

Systems Analysis in the Great Acceleration

Methods, Experiences and Research Avenues

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Methods

We are living through a Great Acceleration ...

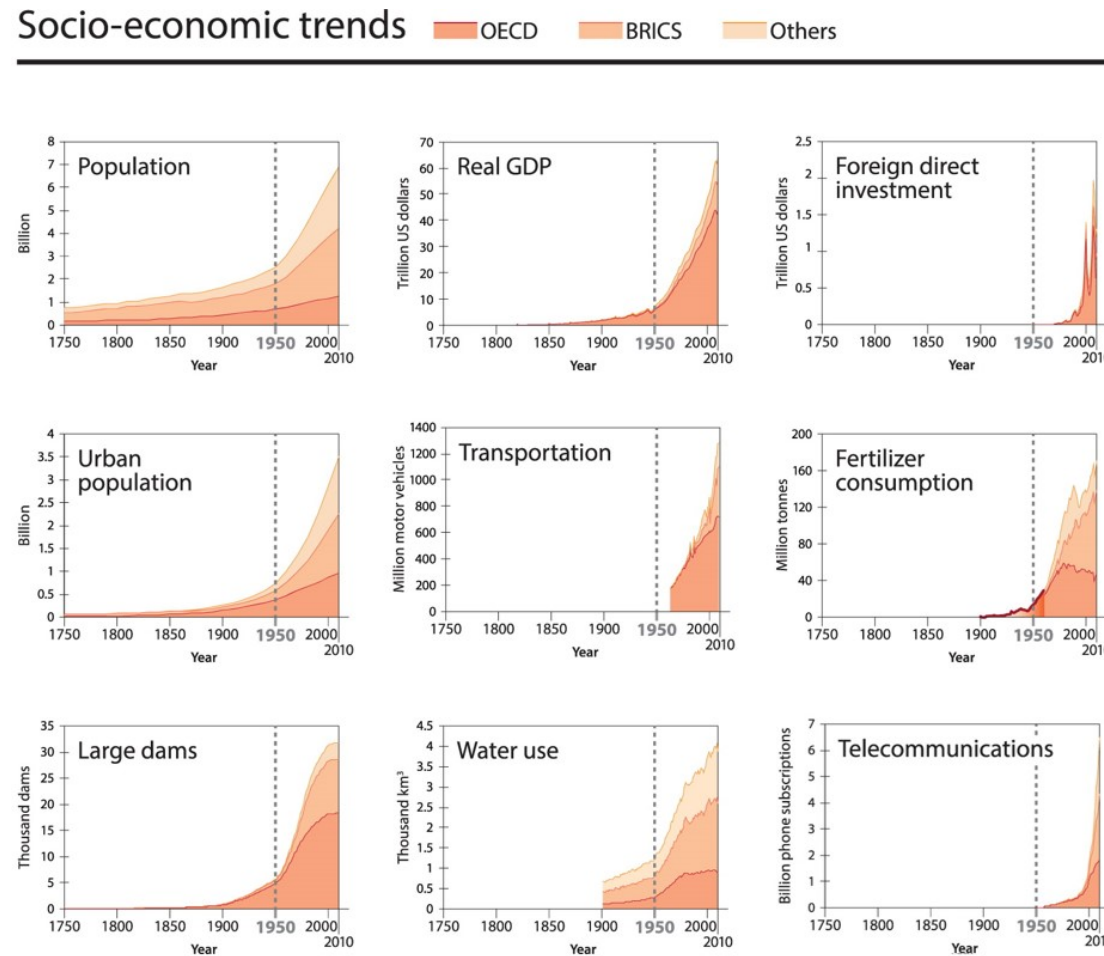


Figure: Steffan et. al. (2015); Slide: (Lempert, 2016)

We are living through a Great Acceleration ...

Earth system trends

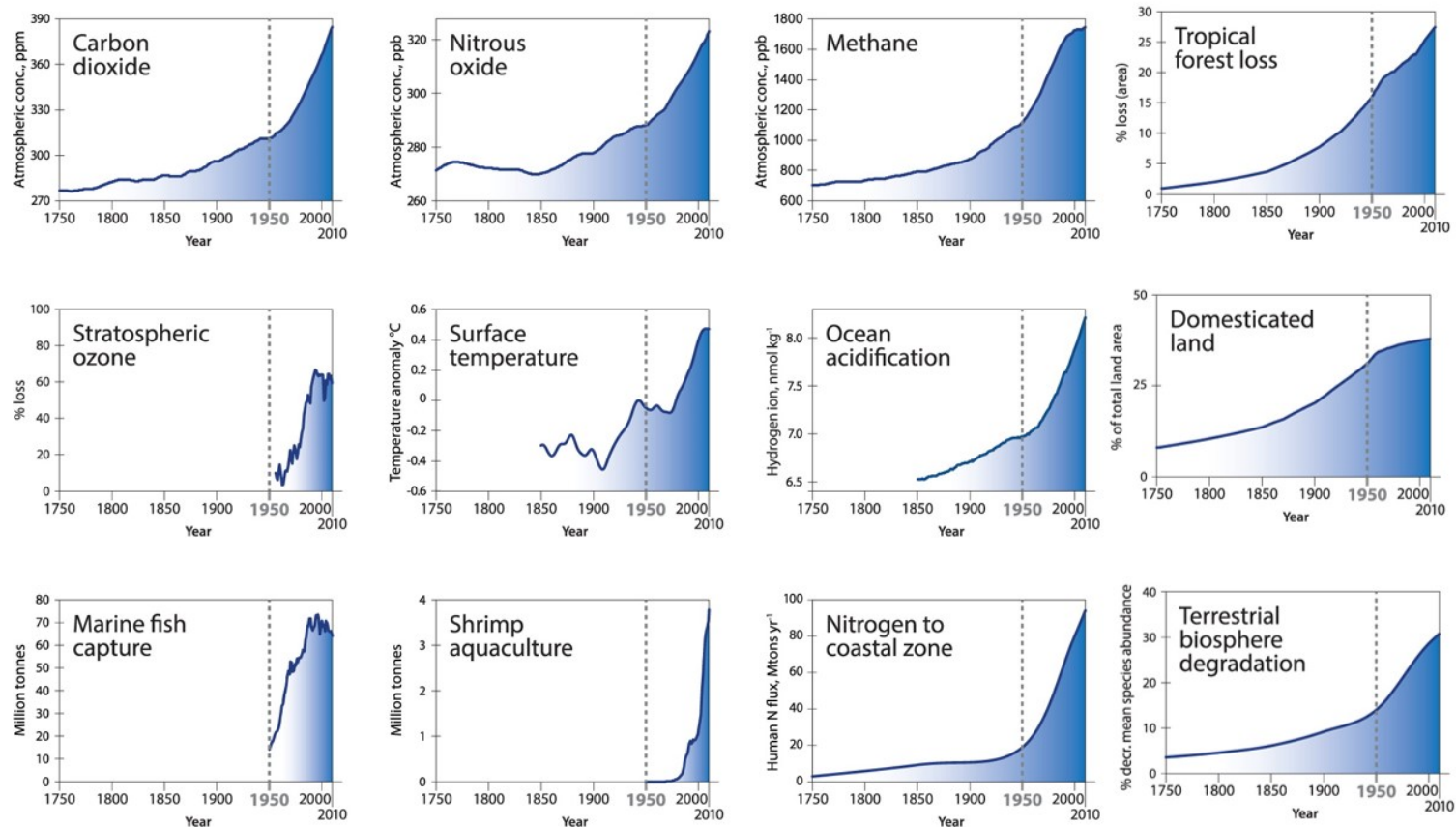
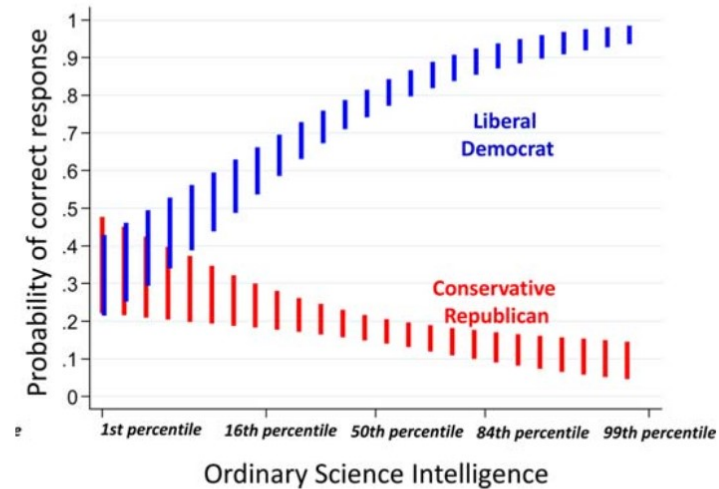
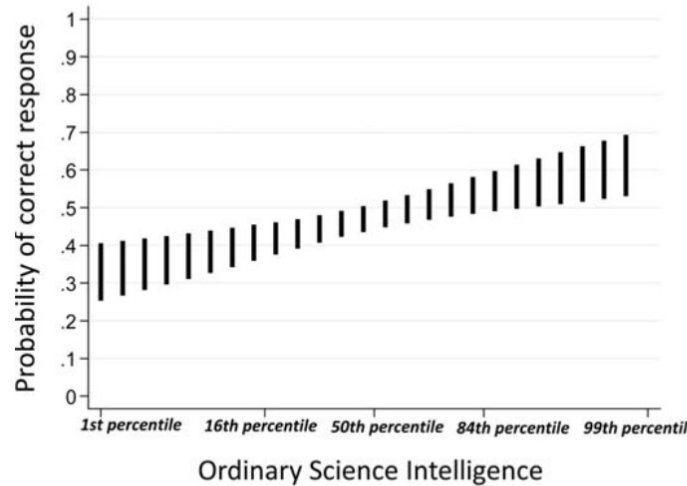


Figure: Steffan et. al. (2015); Slide: (Lempert, 2016)

... and judgements about science are often tribal

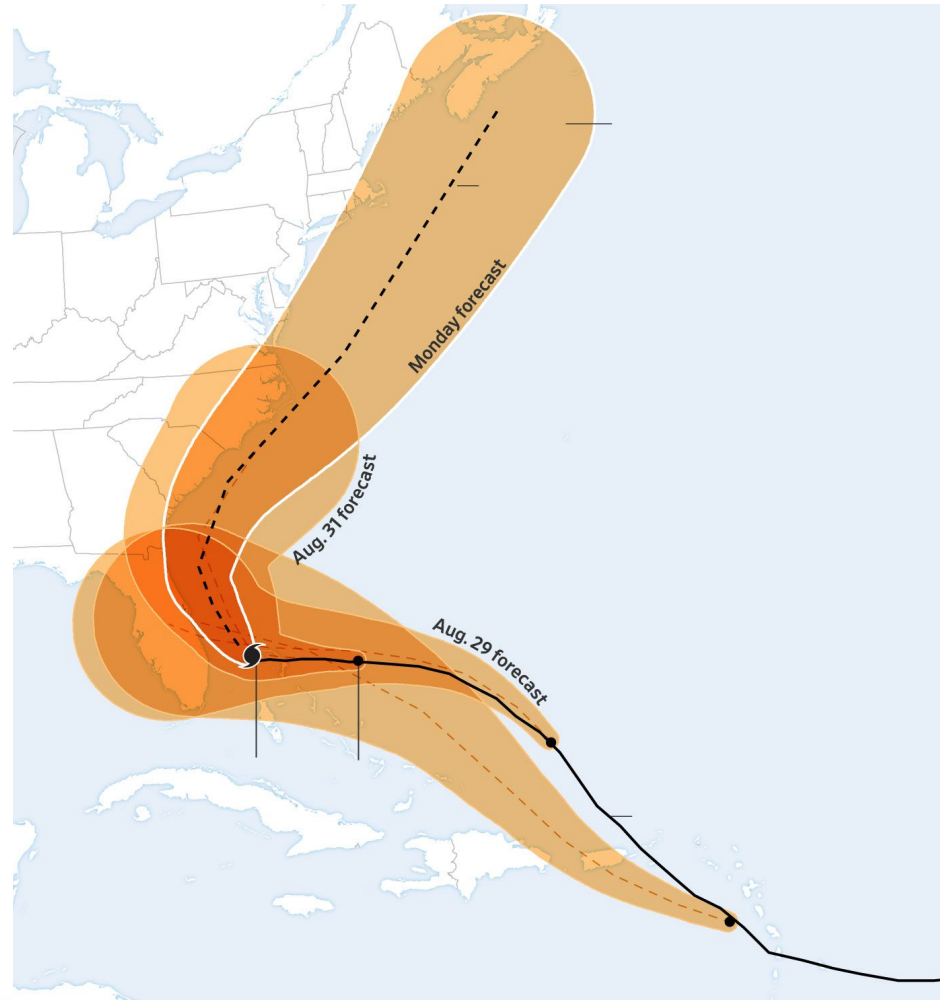
*There is “solid evidence” of recent global warming due
“mostly” to human activity such as burning fossil fuels*



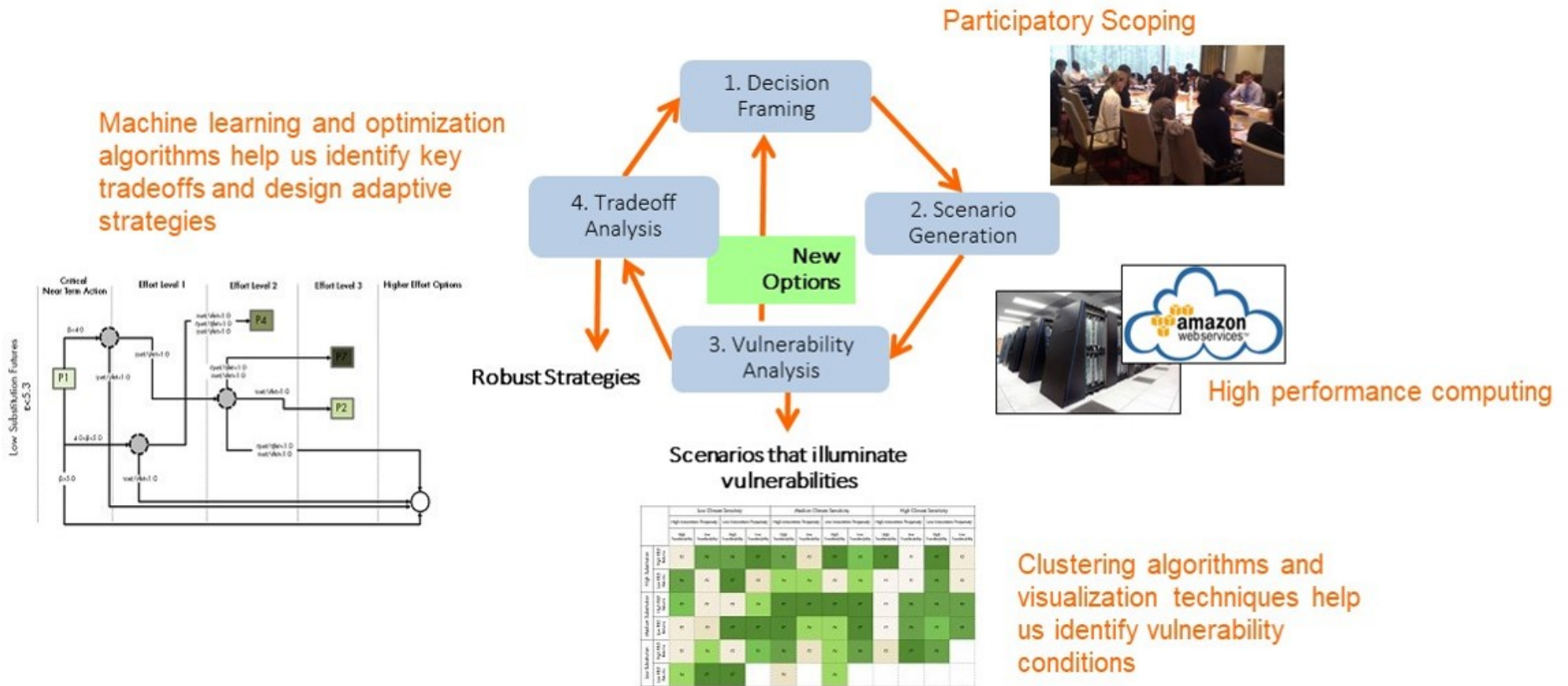
Kahan, D.M., *Climate-Science Communication and the Measurement Problem*. *Advances in Political Psychology*, 2015. 36

Slide: (Lempert, 2016)

The combination of both often surprises us and complicates the role of analysis



Robust Decision Making (RDM) is a framework that has proven useful in these contexts



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See: RAND Water and Climate Resilience Center—www.rand.org/water

Experiences



Developing a Robust Water Strategy for Monterrey, Mexico Diversification and Adaptation for Coping with Climate, Economic, and Technological Uncertainties

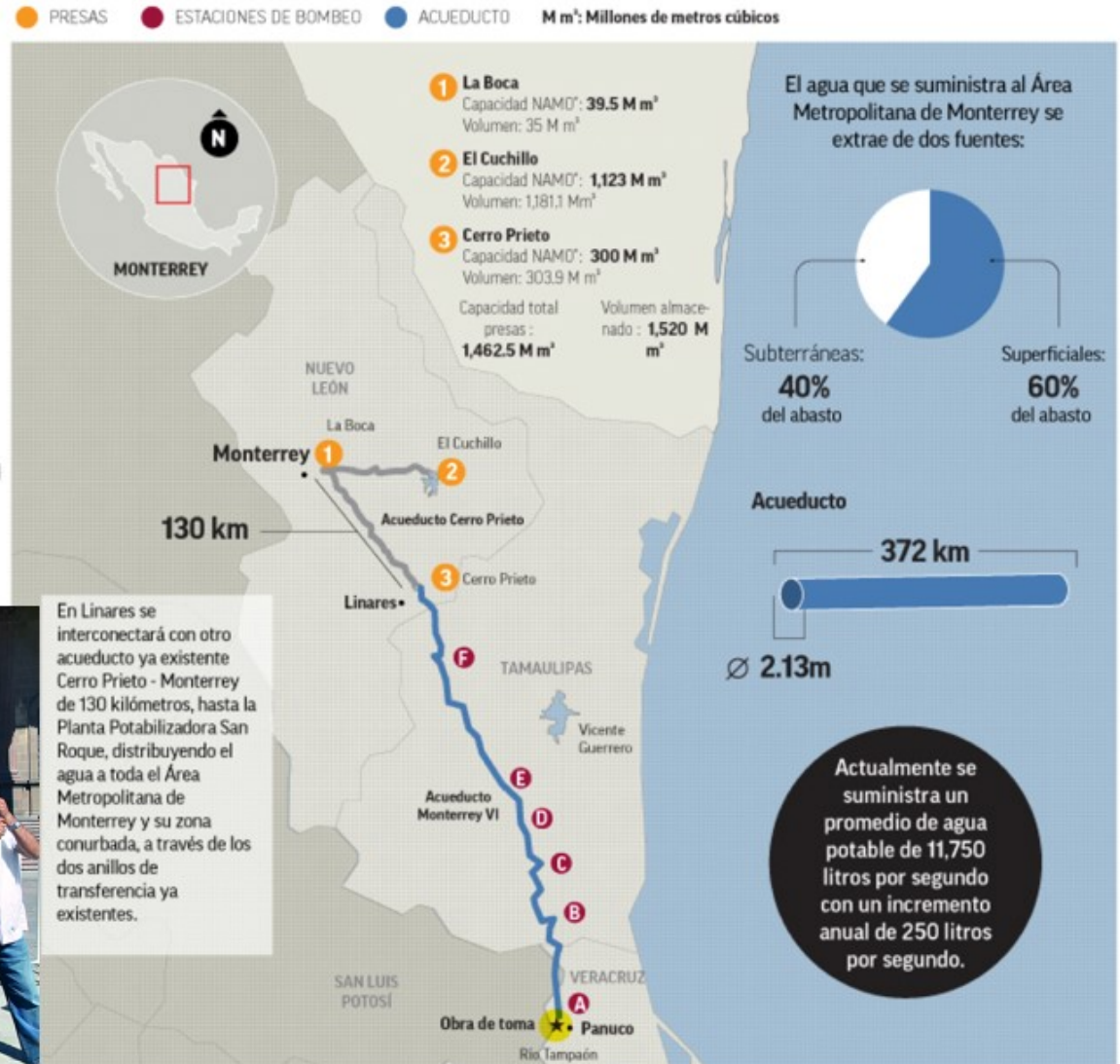


RDM was used for reshaping long-term water planning in Monterrey, Mexico

- is Mexico's 3rd largest metropolitan area
- Rapidly expanding population and economy
- At its limit of developed supplies
- Potentially sensitive to climate change

Region was on the cusp of implementing a costly mistake

- Large expensive water transfer project
- Many potential impacts and opposition
- Uncertain benefits



Preliminary systems analysis highlighted risk of single, large project

- Used RDM to highlight vulnerability of the transfer project in the uncertain future
- Led to the use of RDM to support a Water Plan for the region

This opened the door to do a full RDM study in a second iteration

Take a diversified
water planning
approach

Develop a water
planning model w/
best available
scientific information

Explore
vulnerabilities of
current system

Evaluate different
portfolios that ensure
reliability at lowest
possible cost

Use RDM to develop
adaptive plan

MONTERREY

Plan Hídrico de NL costará 6 mil mdp

Nuevo proyecto sustituye a Monterrey VI, el cual valía 62 mil millones de pesos.

Alejandra Mendoza
amendoza@elfinanciero.com.mx 24.05.2017
Última actualización 24.05.2017

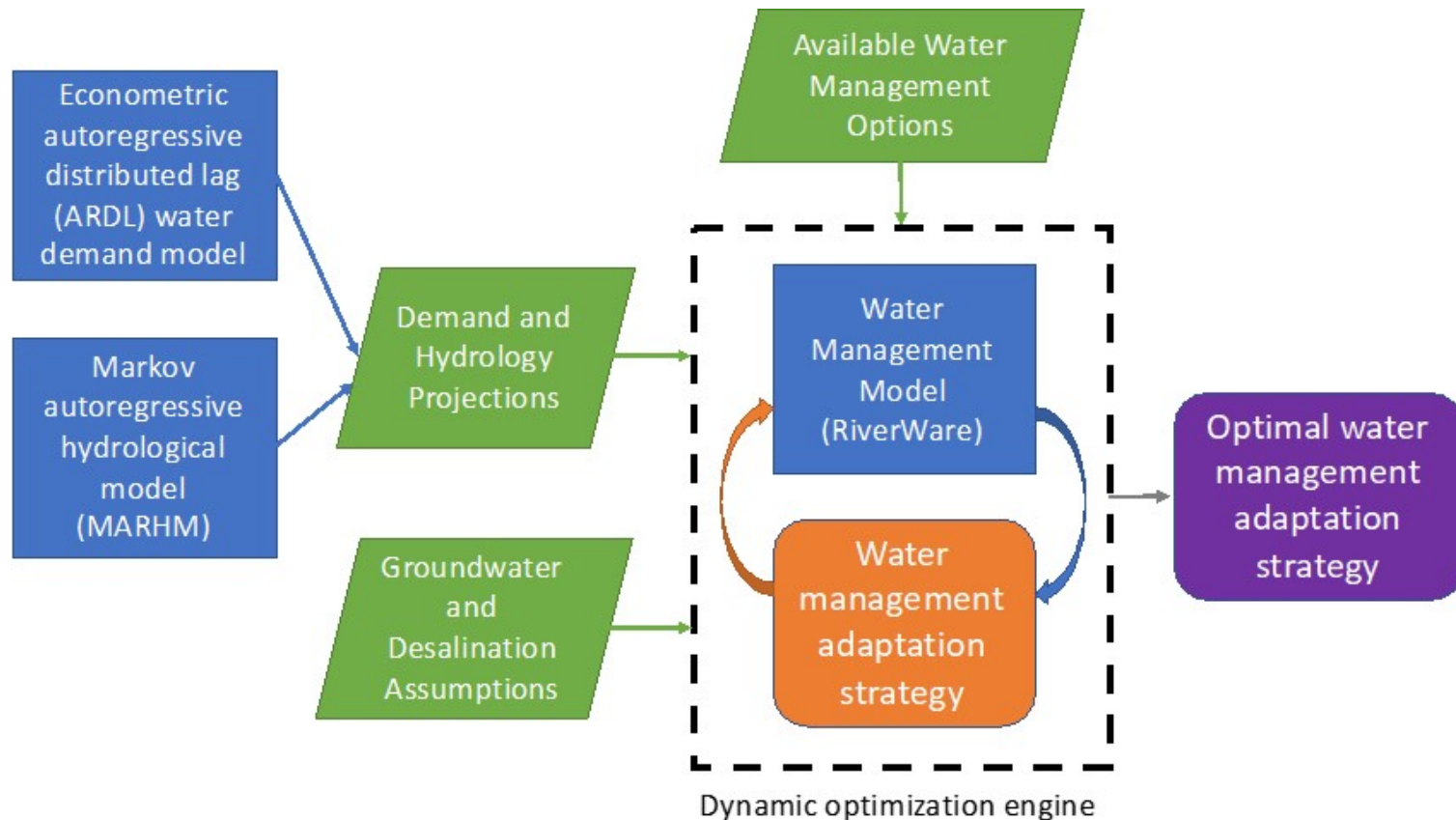
ETIQUETAS: Monterrey, agua, Nuevo León, Presa,
Monterrey VI, Fonadin, mty, Plan Hidrico.

ARTICULO

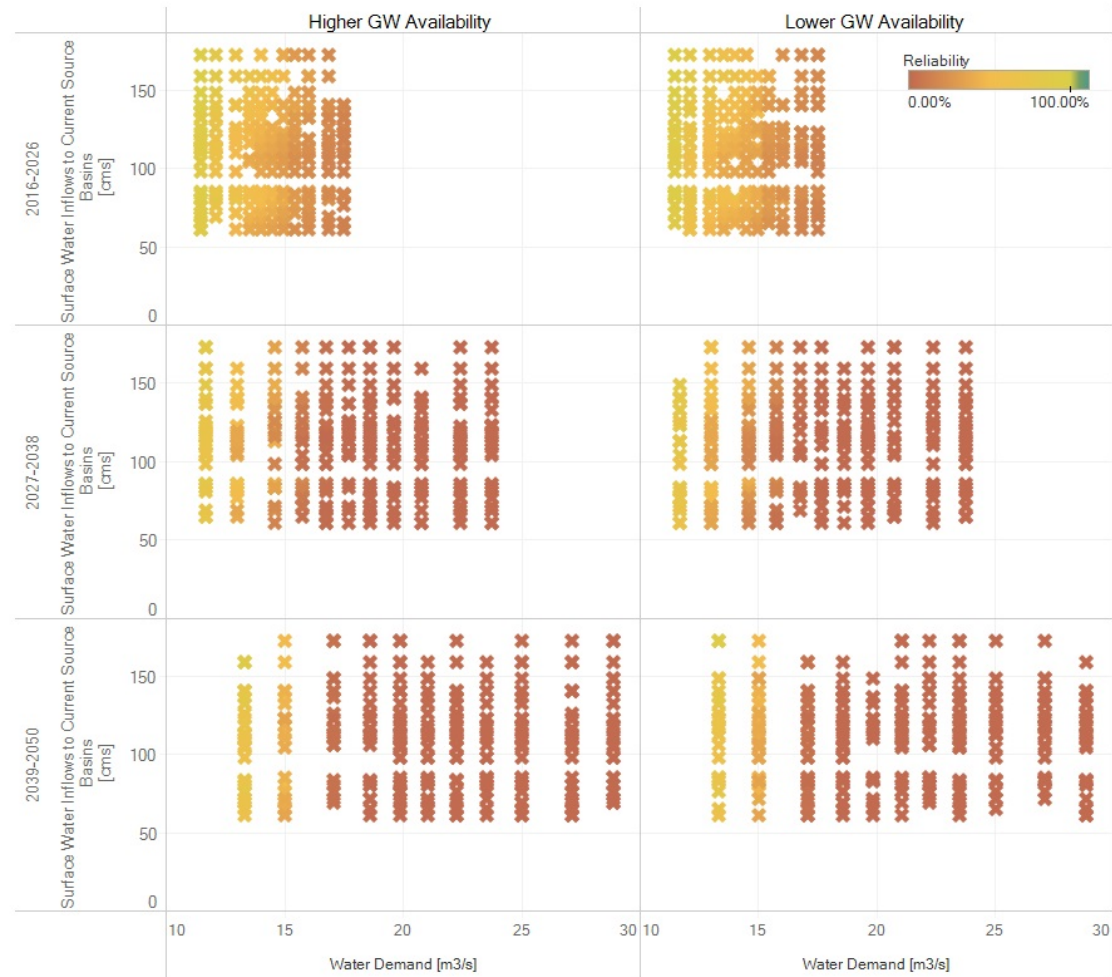
0 Comentarios



Through exhaustive stakeholders collaboration we developed new tools to evaluate options



Identified future conditions in which current strategy would not suffice



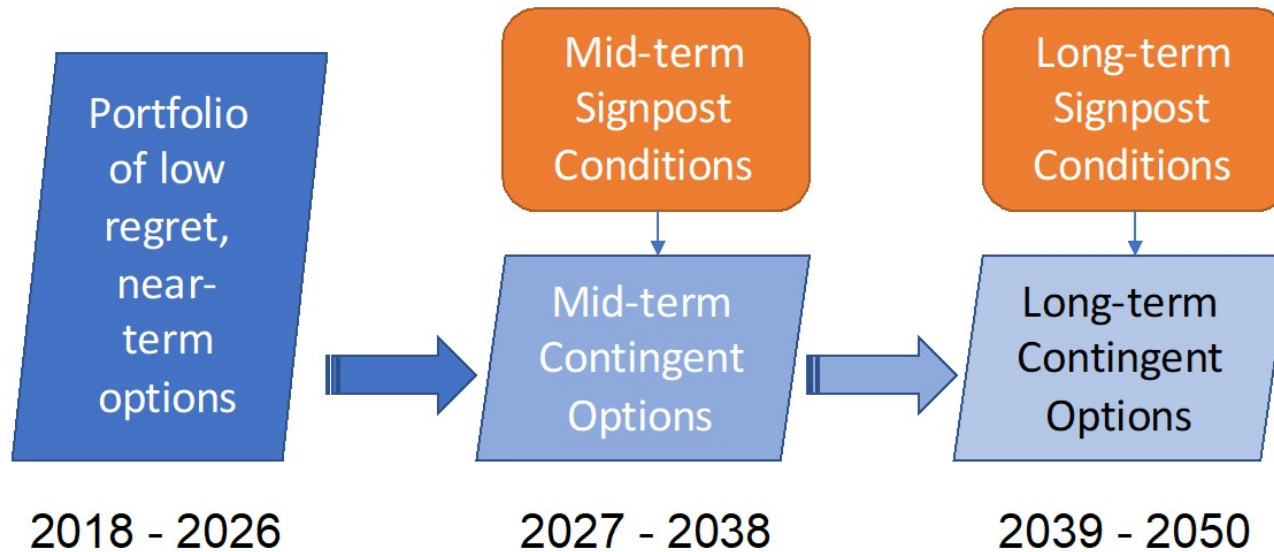
Used optimization to determine which investments would most cost effectively improve supply reliability

Portfolio Performance and Characteristics

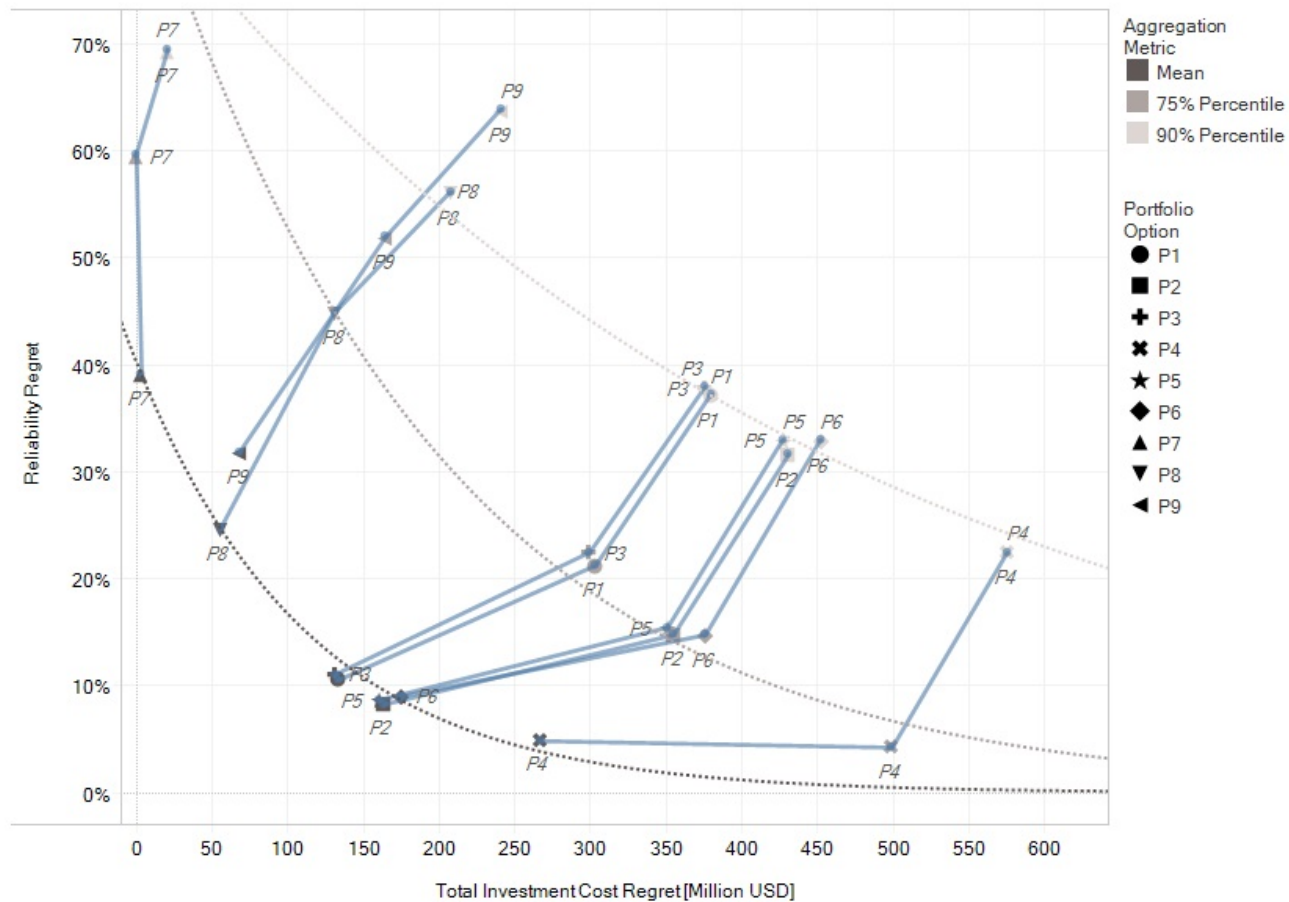
Historical Synthetic Climate Scenario

[illegible]

Develop an approach to define robust, adaptive strategies



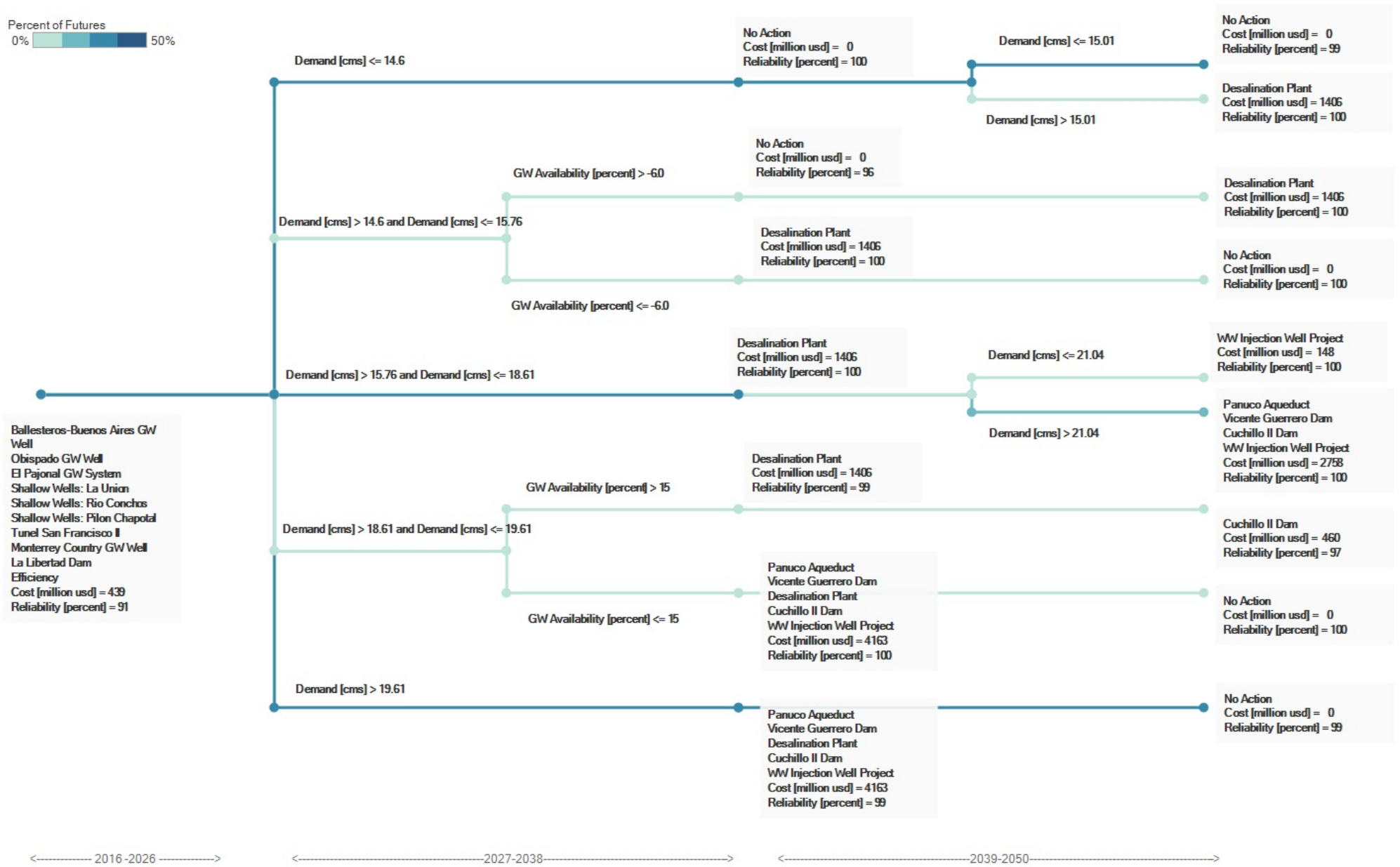
Participatory analysis of optimal portfolios across scenarios reveal “low-regret, near-term options”



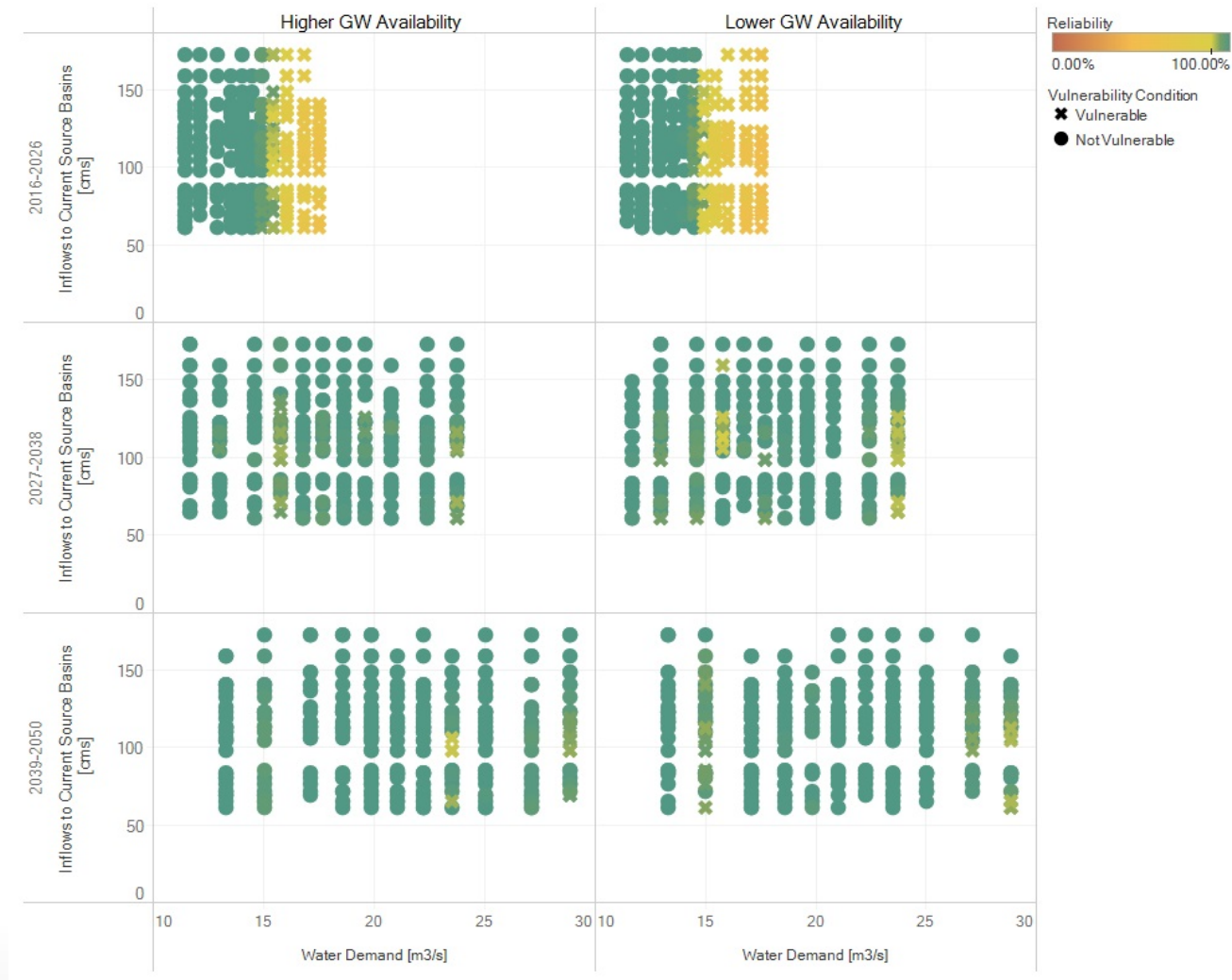
Successive optimizations (4.9 million runs) used
to define adaptive pathways

Robust, adaptive strategy defers decisions on large, controversial projects...

Percent of Futures
0% 50%

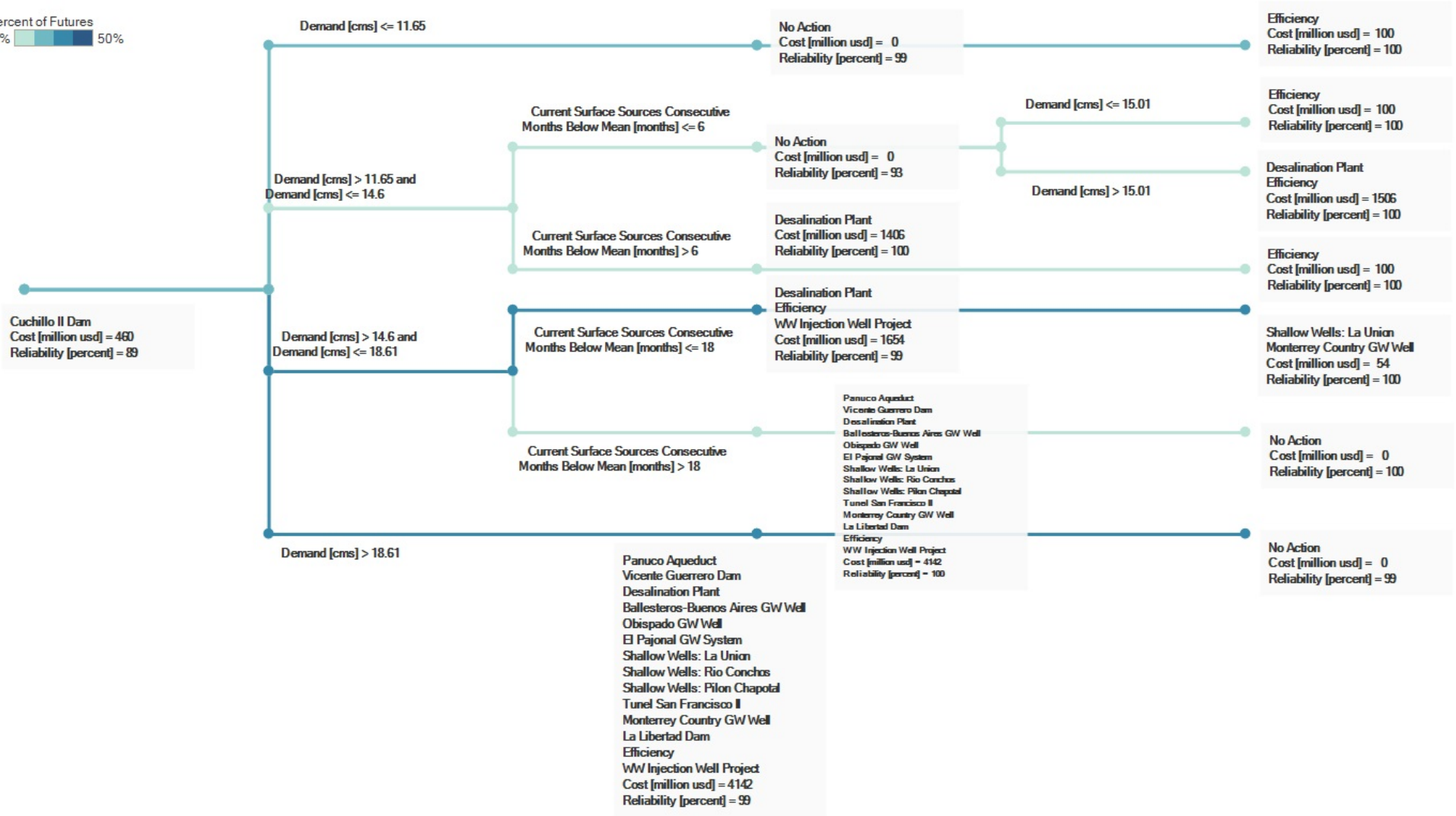


...and ensures water supply reliability over wide range of plausible futures



Options in Pareto Frontier highlight long-term
resilience-robust tradeoffs of short-term
decisions

Percent of Futures
0% 50%



← 2016-2026 →

← 2027-2038 →

← 2039-2050 →

Monterrey Study Outcomes

- Monterrey Water Plan complete and moving towards implementation (first Water Plan in Mexico)
<http://planhidriconl.mx/>
- Inclusion of innovative options such as network efficiency and conjunctive use
- New groundwater monitoring program established
- Elevated role of planning in state, supported by the Water Fund

Research Avenues

Understand how to better transfer skills and findings



As computational power becomes more ubiquitous

- Beware of statistical error propagation in integration process
- Inference validation in complex models
- Push for automated generation of statistically estimated pathways

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