Resilience by Design in CDMX and the Valle de México

Sarah Freeman *with*

World Bank: Diego Rodriquez, Veronica Martinez, Homero Paltan

University of Cincinatti: Jacob Tracy, Patrick Ray

University of Massachusetts, Amherst: Sungwook Wi, Savannah Wunderlich, Fred Boltz, Casey Brown

Agua Capital: Eduardo Vazquez, Pipola Gomez


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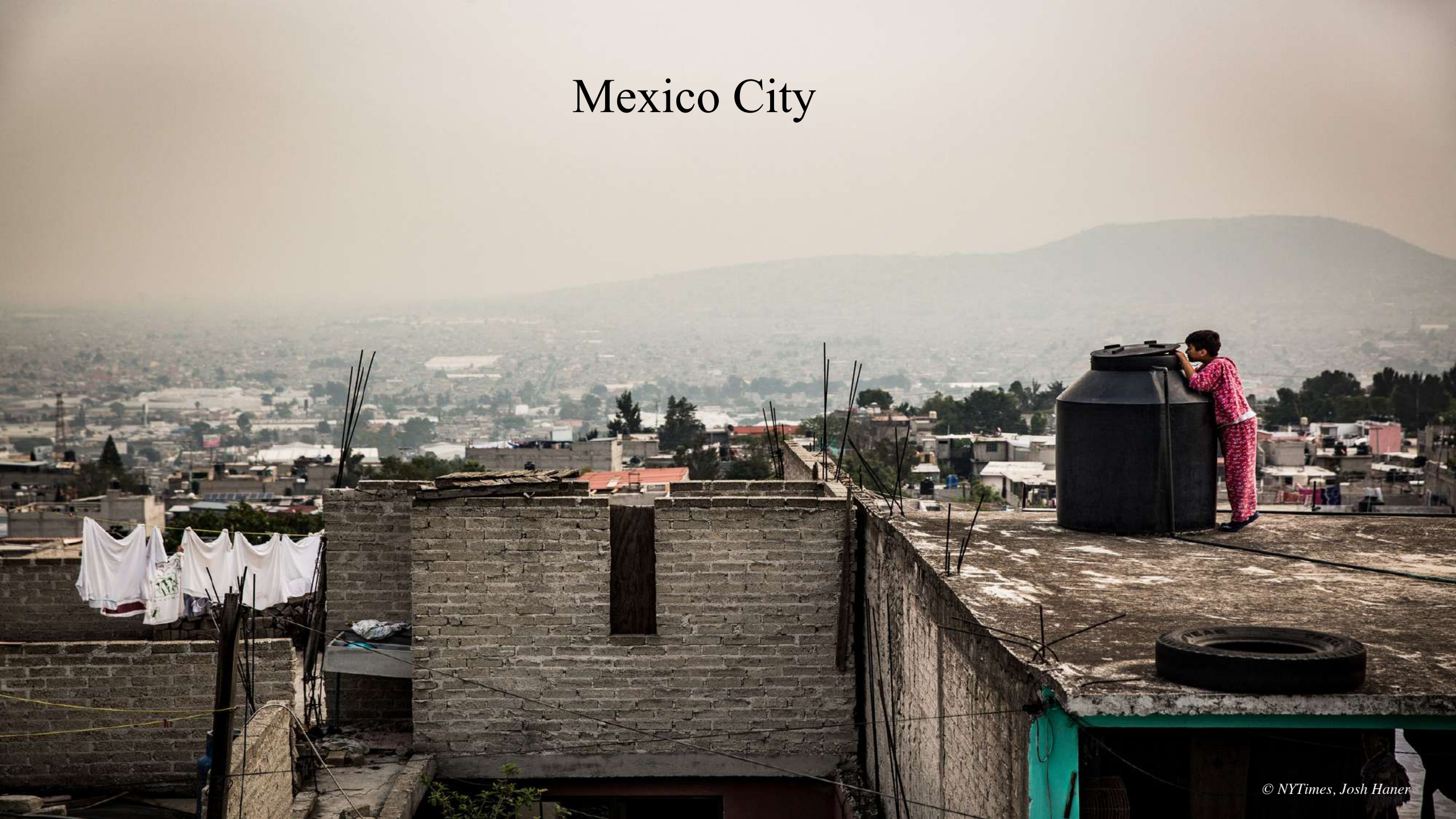
Ciudad de México
Isabel la Católica
sacmex
Pino Suárez


Tlalnepantla
de Baz
Mexico City
DOCTORES
COLONIA
ASTURIAS

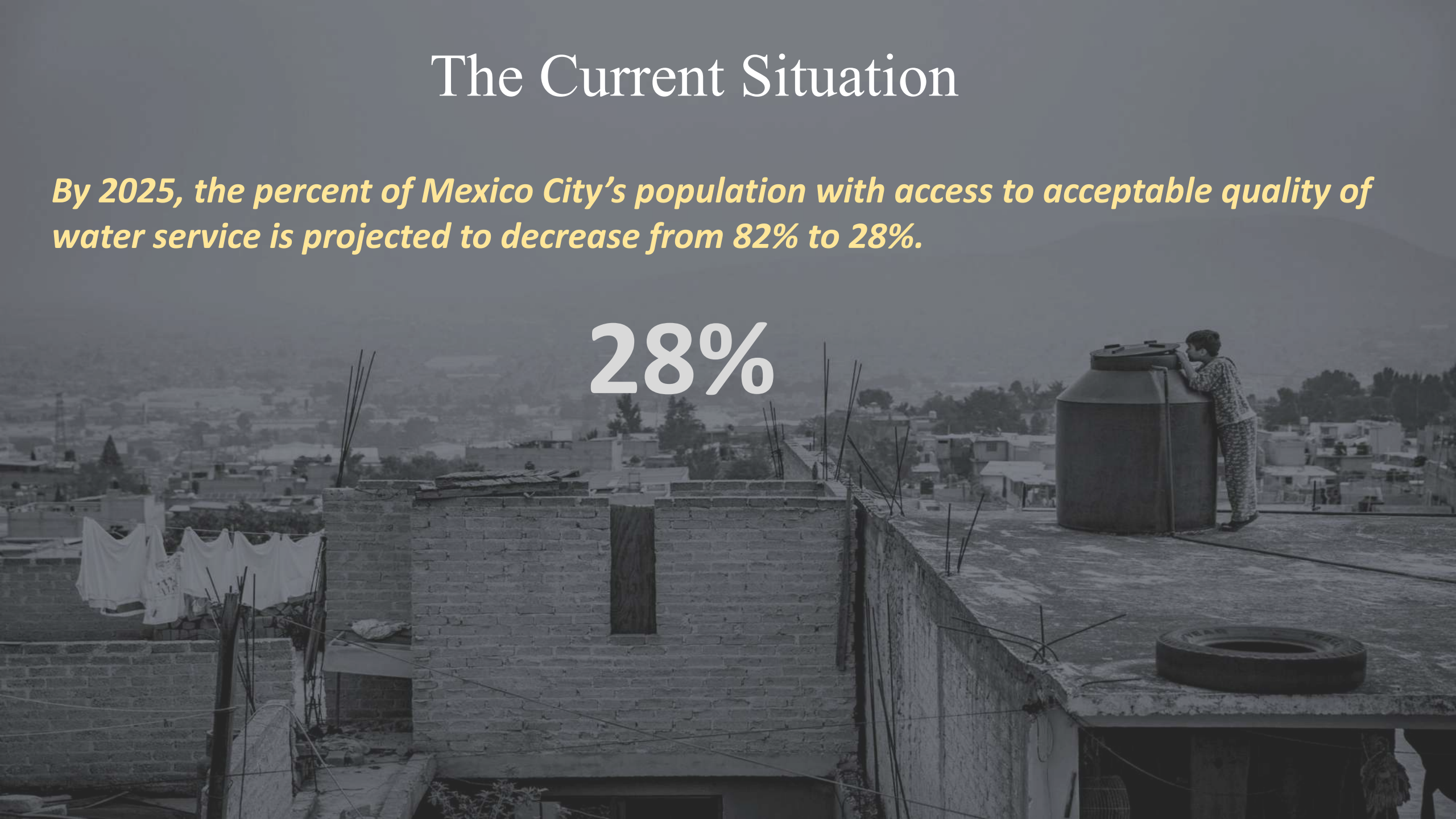
Mexico City



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%.

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 .

Water Management for Megacities

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?

CONAGUA
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AGUA CAPITAL

The ROCKEFELLER FOUNDATION

University of Massachusetts Amherst

University of CINCINNATI

SACMEX

CONSEJO DE CUENCA LERMA-CHAPALA

100 RESILIENT CITIES

THE WORLD BANK
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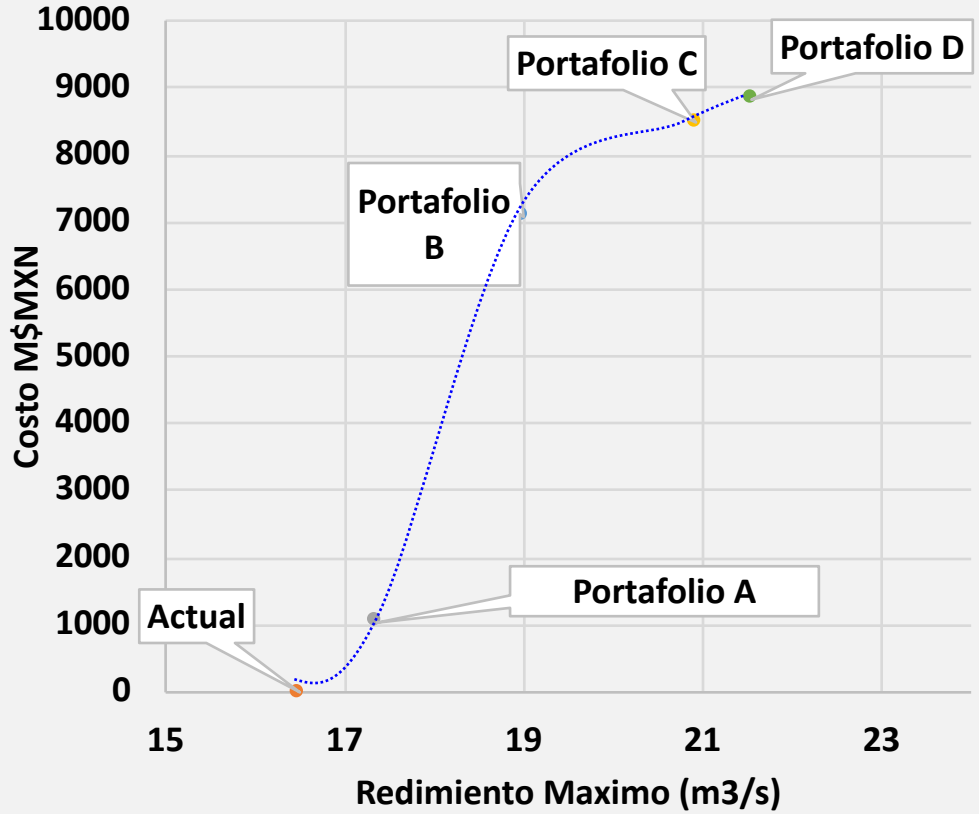
Traditional Water Resources Planning

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

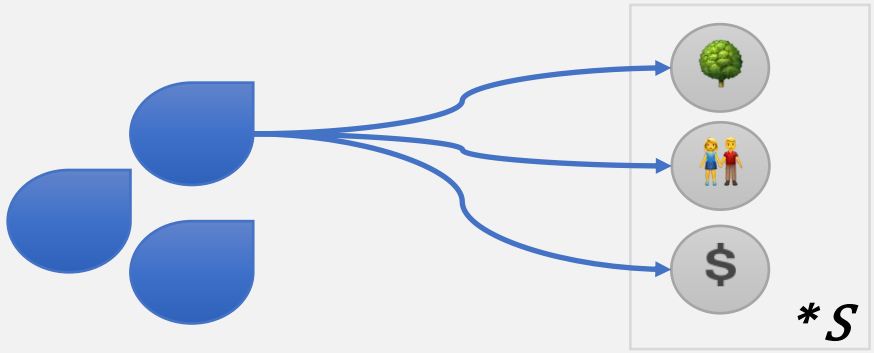
Confronting Climate Uncertainty in Water Resources Planning and Project Design

The Decision Tree Framework

Patrick A. Ray and Casey M. Brown

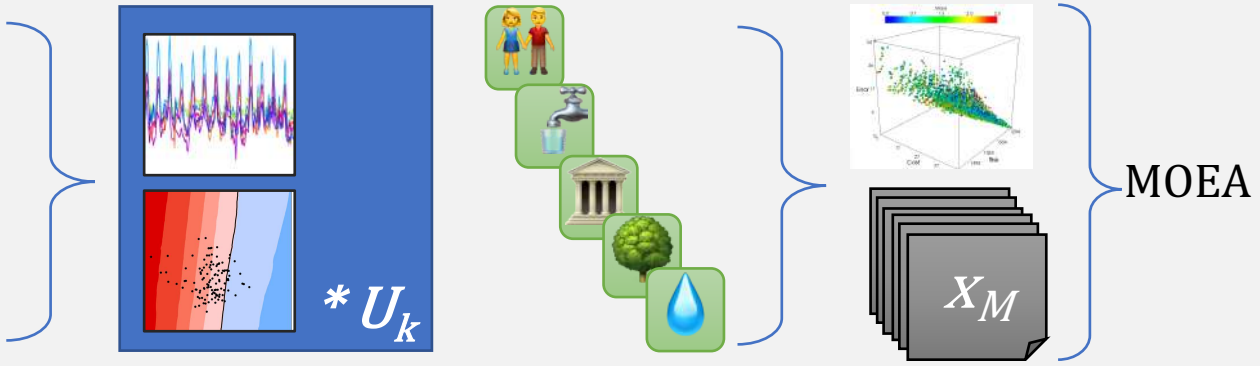
WORLD BANK GROUP

Resilience by Design



1. Definition of S critical subsystems.

2. Define metrics



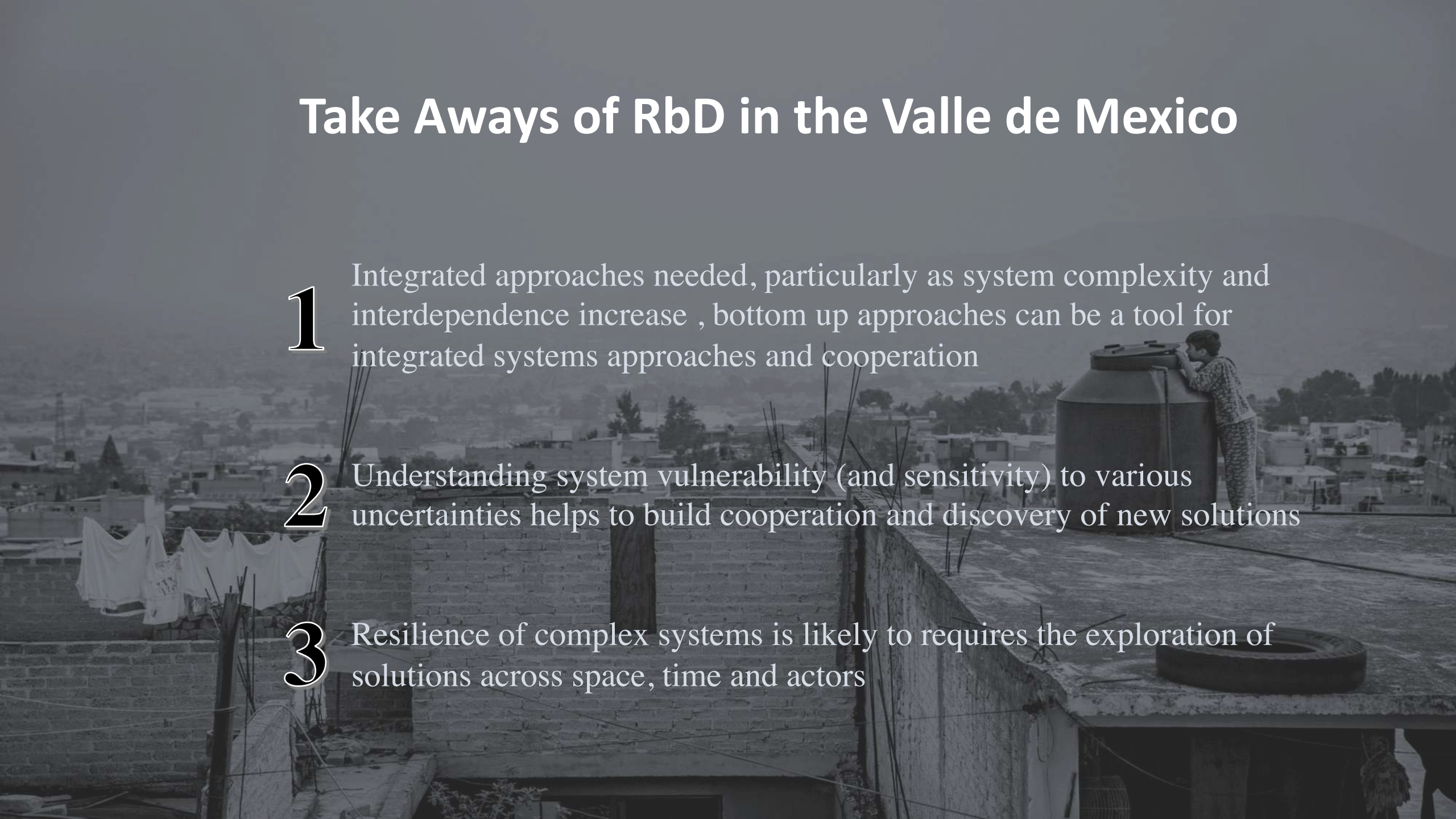
3. Expore system vulnerability/sensitivity

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 requires the exploration of solutions across space, time and actors

…but first, Stakeholders are Crucial!

- 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

1 **Water Resilience by Design in Mexico City: A Participatory Human-Hydrologic Systems Approach**

2 Sarah St. George Freeman[1], Casey Brown[1], Hector Cañada[6], Veronica Martinez[2], Adriana

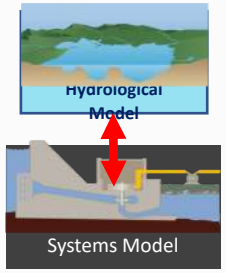
3 Palma Nava[7], Patrick Ray[4], Diego Rodriguez[2], Andres Romo[5], Jacob Tracy[4], Eduardo

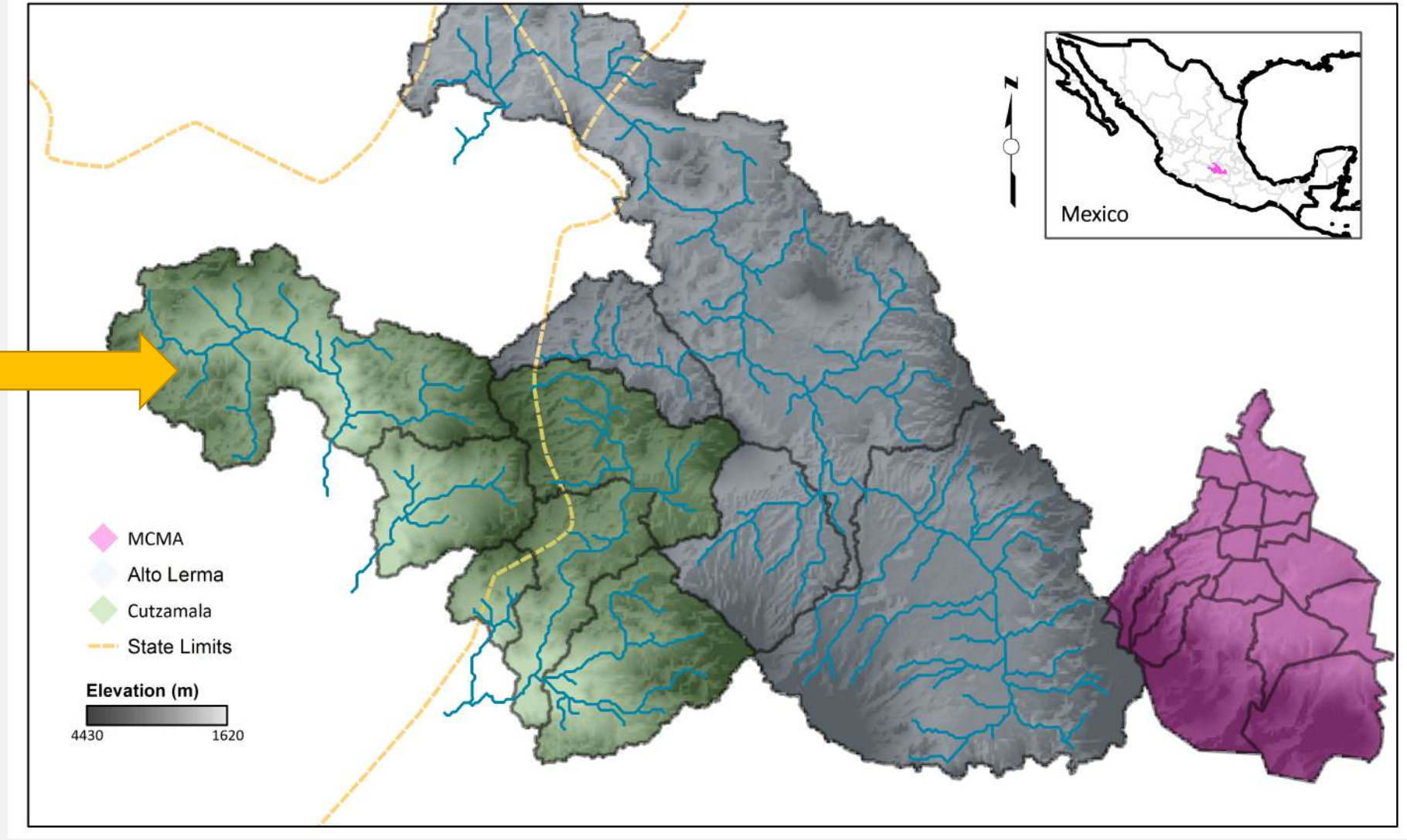
4 Vázquez[5], Sungwook Wi[1], and Frederick Boltz[1]

5 [1] University of Massachusetts Amherst
6 [2] The World Bank
7 [3] University of Cincinnati
8 [4] Agua Capital
9 [5] Consejo de Cuenca Lerma-Chapala
10 [6] Sistema de Aguas de la Ciudad de México (SACMEX)

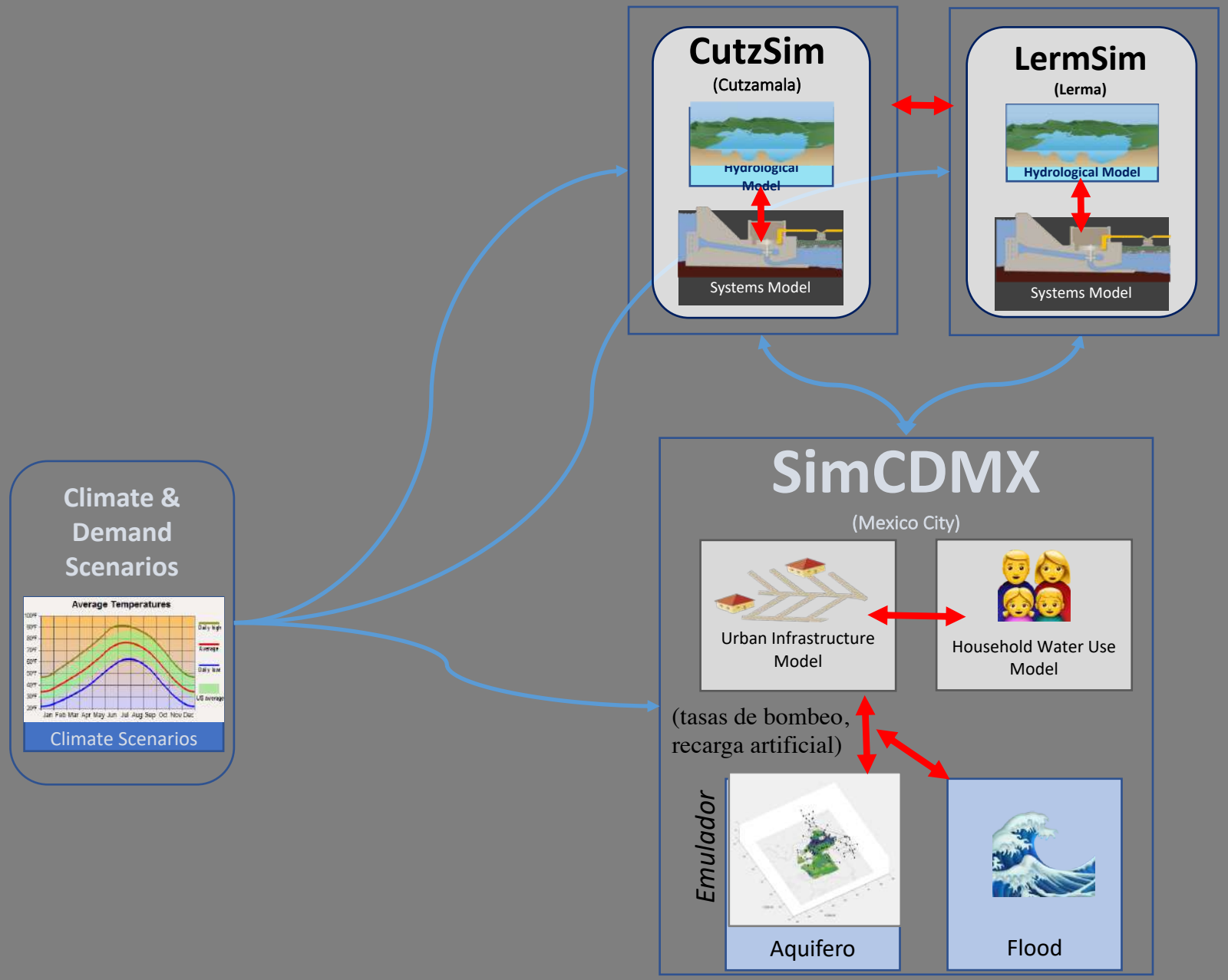
Bottom up approaches as a tool for system integration

CutzSim
(Cutzamala)



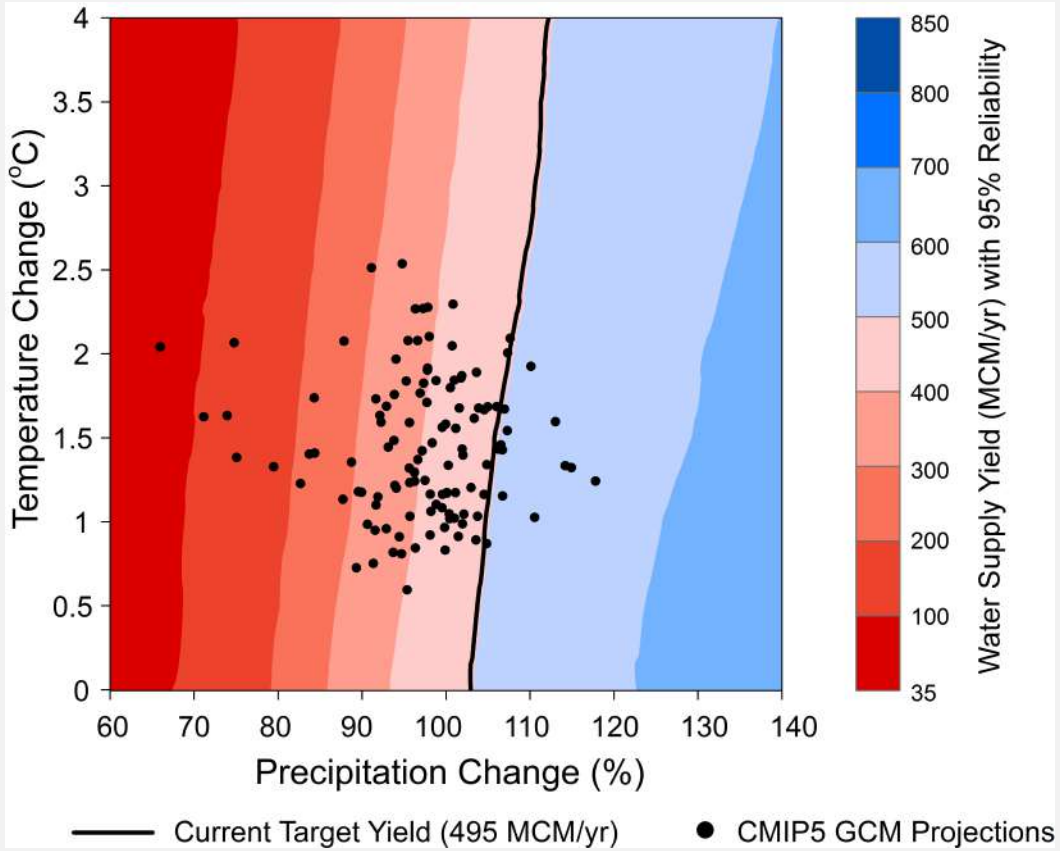


Bottom up approaches as a tool for system integration

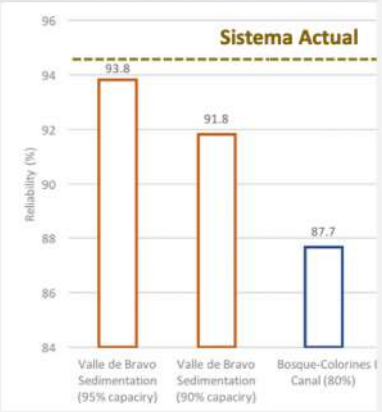


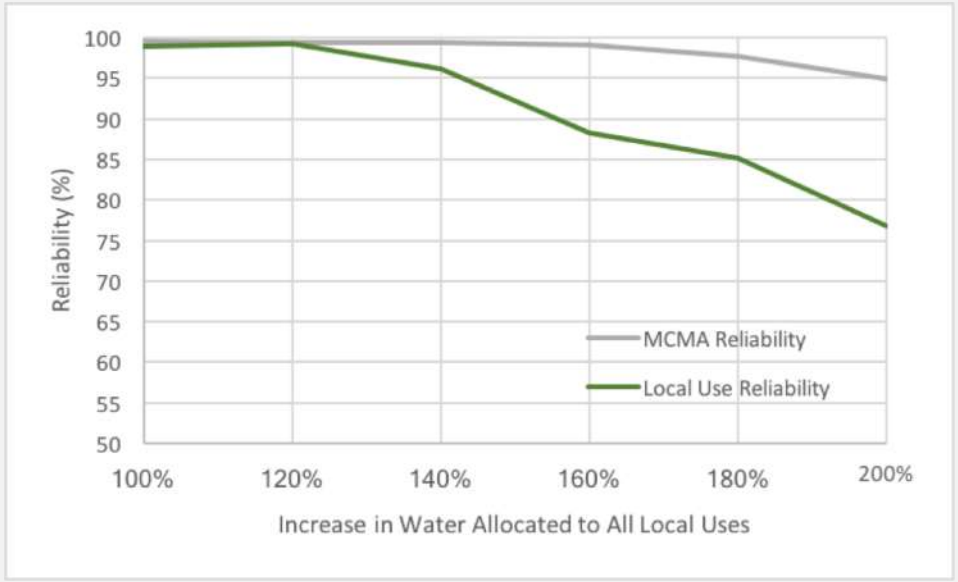
Importance of multi-factor vulnerability

Cutzamala vulnerability to climate



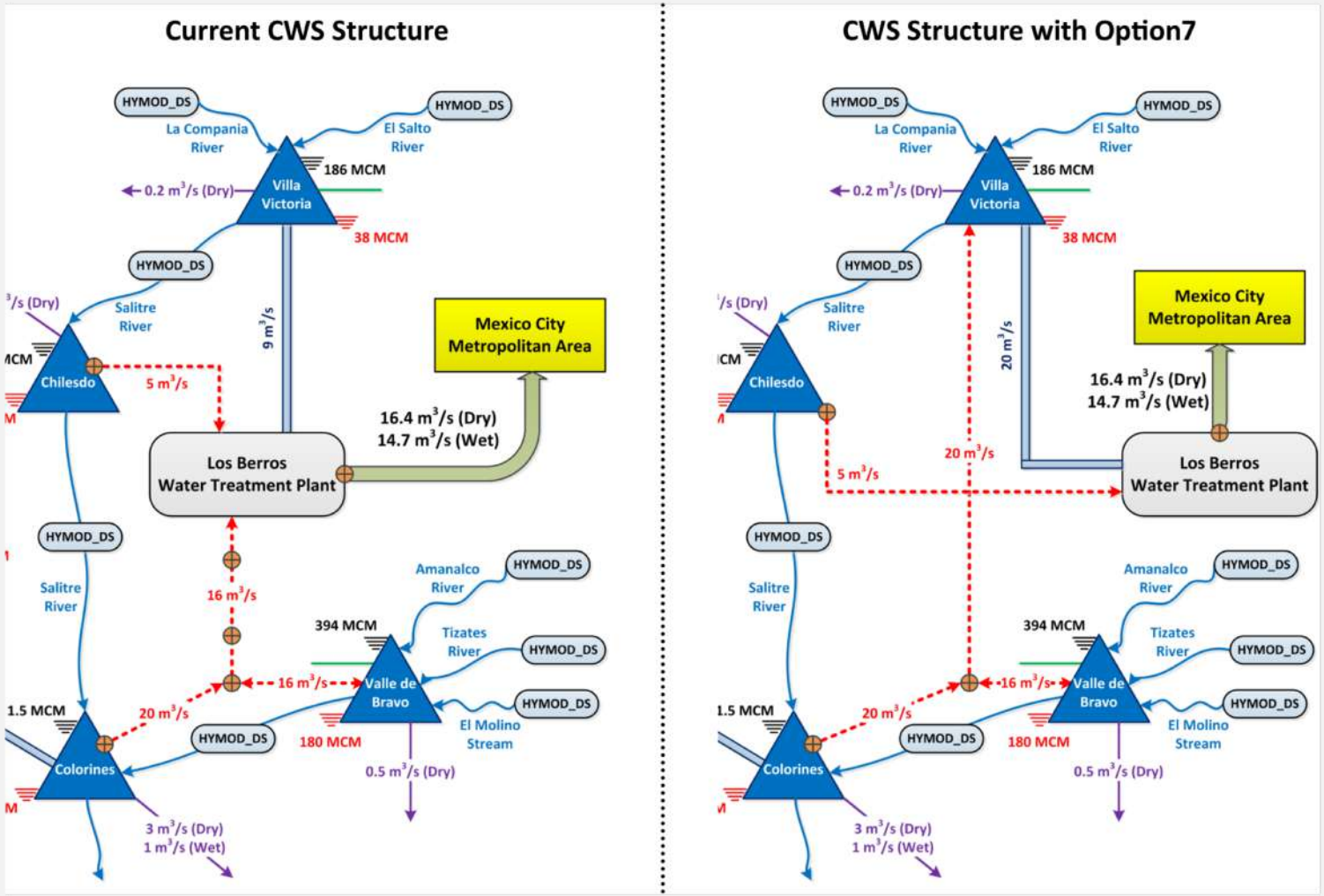
Sensitivity to demand and maintenance



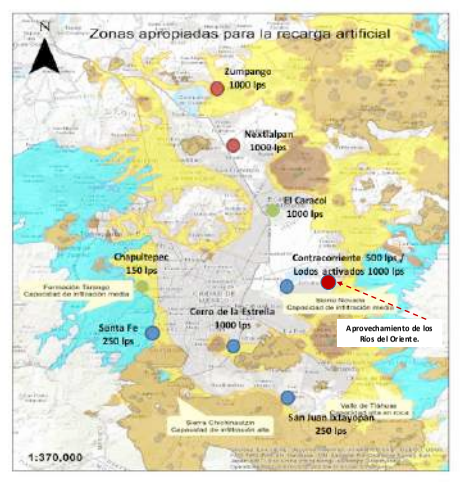


**Results in this presentation are preliminary or provisional and are subject to revision.*

Importance of multi-factor vulnerability



Solutions across actors

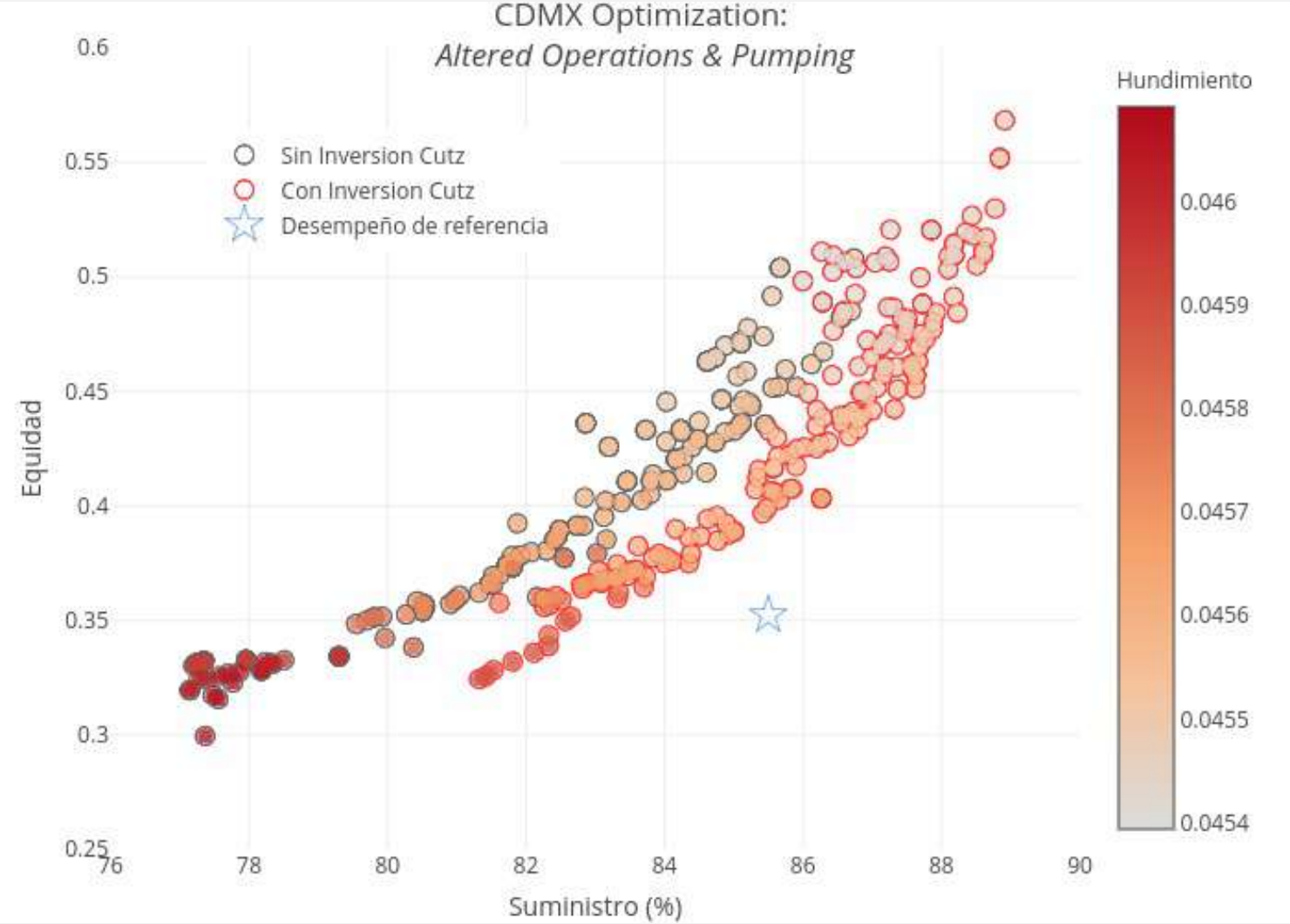


Evaluation of Predefined Projects
(The World Bank)

Management Solutions
(*operations OCAVM and SACMEX*)

Workshop Defined Solutions
(Agua Capital)

Solutions across actors



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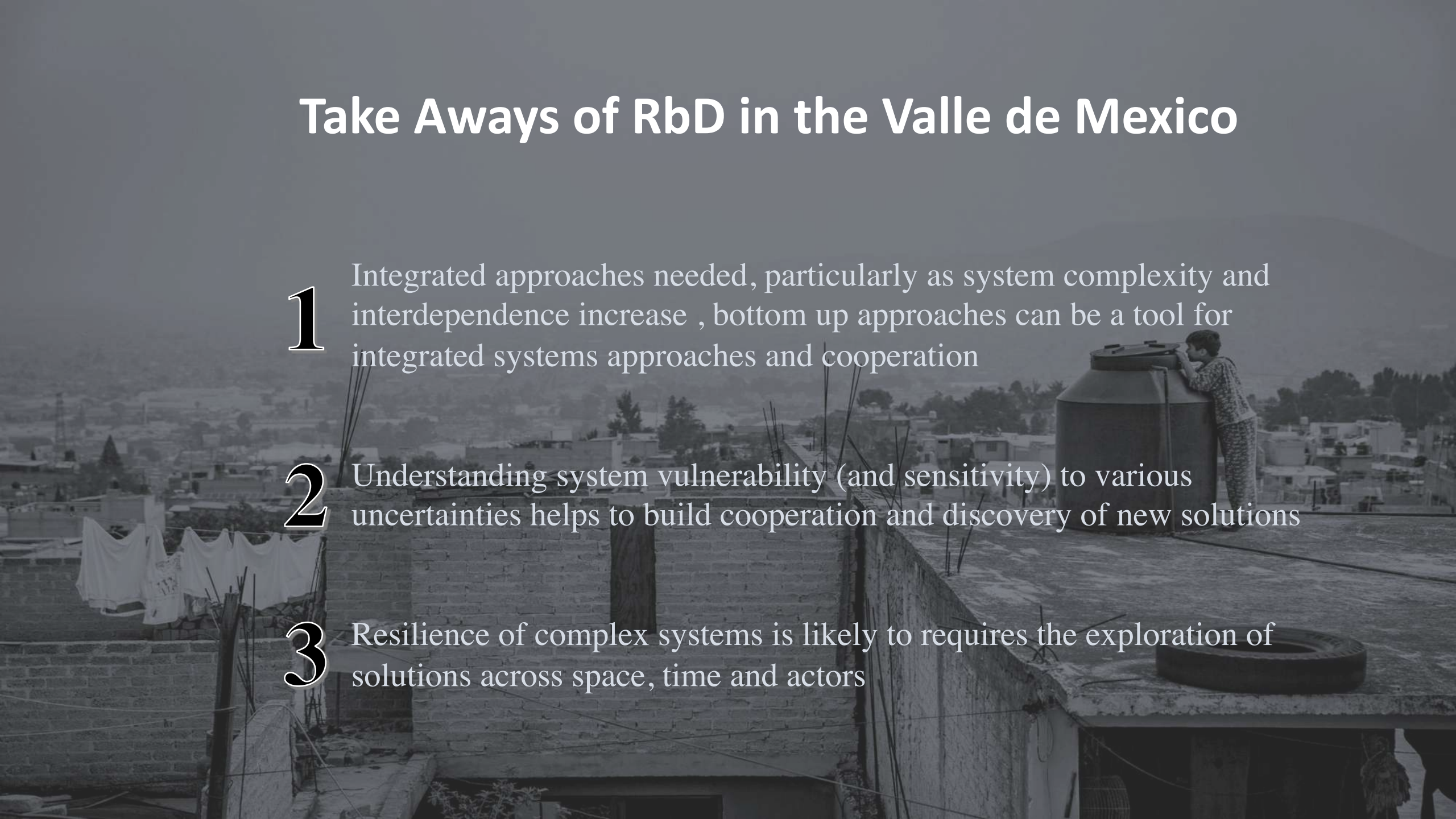

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Gracias y next steps

- 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 engagment

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