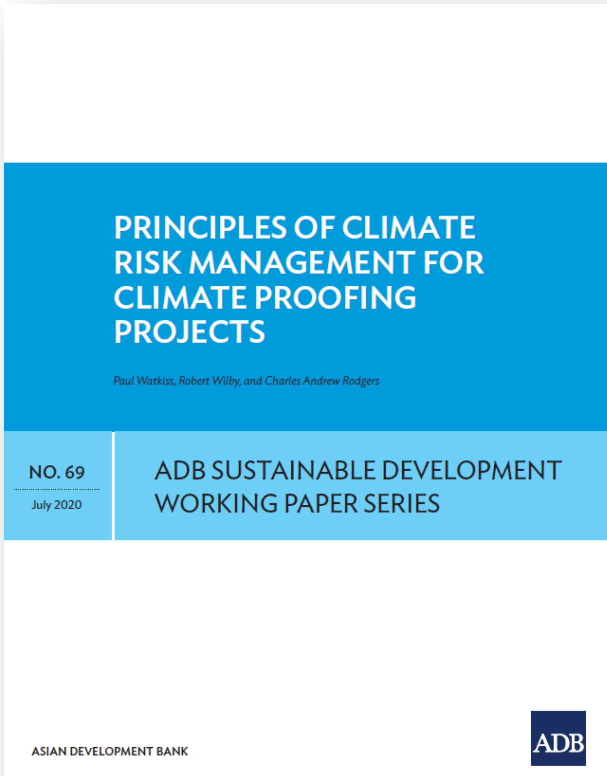
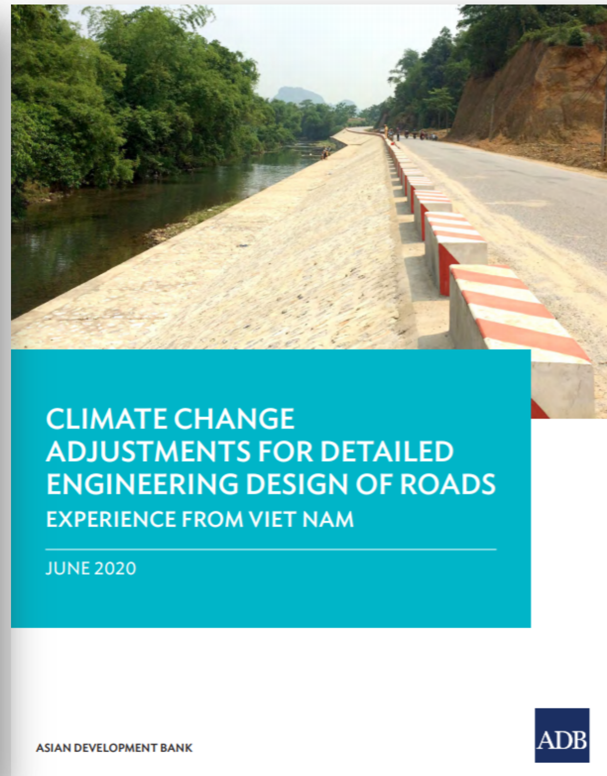
On decision support amid uncertainties
(or how not to overcomplicate matters)

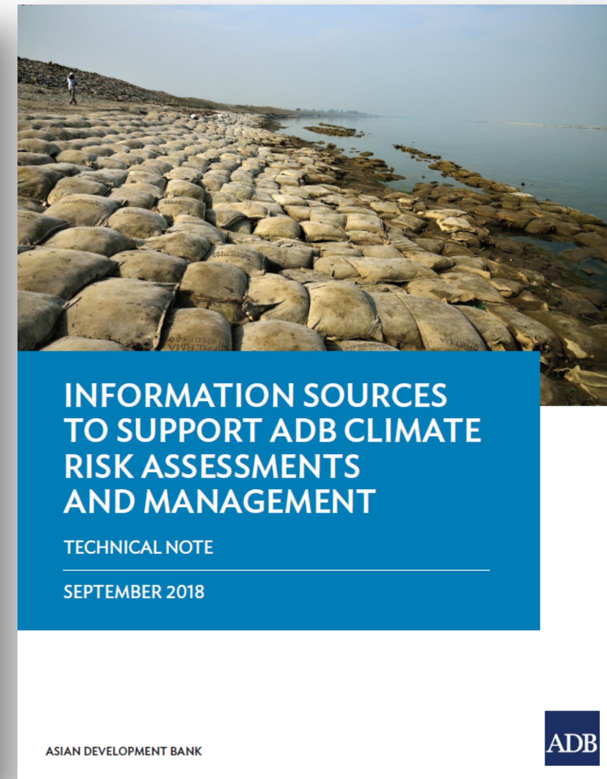
Rob Wilby, Loughborough University, UK



Source: Watkiss et al. (2020)



Source: ADB (2020)



Source: ADB (2018)

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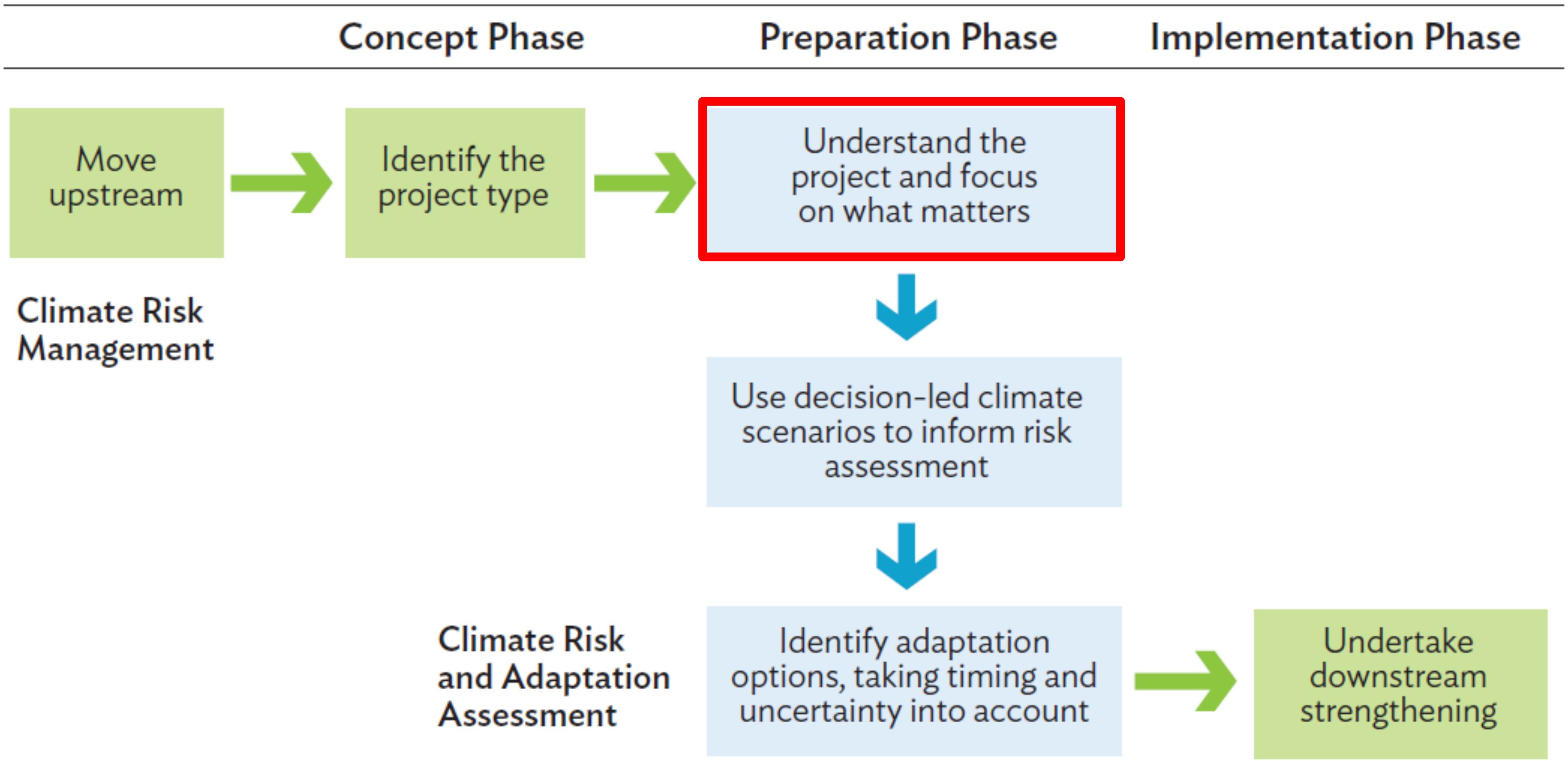
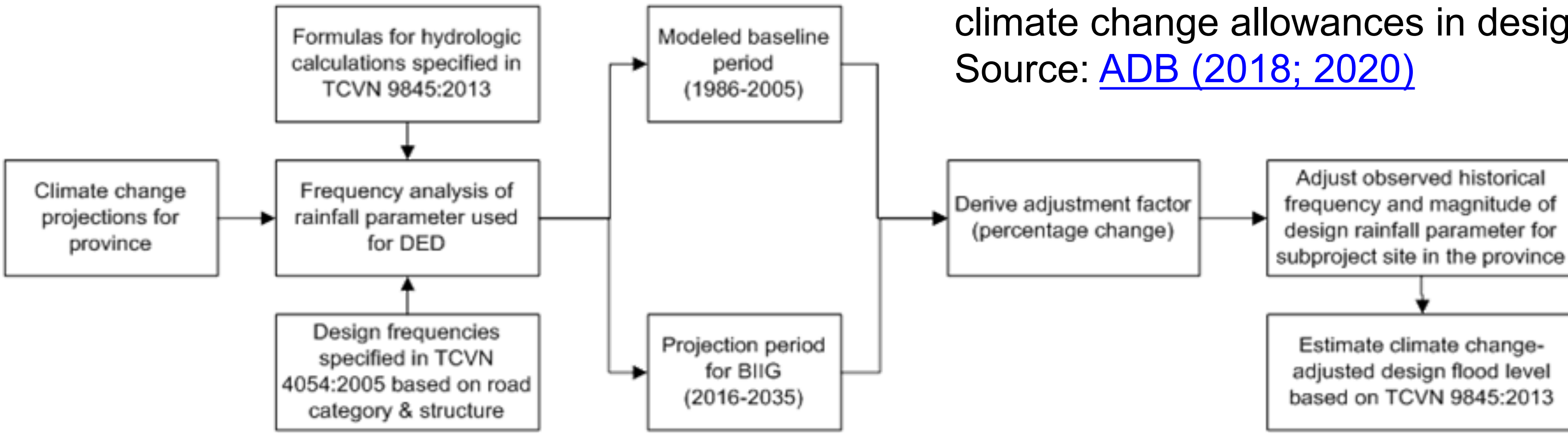
Start with decisions not scenarios

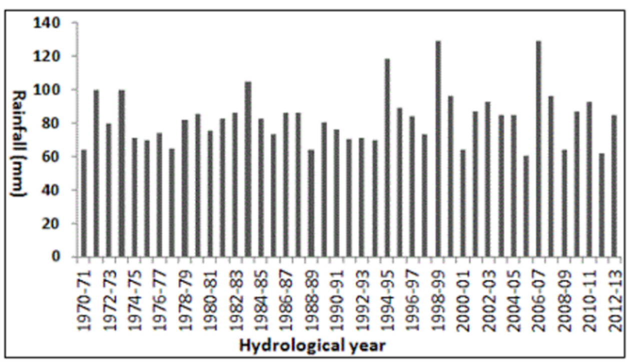


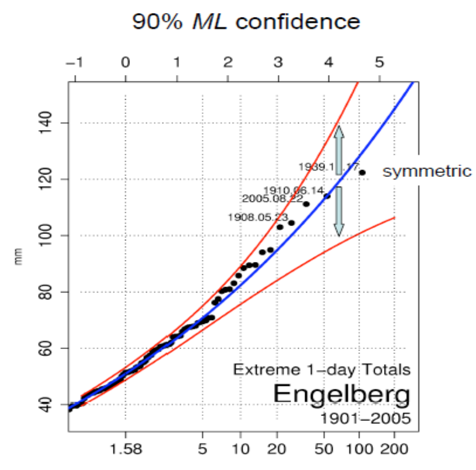
Source: Watkiss et al. (2020) *Principles of climate risk management for climate proofing projects*. Working Paper No. 69. Asian Development Bank, Manila, Philippines.

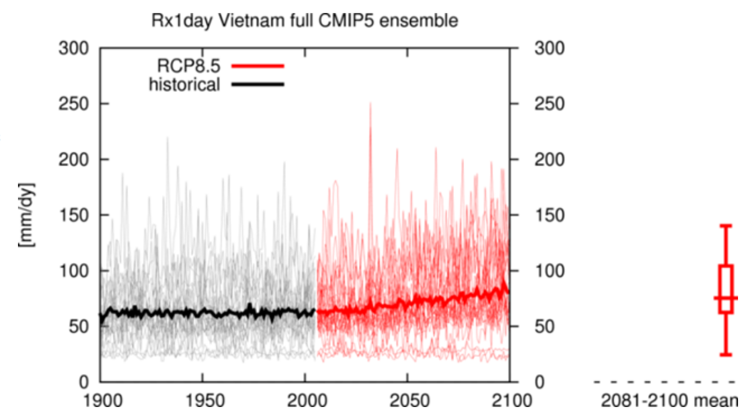
Work with existing procedures



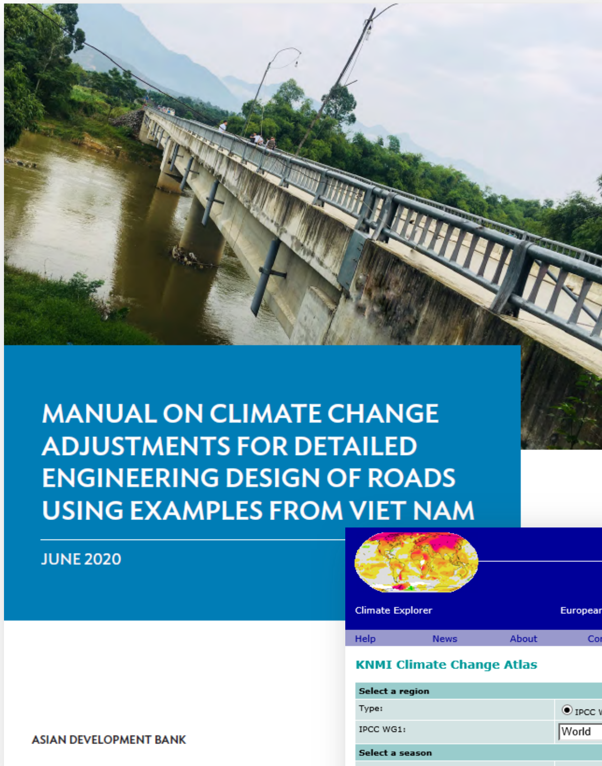
Viet Nam procedures for incorporating climate change allowances in design. Source: [ADB (2018; 2020)]







Provide resources and tools for practitioners



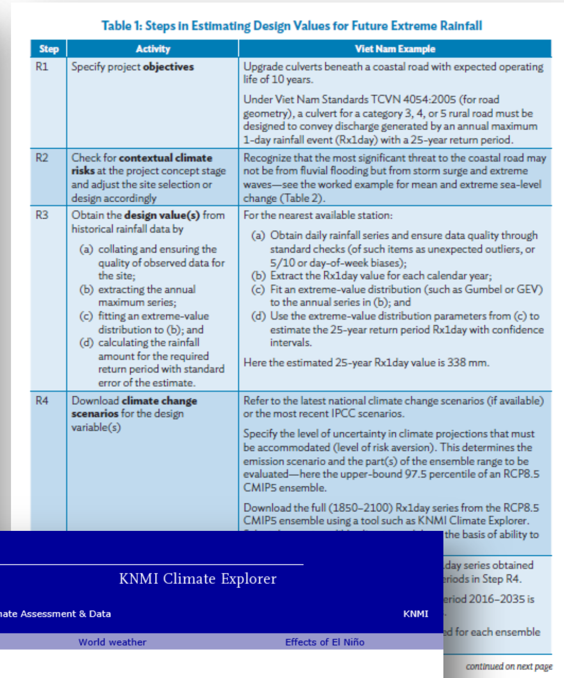


Table 1: Steps in Estimating Design Values for Future Extreme Rainfall

Step	Activity	Viet Nam Example
R1	Specify project **objectives**	Upgrade culverts beneath a coastal road with expected operating life of 10 years. Under Viet Nam Standards TCVN 4054:2005 (for road geometry), a culvert for a category 3, 4, or 5 rural road must be designed to convey discharge generated by an annual maximum 1-day rainfall event (Rx1day) with a 25-year return period.
R2	Check for **contextual climate risks** at the project concept stage and adjust the site selection or design accordingly	Recognize that the most significant threat to the coastal road may not be from fluvial flooding but from storm surge and extreme waves—see the worked example for mean and extreme sea-level change (Table 2).
R3	Obtain the **design value(s)** from historical rainfall data by (a) collating and ensuring the quality of observed data for the site; (b) extracting the annual maximum series; (c) fitting an extreme-value distribution to (b); and (d) calculating the rainfall amount for the required return period with standard error of the estimate.	For the nearest available station: (a) Obtain daily rainfall series and ensure data quality through standard checks (of such items as unexpected outliers, or 5/10 or day-of-week biases); (b) Extract the Rx1day value for each calendar year; (c) Fit an extreme-value distribution (such as Gumbel or GEV) to the annual series in (b); and (d) Use the extreme-value distribution parameters from (c) to estimate the 25-year return period Rx1day with confidence intervals. Here the estimated 25-year Rx1day value is 338 mm.
R4	Download **climate change scenarios** for the design variable(s)	Refer to the latest national climate change scenarios (if available) or the most recent IPCC scenarios. Specify the level of uncertainty in climate projections that must be accommodated (level of risk aversion). This determines the emission scenario and the part(s) of the ensemble range to be evaluated—here the upper-bound 97.5 percentile of an RCP8.5 CMIP5 ensemble. Download the full (1850–2100) Rx1day series from the RCP8.5 CMIP5 ensemble using a tool such as KNMI Climate Explorer. ... the basis of ability to
		...day series obtained ...riods in Step R4.
		...riod 2016–2035 is
		...d for each ensemble

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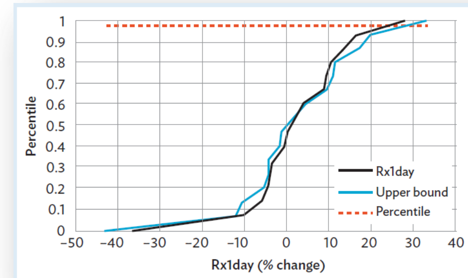
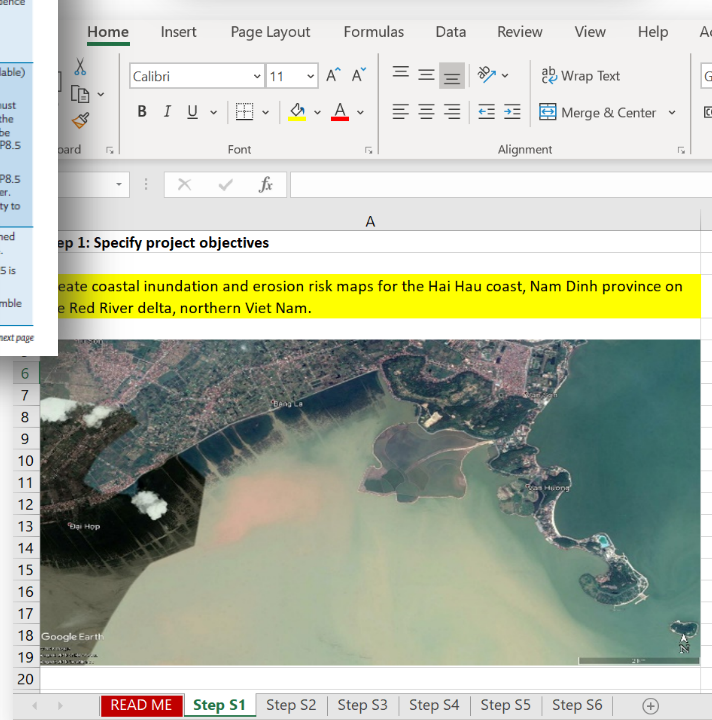
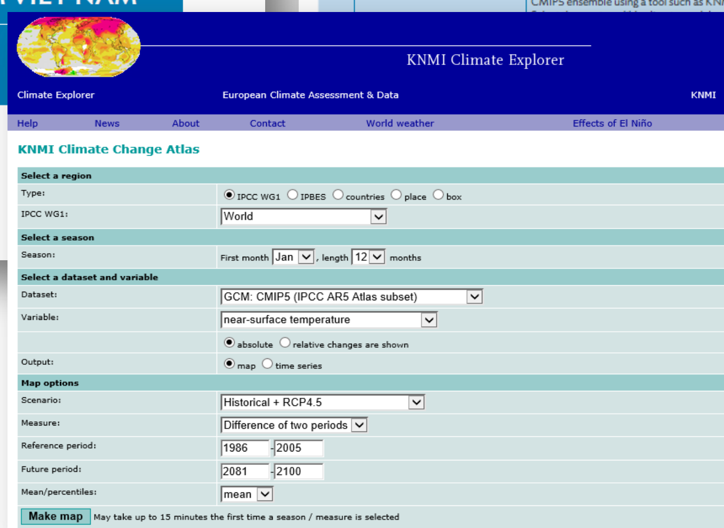






Source:
[ADB (2020)]

Think “tool kit”

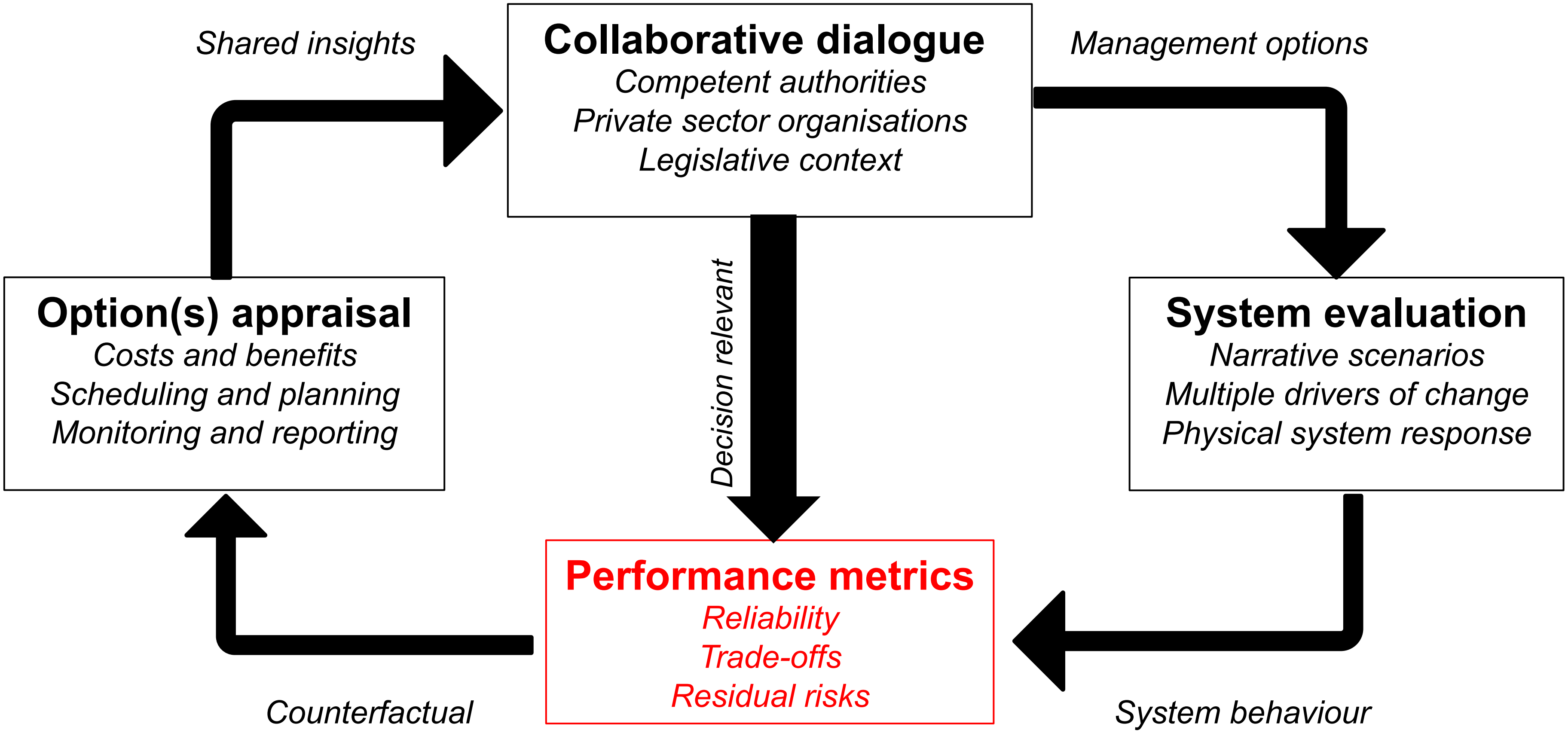
Extra materials

Source: EBRD

A $15 billion* question…how to adapt?

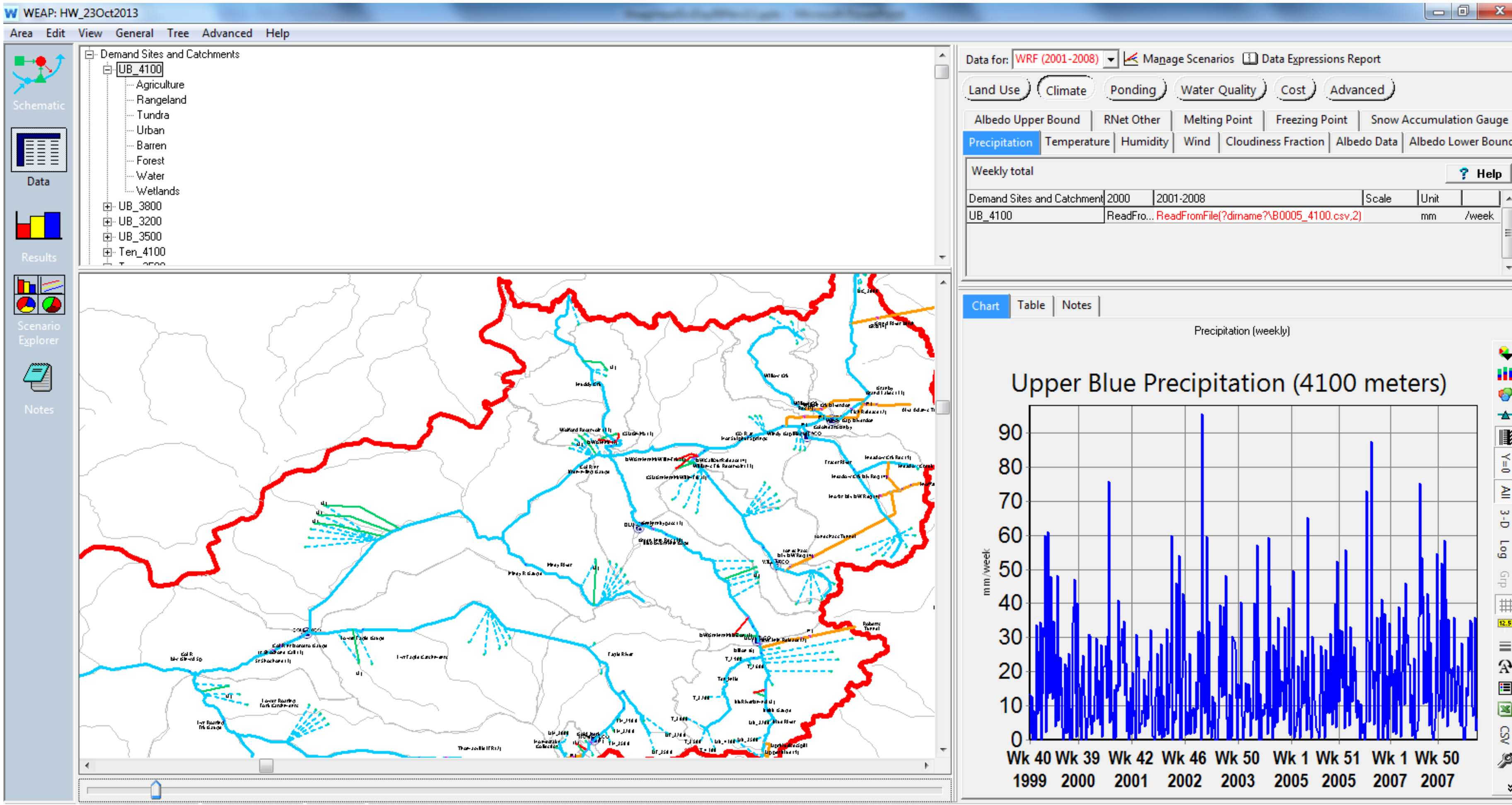
*EBRD (2020)

Adaptation performance metrics



An adaptation option appraisal framework (*as deployed with Denver Water in the Upper Colorado River Basin*). Adapted from Yates et al. (2015)

Systems modelling: To evaluate adaptation measures



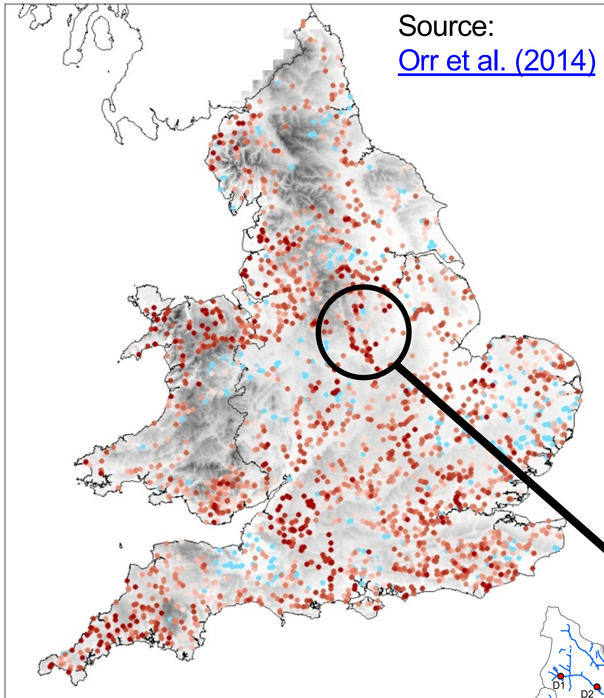
Water Evaluation And Planning (WEAP) representation of the Upper Colorado River Basin. Source: Yates (pers. comm.)

Physical experiments:

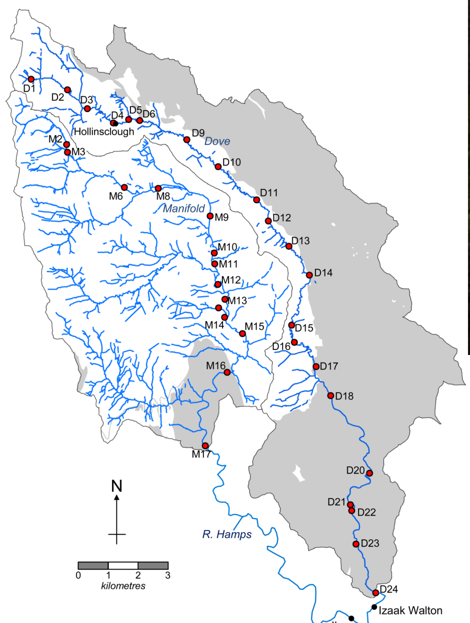
To evaluate adaptation measures

Loughborough University Temperature Network (LUTEN)

2011 onwards



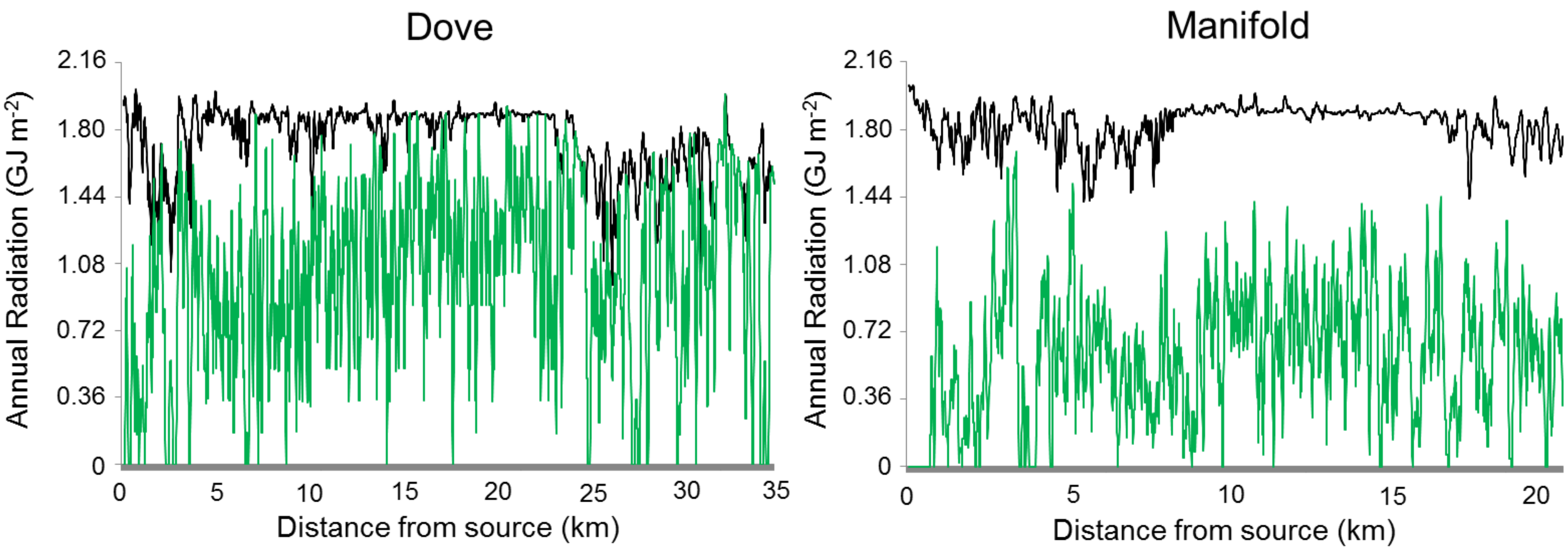
Source: Orr et al. (2014)



37 sites

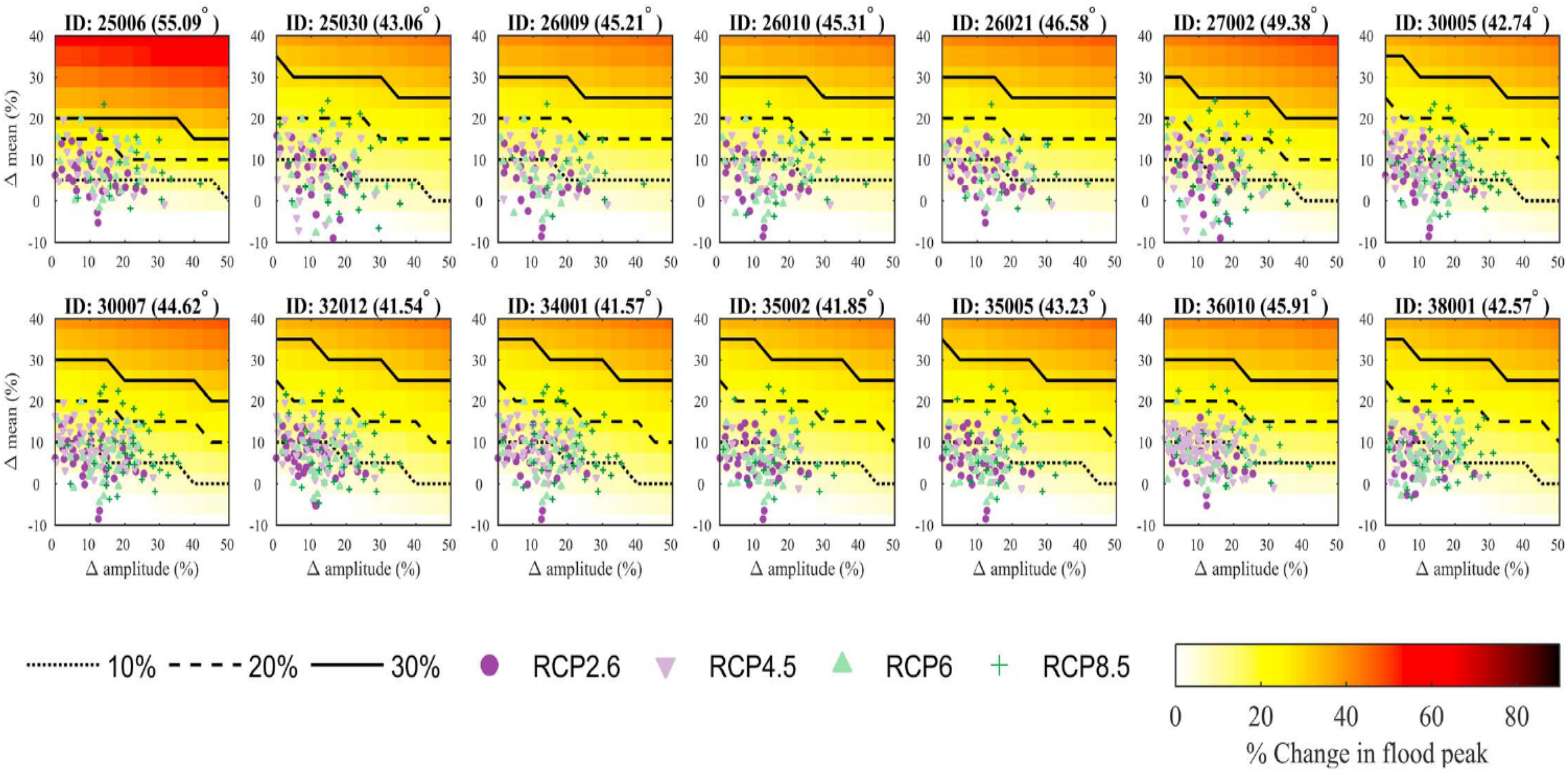
See: Johnson et al. (2013)

Where and how much riparian shade?



Downstream profiles of estimated annual direct solar radiation receipt (GJ) for a **treeless landscape (black)** and landscape with **30m high trees (green)** in the Dove (left) and Manifold (right). The analysis showed that ~ 1km of shade is needed to cool the rivers by 1°C in summer. Source: Johnson and Wilby (2015)

Stressing adaptation options/standards



Response surfaces for changes (%) in 20-year flood magnitude with incremental changes in the mean (x axis) and seasonality (y axis) of the annual precipitation cycle for selected catchments in Ireland based on CMIP5 models and four RCPs. Source: Broderick et al. (2019)