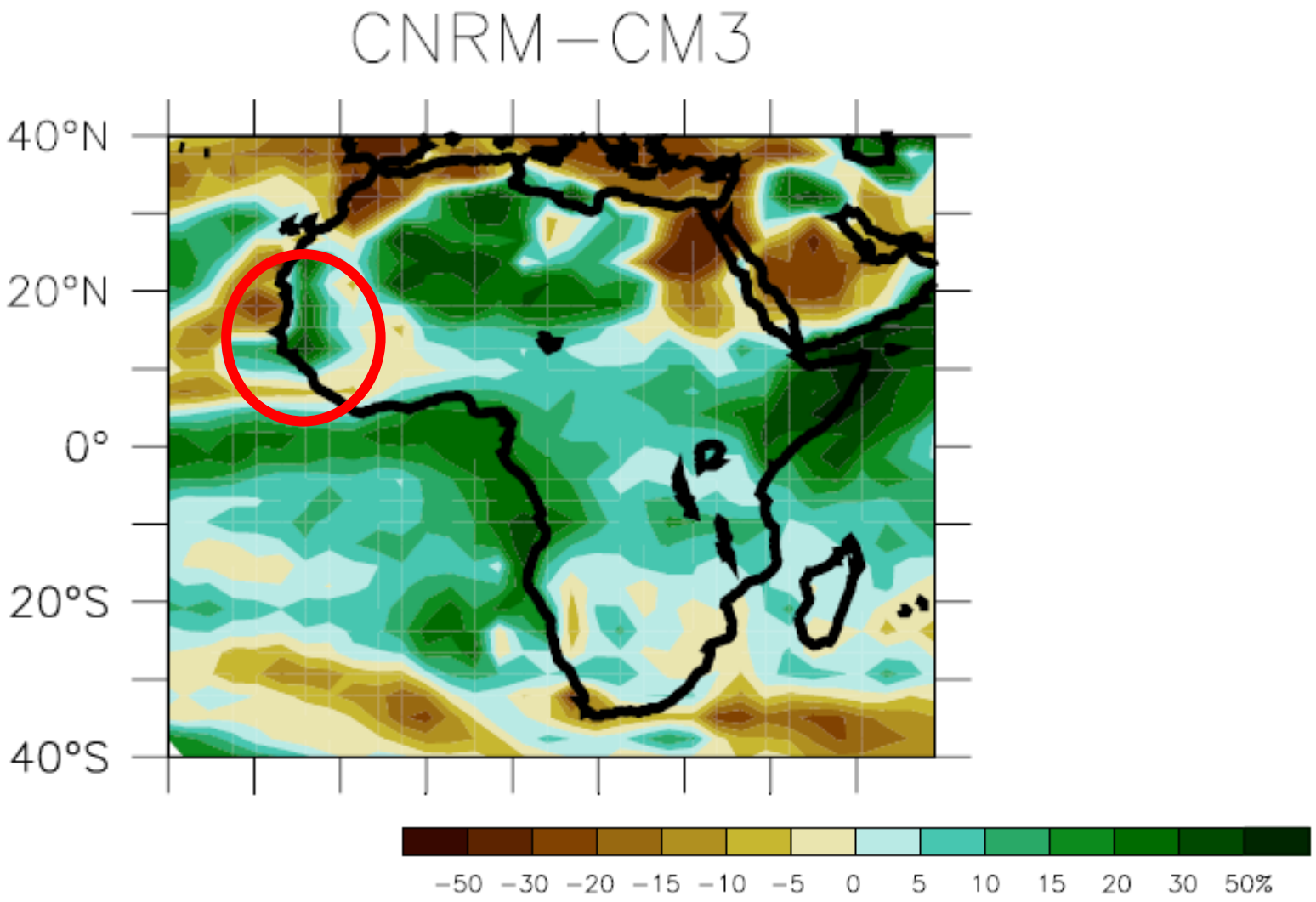
Freshwater Resilience by Design:

Prof. Casey Brown

University of Massachusetts Amherst

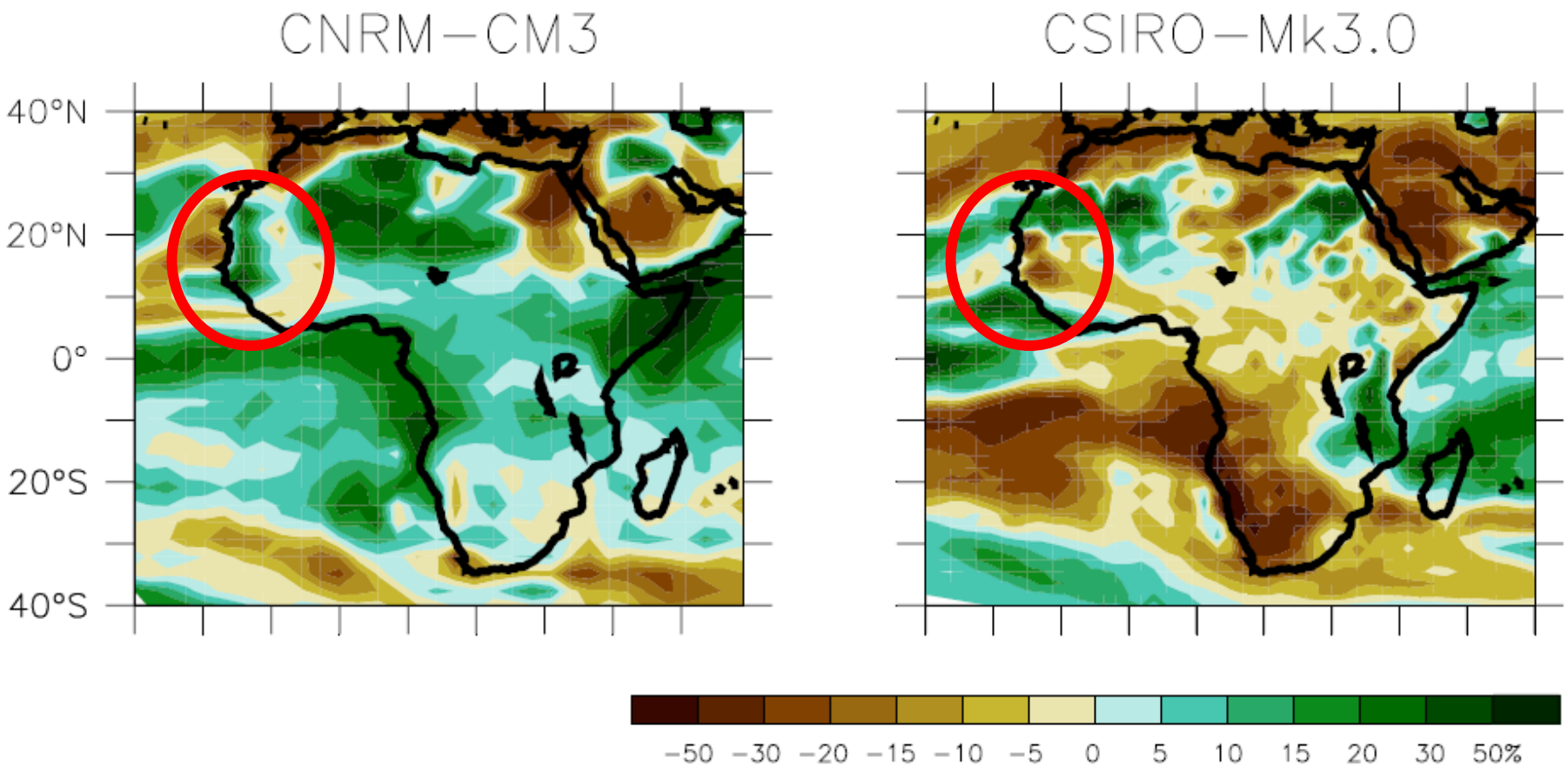
what future to plan for?



from S. Hallegatte

The Meteo-France model, from IPCC

Climate projections disagree



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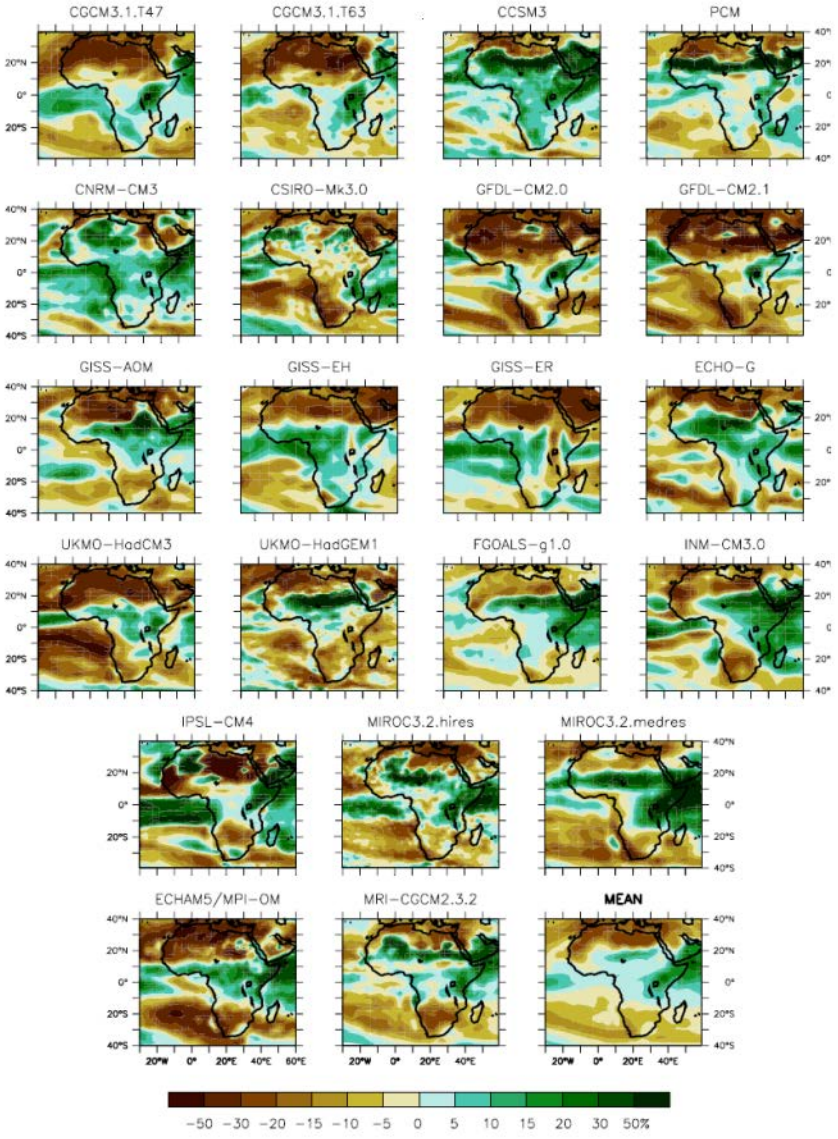
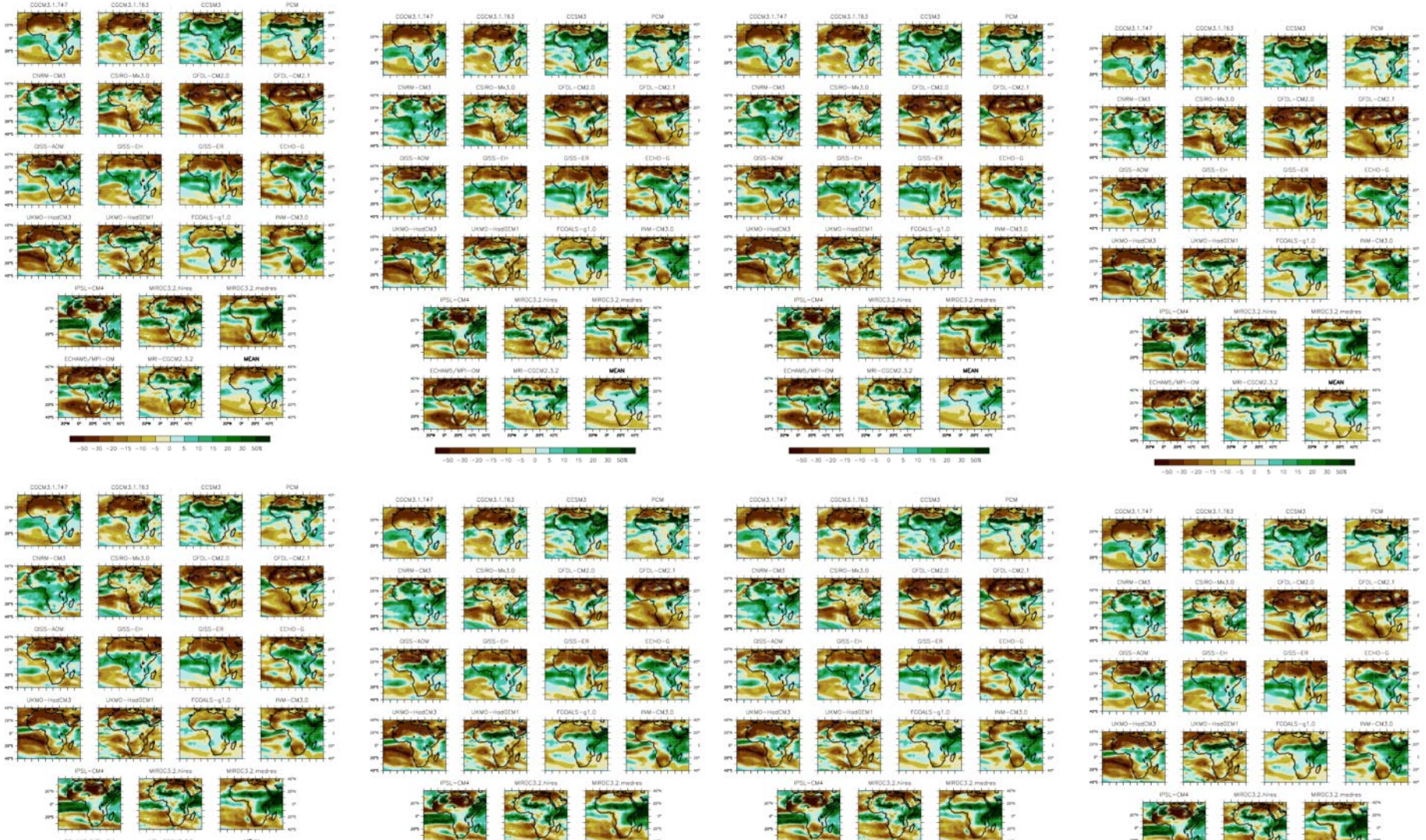
The Meteo-France and the Australian model, from IPCC

… and we have a lot of models…



from S. Hallegatte

… and future climates depend on future climate policies and socio-economic trends…



resilience

"The **ability** of a system to absorb impacts from a shock or disturbance and then recover to a state of continued functionality"

"The **ability** of a system to withstand and recover from shocks and disturbances and to maintain functionality in the face of chronic stressors"

"The **ability** to thrive under acute shocks and chronic stresses – to respond and adapt to change and to transform when conditions require it"

resilience

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resilience

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"The **ability** to **thrive** under acute **shocks** and chronic **stresses** – to respond and adapt to change and to transform when conditions require it"

performance-based resilience

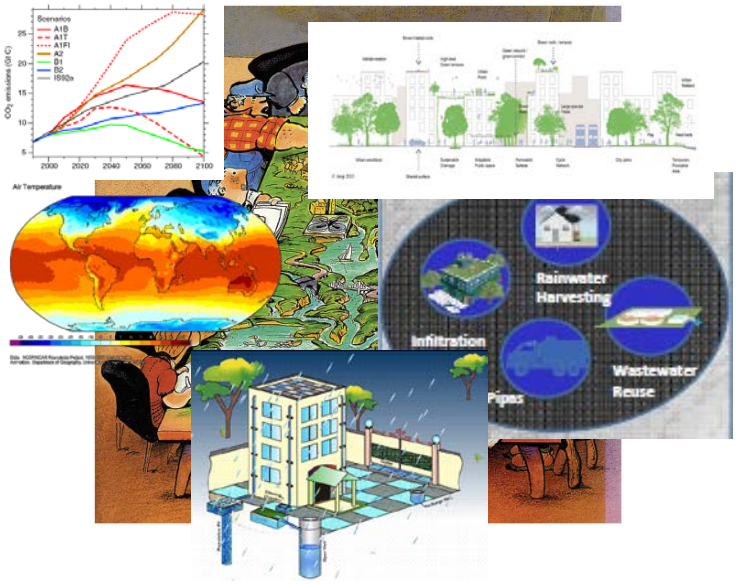
- Perform well over a wide range of futures
- Recover after failure
- Transform to new configuration if needed

Resilience by Design

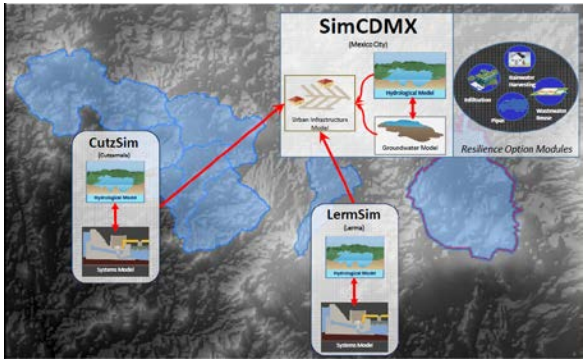
Current Practice		Our Approach
Single objective	the **risk** in current practice	*Multiple objectives*
	Focus on Cost Minimization misses potential resilience benefits, creating fragile systems	Resilience of: • **Economic/Service objectives** • **Social/Equity objectives** • **Environmental objectives**
Single future		*Multiple futures*
	Overconfidence in our expected future leads to	Future Climates Population Growth and Demographic Change Economic Growth and Change Changing Societal Preferences
Single project		*Multiple projects*
	Considering the best design for a single project misses opportunities for integration and diversification	Link urban investment program and policies with investments and policies in the connected river basins, and the evaluation of benefits and costs in each location

Resilience by Design

1 Define Resilience and Scope



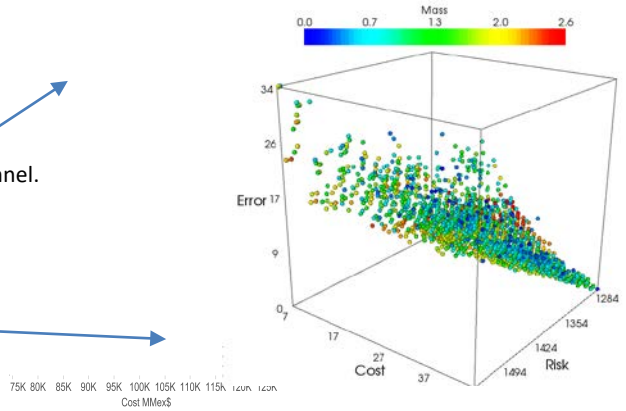
2 Collaborative Modeling



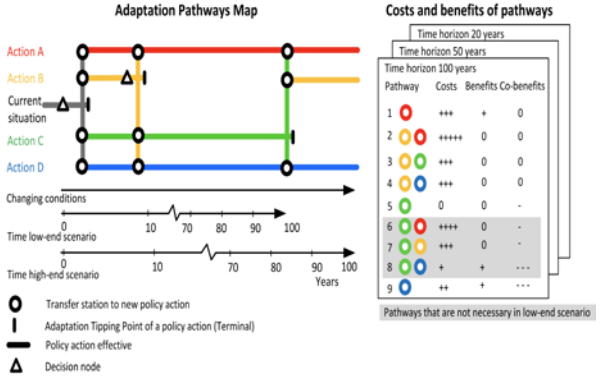
3 Data Analytics discovers optimal resilience investment portfolio

Enlargement of the Bosque-Colorines tunnel.

Construction of Temascaltepec



4 Design Water Security and Resilience Plan Implementation



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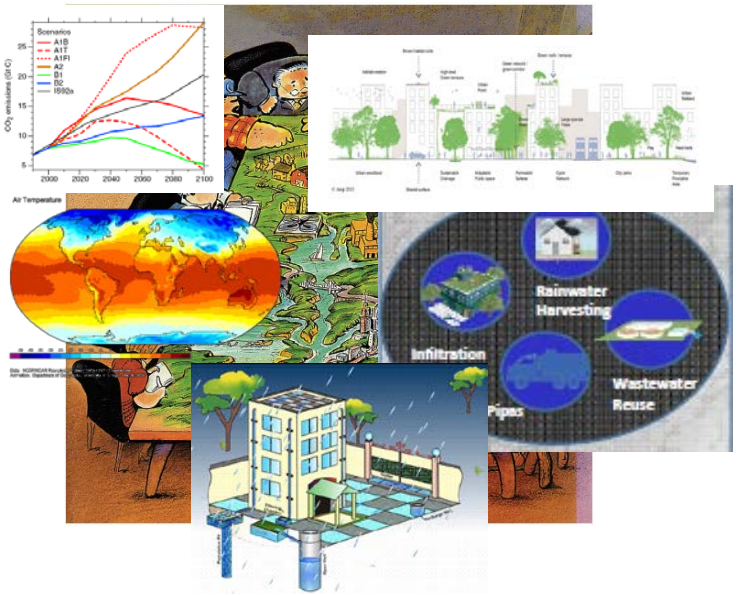

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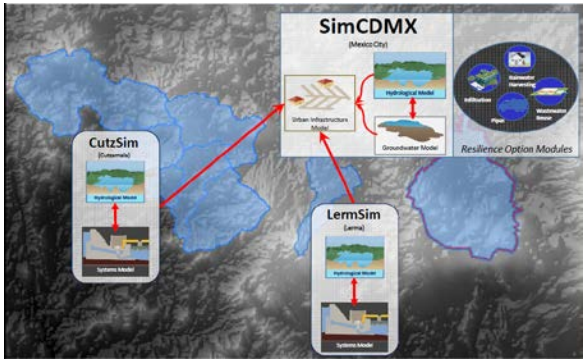

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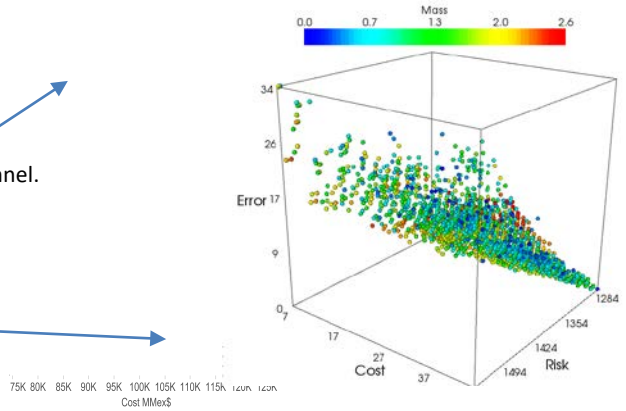

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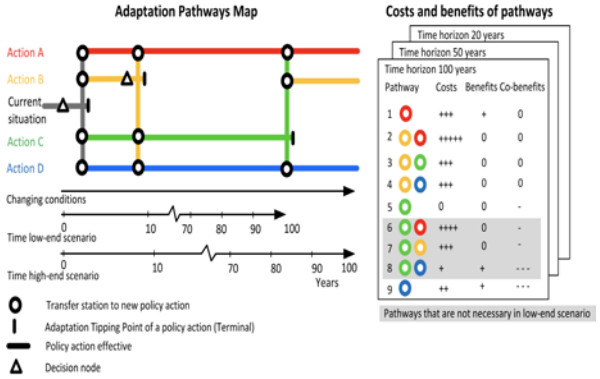
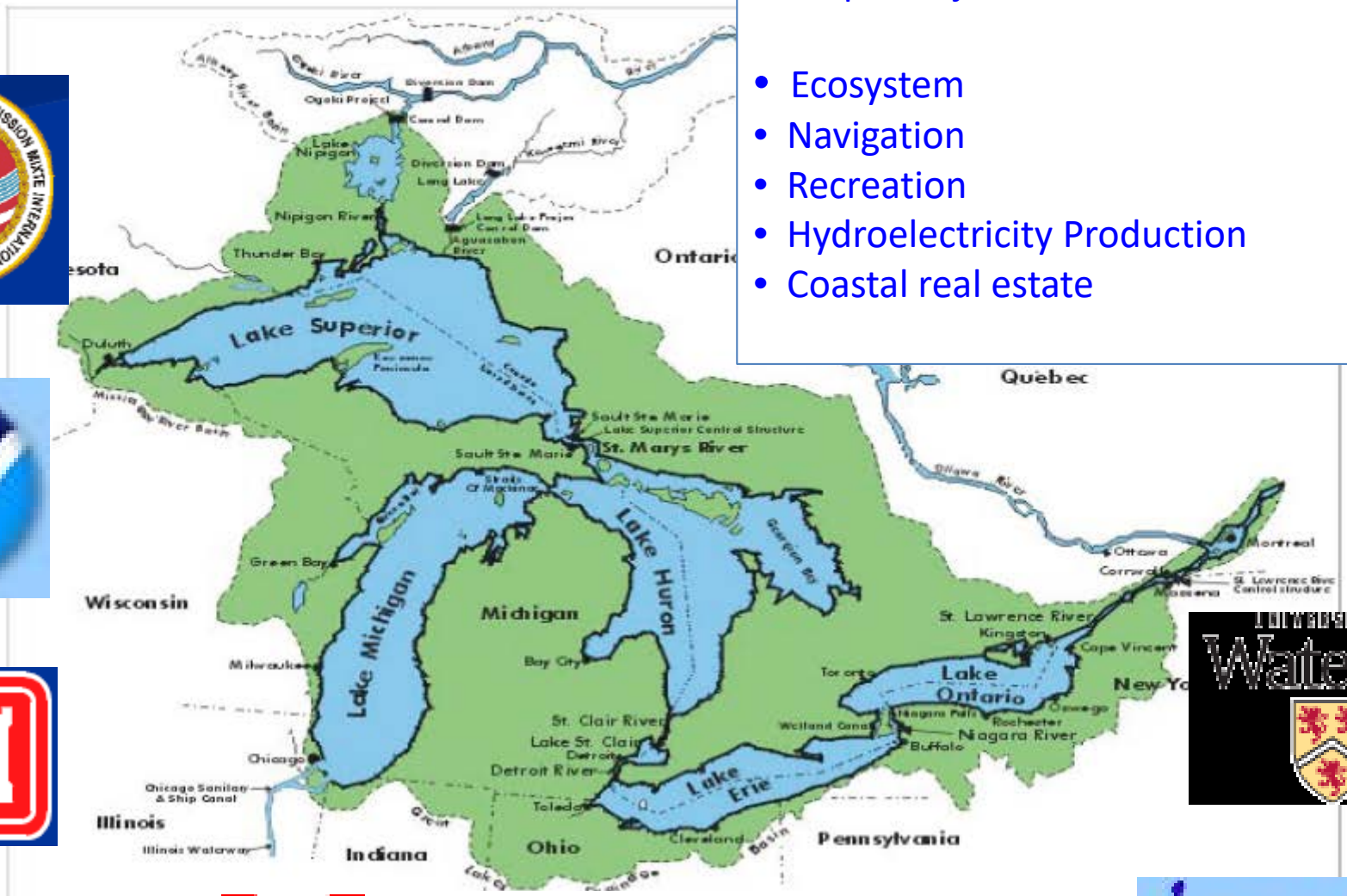


International Upper Great Lake Study

Multiple Objectives:

- Ecosystem
- Navigation
- Recreation
- Hydroelectricity Production
- Coastal real estate



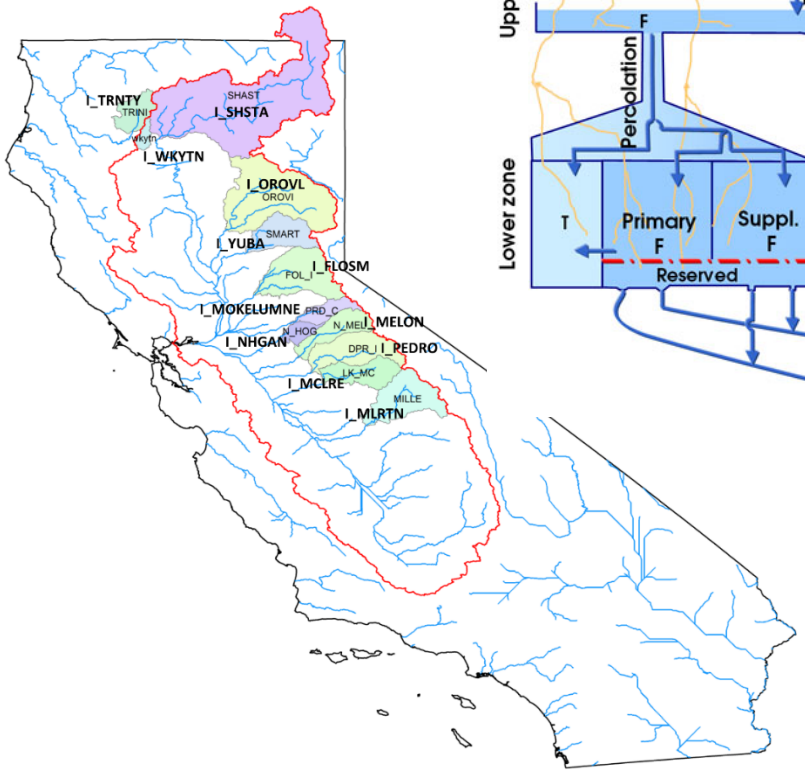
Environment Canada

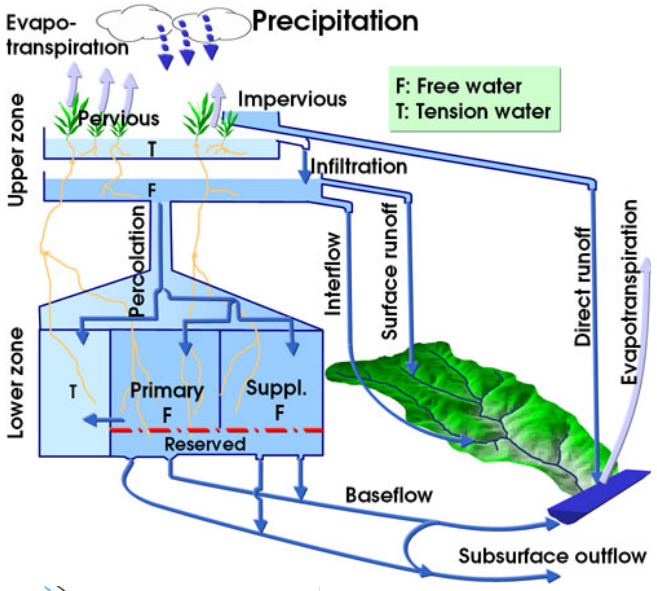
Environnement Canada

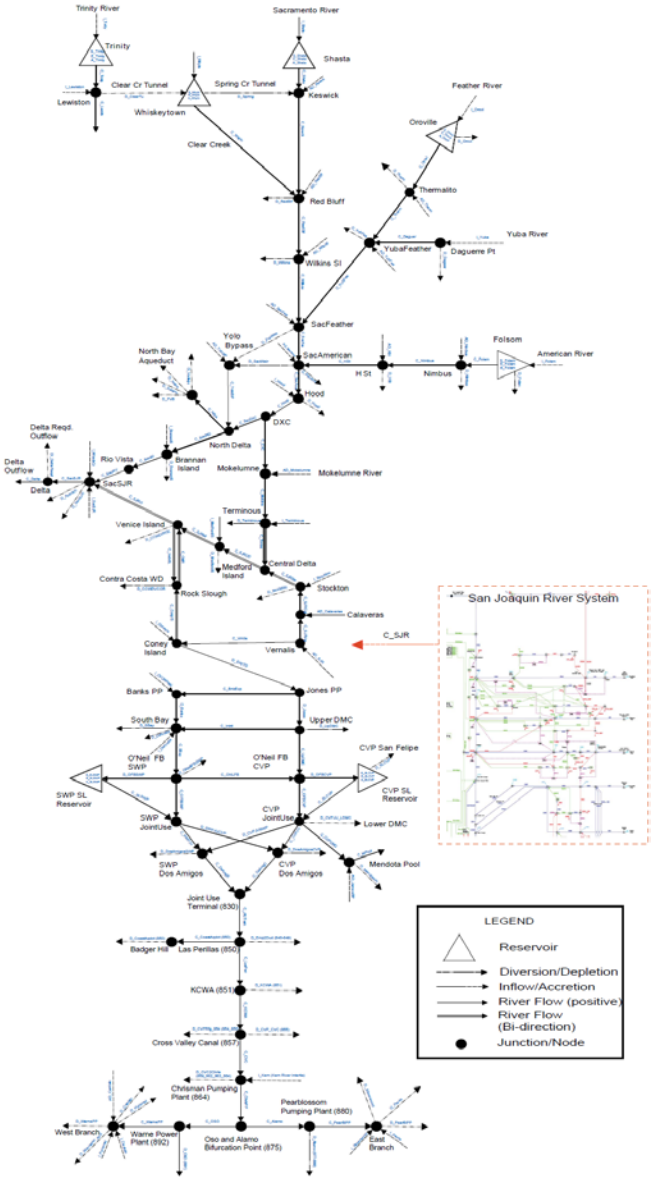
IJC Climate Change Guidance Framework

To provide clear guidance for addressing climate change in IJC policy and operations using the best available science and stakeholder inputs

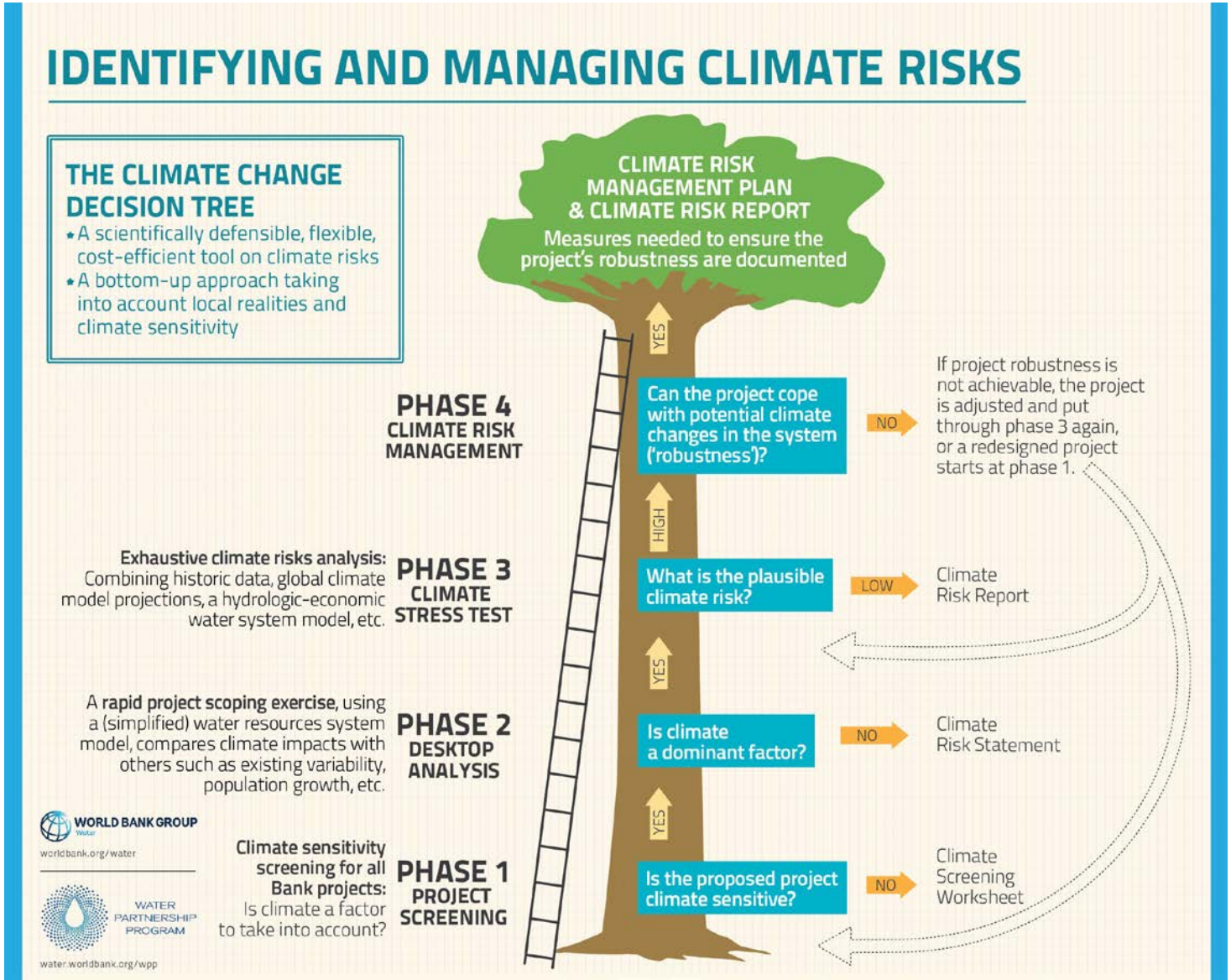
California Department of Water Resources Vulnerability Study







A Roadmap to Water Security and Resilience

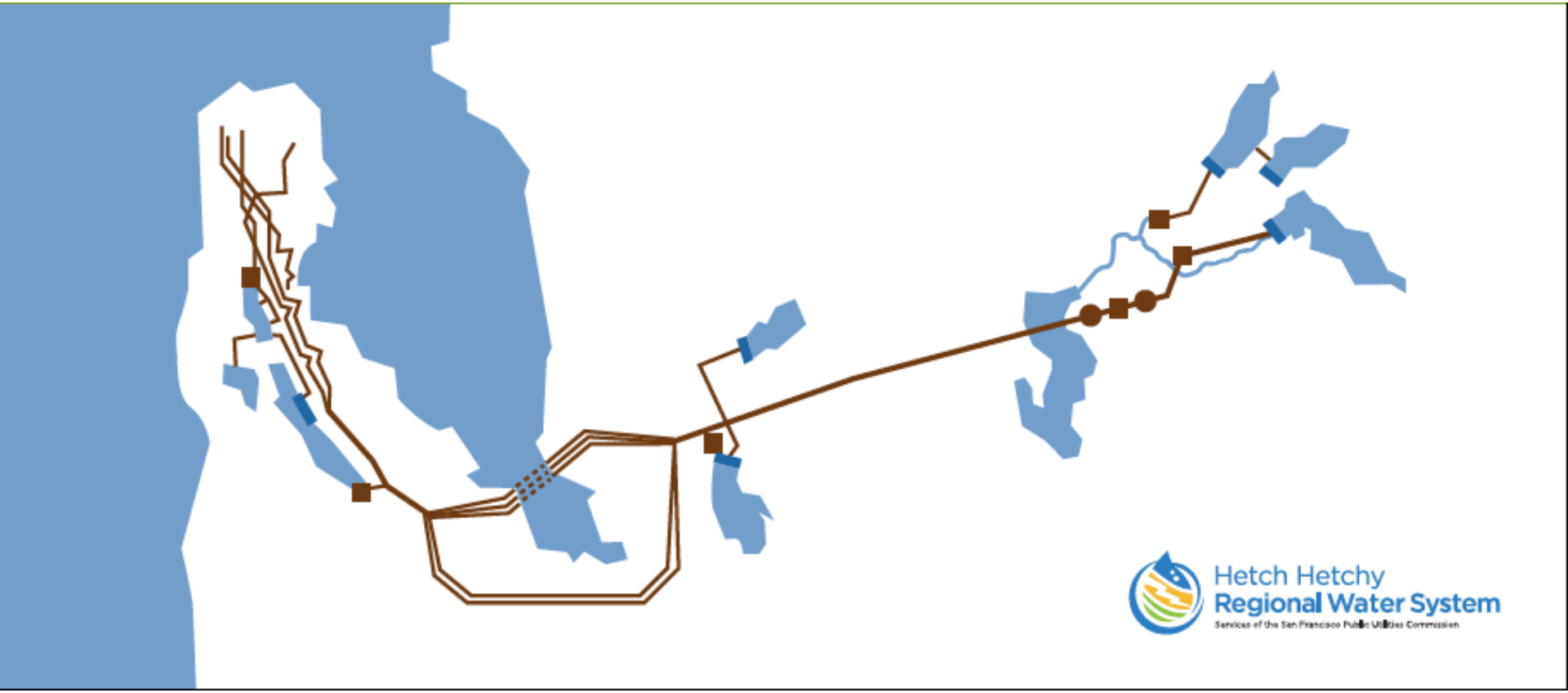


Nepal - Upper Arun Hydroelectric Plant

Colorado Springs Public Utilities

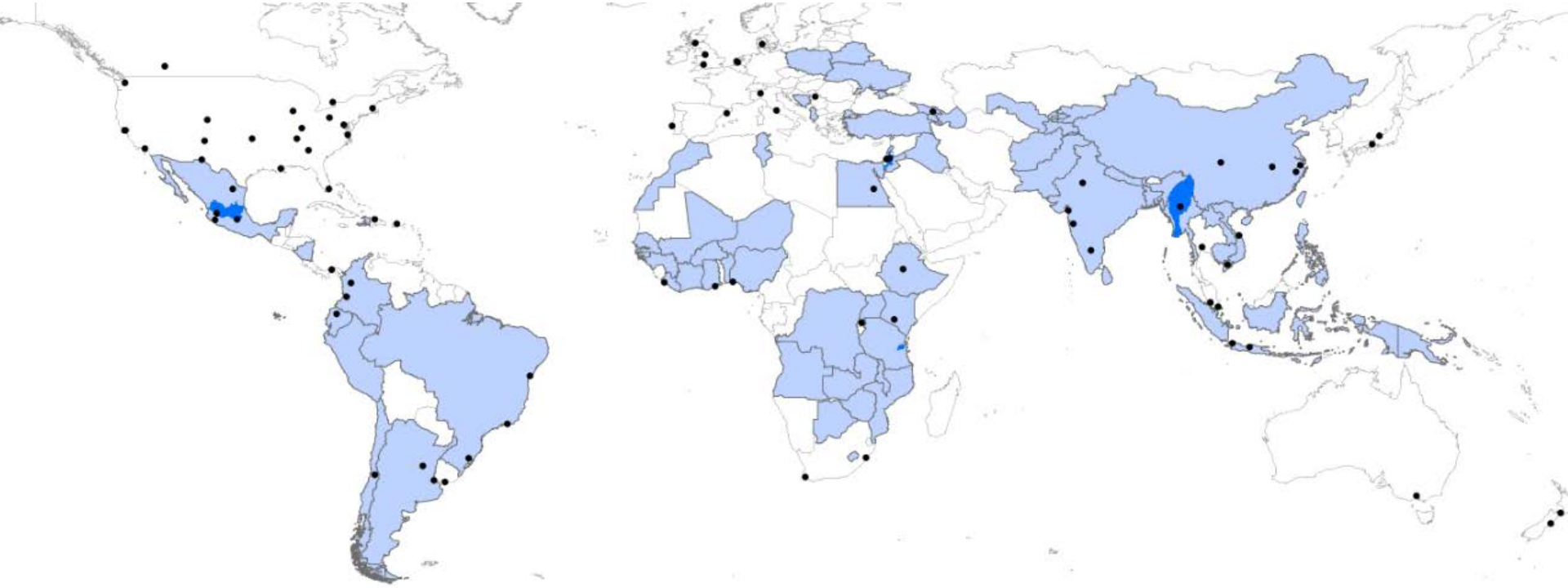
San Francisco Water

SF Water Long Term Vulnerability Assessment and Adaptation Planning



The Opportunity:
Cities, World Bank and Water Resilience:

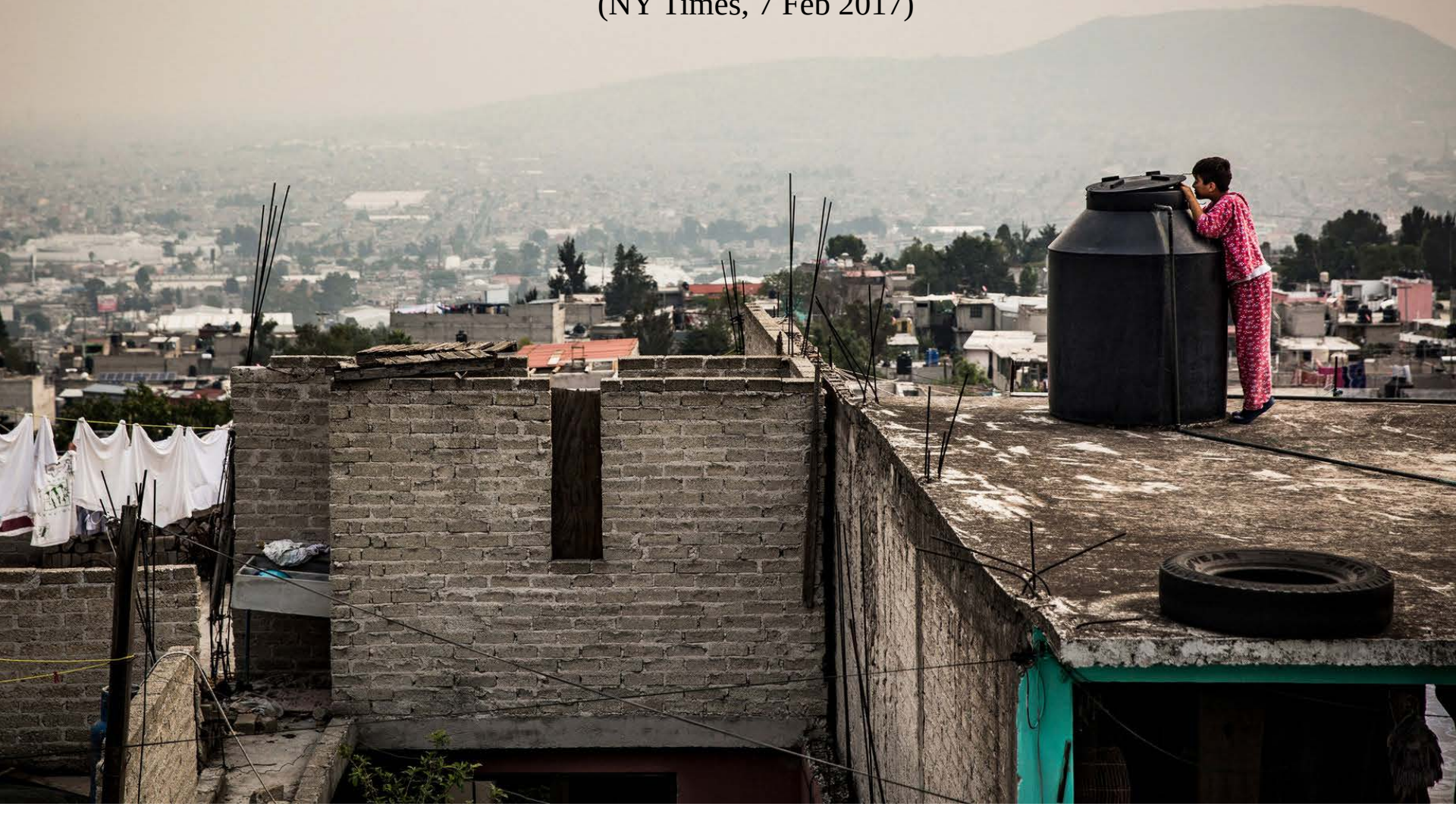
- 65% of Resilient Cities face water related risks
- World Bank water investment portfolio of $6B
- Can we leverage WB investing and Resilience Strategies to ***transform water infrastructure***?



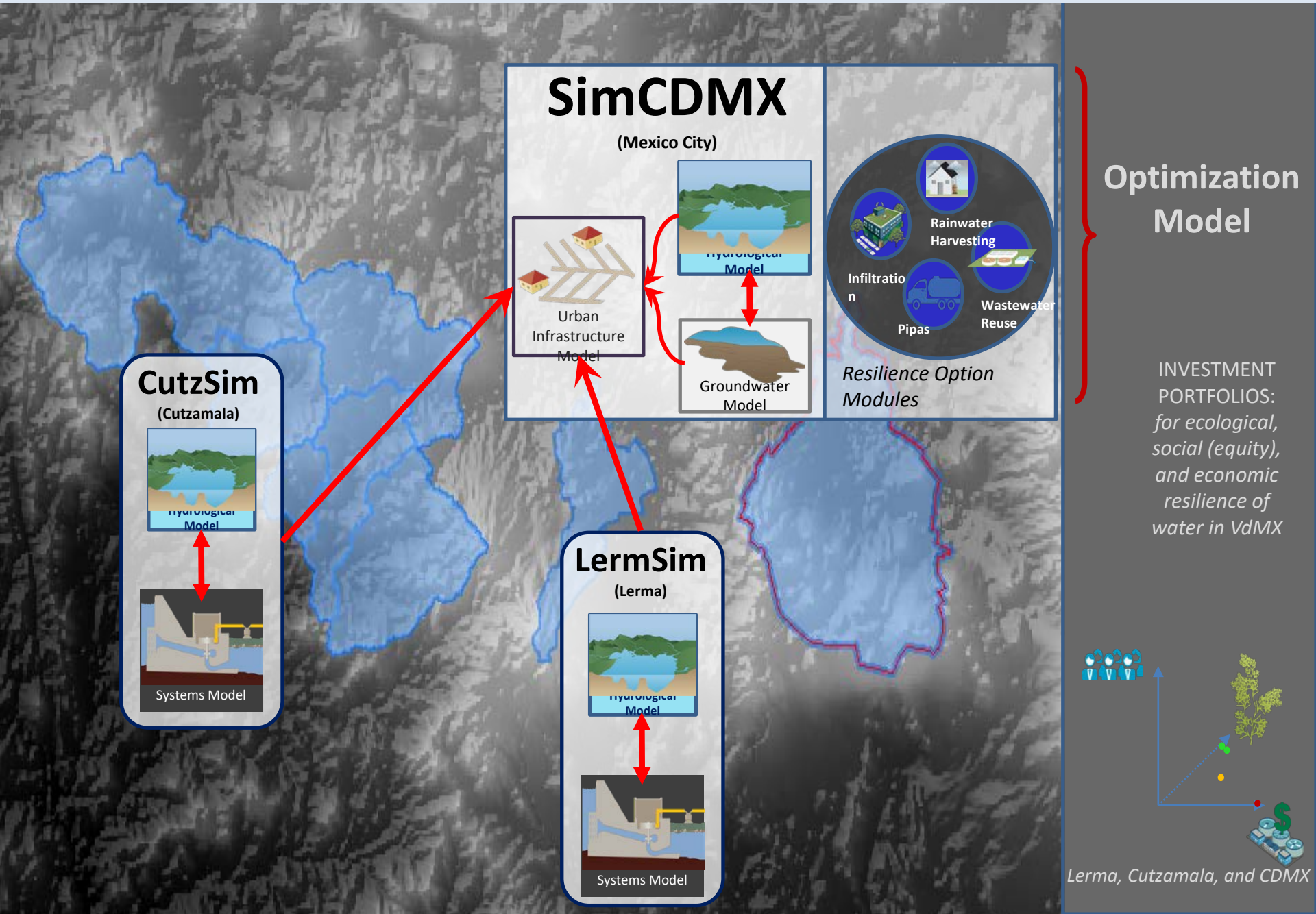
Mexico City:

Parched and Sinking, Faces a Water Crisis

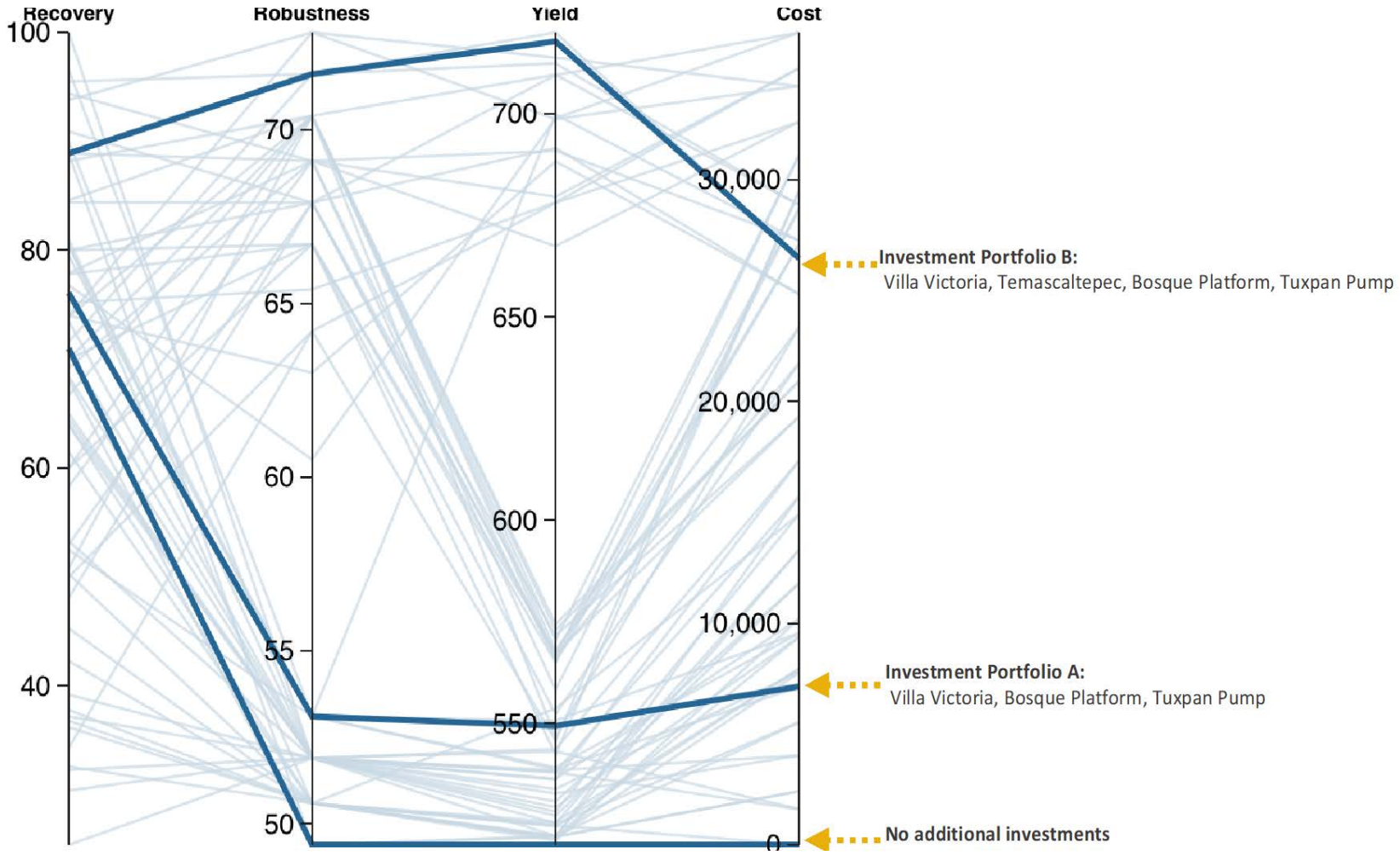
(NY Times, 7 Feb 2017)



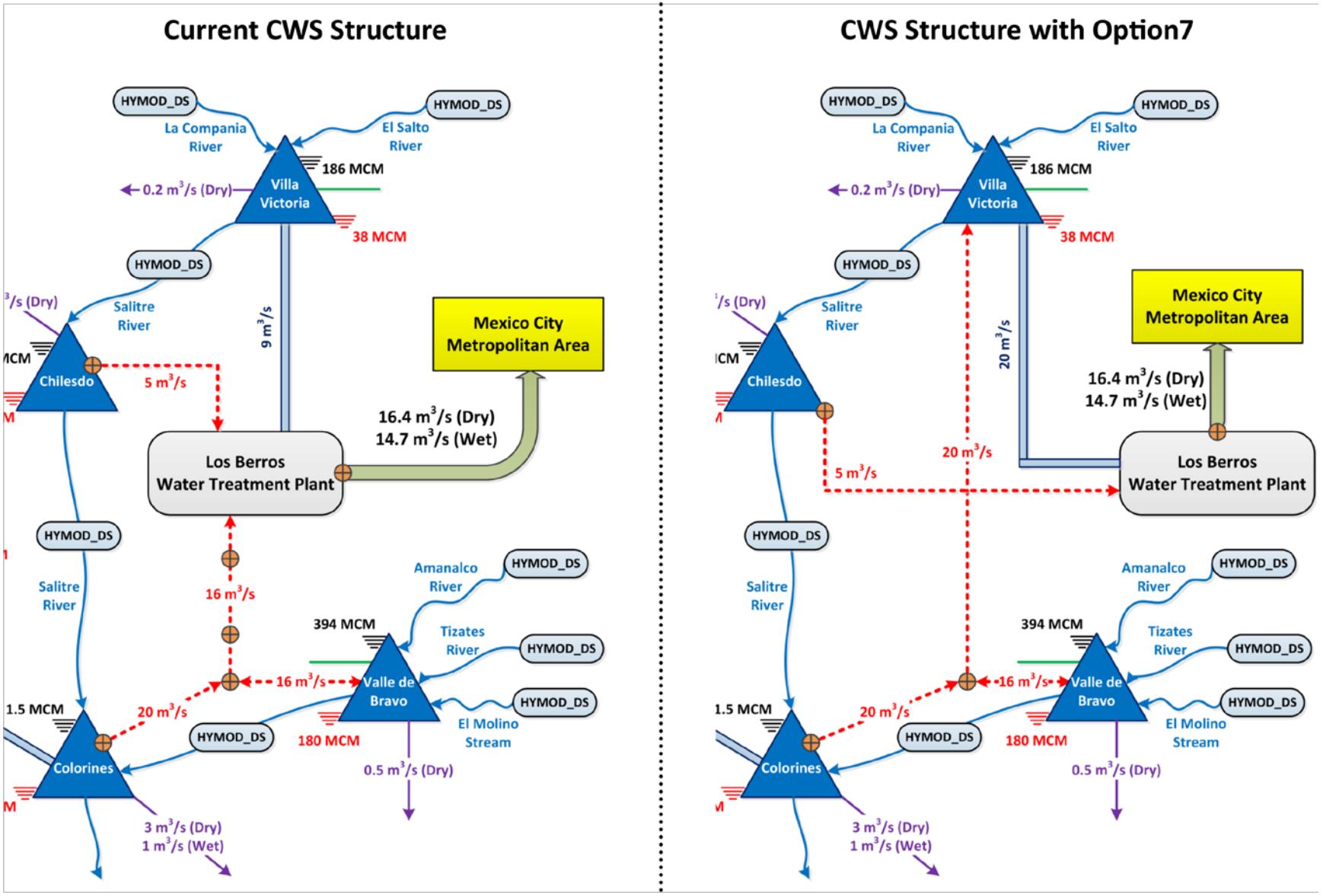
OpenAGUA – Cloud, Collaborative, decision system



Evaluating Resilience of Alternative Designs



Resilience through Connectivity



Conclusion

- Freshwater Resilience requires investment done in new ways
- There's a significant and important opportunity to re-engineer water infrastructure
- However, if we evaluate designs as we always have, we'll choose the designs we always have

Thank You. Questions: casey@umass.edu