

**Building Resilience to a Changing Climate:
A Technical Training in Water Sector
Utility Decision Support**



Practical Considerations for Climate Analysis and Adaptation: Know before you go ...

Lurna Kaatz, Denver Water / WUCA

Julie Vano, Aspen Global Change Institute

Climate Adaptation Conundrum

- Can't be prepared for everything
- Can't afford to be prepared for the worst case
- Can't afford to be unprepared

How do you approach this challenge?

Getting Started in Four Steps

- **Understand:** Climate science and model projection capabilities and limitations
- **Assess:** Water system vulnerability to potential change
- **Plan:** Incorporate climate uncertainty into water utility planning
- **Implement:** Adaptation strategies

ENGAGE

Motivating action, engaging and supporting others, and developing climate messages

UNDERSTAND

Understanding climate science, your system, and your system's vulnerabilities, risks, and opportunities

Climate Adaptation Actions

to promote climate-resilient water utilities and thriving communities.

Leading Practices

SUSTAIN

Monitoring conditions, developing funding, maintaining capacity, and managing expectations

PLAN

Planning for multiple futures and building capacity

IMPLEMENT

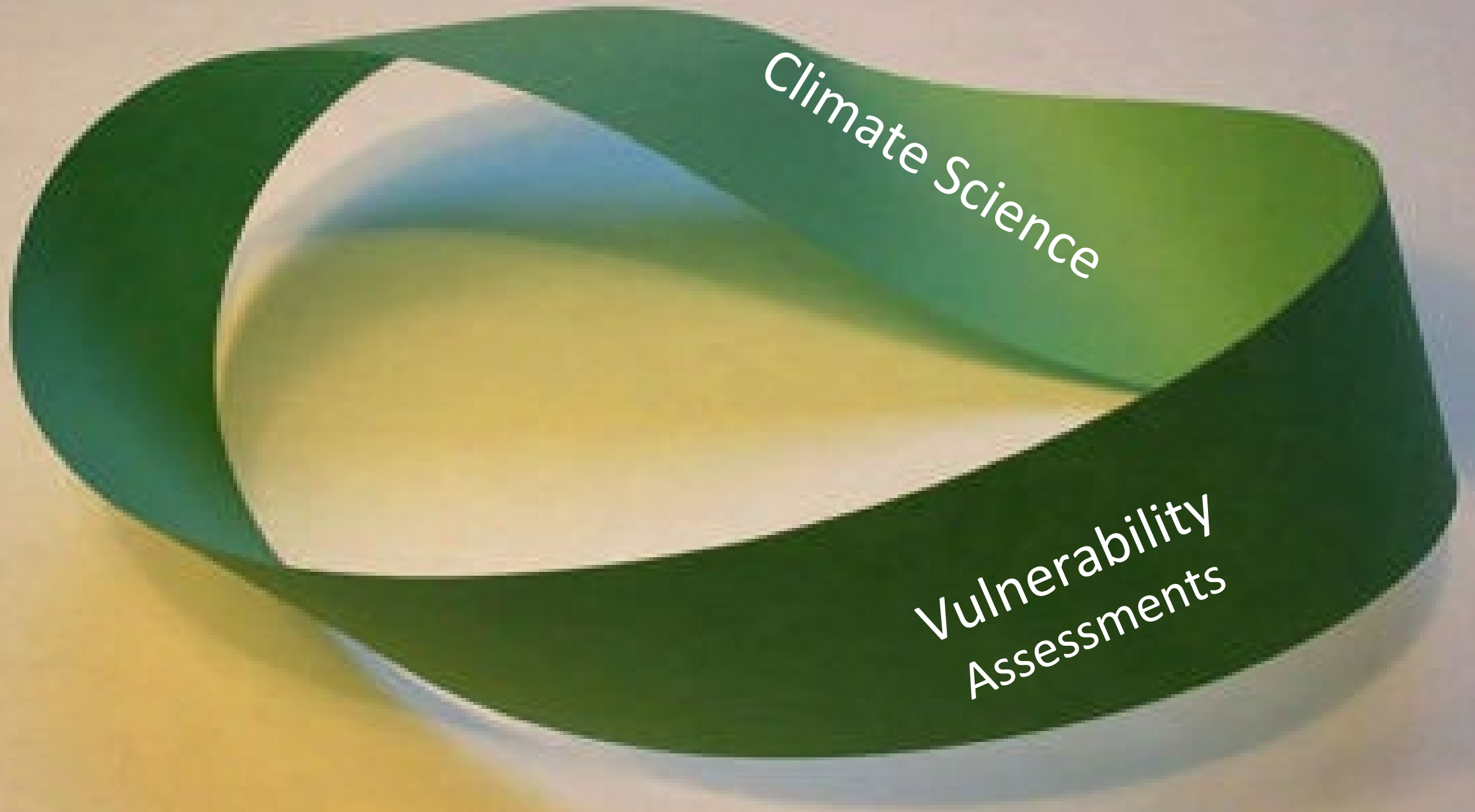
Acting to implement changes in assets and actions

Before You Jump In – Clearly Articulate...

- What is your end game? What question(s) do you want to answer?
- How will you get there?
 - Method – simple, sophisticated
 - Data – type, scale
 - Tools – current, new?
- Will it be useful?
- New science?
- Messaging – internal, external



Goal is to Avoid Analysis Paralysis



Guiding Principles: The Dos and Don'ts

- I. It is important to evaluate climate risk
- II. Models can be helpful tools, if used appropriately
- III. Uncertainty is everyone's responsibility

Water managers
planning for the
unexpected is their
responsibility

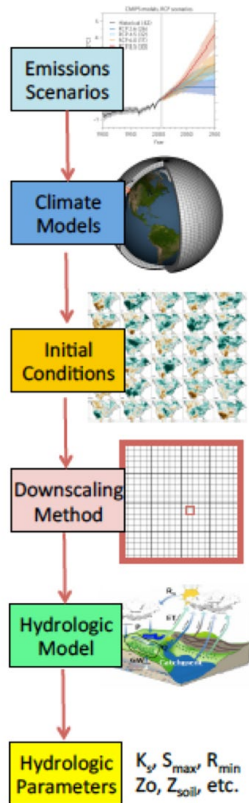


Scientists being clear
about uncertainties and
placing them in context is
their responsibility



Do Be Aware of Multiple Ways to Evaluate Future Changes

Scenario studies



Clark et al. 2016; connect models in a chain

Stochastic hydrology

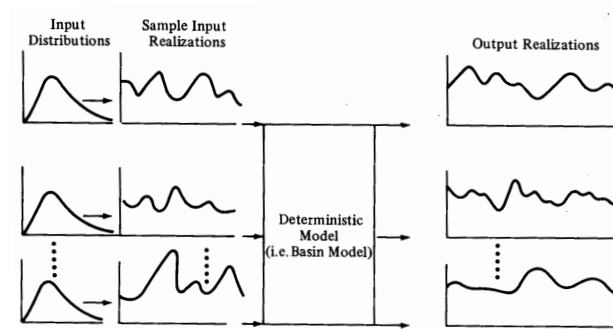
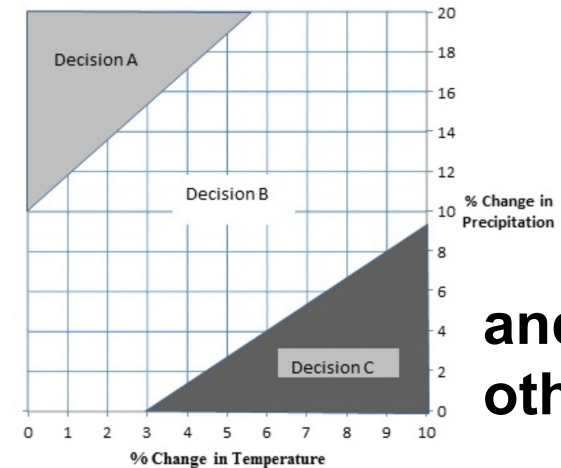


Figure 1.3 Concept of Monte Carlo experiments.

Bras and Rodriguez-Iturbe, 1985; generate synthetic timeseries using statistics from the past

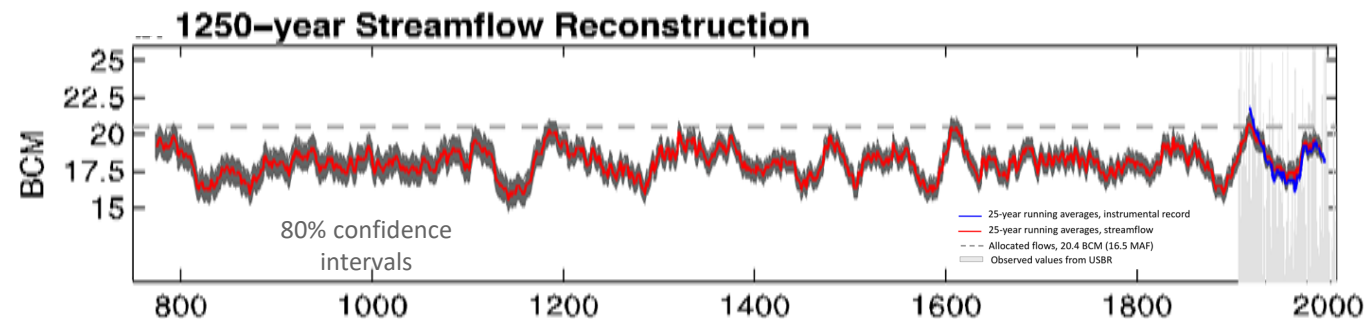
Climate-informed vulnerability analysis



and others...

Brown et al., WRR, 2016; explore system vulnerabilities with perturbations

Paleoclimate studies



Vano et al., BAMS, 2016; generate timeseries using reconstructions of the distant

Do Understand How the Decision Being Evaluated is Important to Model and Approach Selection

What are the questions we are trying to answer?

How will flows in April-September change in the future?

How should facilities be sized to prevent sewer overflows?

How will the magnitude, duration, and frequency of drought change?

How much warmer will streams be in 20 years?

water supply, streamflow timing, drought, stormwater, wastewater

FIT FOR PURPOSE

Do Start by Determining the Level of Details that Fits Your Need and Resources

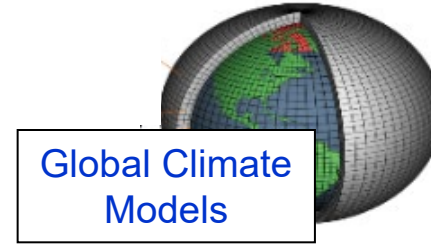
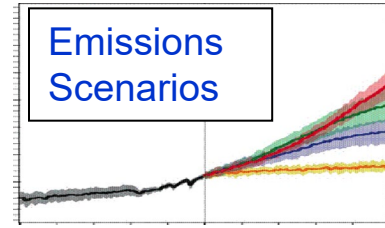
Additional Considerations:

- How much will it cost?
- How long will it take?
- To what extent will the analysis improve the decision?
- Can appropriate data and information be obtained?
- Who will undertake the analysis?
- How much information can you manage?

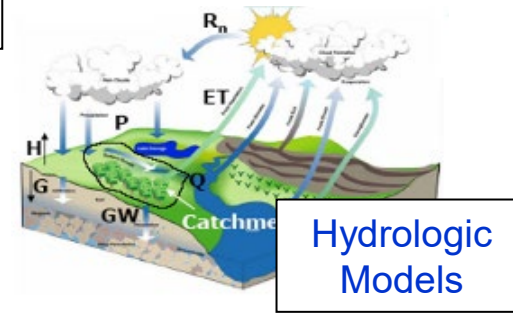
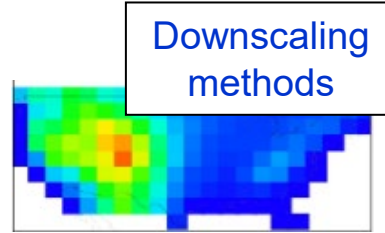




Understanding climate science, your system, and your system's vulnerabilities, risks, and opportunities



Joel



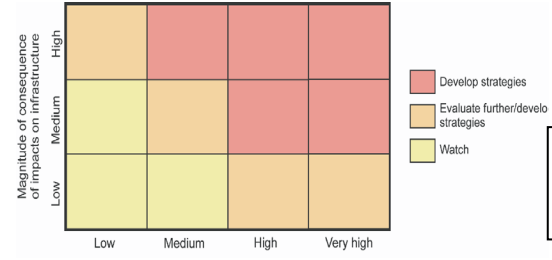
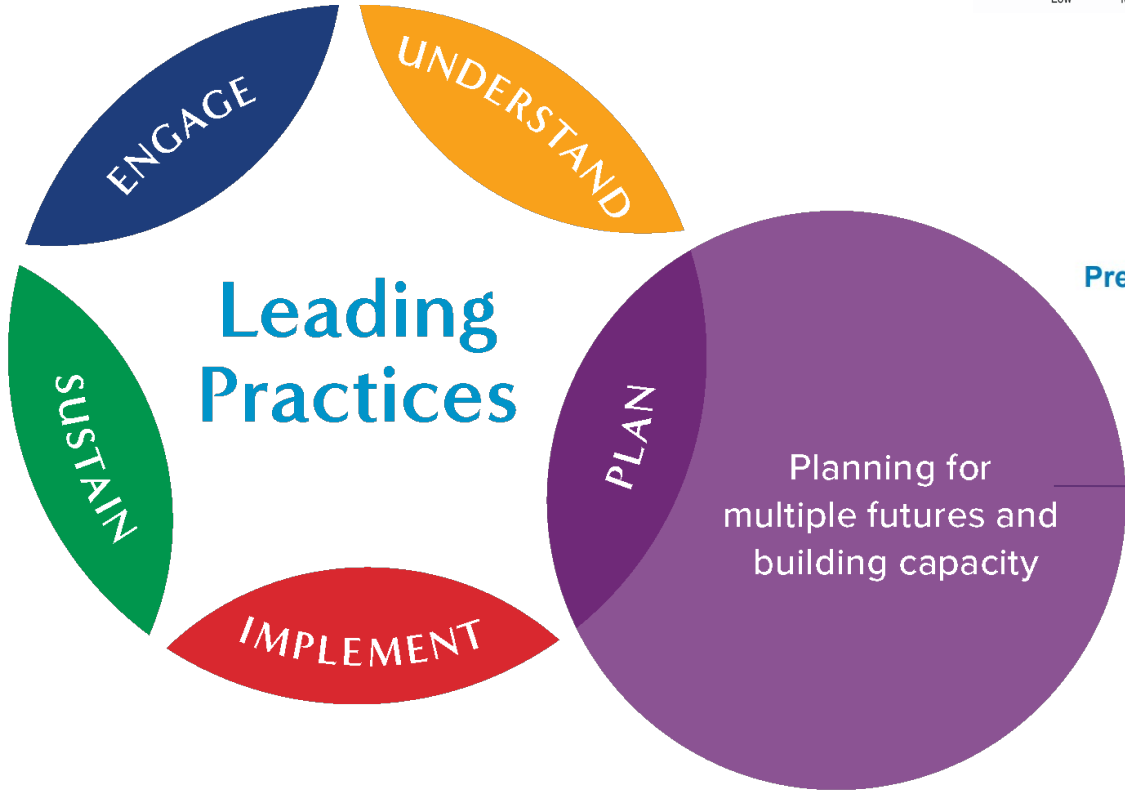
Julie



Jim

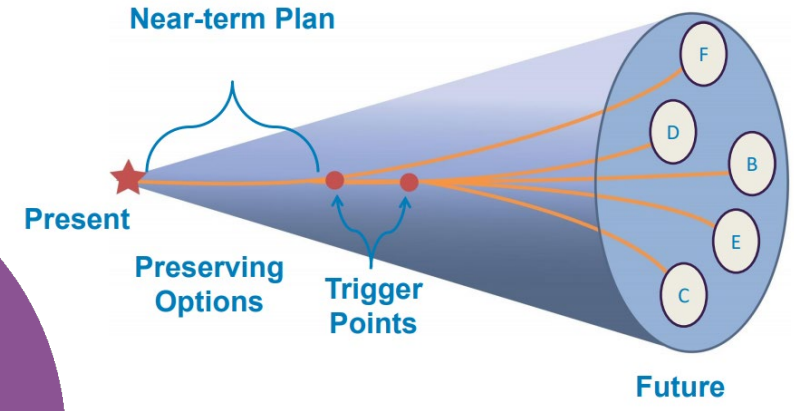


BUREAU OF RECLAMATION



General Planning methods

Joel



Rob





Zane

SOUTHERN NEVADA
WATER AUTHORITY

Case
Studies
&
Panel
Discussion



Brandon



COLORADO
Colorado Water
Conservation Board

Michelle

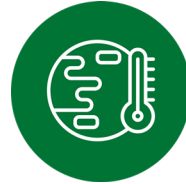
Department of Natural Resources



Organizational Structure



Communication



Technical Challenges



Resources & Capacity



Policies

Heidi

Community building



YOU

Person on your right

Person on your left

Person diagonal to you...

All of us

Are you ready?