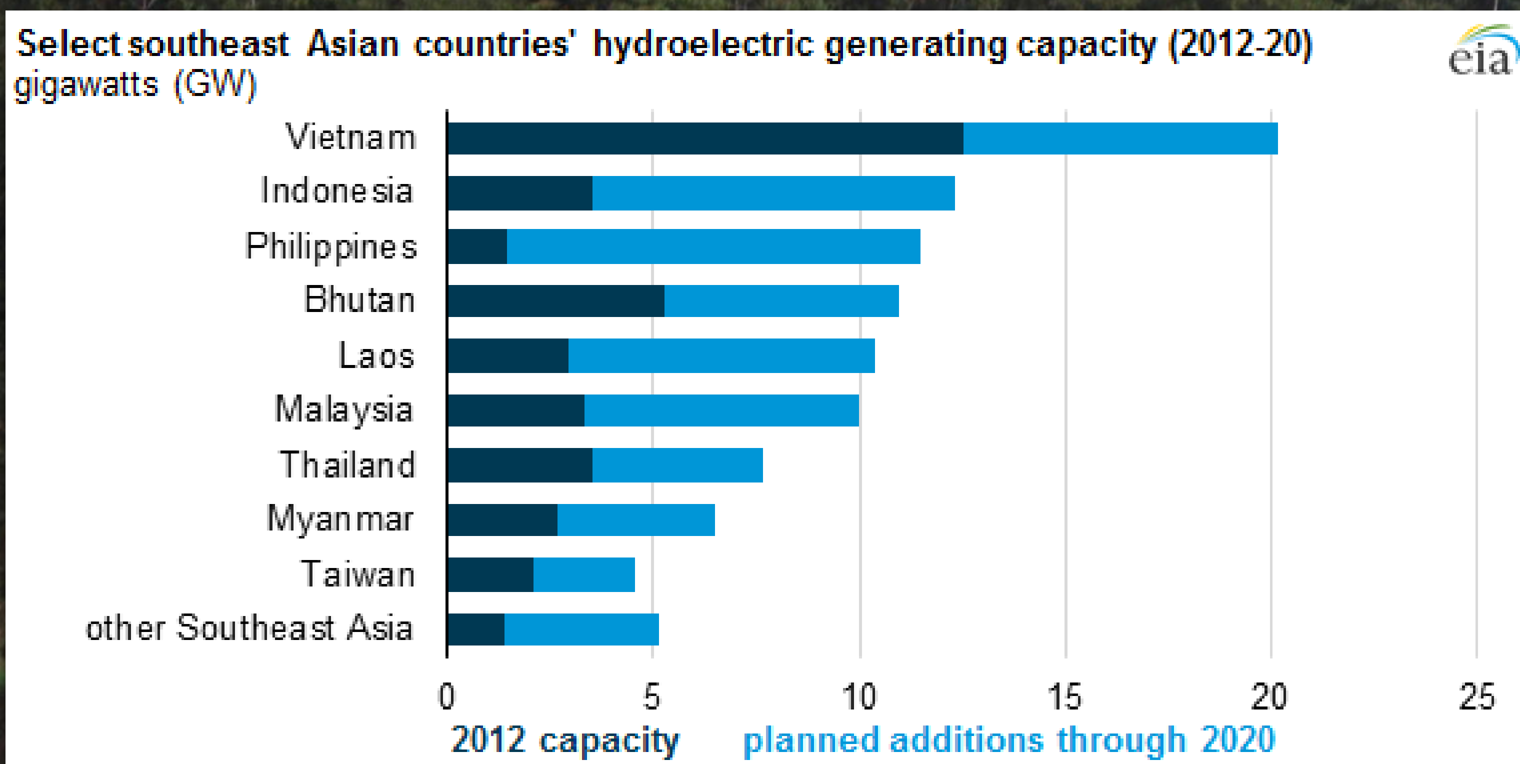

Water at CoP21
#CLIMATE IS WATER
"Solutions for the future"

CLIMATE CHALLENGES FOR THE DEVELOPED & DEVELOPING WORLDS



>200 new dams in Vietnam by 2017

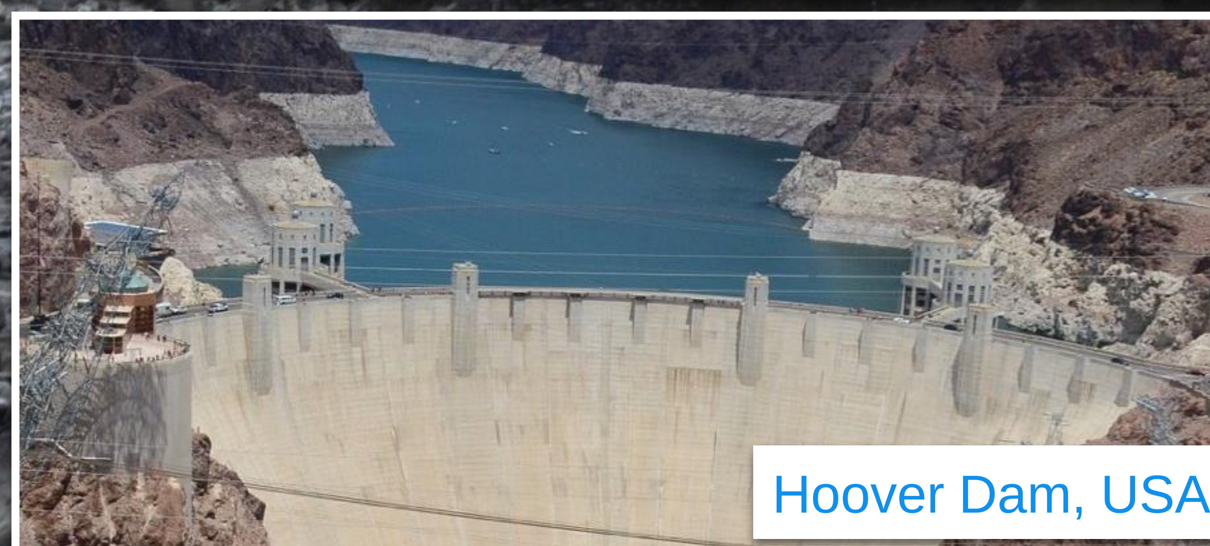
71 new Mekong dams by 2030

11 new Mekong dams (9 GW) in Laos by 2020

>300 in the Himalayas
>450 planned in Mekong, Amazon, Congo

African potential more than doubling

The challenge for both systems: can we transition from highly customized "boutique" approaches to systematic, scaleable, consistent solutions?


Hoover Dam, USA

Source: U.S. Energy Information Administration, International Energy Statistics and compiled press reports

So, what are the climate challenges?

climate extremes / disasters|
super droughts & floods|
tropical cyclones|

|steady, creeping, predatory change
|climate "weirding"
|transformation

FORECAST: INCREASING UNCERTAINTY

HOW WE HAVE MANAGED

past → present → future

design, planning, operations

past – – → present ⇢ future

HOW WE WILL MANAGE

SLOPPY, NON-QUANT ⟷ INSTITUTIONS
RIJKSWATERSTAAT: 300 YEARS

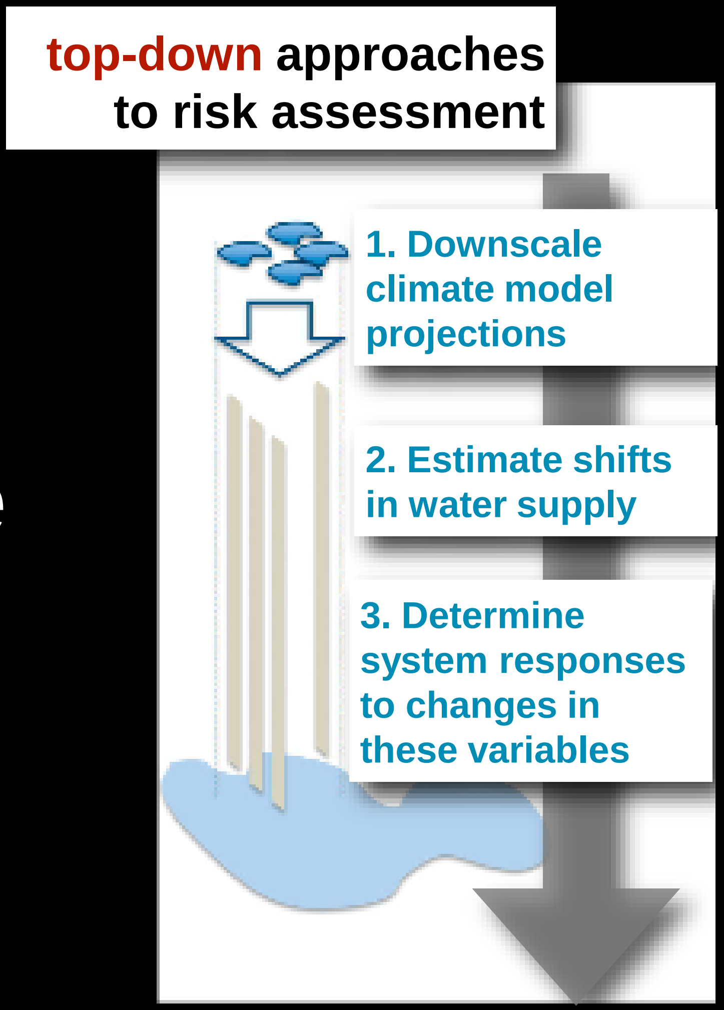
INFRASTRUCTURE
DUJIANGYAN DAM: >2000 YEARS ⟷ PRECISE, ACCURATE, QUANTITATIVE

ACCURATE, SEMI-QUANTITATIVE ⟷ ECOSYSTEMS: ~10,000 YEARS

CLIMATE ADAPTATION SINCE ~1995

How do we identify risks in advance?

- Climate model downscaling is inadequate for applications that require accuracy and confidence
- Engineers have been working extensively on the issue with an infrastructure emphasis; can we build on their lessons?

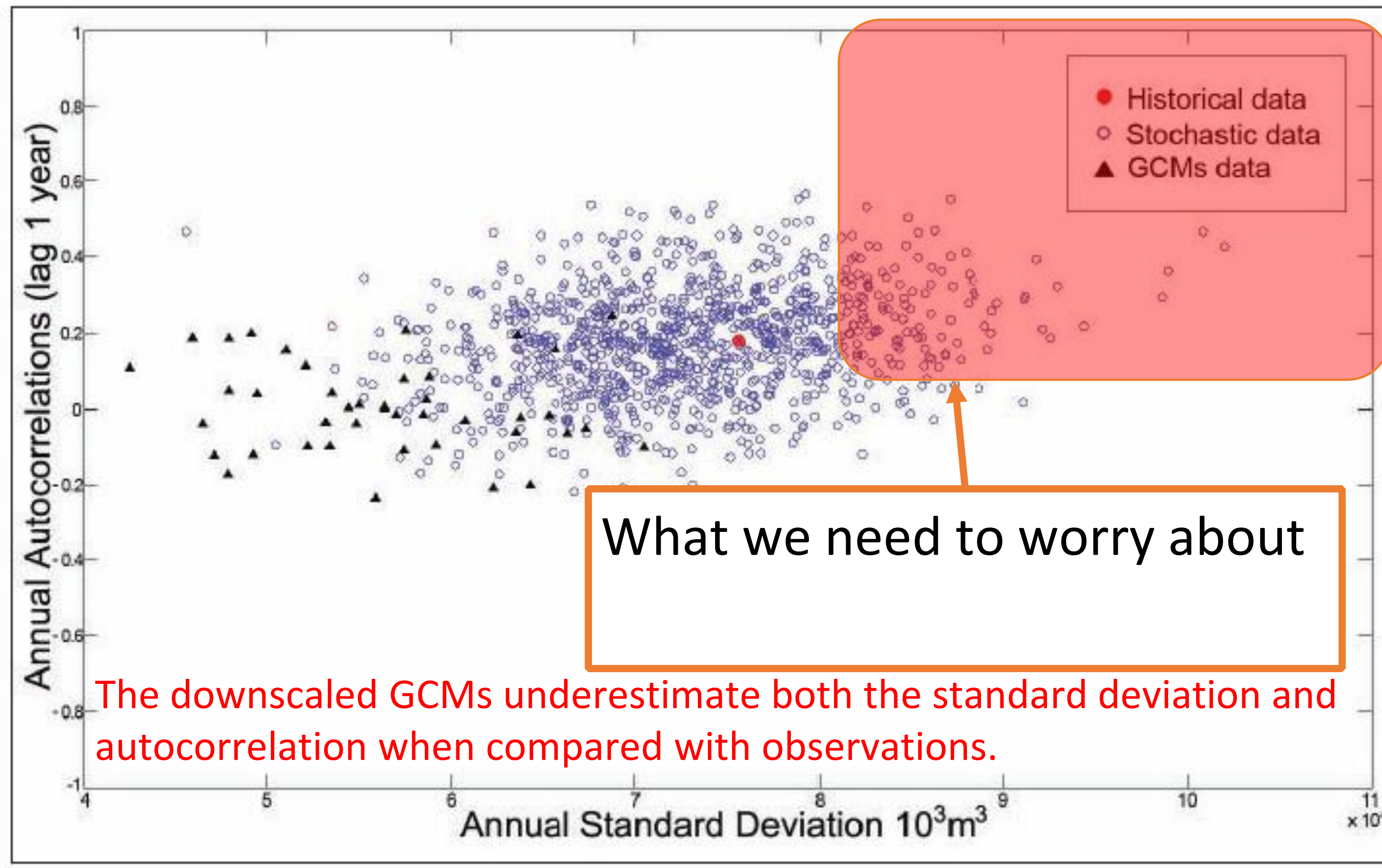


Brown et al., 2012, *WRR*
Weaver et al. 2012 WIREs *Climate Change*

THE LIMITATIONS OF CLIMATE MODELS TO UNDERSTAND THE FUTURE

Top-down risk assessment using GCM-based climate scenarios:

1) Underestimates risks to the water system (Brown and Wilby 2012)
2) Has irreducible uncertainty in temporal and spatial scales of interest to water resources planning (Stainforth et al. 2007)
3) Is limited and biased for precipitation variability (Rocheta et al. 2014) with amplified carry-over effects for run-off estimates (Fekete et al. 2004)
4) Can't provide probabilistic representations of uncertainty (Hall 2007)
5) Has the least skill in climate extremes (Dai et al. 1998) – flood and drought.



courtesy Patrick Ray, UMass

Fig. 1. Variability statistics of bias-corrected, statistically downscaled historical general circulation model (GCM) 30-year simulations (triangles) and resampled historical 30-year streamflow

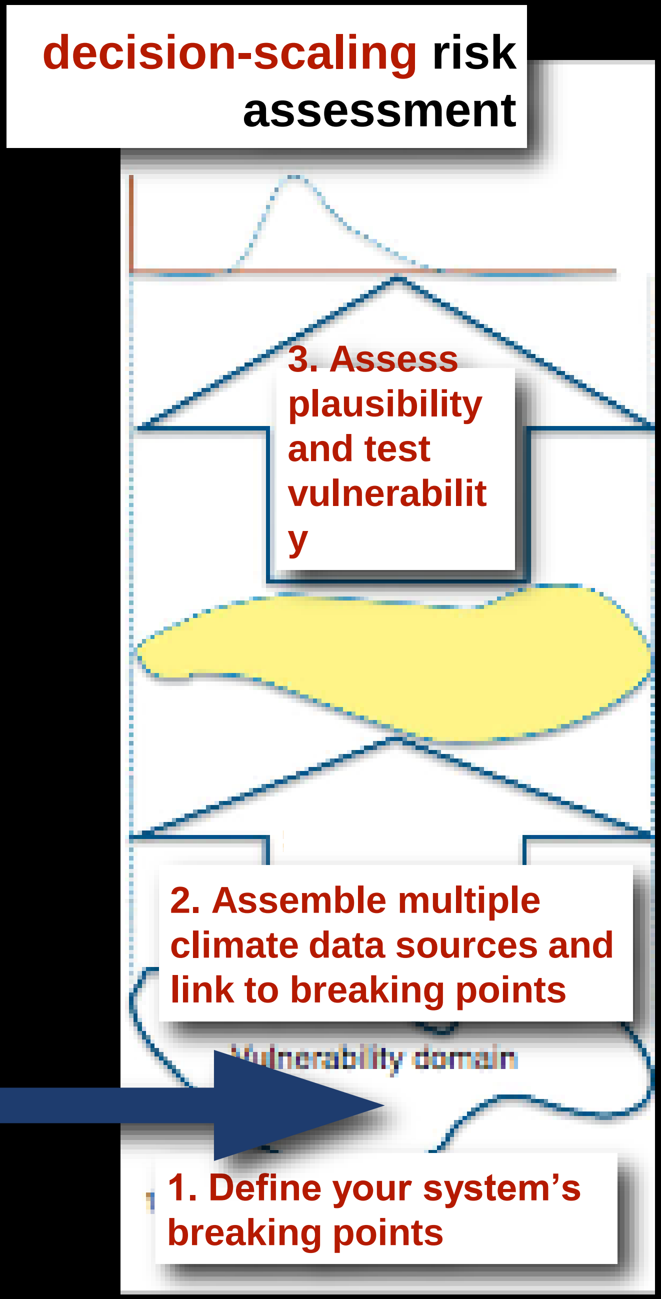
A BOTTOM-UP METHODOLOGY: DECISION SCALING

- Likelihood of impacts
- How robust is the system?
- Non-climate + climate factors
- No assumptions on time of impact, particular GCMs, or scenarios
- Can we use additional data sources?

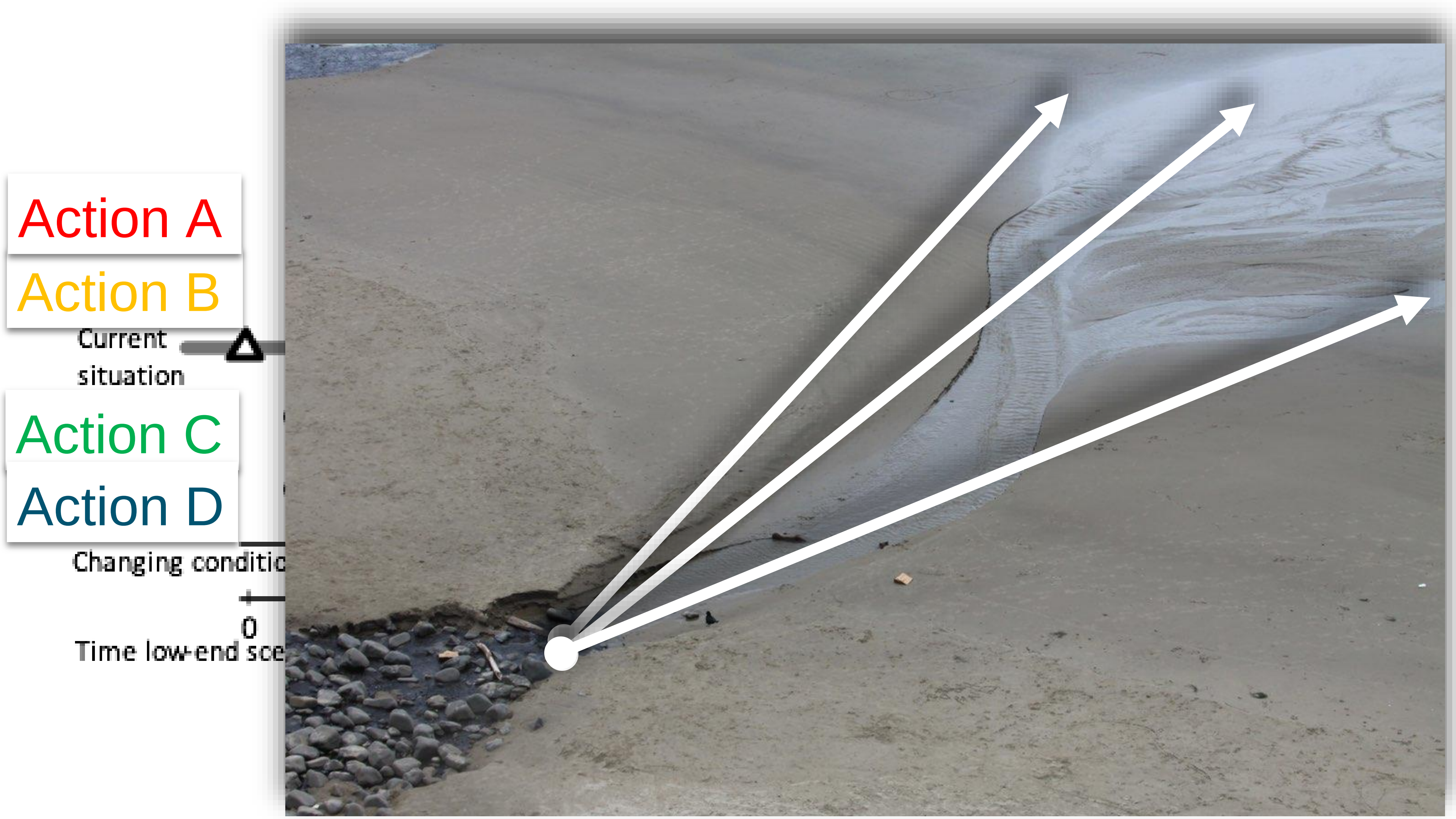
The story of the development of decision scaling:

http://AGWAGuide.org/EEDS/

“PERFORMANCE INDICATORS”



SEQUENTIAL DECISION MAKING THROUGH ADAPTATION PATHWAYS



THE CENTER OF AGWA:
THE GUIDING ELEMENTS

AGWA’s Guiding Elements

- Use bottom-up approaches to vulnerability analysis
- Sustainability must encompass engineering and ecological visions
- Economic approaches to maintain flexibility and resolve uncertainty
- Flexible governance mechanisms to enable sequential decision making

POLICY

TECHNICAL PROGRAMS

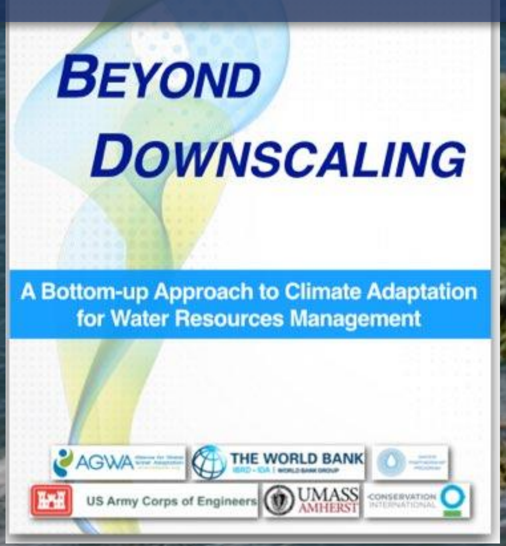
“core guiding elements”

CRIDA

Global Policy

Policy that enables actions mindful of the special problems of water

Beyond Downscaling

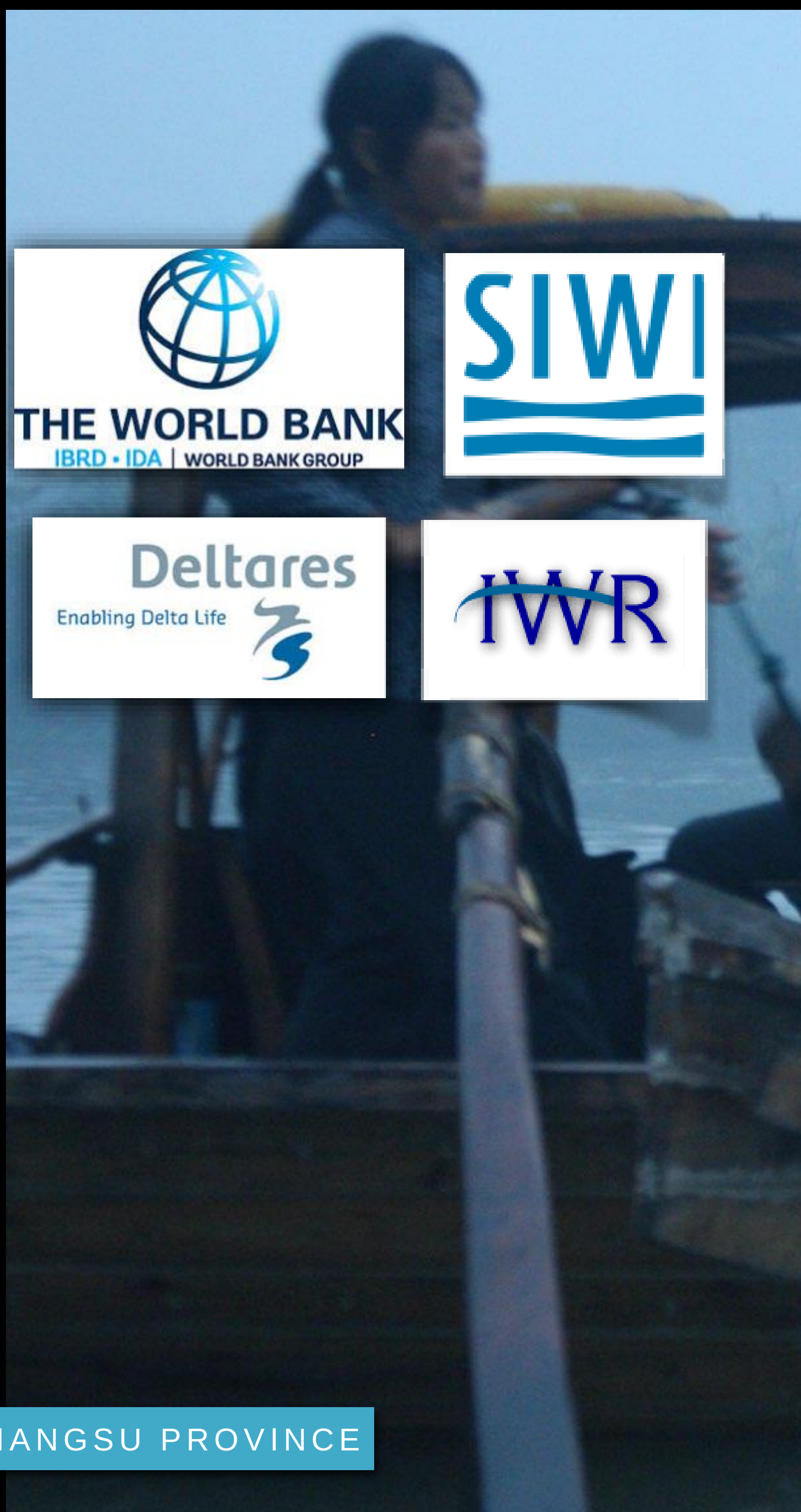


Water-climate bonds standard

WB decision tree

TRAVELING ON A WATER & CLIMATE JOURNEY

THE AGWA NETWORK

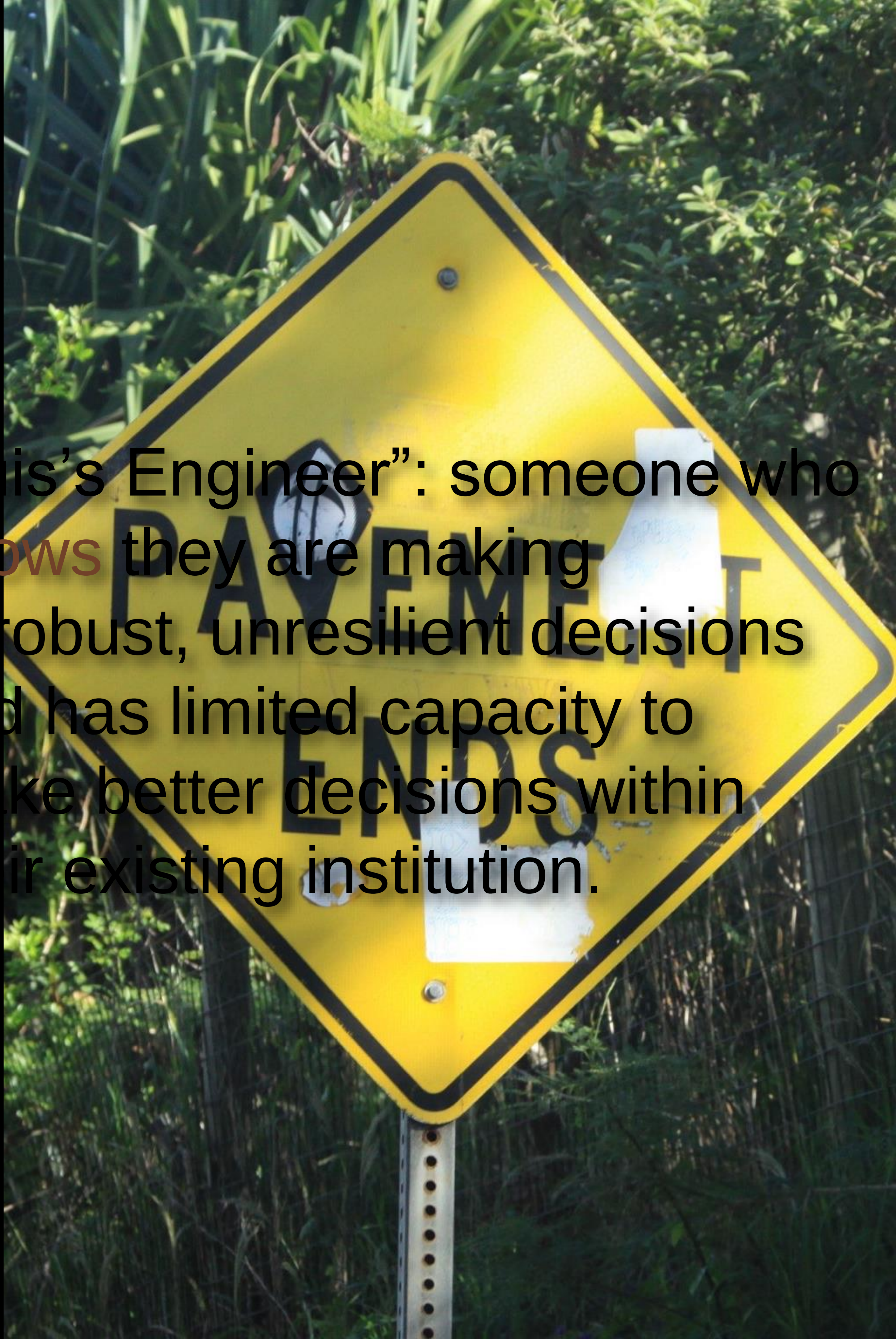


JIANGSU PROVINCE

- Founded 2010
- Co-chaired by the World Bank & SIWI
- Steering committee members include:
  - Deltares
  - US Army Corps of Engineers
  - Seattle Public Utilities
  - World Business Council of Sustainable Development
- Focused on how to mainstream technical and policy approaches to freshwater climate adaptation
- >800 network members; 40 percent increase in membership in past 15 months
- Most members have a technical expertise and serve as an adaptation resource within their organization

OUR AUDIENCE

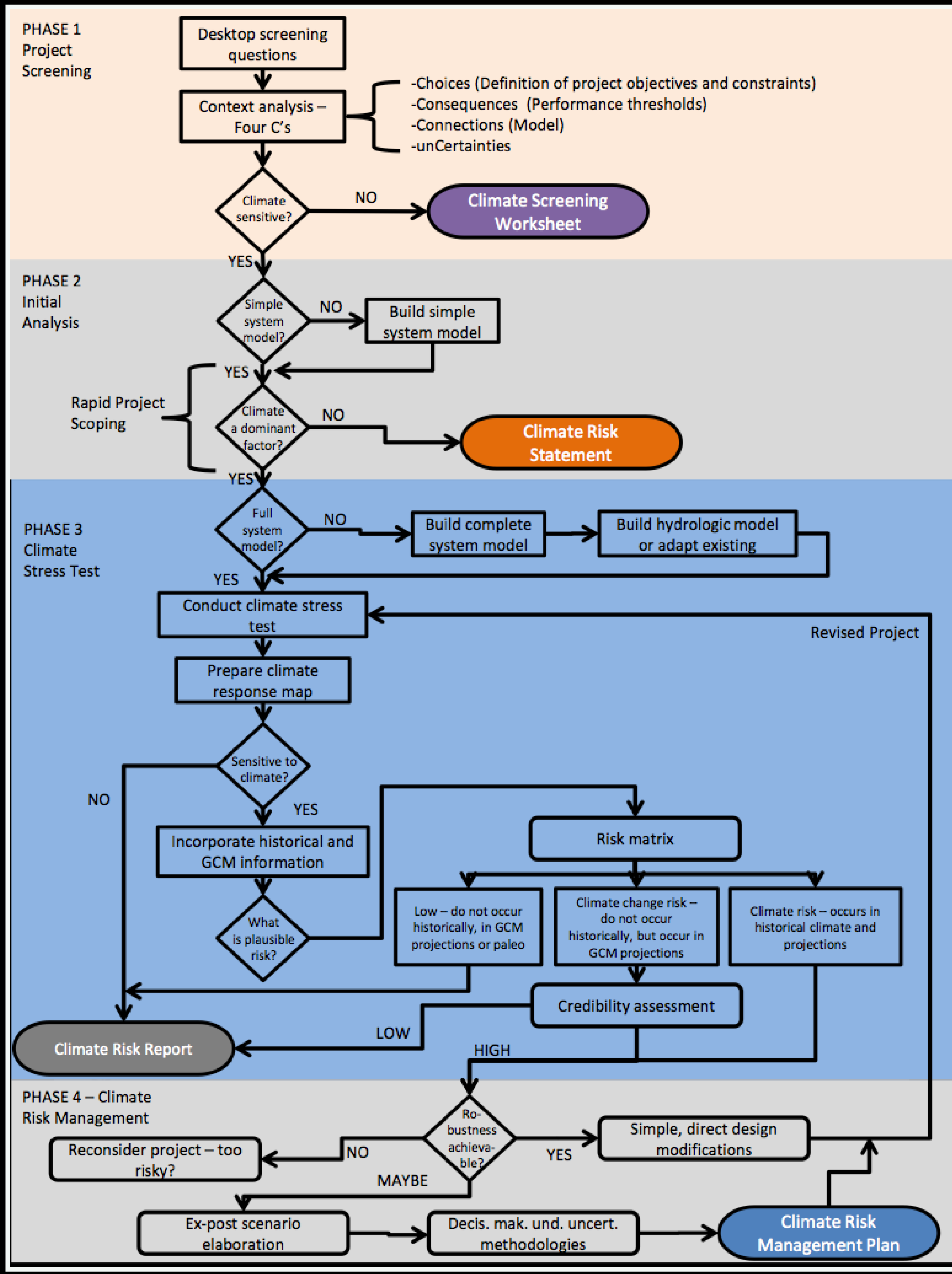
- Technical water professionals seeking to integrate climate change practice into their work (“Luis’s engineer”)
- Policymakers working on water and climate related issues



is’s Engineer”: someone who
knows they are making
robust, unresilient decisions
d has limited capacity to
ke better decisions within
ir existing institution.

CONFRONTING CLIMATE UNCERTAINTY: THE DECISION TREE FRAMEWORK

- Ray/Brown, August 2015
- Guides development bank loan officers in quantifying climate risks for water investments
- Step-wise process, now in widespread pilot projects



https://openknowledge.worldbank.org/handle/10986/22544

INTEGRATING ECOSYSTEMS WITHIN ENGINEERED MANAGEMENT SYSTEMS: EEDS

AGWA Guide

Values and approaches to design and natural resource management change over time. In the same way that concerns about the assumption of stationarity created an opening for rethinking the role of climate, a desire to minimize negative ecological impacts from dams has grown since the 1960s worldwide. In practice, ecologists have often served as the scientific "voice" of aquatic ecosystems, opposing the work of engineers. In contrast, the task of economic development and poverty alleviation worldwide has often deeply involved the work of engineers designing water infrastructure. Both disciplines have honorable goals.

Over recent decades, these disciplines have found little common ground, however. Their differences have been exacerbated by significant differences in how they define sustainability. Indeed, they often use distinct words to describe how sustainability should function: ecosystems should be "resilient" to impacts and change, while infrastructure should be "robust" to a range of possible futures. In many cases, the qualities that ecologists used to define resilience could not be easily translated into the operational and design language of engineers. Certainly most engineers care deeply, even passionately, about sustainability and ecosystems. But the resilience-robustness gap has proven durable.

A Story of Different Perspectives

- In projects involving engineers and ecologists working together, there is often a disconnect between the two groups. Traditionally, they work separately - even on the same project, with engineers producing an original design, and ecologists then working within the constraints of that design to try to mitigate the ecological impacts.
- This difference is both structural and cultural - structural because of how projects are traditionally planned and implemented, and cultural because of the different types of values and worldviews the two groups tend to hold.

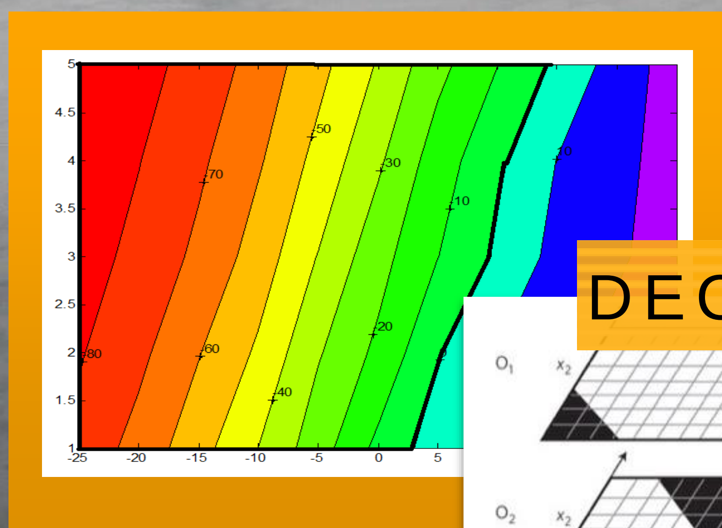
http://AGWAGuide.org/EEDS/ Poff, et al., 2016, *Nature Climate Change*

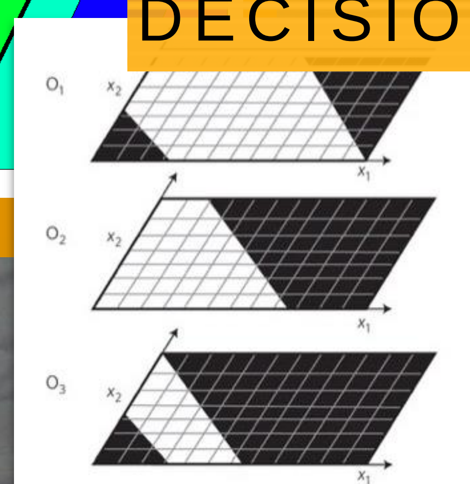
http://www.nytimes.com/2015/12/09/business/energy-environment/heading-off-negative-impacts-of-dam-projects.html?_r=2

AGWAGUIDE.ORG/CRIDA/

SUPPORTING WATER MANAGERS WITH MAINSTREAMING ADAPTATION

How do we diagnose quantitative risk with stakeholders?

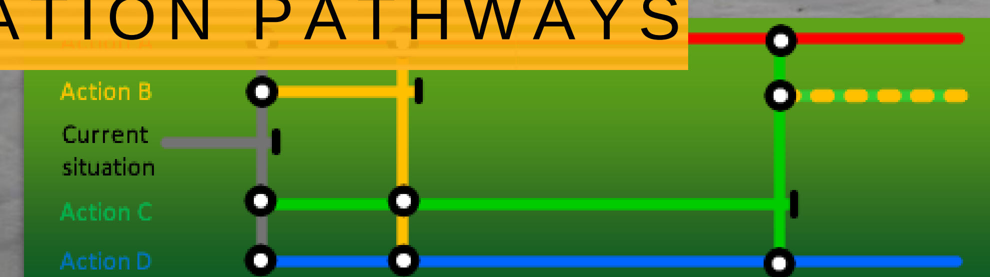




DECISION SCALING

How do we define long-term decision making given ongoing uncertainty?

ADAPTATION PATHWAYS



EEDS

Can we integrate ecological and infrastructure risk simultaneously?

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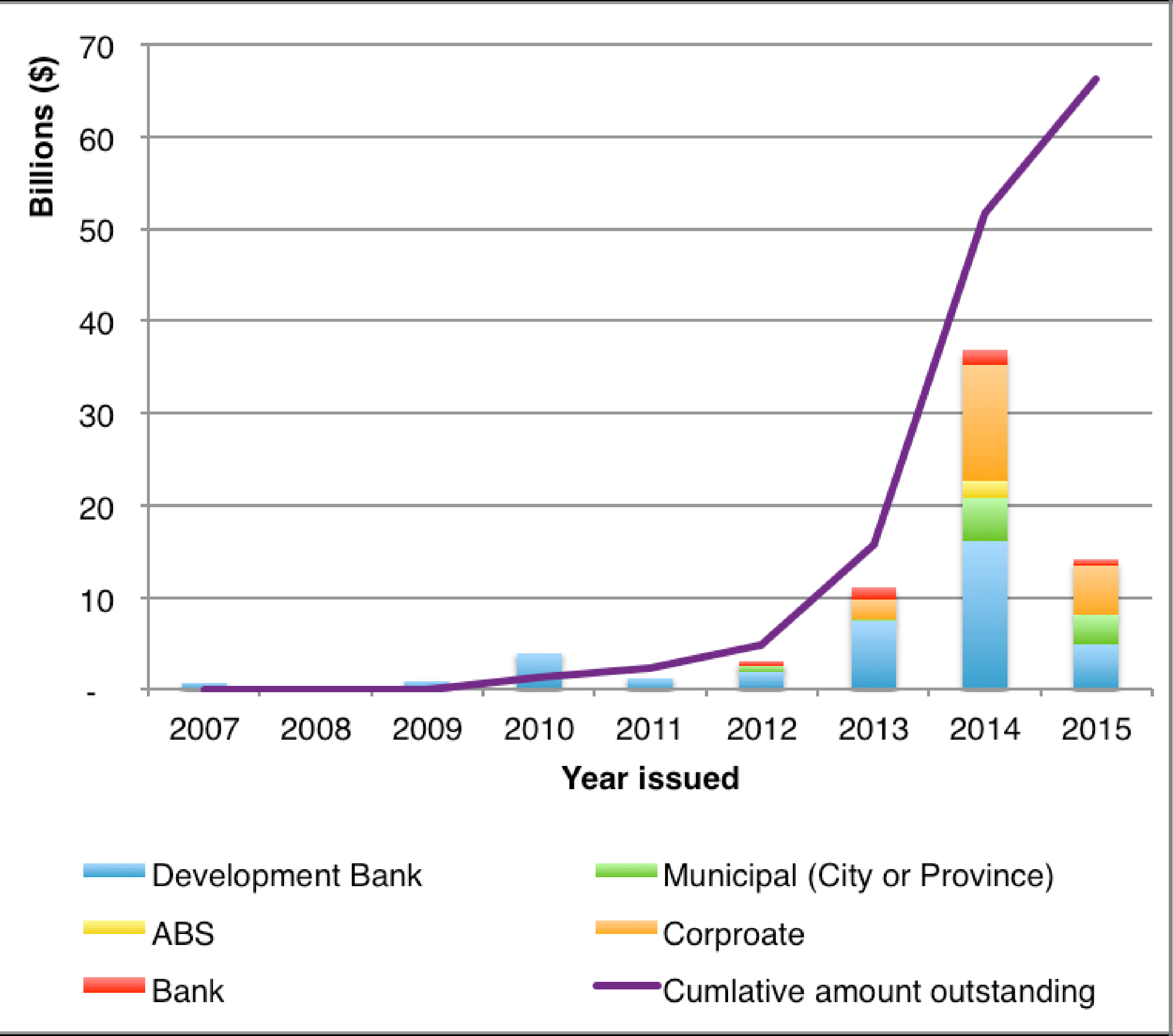
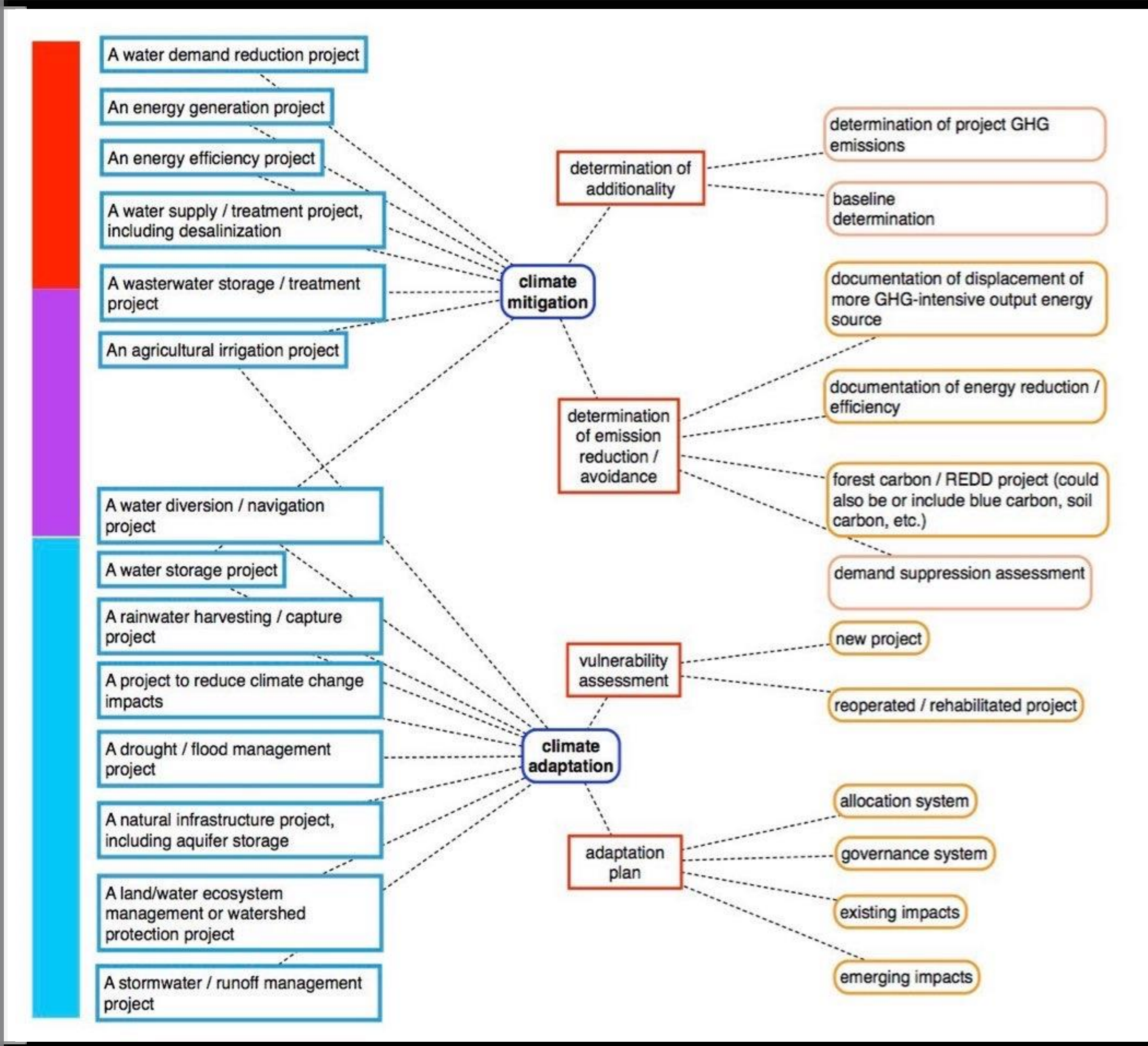
CLIMATE BONDS STANDARDS

AGWAGUIDE.ORG/GREENBONDS/





Join AGWA — Work with AGWA

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