Gap	Opportunity	Action
			sharing with the wider monitoring community	types of priority with WG Plant Health to include in the ERAMMP field survey; WG to consider commissioning a workshop to explore options and current activities.
4	Gap	Contaminants in wildlife	Citizen science x professional laboratory analysis	The citizen science predatory bird monitoring scheme which is supported by professional CEH laboratory analysis has been in progress since 1999. It provides information on a range of contaminants entering the food chain. Is there reporting for Wales? The new UK honey scheme will provide levels of contaminants passed from vegetation exploited by honey bees. Uptake of this citizen science scheme which is supported by professional CEH laboratory analysis could be promoted in Wales.
5	Gap	Pathogen transfer from farm to coastal waters	Joint working	ERAMMP Land Sea interface review to be asked to consider this issue.
6	Overlap/synergy	Use of EO for land use change	To compare EO products to increase comparability and quality	Already in progress as part of collaborative working between ERAMMP, Living Wales and NRW.
7	Overlap/synergy	Tracking of invasive and non-native species	Shared protocols	CEH and NRW to liaise to explore potential for aligning INNS (invasive non-native species) training for ERAMMP and NRW surveyors.
State (Extent)				
8	Gap	Protected site monitoring	Development of analogue method to exploit ERAMMP field survey to identify general condition and risk	NRW (Pete Jones) and CEH/ERAMMP (Simon Smart) to organise a workshop to consider possible approaches going forward.
9	Gap	Habitat and linear extent	EO LIDAR Combined approaches with field elements	Living Wales are exploring the potential for EO to report on habitat extent change (and condition). NRW are commissioning a LIDAR survey. We are waiting on confirmation of the specifications before the application can be assessed with respect to a wide range of potential options including woodland extent; hedge length, height and structural condition, peatland drainage, walls etc. Changes to the ERAMMP field survey will move from a field survey based approach to a combined field and EO approach to reduce costs and increase repeatability. However, many elements will be lost. Of particular note are extent and condition of various woody features including wood pasture; management of hedges and structural condition (see also diversity) etc. Option is to include some specific parameters of priority back into the field survey. Decision required to explore costs and options urgently as pilot is already in progress.
10	Gap	Soil condition below 15cm and some metrics with 15cm; Soil moisture	EO, LIDAR, data integration; field survey; common protocols for citizen science	Current topsoil assessment with GMEP/ERAMMP will be augmented in the future with other data sources of soil condition. For agency data to be used (e.g. from assessment for eligibility for future CAP replacement schemes) it is essential for the contracts to allow for data to be used. Currently this is not the case. CEH-aligned funding is also

No.		Gap	Opportunity	Action
				<p>exploring a wide variety of other sources (e.g. commercial labs; farmers etc.) and developing the approaches to combine these data to increase spatial granularity and reduce uncertainty. Samples are being stored so future priorities not being assessed due to cost constraints can be analysed at a later date.</p> <p>EO approaches are also being developed e.g. for soil moisture within the aligned funding. A network of CEH which exploits cosmic rays and in CEH situ moisture sensors will also be exploited. The extent of the Aberystwyth network and availability of data needs to be explored. These data will be used to both better understand soil water regulation; the role of e.g. drought in driving landscape and soil condition change and test and parameterise models used to explore future scenarios (e.g. Brexit; climate change; ecosystem supporting functions)</p> <p>However, the gap is (to our knowledge) that there is no monitoring of soil to depth. Some data will become available from research requirements from CEH aligned funding (a targeted programme on understanding and modelling change in soil carbon SOC_D),</p>
11	Gap	Soil erosion and landslip	EO; field and LIDAR	
State (Diversity)				
12	Gap	Protected site monitoring	Joint working / novel field data analysis	<p>Approach would involve CEH and NRW ecological specialists to meet and agree an approach involving both CEH with sense-checking by NRW statisticians (latter already agreed to participate if approved). This is to be included in GMEP outstanding analysis activity if agreed by NRW and WG.</p> <p>Note: It is recognised by all that this would only capture a representative small (2-3%) subsample of the 1000's of protected sites and does not capture the features for which sites have been designated. There are also considerations regarding GMEP data being used for statutory purposes as land owners were assured this would not be the case. A compromise could be to explore the potential of using GMEP data but include the potential use as part of the ERAMMP survey. Access permissions may however significantly be reduced if this was done. Decision by WG and NRW required.</p>
13	Gap	Pollinators	To include more sites as part of the ERAMMP field survey	The new England and Wales pollinator survey builds on the previous GMEP survey exploiting baseline data and sites but will not report at Wales-level as number of sites included from the GMEP survey is only 17 of the 300. Sites could be re-introduced back into the ERAMMP field survey or a subset of sites which would provide the most information on change linked to management interventions of interest. Decision required if costs and options are required.
14	Gap	Genetic diversity	Exploitation of eDNA techniques	<p>Already captured for soil within GMEP – not included in ERAMMP as significance of change would be challenging to interpret.</p> <p>Option to include as part of UK honey scheme for diversity of plants exploited by pollinators. Decision needed if this is of interest.</p> <p>See woodland and freshwater reviews for other options.</p>

No.		Gap	Opportunity	Action
15	Gap	Management; topographical and geological diversity	Exploitation of existing maps and databases	<p>An exploration of rare soils in Wales was carried out by CEH and published. Potential to extract a simple metric for report at national and area statement level could be explored. Decision required.</p> <p>Topographical diversity should be easily extractable from digital elevation maps. Who?</p> <p>Management information should be available from extraction from the agriculture survey data. Who?</p>
16	Opportunity	Headwaters and ponds	eDNA	
State (connectivity)				
17	Gap	Land-Sea connectivity	Non identified	Major issue particularly for migratory species. Cross-continent issues outside of Wales' control recognised for many species (e.g. birds/fish)
18	Gap	Risk element for pests and disease from connected features	Potential approach combining field data with EO and various known risk factors	There is an opportunity to explore this perhaps linking to areas of know disease outbreaks; land with known high risk factors e.g. land with uncontrolled animal access to waters etc. Could be considered as part of the proposed workshop on pests and disease and also considered in ERAMMP Land-Sea Interface (LSI) review. Decision required.
19	Overlap / synergy	Biodiversity metrics	Comparison of outputs; Combining best elements of approaches?	Three new metrics are being developed which exploit or integrate different data sources which attempt to provide simple insights into ongoing trends integrating different types of biodiversity data. A comparison of their outputs for Wales could reveal key differences.
20	Overlap / synergy	Connectivity metrics	Joint working to develop a consistent approach and unified metric	There are a number of products coming through with respect to connectivity / networking. There is an opportunity to compare and contrast these with the aim of providing one unified product (as for woodland opportunity and peatland). NRW (Pete Jones) and CEH/ERAMMP (Simon Smart) to convene a workshop to explore options.
21	Overlap / synergy	Protected Site monitoring	See above for extent	See above for extent
22	Overlap / synergy	Condition assessment	EO	<p>Living Wales is integrating a series of products to inform on ongoing change across the landscape. Many of these will inform on condition related to biodiversity change but will not explicitly inform on species change.</p> <p>GMEP developed a national ANPP product to inform on how changes in condition may be impacting on one ecosystem supporting service.</p>
23	Overlap / synergy	'Within habitat' habitat diversity	EO	<p>Various organisations have developed a 'habitat diversity' metric which describes the heterogeneity within a given landscape unit. This derives from data sources such as EO derived land cover maps or field surveys such as NRW Phase I and II. Whilst direct comparisons have not been made it is unlikely these metrics differ significantly.</p> <p>It is also possible to extract a 'within habitat' habitat diversity from land cover maps (i.e. diversity within habitat polygons). CEH's aligned funding is exploring this option and developing algorithms to capture historic change in land cover from 1990 onwards in Wales by re-analysing past spectra is also in progress to provide a change from 1990, 2007 and 2015 and 2018/19. Both of these, including condition products (e.g. GMEP ANPP</p>

No.		Gap	Opportunity	Action
				product), are being used to inform the responsive monitoring square selection for ERAMMP and being used to help understand trends observed for e.g. soil carbon.
Impact				
24		Provisioning services		All actions noted potential sources of information. IACS data for agricultural production; timber yield for forestry (LULUCF as a minimum for latter should be available?); ONS data/BGS for minerals; BGS borehole data for ground water.
25	Gap	Supporting services		It was noted the ECN Snowdon site is at risk.
26	Overlap / synergy	Resilience	Joint working	Various activities and approaches have been developed and many different workshops involving different organisations. A workshop of organisations dealing with data-led approaches including NRW/ERAMMP agreed.
27	Overlap / synergy	Management outcomes	Shared protocols and joint working	There is a need to track actual outcomes of management interventions whether from NRW, NGOs, Glastir or SMS schemes. ERAMMP are developing a subset of metrics as part of the National Park contract which will allow for intervention sites to be benchmarked against the national dataset using common field approaches and a more dynamic set of metrics for change in functions which are being specifically targeted e.g. flow; rainfall infiltration etc. This is in response to the demand from a various land owners, National Park and also various SMS in which CEH is involved. The full ERAMMP team (including National Park, National Trust etc) to ensure the practicality of these approaches. Input from NRW would be welcomed.

5 Recommendations

As the complete list of potential activities was beyond the capacity and resources of both NRW and ERAMMP, the ERAMMP Steering Group was asked to prioritise which should be followed up with a timeline for completion on the 20th Sept 2018 meeting. These three categories were identified as the priorities:

1. Habitat extent and condition data

The top priority was identified as more joint analysis of data particularly with respect to extent and condition data of habitats to support SMNR³. Other priorities were for linking to ongoing NRW Phase II survey work on peatlands and ensuring more joint working on priorities for soil monitoring.

2. EO and LIDAR

NRW were keen to work together and learn more about the ERAMMP proposed combined EO x field survey approach for assessing change in habitat extent. The extensive and well-audited datasets of habitat of NRW (and legacy bodies) could be valuable for ground-truthing of EO assessments alongside the ERAMMP field survey data. Collective working between ERAMMP, NRW, Living Wales and the wider community e.g. Defra with respect to remote sensing in general, was prioritised. The potential role of the new national programme of LIDAR was also highlighted as a potential opportunity for partnership working for connectivity and extent metrics.

3. Resilience

Joint working to develop an operational approach to reporting on resilience was highlighted. This also informed NRW priorities for elements to be included in the ERAMMP field survey to ensure an appropriate balance to diversity, connectivity, extent and condition combining field and EO approaches.

³ SNMR: Sustainable Management of Natural Resources:
<http://www.assembly.wales/research%20documents/19-002%20-%20smnr/19-002%20-%20web%20-%20english.pdf>

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