



**Building and Refining Scenarios**  
**Module 4b– Selecting Drivers and Logics**

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## **Phases in Scenario Planning**

- I. Preparing for the process
- II. Building and refining scenarios**
- III. Using scenarios to evaluate, prioritize, and implement management actions

# Assateague Island National Seashore

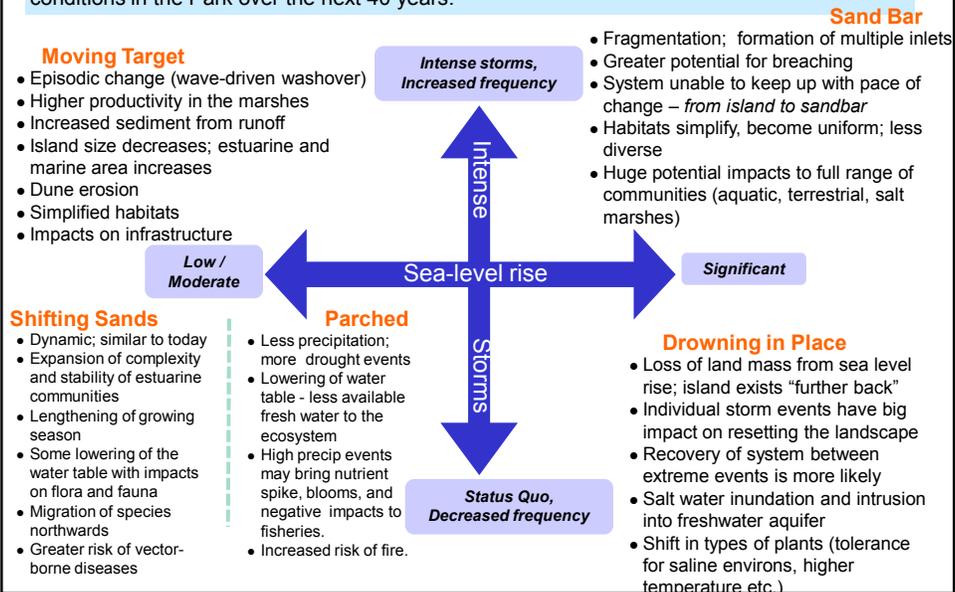


Climate Variable	General Change Expected	Confidence Level
Temperature	Increase, but not uniform	Virtually certain
Precipitation	Probable decrease in total annual precipitation	Low
Sea Level	Increase	Moderate
Drought	A modest increase in drought frequency in the warm season	Moderate
Snow cover	Increase in snow-free days; decreased snow accumulations	High
Length of growing season	Increase	High
Extreme Events: Temperature	Warm Events Increase / Cold Events Decrease	Moderate to high
Extreme Events: Precipitation	Possible decrease of frequency of heavy rain, but countered by rise in intensity.	Low to moderate
Extreme Events: Cold Season Storms	Increased intensity.	Low to moderate
Extreme Events: Warm Season Storms	Increased intensity; possible decrease in frequency	Low

Note: 1. The study also included additional information such as "Range of Change Expected & Reference Period", "Size of Expected Change Compared to Recent Changes" and "Synoptic Signs". The complete table can be found in the appendix to this document.

# Assateague Island National Seashore

The ID team identified the most important and most uncertain climate drivers that will affect conditions in the Park over the next 40 years.



## Building Scenarios: Steps

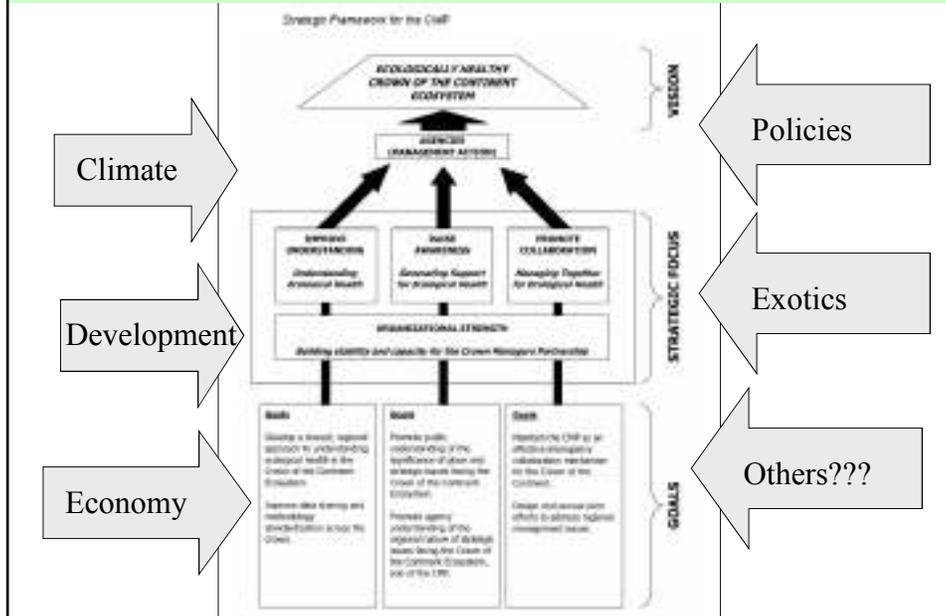
1. Refine scope and focus question
2. Identify key external drivers
3. Assess and prioritize critical drivers
4. Explore and select scenario logics
5. Develop outlines of time evolution
6. Develop scenario narratives
7. Evaluate scenarios

## Scope/Focus and Key Drivers

- Identify a focal issue: the intersection of knowable & unknowable and controllable & uncontrollable
- Identify uncertainties with large impact on focal issue: 2-3 critical drivers or themes
- Consider views of key actors within your system

**Question:** What is a Driver?

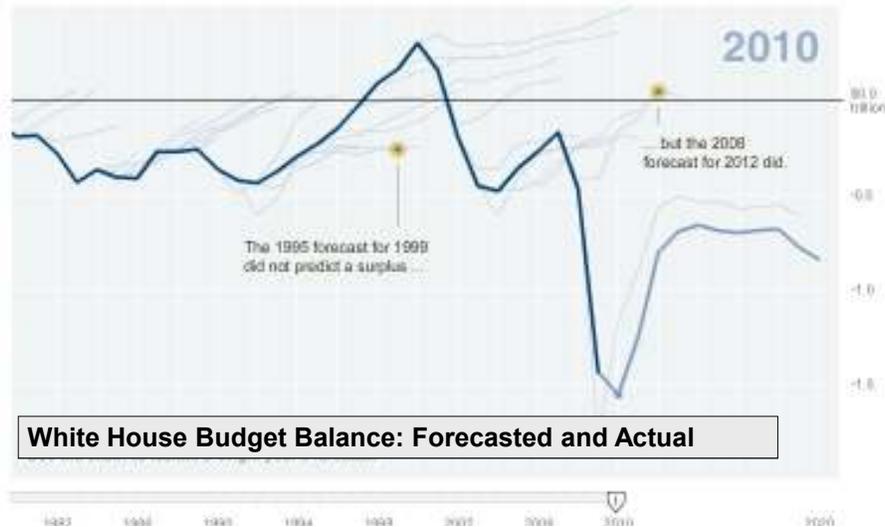
## Drivers: Key Uncertain Forces Outside Your Control



## Common Key Climate Uncertainties

- changes in seasonal hydrology: rain/snow, seasonality shift, frequency and intensity of extreme events
- timing and type of precipitation
- seasonal water balance
- shifted seasonality
- rate of change: 4C at 2100 vs. 2060
- fire frequency and severity
- extreme temperature events (>90, <70, <32)

## Non-climate Uncertainties – Budgets...



From NYT, 2 Feb 2010

## PEST-STEOP-PESTLE Brainstorming

**Objective:** to identify all the variables that could have important impacts for your management challenge

### PEST-STEOP-PESTLE

- Political
- Economic
- Sociological
- Technological
- Legal
- Environmental

### Emerging Trends

Johansen, 2008

- Diasporas and emerging economies
  - human migrations
  - distant connections
- Commons and collaboration
  - volunteerism
  - coordination
- Food and water disruptions
- Integration of technology, human, environmental systems
  - ubiquitous monitoring
  - engagement at a distance
- Intensifying rich/poor divide

### Activity 3

- PESTLE Brainstorming: at least 5 drivers for each!

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#### Easy Method to Rank the Results:

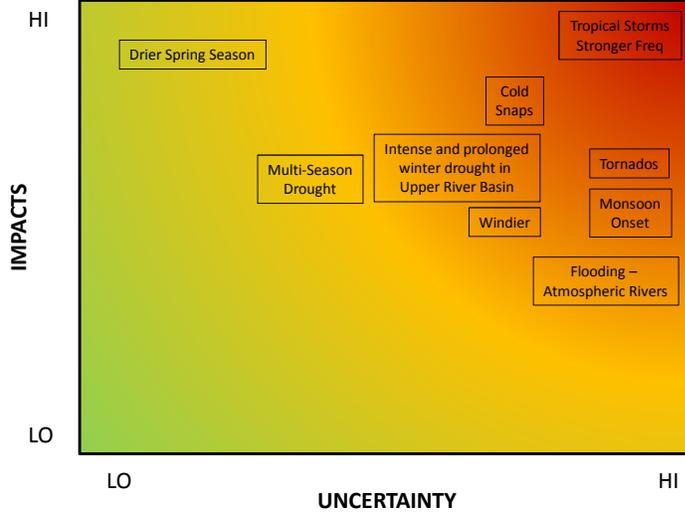
- Use sticky dots and vote
- Report out and re-vote
- Six dots per person
- Apply in any combination (1 on 6, 6 on 1)



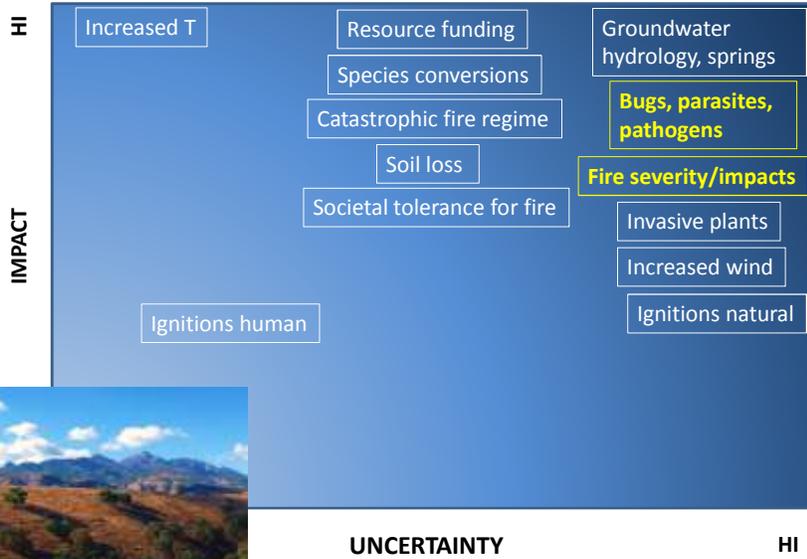
### Activity

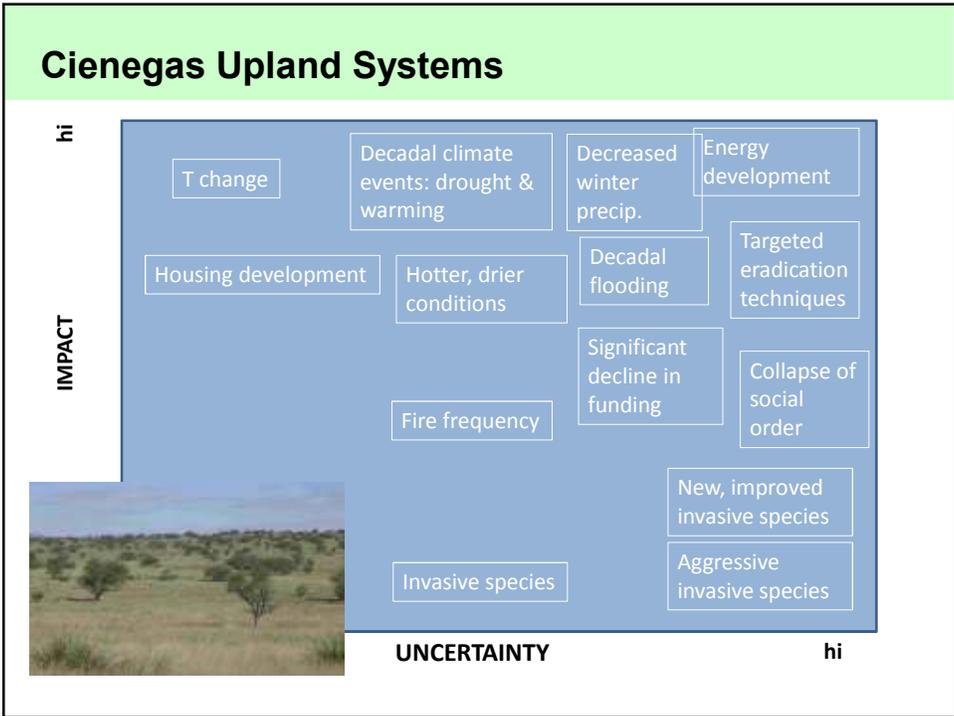
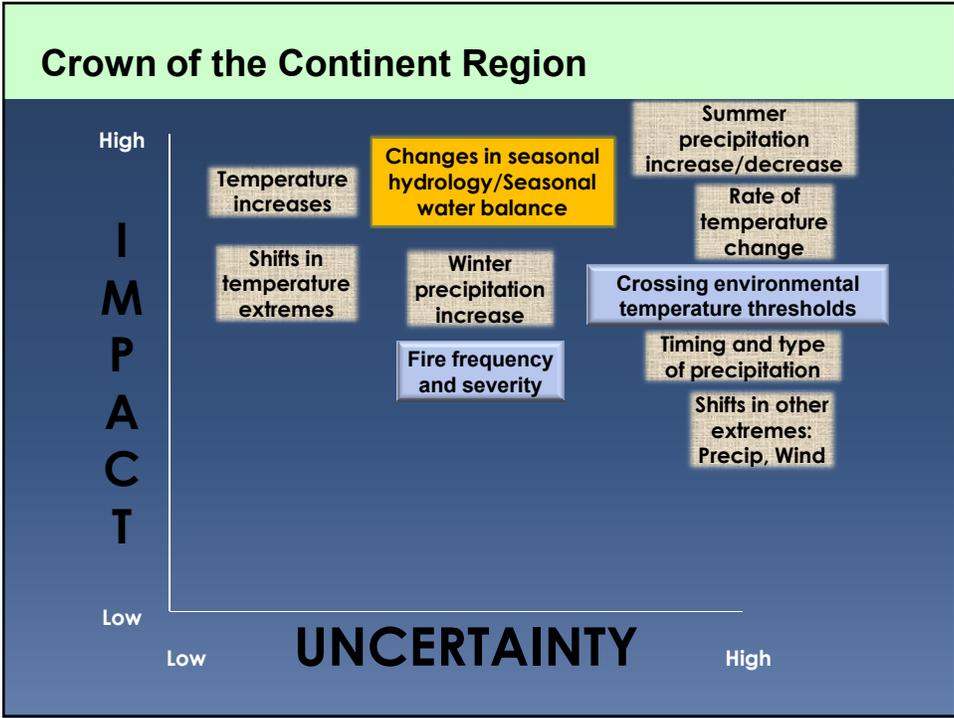
- PESTLE Brainstorming: at least 5 drivers for each!

## Southwest Regional Climate

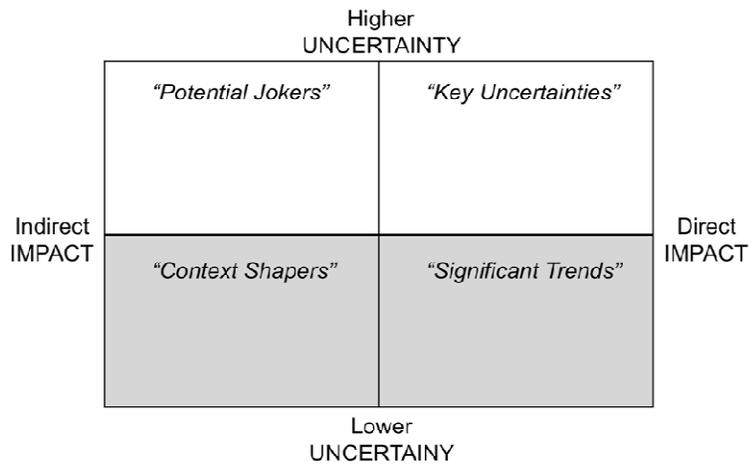


## Cienegas Montane Systems





## Alternative Impact vs. Uncertainty Table



modified from Ratcliffe 2002

17

## Prioritizing Critical Drivers

**Objective:** to prioritize drivers for use in building scenarios

### Outcomes

- Identify 2-7 drivers to consider in generating scenarios
- Identify drivers that should appear in all scenarios

### Activity 5

- Impact vs. Uncertainty Plot

## Building Scenarios: Steps

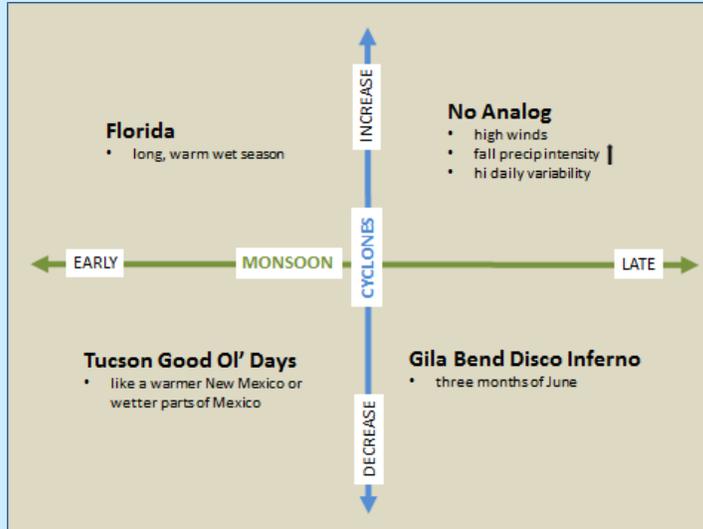
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## Scenario Logics

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  - **Quadrant Method**
    - Themes
  - Nested Quadrants
    - Decision Tree
  - Chained Quadrants
    - Matrix
    - NPS "Flash Cards"

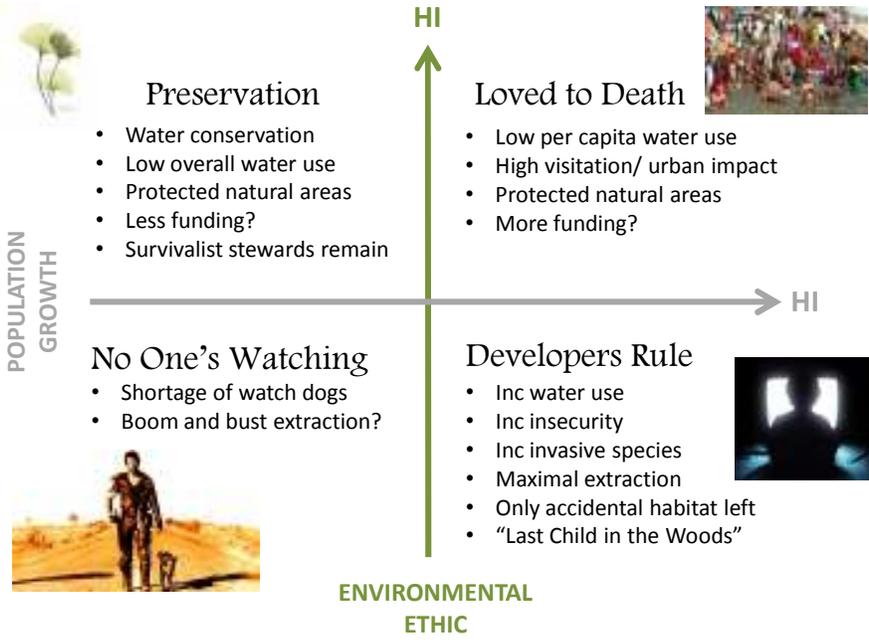
**Goal: Strategically select 3-5 diverse and challenging scenarios for building out into more detail**

# Southwest Regional Climate Scenarios

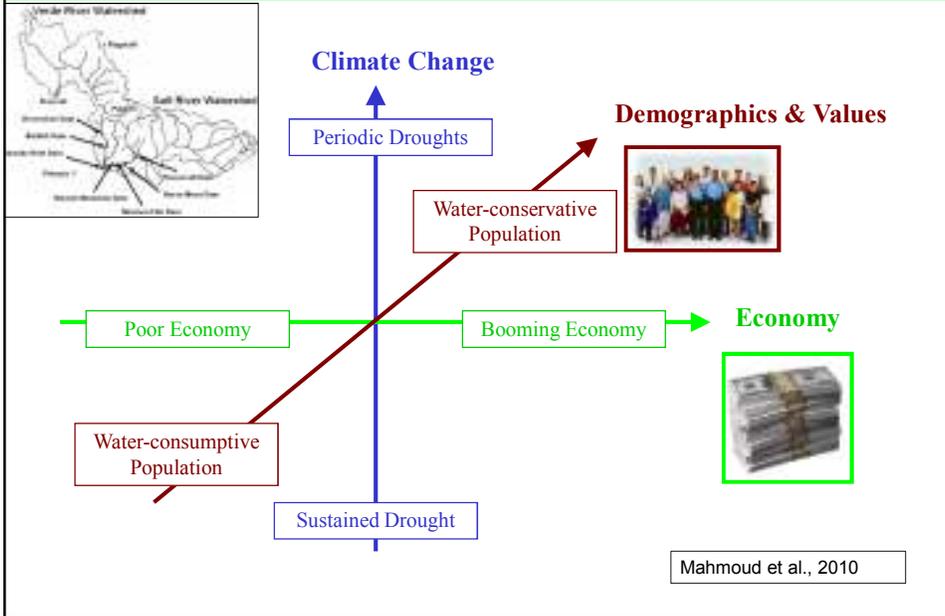


FOR ALL CLIMATE QUADRANTS: Temperatures increasing; Temperature extremes increasing; Environmental thresholds exceeded; Earlier spring runoff; Growing season & Fire season extended; Phenological mismatches

# Cienegas Montane Systems



## Salt River Basin, AZ Water Supply Research



## AZ & NM Water Management Research

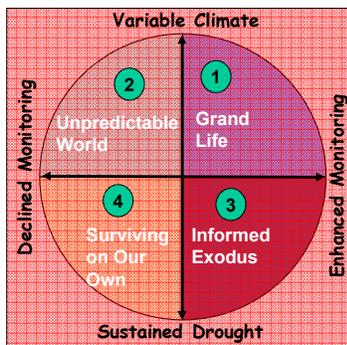
Three Critical Dimensions

Climate → Sustained Drought vs. Variable Climate

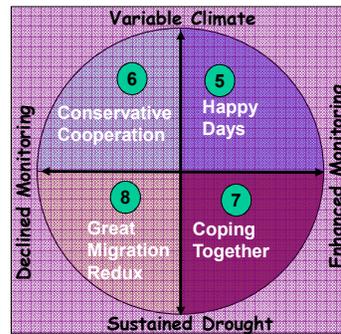
Development Pattern → City Infill vs. Ranchettes

Monitoring Resources → Declined vs. Enhanced Monitoring

### Ranchettes

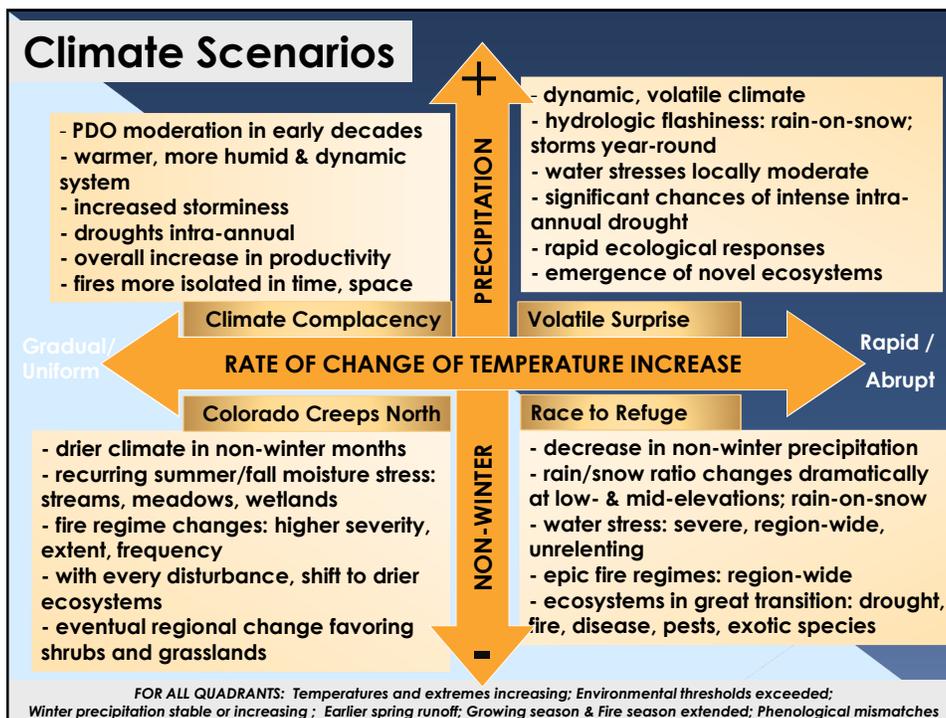


### City Infill



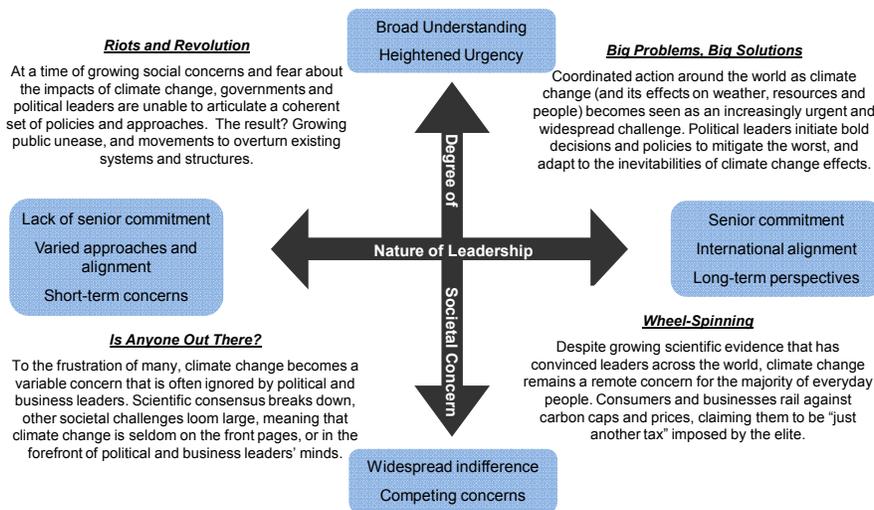
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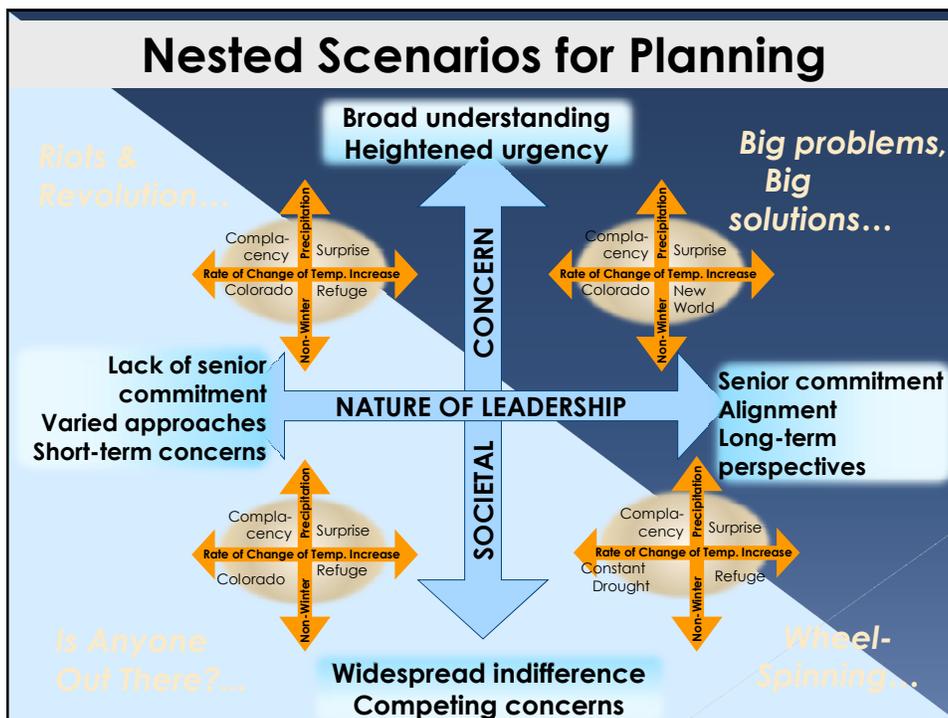
## Nested Scenario Development

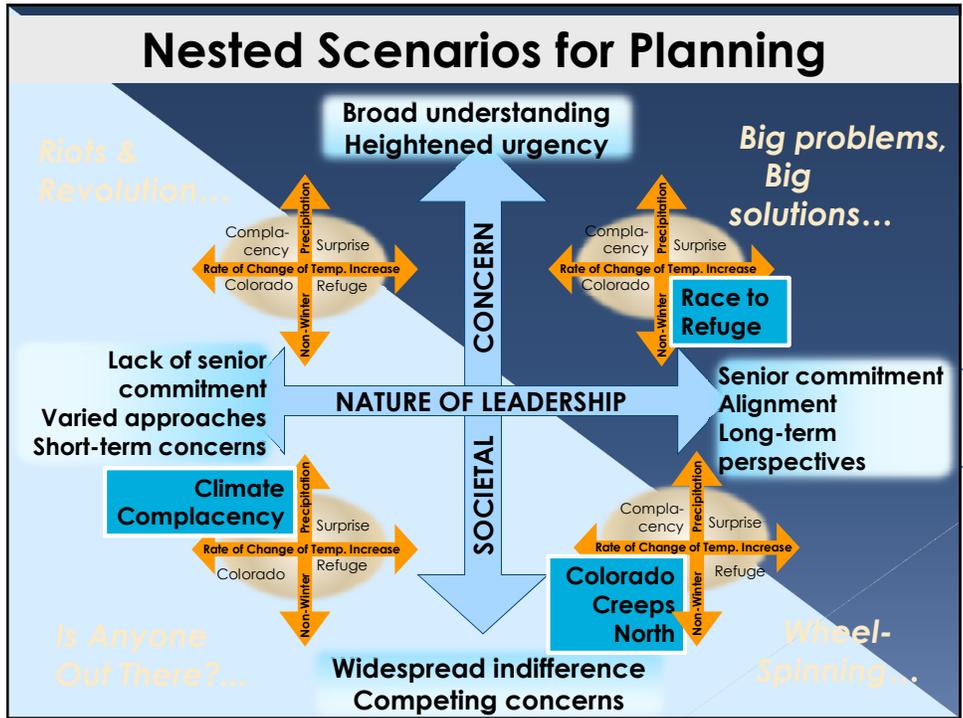
> Cross the critical uncertainties together to form a high-level matrix. This creates 4 different pictures for the future social and political landscape around climate change



NPS, 2010

## Nested Scenarios for Planning





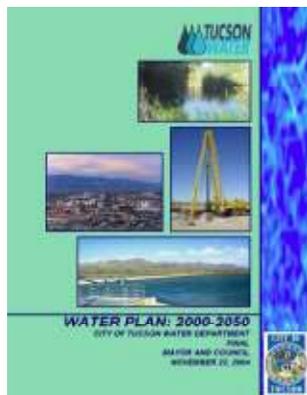
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## Chained Scenarios: Tucson Water 2000-2050, 2008 Update, and Beyond

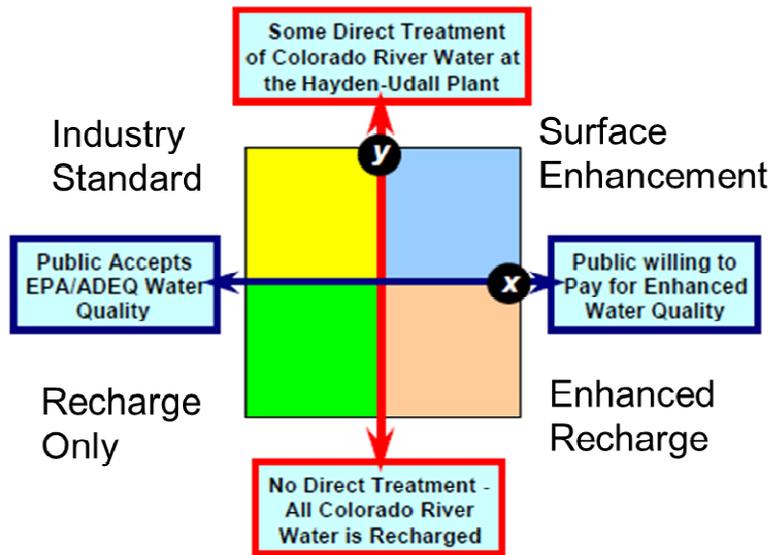


Tucson Water: 225,000 connections, 775,000 people, 350 square miles

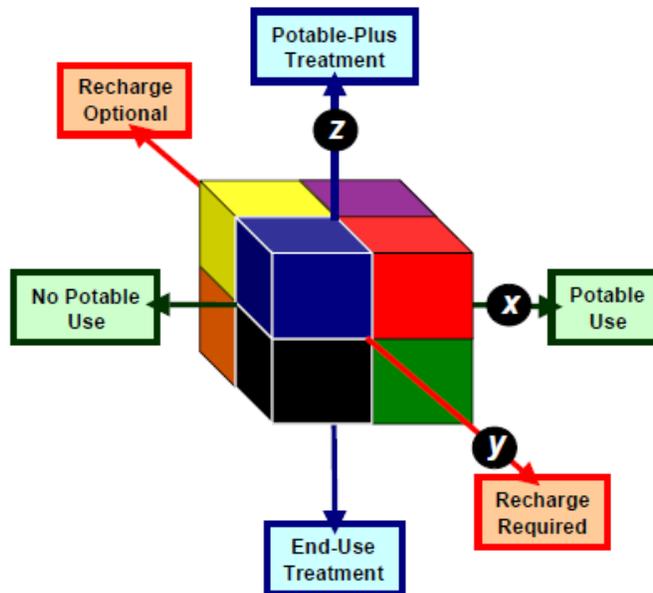


and 2008 Update

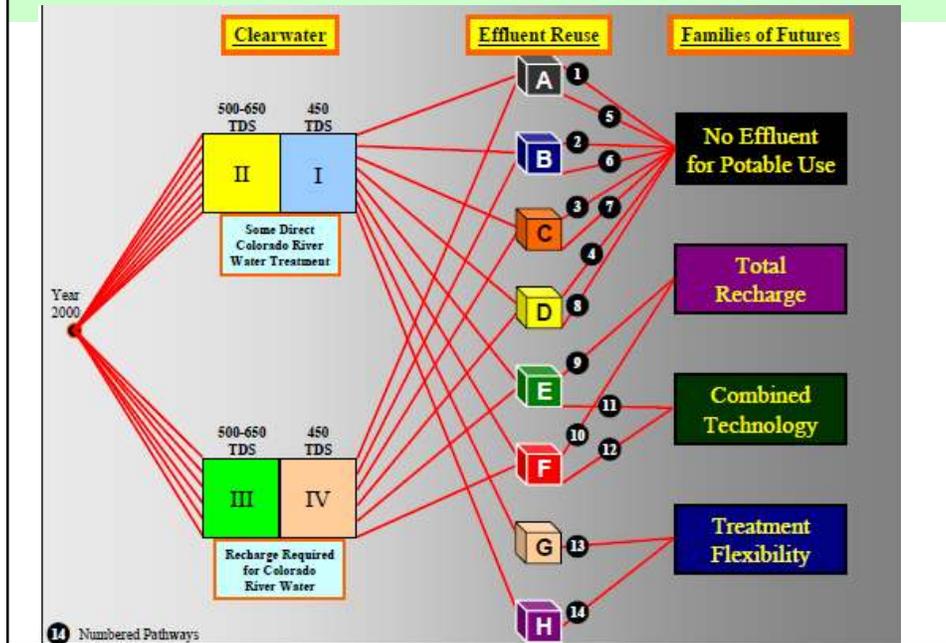
### Chained Scenarios: Short-term Uncertainty over Customer Values re: CO R Water



### Chained Scenarios: Long-term Uncertainty over Customer Values re: Wastewater Effluent



## Combining Short- and Long-term Scenarios



## Revisiting the Scenarios in 2008

	With Additional Demand Management	Without Additional Demand Management
Obligated Area	Scenario A	Scenario B
Potential Service Area	Scenario C	Scenario D

**New critical uncertainty:** Water demand

**Some uncertainties gone:** Decision H<sub>2</sub>O in 2006/7. Customers OK with basic water standards

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## Theme-based Scenario Development

**Water Utilities Climate Alliance (WUCA):** 10 large metro providers to 43M  
- review and test decision approaches (Scenario planning, Robust Decision Making, Portfolio Analysis)

### Denver Water's Planning Futures

**Traditional Future** -The future is extrapolated from past trends, few other unanticipated major changes occur. ("Business as Usual")

**Water Quality Rules** -The public demands the highest practical quality of drinking water.

**Hot Water** -A warmer climate accompanied by more frequent and more severe droughts.

**Economic Woes** -An ongoing energy crisis accompanied by a prolonged, deep economic downturn.

**Green Revolution** -Environmental values become dominant social norms.

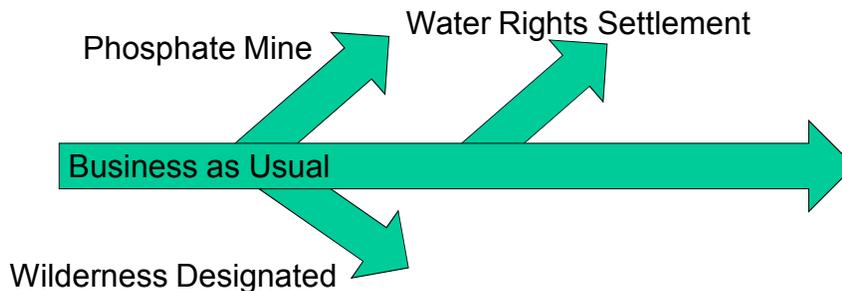
Waage, 2010.

## Decision Tree Scenario Development

**Perceived Advantage:** can start with “official future”, “least change”, or “business as usual” futures

Good for “Yes/No” uncertainties. Examples:

- new mining development
- species goes extinct
- transformative fire
- others??
- wilderness designation
- invasive becomes naturalized
- Indian water rights settlement



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## IPCC SRES Scenarios: Drivers of Global Climate

**Caution!** With lots of drivers: More difficult to confirm plausibility and internal logical consistency of scenarios

Family Scenario Group	A1				A2	B1	B2
	A1C	A1G	A1B	A1T	A2	B1	B2
Population growth	low	low	low	low	high	low	medium
GDP growth	very high	very high	very high	very high	medium	high	medium
Energy use	very high	very high	very high	high	high	low	medium
Land- use changes	low-medium	low-medium	low	low	medium/high	high	medium
Resource availability <sup>d</sup>	high	high	medium	medium	low	low	medium
Pace and direction of technological change favoring	rapid	rapid	rapid	rapid	slow	medium	medium
	coal	oil & gas	balanced	non-fossils	regional	efficiency & dematerialization	"dynamics as usual"

From: IPCC 4<sup>th</sup> Assessment

**Flash Cards:** Put one variable on each flashcard, with two opposites choices of conditions, on each side. Then flip and choose!

## Selecting Scenario Logics

**Objective:** create and test different driver combinations to develop strategic scenario 'skeletons'

### Process

- Work with combinations of different drivers, rapidly assess the plausibility of scenarios, the divergence of the challenges (and opportunities) posed
- Identify specific scenarios to build out

### Activity 6

- Explore and select scenario logics