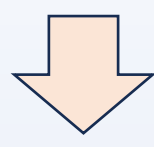
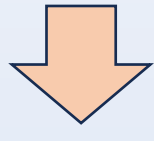


Developing national climate risk indicators of spatial and temporal variations in river water temperature for the UK.

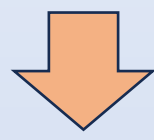
The United Nations Environment Programme (UNEP) primary goal:



To effectively incorporate climate change mitigation and adaptation measures into their respective national development frameworks.



Evidence suggests impact of climate change on rise of river temperatures will be further intensified due to heightened water abstractions aimed at meeting human water demand.



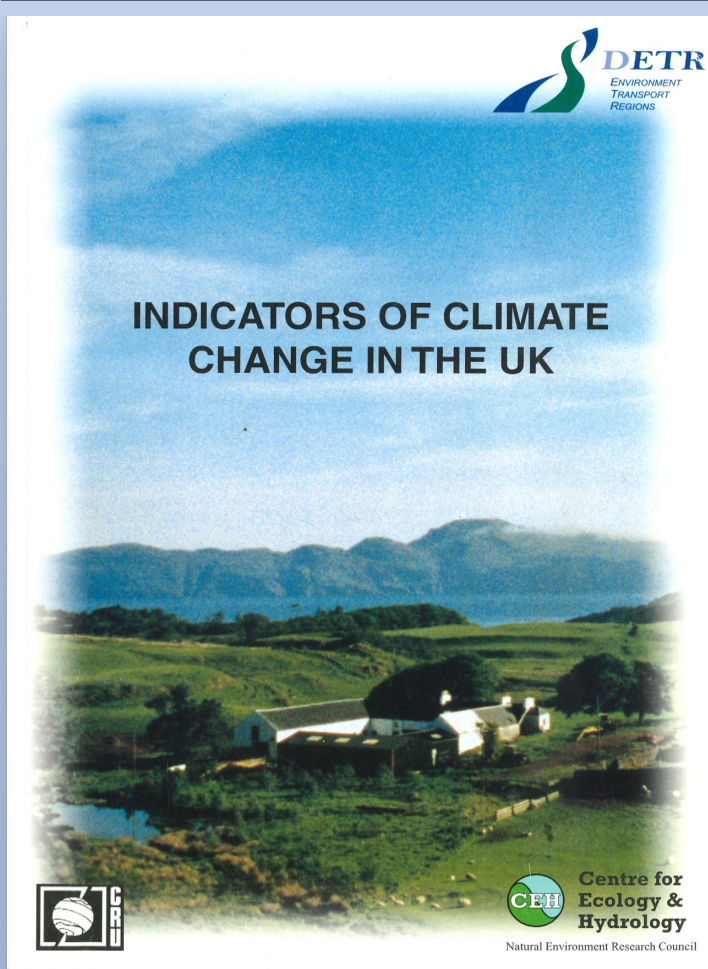
The necessary modifications entail adopting a smarter decision-led approach to incorporate climate information into climate services and water management.



“Monitoring to Manage”

Climate risk indicator
(20+ years ago)

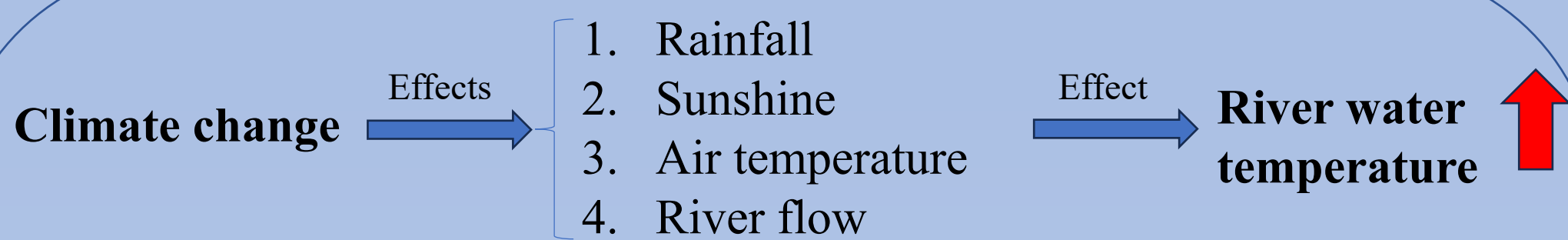
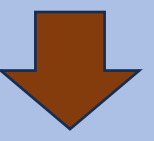
Climate risk indicator
(now)



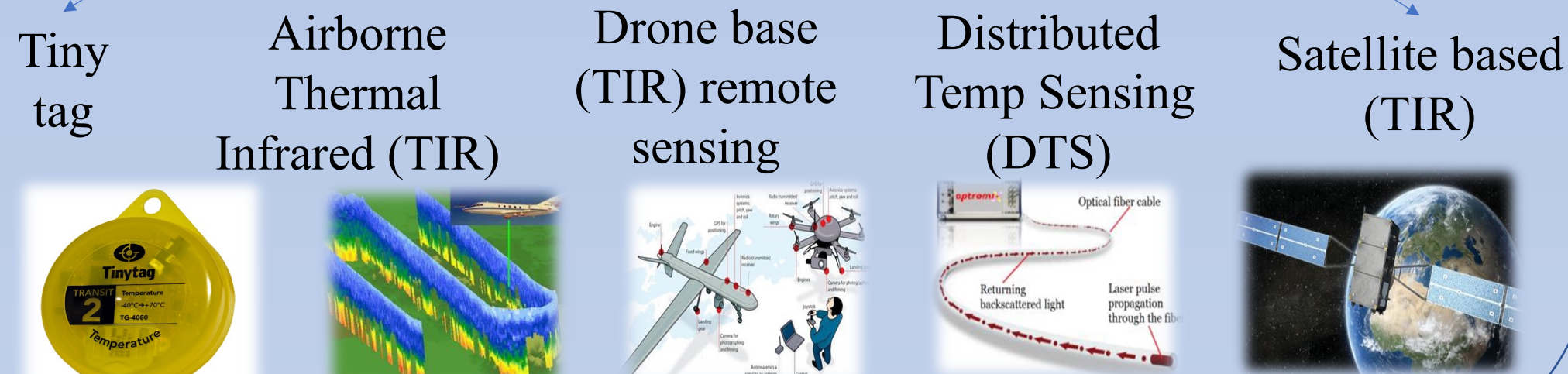
The UK Climate Change Committee uses indicators to assess trends in:

- (1) **Risk factors** (hazard, vulnerability and exposure).
- (2) **Adaptation action** (input and output).
- (3) **Climate impacts** (across various sectors and administrative units).

Source: [ADAS \(2021\)](#)



Monitoring technologies on river water temperature (Tw):



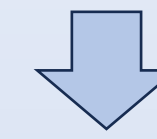
Britain takes water for granted – and we’re heading towards a crisis

Decreasing rainfall, rising temperatures, a growing population and leaky pipes are threatening to leave us parched



CREDIT: [Anthony Devlin/Bloomberg](#)

Drought and Water Temperature



Drought-related climate risks identified by CCRA3
” More action needed”
has received much less attention, compared to flooding.



The national capability to track the impacts of past and present droughts and monitor resilience to future drought risks is lacking.

Data sources :

Data source with Description	Source
Natural Resources Wales. • This Tw archive contains 42 million temp measurements at around 30 000 sites. • Sub daily data (hourly and 15-min sampling) are available for 351 sites, • Some records span several decades, but the average length is 14 years.	Archive
Surface Water Temperature Archive up to 2007	Achieve
LIDAR composite DTM 1m	Archive

Modelling: Spatio-temporal model to:

1. Provide temporally varying Tw predictions.
2. Provide improved spatial coverage and characterisation where Tw data are discontinuous.
3. Create a single metric of energy availability and a single relationship between this metric and Tw that extends across sites and time.
4. Examine the relationship between Tw and Ta, affected by landscape characteristics that influence energy exchange processes (e.g., woodland, geology/groundwater inputs).



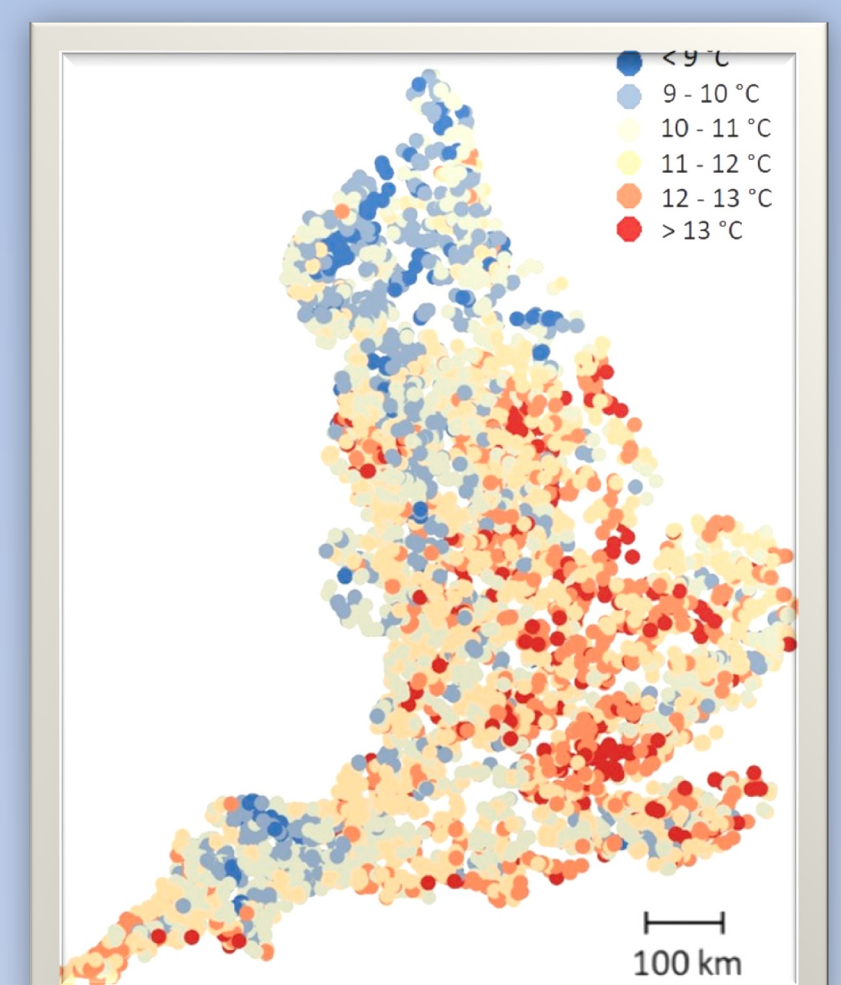
River Water Temperature
As a
Climate risk indicator
To



Underpin a priority national indicator of long-term Tw for CCRAs

Key applications:

1. Benchmarking current performance (over multiple decade).
2. Evaluating outcomes of climate actions.
3. Communicating risks to diverse audiences.
4. An evaluation of spatial and temporal changes in exposure level.



Source: [Wilby and Johnson \(2020\)](#)

References:

1. Wilby et. al (2020). Climate variability and implications for keeping rivers cool in England. [Volume 30](#), 2020, 100259
2. Tart et. al (2020). Market demand for climate services: An assessment of users’ needs. [Volume 17](#), January 2020, 100109
3. Jackson et. al (2018). A spatio-temporal statistical model of maximum daily river temperatures to inform the management of Scotland’s Atlantic salmon rivers under climate change. [Volume 612](#), 15 January 2018, Pages 1543-1558
4. Isaak et. al (2020). Thermal Regimes of Perennial Rivers and Streams in the Western United States. [Volume 56, Issue 5](#) p. 842-867
5. O’Connor et. al (2022). Relating drought indices to impacts reported in newspaper articles. [Volume 43, Issue 4](#) p. 1796-1816