25 Year Environment Plan: Measuring Progress - Consultation Response

Yorkshire Integrated Catchment Solutions Programme (iCASP)

January 2019

iCASP

1. Yorkshire Integrated Catchment Solutions Programme (iCASP) is a five-year (2017-2022) UK Research and Innovation-Natural Environment Research Council-funded partnership established to support the UK Industrial Strategy. iCASP aims to generate £50 million+ of benefits to Yorkshire's economy by influencing investments, informing policies and strategies, identifying cost savings, and creating new products and jobs. It will do this through projects that support the use of environmental science in catchment management, including by consolidating existing evidence. As well as regional impact, iCASP is aspiring for national and international influence through sharing the experience of regional projects at the national level, and by exporting catchment management expertise and products internationally.

2. iCASP partners are: University of Leeds, University of Sheffield, University of York, National Centre for Atmospheric Science, Arup, Bradford Metropolitan Borough Council, City of York Council, Dales to Vales River Network-Yorkshire Dales Rivers Trust, Environment Agency, IUCN UK Peatland Programme, JBA Trust, Leeds City Council, Linking Environment and Farming, Met Office, Natural England, National Farmers' Union, Pennine Prospects, Yorkshire Water, Yorkshire West Local Nature Partnership, and Yorkshire Wildlife Trust. iCASP is also looking to work with additional organisations through its projects.

3. iCASP is based out of water@leeds at the University of Leeds, one of the largest interdisciplinary centres for water research in any university in the world.

4. Further information about iCASP can be found at https://icasp.org.uk/

Consultation response

5. This response is on behalf of a number of academics from across the iCASP university partners: Prof. Pippa Chapman (University of Leeds), Prof. Jonathan Leake (University of Sheffield), Dr Paul Kay (University of Leeds), Prof. Joseph Holden (University of Leeds), Dr Alison Dunn (University of Leeds), Dr Megan Klaar (University of Leeds), Dr Kevin Hicks (University of York), Dr Gordon Mitchell (University of Leeds), Prof. Lee Brown (University of Leeds).

6. The response is not on behalf of the entire iCASP partnership.

7. This response addresses two of the main questions posed by the consultation:

   Q1. Whether the proposed framework describes the environment in a meaningful way;

   Q2. Potential gaps in the headline indicators and / or system indicators and how to fill those gaps.

in relation to indicators on: soil health, air quality, water quality, and flooding.

8. iCASP would be interested in supporting Defra in the further development of the indicator framework. Further correspondence should be addressed to Robert Munroe, iCASP Programme Management, R.Munroe@leeds.ac.uk / iCASP@leeds.ac.uk

General comments

9. Detail is lacking for some of the indicators included in the draft framework making meaningful review challenging.

10. There is a strong focus in this draft framework on existing indicators/monitoring systems. This misses the opportunity to review what new information and processes would be useful to measure 25 Year Environment Plan (25YEP) progress.

11. There are currently no indicators that focus on natural capital equity/distribution. These would help to measure whether the 25YEP is delivering on the statement in its introduction 'Through this Plan we want to ensure an equal distribution of environmental benefits, resources and opportunities'. This would help to link the 25YEP to the health sector.

Indicator specific comments

12. ***H29:*** *Soil Health Indicator*. We are supportive of the Sustainable Soil Alliance's (SSA) and Prof. Jonathan Leake's, University of Sheffield, submissions to this consultation (Prof. Leake is on SSA's Science Panel and is iCASP Sustainable Agriculture Workstream Lead). **Soil Health should be included as a Headline Indicator.** Further information on this rationale is available here.

13. There is much debate about which indicators to use to monitor soil health as the most relevant will depend on the main functions the soil performs. At a minimum a composite indicator should include physical, chemical, biological and hydrological properties of soil. Key individual indicators for components of soil health that relate directly to soil functions and services include:

- Soil organic carbon
- Infiltration capacity
- Hydraulic conductivity
- Porosity
- Bulk density
- Water holding capacity
- Water stable aggregates
- Number of earthworms

14. At present the hydrological properties mentioned in paragraph 12 are not routinely monitored in soil surveys, e.g. Countryside Survey, which is problematic for understanding flood risk and flood risk mitigation.

15. Soil organic carbon content and soil bulk density should be measured throughout the soil profile and not just the top 30cm to note changes in soil organic carbon storage. This is because while several studies have observed that changes in tillage practice from conventional and deep ploughing to zero and minimal tillage result in an increase in soil

organic carbon (SOC) content in the surface 30 cm (e.g. Sun et al., 2011)[1], they find that over a greater depth (e.g. 60 to 100 cm) the SOC contents were similar for all tillage practices. This suggests that tillage practice influences the distribution of soil carbon in the soil profile, but not the sequestration of carbon in the whole soil profile and thus does not contribute to climate change mitigation, even if there are functional benefits for soil hydrological function.

16. iCASP recently completed a rapid, impartial review of academic evidence on the influence of 10 different land management activities on the indicators mentioned in paragraph 12 in order to inform the new Environmental Land Management Scheme - more information is available here https://icasp.org.uk/projects/public-goods-soil-health/

17. ***H1:** Concentrations of fine particulate matter ($PM_{2.5}$).* ***H2:** Area exposed to damaging levels of ammonia (NH_3) in the atmosphere*. At the ecosystem level, NH_3 deposition cannot be viewed alone, but needs to be considered in the context of total nitrogen deposition. Currently, critical loads for nitrogen deposition do not distinguish between reduced and oxidised nitrogen.

18. Although recent UK-wide survey work and manipulation studies have shown that the form of nitrogen deposition does affect outcomes, the situation is complex; responses may be species specific or not apparent (i.e. species are insensitive to form and only the nitrogen dose matters). Furthermore, both forms can be damaging to species, but the mechanisms underpinning the damage may be quite different, e.g. *Sphagnum capillifolium* is sensitive to both reduced and oxidised nitrogen, the former probably mediated by accumulation and toxicity and the latter via increasing cellular pH (Sheppard et al 2014)[2]. In addition, both above and below ground transformations of the deposited nitrogen form can occur (Stevens et al 2010)[3].

19. The extent of the network and thereby the availability of NH_3 concentration data at sensitive sites of high conservation status is limited.

20. The joint effects of NH_3 with other air pollutants such ozone or carbon dioxide concentrations (which are both increasing) are poorly understood.

21. ***H3:** Water tests meeting good status.* This limited description of what is being monitored for the Water Framework Directive is potentially at odds with the Environment Agency's Strategic Monitoring Review likely to recommend more targeted monitoring of particular pollution problems. We are supportive of identifying particular pollution problems in catchments using existing data, risk mapping and walk-over surveys and monitoring these monthly with additional flow-based sampling until the problem identified is resolved. Resources can then be targeted at another problem. A suite of variables to monitor could comprise nutrients, sediments, metals, polynuclear aromatic hydrocarbons, standard water quality variables (pH, Dissolved Oxygen, Electric Conductivity), but these should be adapted to the particular pollution problem being addressed, as should sampling frequencies.

[1] Sun, B., Hallett, P.D., Caul, S., Daniell, T.J. and Hopkins, D.W., 2011. Distribution of soil carbon and microbial biomass in arable soils under different tillage regimes. Plant and Soil, 338(1-2), pp.17-25.

[2] Sheppard, L. J.; Leith, I. D.; Mizunuma, T. ; Leeson, S. ; Kivimaki, S. ; Cape, J. N.; Dijk, N.; Leaver, D. ; Sutton, M. A.; Fowler, D.; Van den Berg, L. J.L.; Crossley, A.; Field, C. ; Smart, S. **2014** Inertia in an ombrotrophic bog ecosystem in response to 9 years' realistic perturbation by wet deposition of nitrogen, separated by form. Global Change Biology 20 566-580.

[3] Stevens, C.J.; Thompson, K. ; Grime, J.P. ; Long, C.J. ; Gowing, D.J.G. 2010 Contribution of acidification and eutrophication to declines in species richness of calcifuges grasslands along a gradient of atmospheric nitrogen deposition. Functional Ecology 24 478-484.

22. ***S5:*** *Pollution loads entering waters*. Limited detail is given on the pollution sources and pollutant groups that this indicator will include - there are specific determinants and groups not currently noted that should be included.

23. ***H25:*** *Emissions of nationally significant substances to the water environment.* This indicator will use the Pollution Inventory which provides information about the releases and transfers of substances from industrial activities regulated by the Environment Agency. This includes the annual emission of certain substances to air, controlled waters and land, and off-site transfer in wastewater and waste. It does not include the following: pesticide use; pharmaceuticals released into the environment via waste water or application, or sewage sludge to land (little information exists on the impact of pharmaceuticals on plant and human health or soil functioning); use of veterinary drugs and transfer to soil and water bodies; emergent contaminants (see paragraphs 27 and 28 below).

24. ***H26:*** *Exposure to wildlife to chemicals in the environment (including marine).* ***H27:*** *Effects on wildlife from exposure to chemicals in the environment*. Although pesticides are mentioned briefly in H26 and H27 in relation to plans to determine the effects on wildlife from exposure to chemicals in the environment, there is a lack of information on how this will be achieved (see paragraph 26 below). Both H26 and H27 do not mention which chemicals will be monitored - these should include emerging contaminants (see paragraph 27 and 28 below). Without this information, the indicator framework will fail to achieve two of its aims - helping to answer: (i) 'have key aspects of our environment improved?'; (ii) have the key pressures on our natural assets changed?'.

25. It is not clear from the text whether 'wildlife' includes all animals and plants - both above and below ground and in water.

26. Agricultural intensification has already increased chemical use worldwide to approximately two million tonnes per year with herbicides accounting for 47.5%, insecticides for 29.5%, fungicides for 17.5% and others for 5.5% (De et al., 2014)[4]. The impacts of this trend on soil health, above ground and below ground biota, water quality and human health are largely unquantified and there are serious data gaps: for example, Bünemann et al. (2006)[5] found no data available for the effects of pesticides on soil biota and soil functions. A recent report of the Special Rapporteur on the right to food (UNGA, 2017)[6] draws attention to the urgency of improved pesticide use policies. Therefore there is a need to link pesticide use to pesticide occurrence in different parts of the environment (not only water).

27. Contaminants of emerging concern are continually evolving and increasing, and often detected at concentrations higher than expected (Sauvé and Desrosiers, 2014; Kay et al., 2017; 2018)[7]. However, there is no specific mention of these in the indicator list. Examples

[4] De, A., Bose, R., Kumar, A. and Mozumdar, S. 2014. Targeted Delivery of Pesticides Using Biodegradable Polymeric Nanoparticles. Springer Briefs in Molecular Science. New Delhi, Springer India. doi.org/10.1007/978-81-322-1689-6.

[5] Bünemann, E. K., Schwenke, G. D. and Van Zwieten, L. 2006. Impact of agricultural inputs on soil organisms: A review. Australian Journal of Soil Research, Vol. 44, pp. 379–406. doi.org/10.1071/SR05125.

[6] UNGA 2017. Report of the Special Rapporteur on the Right to Food. Human Rights Council Thirty-fourth session, 27 February–24 March 2017. Document A/HRC/34/48. United Nations. documents-dds-ny.un.org/doc/UNDOC/GEN/G17/017/85/PDF/G1701785. pdf?OpenElement.

[7] Sauvé, S. and Desrosiers, M. 2014. A review of what is an emerging contaminant. Chemistry Central Journal, Vol. 8, No. 15. doi.org/10.1186/1752-153X-8-15;

include pharmaceuticals, hormones, industrial chemicals, personal care products, flame retardants, detergents, perfluorinated compounds, caffeine, fragrances, cyanotoxins, nanomaterials, microplastics and anti-microbial cleaning agents and their transformation products. Impacts on people and biodiversity will be mainly delivered via water and are largely unknown (WWAP, 2017)[8].

28. The following could help to address this gap:

(i) Data on pesticide use could be made mandatory for farmers to record thus application rates of different pesticides could be quantified

(ii) Data on pesticide concentrations in water bodies need to be collected and collated at a national level. Data sets on pesticide concentrations in soils and plants are sparse.

(iii) Research to determine impact of pesticides on biodiversity, aquatic and terrestrial ecosystems and human health is needed.

29. ***H5:*** *Waters achieving sustainable abstraction criteria*. Methods used to assess ecological impact within this indicator are not underpinned by scientific evidence but instead derive from outdated expert opinion, making the validity of this indicator questionable. The advances in scientific knowledge merit a more robust analysis of ecological impact and abstractions.

30. ***H20:*** *Disruption or unwanted impacts from flooding or coastal erosion.* ***H22:*** *Communities resilient to flooding or coastal erosion*. These indicators should consider communities at risk in areas where traditionally they would not qualify for engineered flood defence. In such situations the impacts of land management and better forecasting solutions to enhance resilience need to be measured.

31. ***H24:*** *Distribution of invasive non-native species and plant pests and diseases*. Baseline data for invasive non-native species distribution needs to be included, currently only disease data is mentioned in the technical description. GB Non Native Species Secretariat datasets could be used. Although the focus of this indicator is England, it would be more informative to consider distribution data at a GB level as secondary spread can occur between England, Wales and Scotland.

Kay, P., Hughes, S.R., Ault, J.R., Ashcroft, A.E. and Brown, L.E., 2017. Widespread, routine occurrence of pharmaceuticals in sewage effluent, combined sewer overflows and receiving waters. Environmental Pollution, 220, pp.1447-1455;
Kay, P., Hiscoe, R., Moberley, I., Bajic, L. and McKenna, N., 2018. Wastewater treatment plants as a source of microplastics in river catchments. Environmental Science and Pollution Research, pp.1-4.

[8] WWAP 2017. The United Nations World Water Development Report 2017. Wastewater: The Untapped Resource. Paris, UNESCO. www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2017-wastewater-the-untapped-resource/