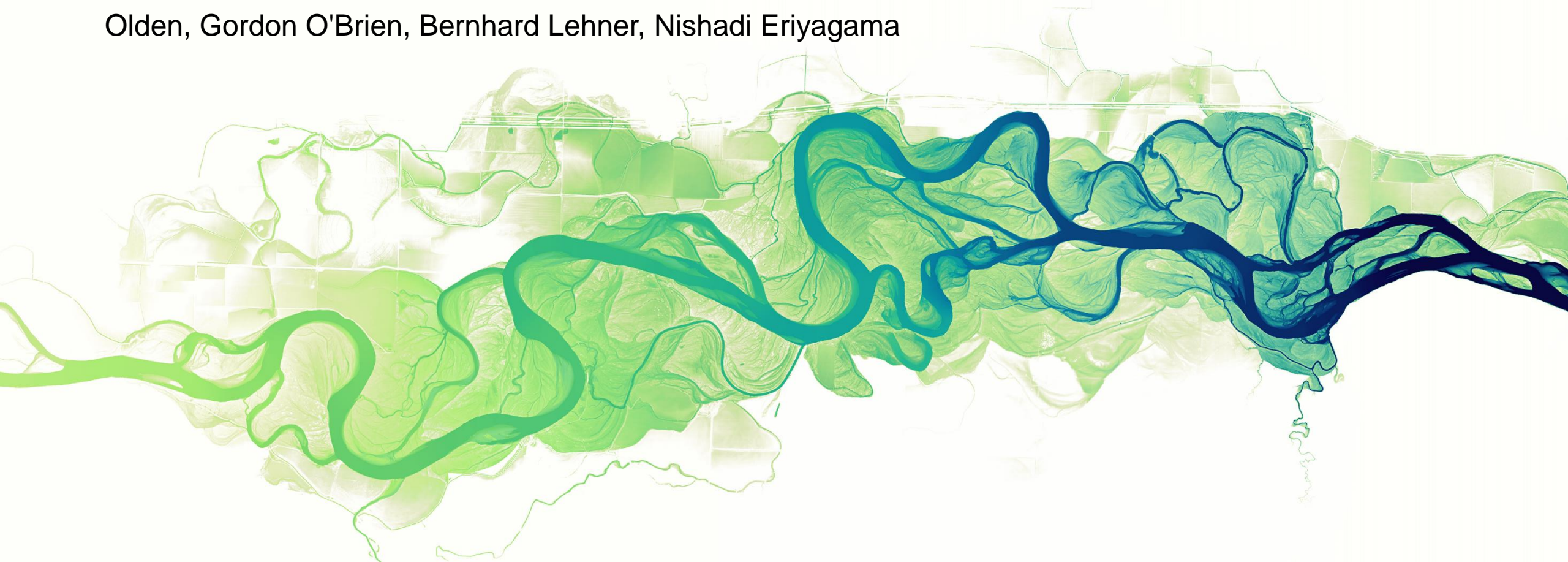
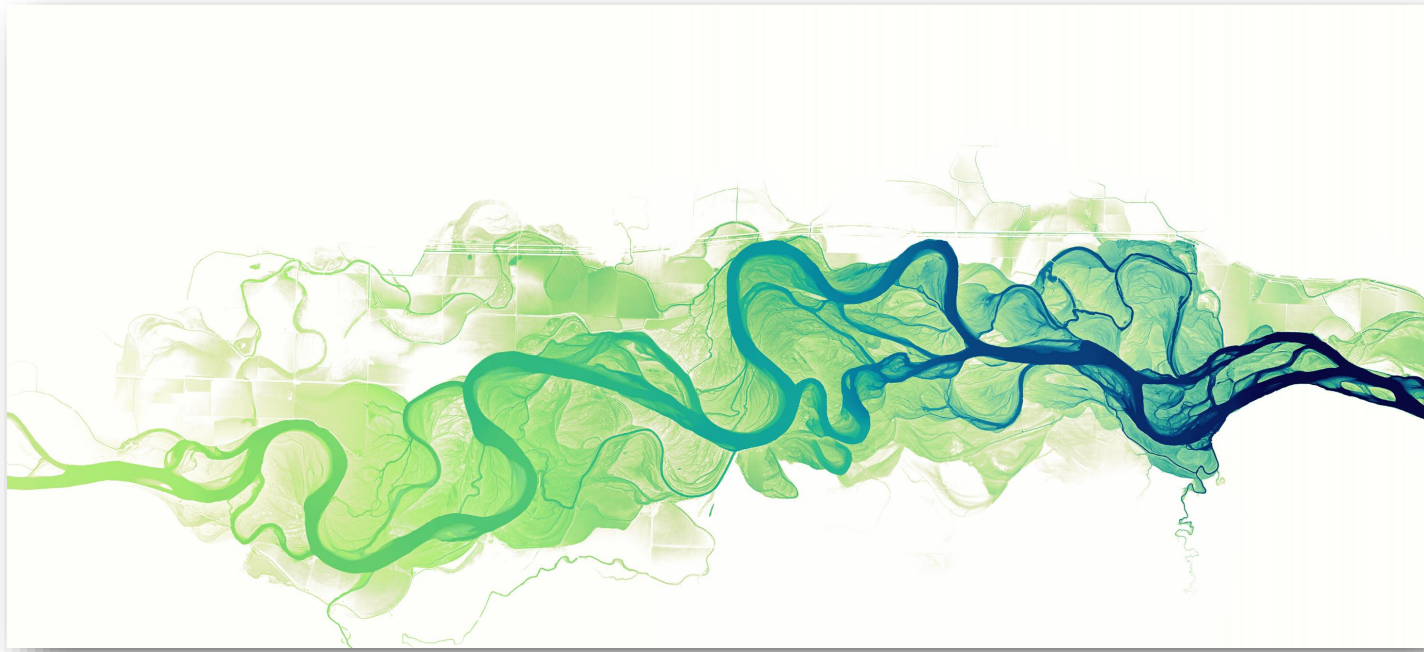


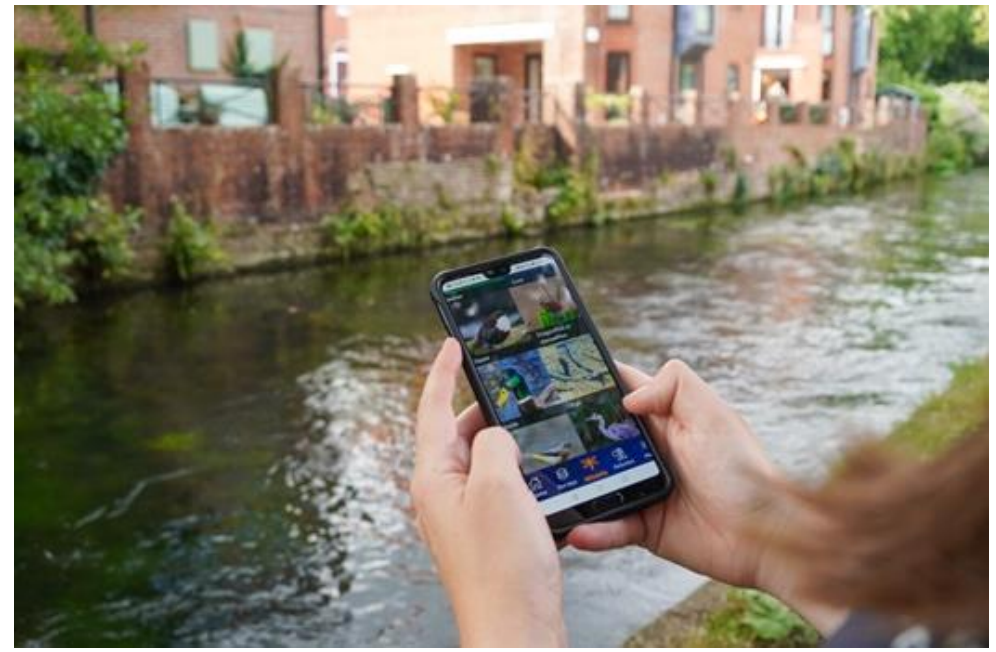
The future of global river health monitoring

Lauren M. Kuehne, Chris Dickens, David Tickner, Mathis L. Messenger, Julian D. Olden, Gordon O'Brien, Bernhard Lehner, Nishadi Eriyagama





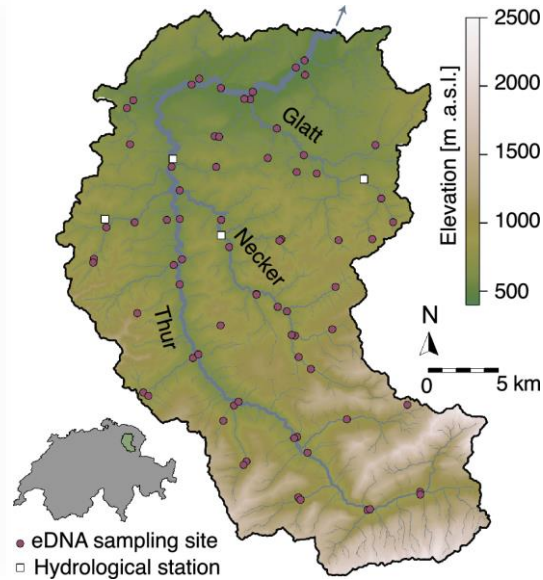
Daniel Coe – danielcoe.com



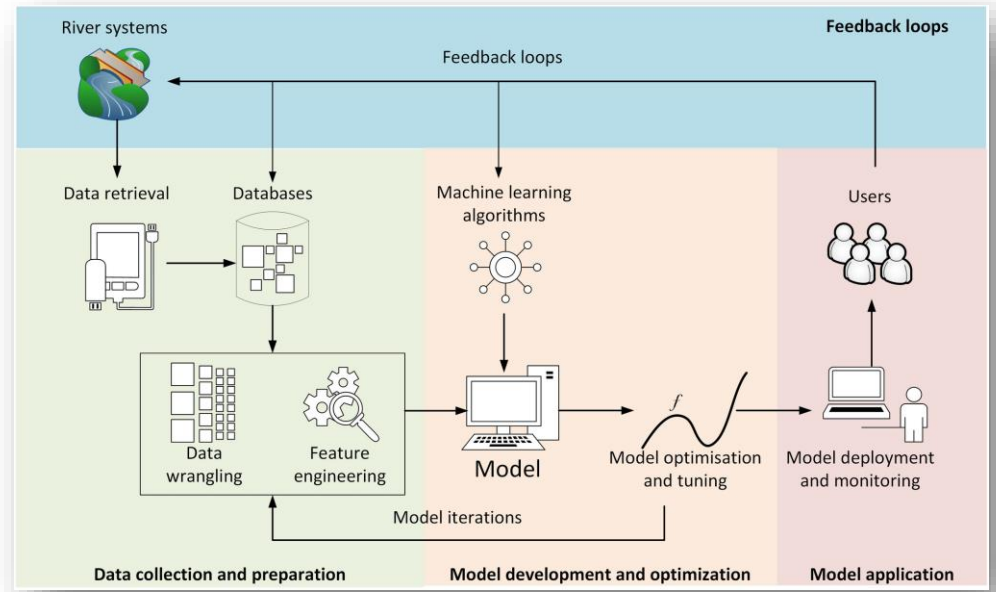
Big River Watch, The Rivers Trust



US National Park Service



Carraro et al. 2023



Ho and Goethals 2022

Why a global river health framework?

- Advocate for representation of river health and river health indicators in global sustainability initiatives (e.g., SDGs)
- Rivers don't fit inside jurisdictions
- Nearly all aspects of human society are impacted by health of rivers
- Provide a road map to focus development of current and emerging technologies to advance river health

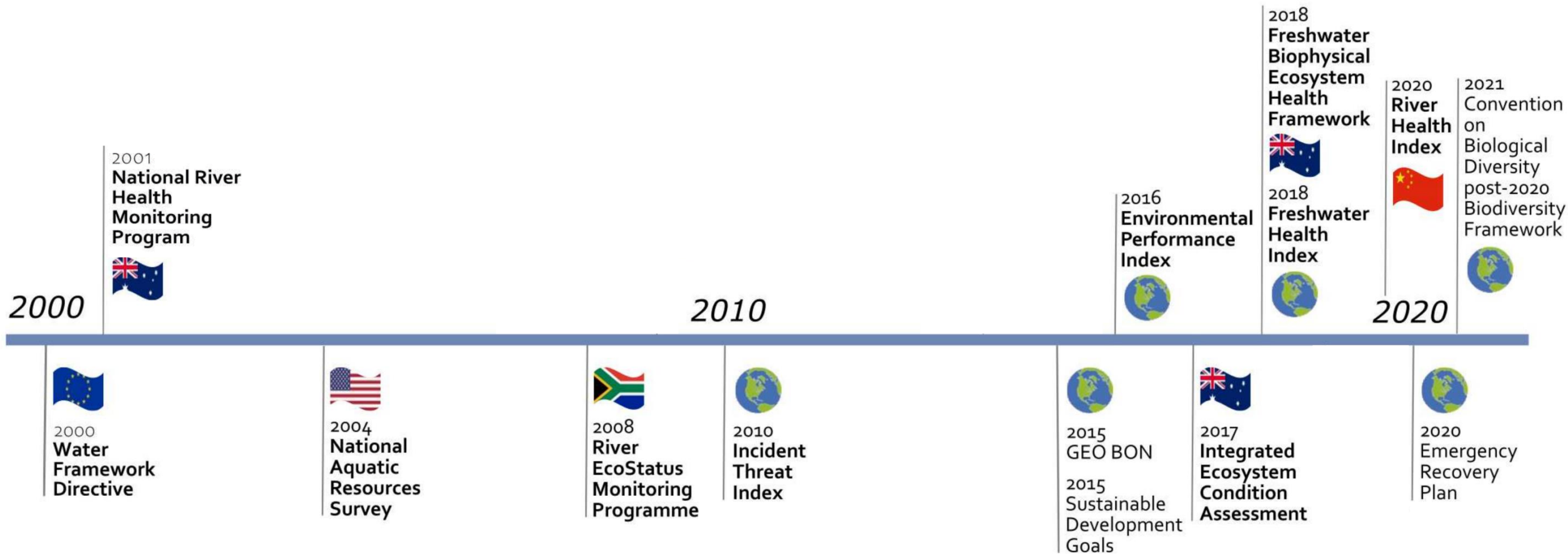
Objectives

To chart a path toward policy-relevant, global river health monitoring

- Review national and regional approaches for river health monitoring
- Identify a scalable framework of indicators



Major frameworks used to evaluate river health





Biology

Fish abundance
Fish richness
Invertebrate diversity
Aquatic invasive species
Primary productivity



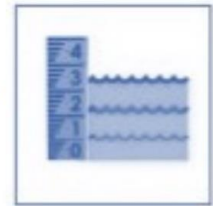
Water quality

Water temperature
Nutrient concentration
Suspended sediment
Ecotoxigants



Physical habitat

Connectivity
Channel feature diversity
Riparian vegetation
Instream vegetation



Hydrology

Surface water extent
Flow alteration

Development of the framework

- Indicators reflect biophysical conditions, to represent **ecosystem state**
- Considered **all** potential indicators, regardless of readiness (e.g., 1)
- Evaluated feasibility of implementation by **2030** and by **2050**
- Emphasized integration of three main data sources – *in-situ*, RS, and modelling – to produce spatially-explicit estimates for all rivers
- For now, excludes human valuations of rivers
- To blend both bottom-up and top-down approaches in a global framework, we call for the establishment of a standardised, common geospatial framework based on pre-defined spatial units

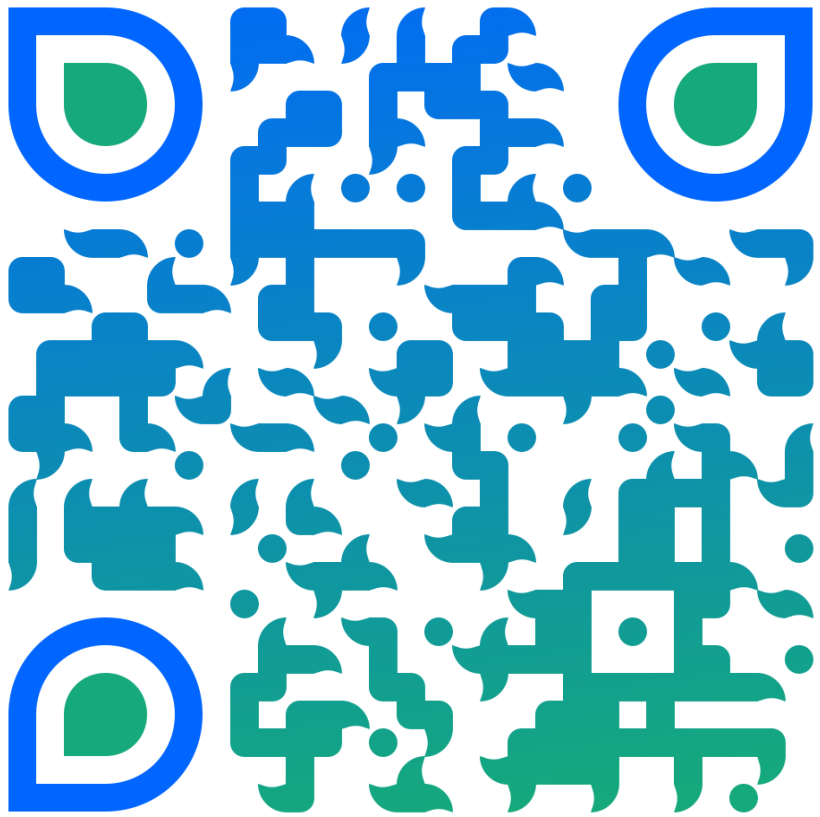
The non-presentable framework

Component	Indicator	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Indicator to regulate goal achievement	Measurement Unit, Source and Method		
												Unit	Source and Method	
Energy	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14
Water	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11	2.12	2.13	2.14
Waste	3.01	3.02	3.03	3.04	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12	3.13	3.14
Climate	4.01	4.02	4.03	4.04	4.05	4.06	4.07	4.08	4.09	4.10	4.11	4.12	4.13	4.14
Land	5.01	5.02	5.03	5.04	5.05	5.06	5.07	5.08	5.09	5.10	5.11	5.12	5.13	5.14
Air	6.01	6.02	6.03	6.04	6.05	6.06	6.07	6.08	6.09	6.10	6.11	6.12	6.13	6.14
Soil	7.01	7.02	7.03	7.04	7.05	7.06	7.07	7.08	7.09	7.10	7.11	7.12	7.13	7.14
Marine	8.01	8.02	8.03	8.04	8.05	8.06	8.07	8.08	8.09	8.10	8.11	8.12	8.13	8.14
Terrestrial	9.01	9.02	9.03	9.04	9.05	9.06	9.07	9.08	9.09	9.10	9.11	9.12	9.13	9.14
Human	10.01	10.02	10.03	10.04	10.05	10.06	10.07	10.08	10.09	10.10	10.11	10.12	10.13	10.14
Health	11.01	11.02	11.03	11.04	11.05	11.06	11.07	11.08	11.09	11.10	11.11	11.12	11.13	11.14
Equity	12.01	12.02	12.03	12.04	12.05	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14
Peace	13.01	13.02	13.03	13.04	13.05	13.06	13.07	13.08	13.09	13.10	13.11	13.12	13.13	13.14
Justice	14.01	14.02	14.03	14.04	14.05	14.06	14.07	14.08	14.09	14.10	14.11	14.12	14.13	14.14
Partnership	15.01	15.02	15.03	15.04	15.05	15.06	15.07	15.08	15.09	15.10	15.11	15.12	15.13	15.14

1. The Sustainable Development Goals (SDGs) are a collection of 17 global goals that all countries pledge to achieve by 2030. The goals are: 1. No Poverty, 2. Zero Hunger, 3. Good Health and Well-being, 4. Quality Education, 5. Gender Equality, 6. Clean Water and Sanitation, 7. Affordable and Clean Energy, 8. Decent Work and Economic Growth, 9. Industry, Innovation and Infrastructure, 10. Reduced Inequalities, 11. Sustainable Cities and Communities, 12. Responsible Consumption and Production, 13. Climate Action, 14. Life Below Water, 15. Life on Land, 16. Peace, Justice and Strong Institutions, 17. Partnerships for Goal Achievement.

Enabling factors

1. Adopting river health monitoring as a priority within local, regional, and global initiatives.
2. Committing to a common framework and coordinating efforts for methods development and data synthesis.
3. Identifying and promoting an international organisation responsible for the coordination of national or regional commitments and accountability.



Kuehne LM, Dickens C, Tickner D, Messenger ML, Olden JD, O'Brien G, Lehner B, Eriyagama N (2023) **The future of global river health monitoring.** *PLOS Water* 2(9): e0000101.

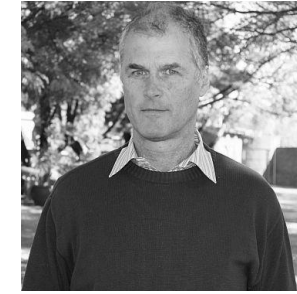
<https://doi.org/10.1371/journal.pwat.0000101>

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