Resilience by Design in CDMX and the Valle de México

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The Current Situation

By 2025, the percent of Mexico City’s population with access to acceptable quality of water service is projected to decrease from 82% to 28%.
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- **Overexploitation of the aquifer** is currently estimated at double the recharge rate.
- **Subsidence** in the city ranges from 4 to 26 cm per year, depending on part of city.
- **Losses in the distribution system** estimated to be 42% of the total water supplied to the city (this includes water not accounted for, illegal capture and leakages).
- **Equity and inclusivity** are major issues; water scarcity and shortages are borne disproportionately by the poor.
- **Urban flooding and storm water management** are a chronic problem.
- The system is highly vulnerable to **earthquakes** and slow to recover.
Urban areas account for under 3 percent of the world’s land surface area (Akbari, Menon, & Rosenfeld, 2009) and yet are home to over half of the world’s population (United Nations, 2018).
¿What can be done to improve resilience of water supply under future (uncertain) risks?
Traditional Water Resources Planning

Engineers (and economists) determine projects based on cost and yield.

- What happens with future shocks?
- Climate change?
- Equity of distribution of benefits?
- Environment?

Resulting in solutions which are **FRAGILE**
Confronting Climate Uncertainty in Water Resources Planning and Project Design

*The Decision Tree Framework*

Patrick A. Ray and Casey M. Brown
Resilience by Design

1. Definition of $S$ critical subsystems.
2. Define metrics
3. Explore system vulnerability/sensitivity
4. Robust stochastic multiobjective optimization

RESILIENCE

of what to what and what can be done?
Take Aways of RbD in the Valle de Mexico

1. Integrated approaches needed, particularly as system complexity and interdependence increase, bottom up approaches can be a tool for integrated systems approaches and cooperation.

2. Understanding system vulnerability (and sensitivity) to various uncertainties helps to build cooperation and discovery of new solutions.

3. Resilience of complex systems is likely to require the exploration of solutions across space, time and actors.
Stakeholder Engagement
- 11 workshops with participants
- >34 institutions
- >70 participants

Key input on:
- Model formulation, validation, and data
- Management objectives
- Uncertain risk factors
- Potential actions and solutions

…but first, Stakeholders are Crucial!
Bottom up approaches as a tool for system integration
Bottom up approaches as a tool for system integration
Importance of multi-factor vulnerability

**Cutzamala vulnerability to climate**

[Graph showing temperature change vs. precipitation change, with current target yield and CMIP5 GCM projections.

**Sensitivity to demand and maintenance**

*Results in this presentation are preliminary or provisional and are subject to revision.*
La disponibilidad de agua en el Sistema Cutzamala va a disminuir.

Importance of multi-factor vulnerability
Aprovechamiento de los Ríos del Oriente.

Evaluation of Predefined Projects (The World Bank)

Management Solutions (operations OCAVM and SACMEX)

Workshop Defined Solutions (Agua Capital)

Solutions across actors
Solutions across actors

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Gracias y next steps

• System wide vulnerability assessment for 9 uncertainties (if you want nerd out on methods, contact me!)

• Evaluation of portfolios of options across all subsystems

• Continued engagement

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