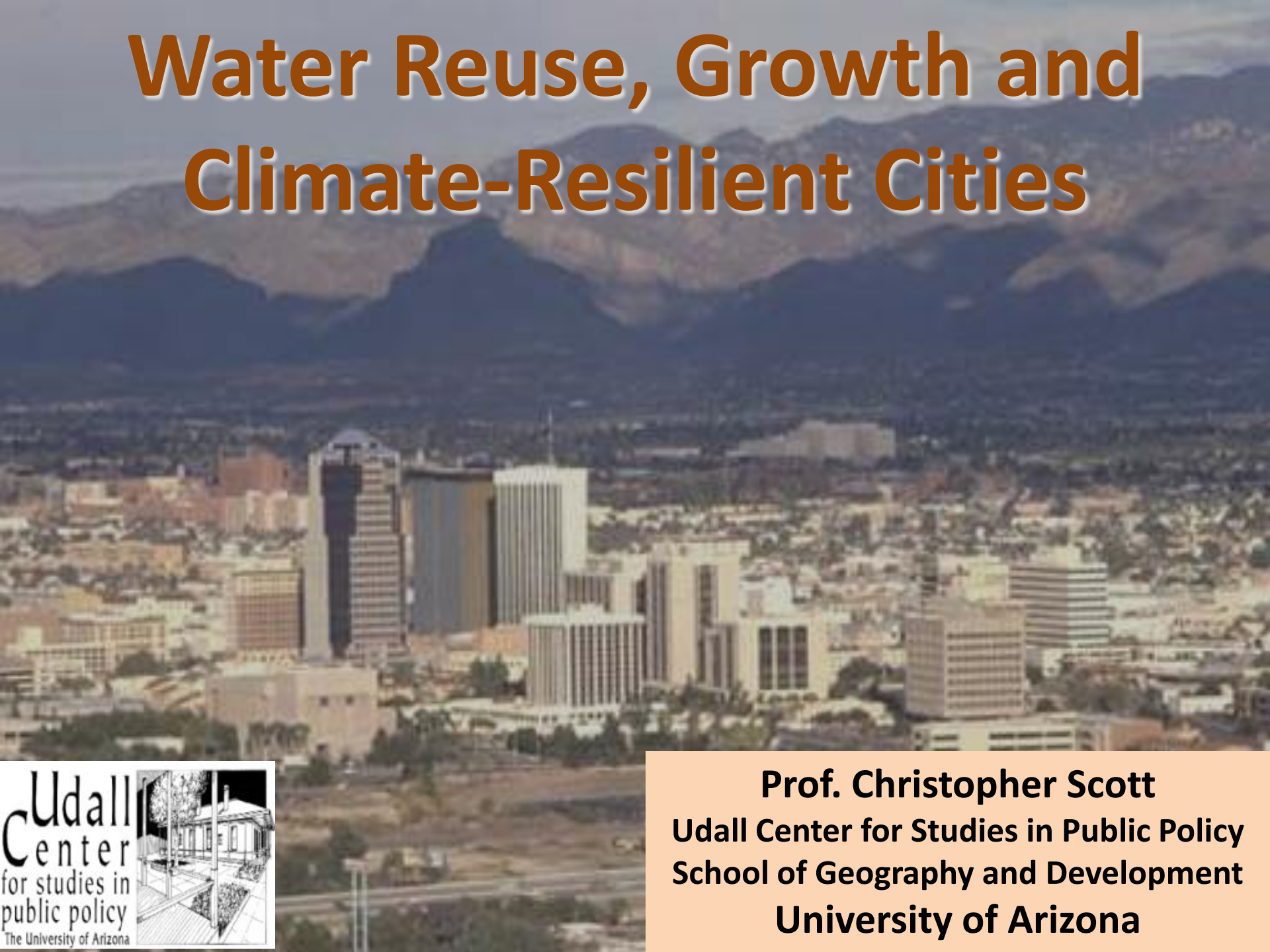
Water Reuse, Growth and Climate-Resilient Cities



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- Determine challenges to sustainable water reuse under rapid growth in the Southwest United States
- Improve understanding of the interactions among technology, cost, institutions, and public choice
- Objectives
  - Partner with public utilities to inventory existing reuse
  - Assess public attitudes on water reuse as related to growth
  - Identify institutional restrictions and enabling conditions for supply-substituting water reuse
  - Assess impact of reuse on regional water demand, supply
  - Provide guidance on incorporating public input into water reuse planning

Climate Change and Growing Cities

Urban authorities often say:

1. “Climate change is a long-term process – why do we have to be concerned today?”

2. “We have more pressing concerns, like supplying water and sanitation services”

3. “Climate change means international carbon agreements – best left to federal authorities”

Valid Concerns, *But…*

1. Climate change is long-term, *but* variability (flood, drought, heat-waves) are already occurring
2. Providing services today is a challenge, *but* these will be most affected by climate: water is a lens that focuses climate change
3. Climate (carbon) mitigation depends on international agreements, *but* adaptation is a local priority where water reuse, urban agriculture are important strategies

Why Adaptation? What is It?

- Foresee future trends, even with uncertainty
- Respond to information, from your own sources or others
- Build resilience
  - ability to face major changes or shocks (like prolonged drought or devastating flooding) and reorganize though not necessarily to the original state
  - flexibility to keep planning options open

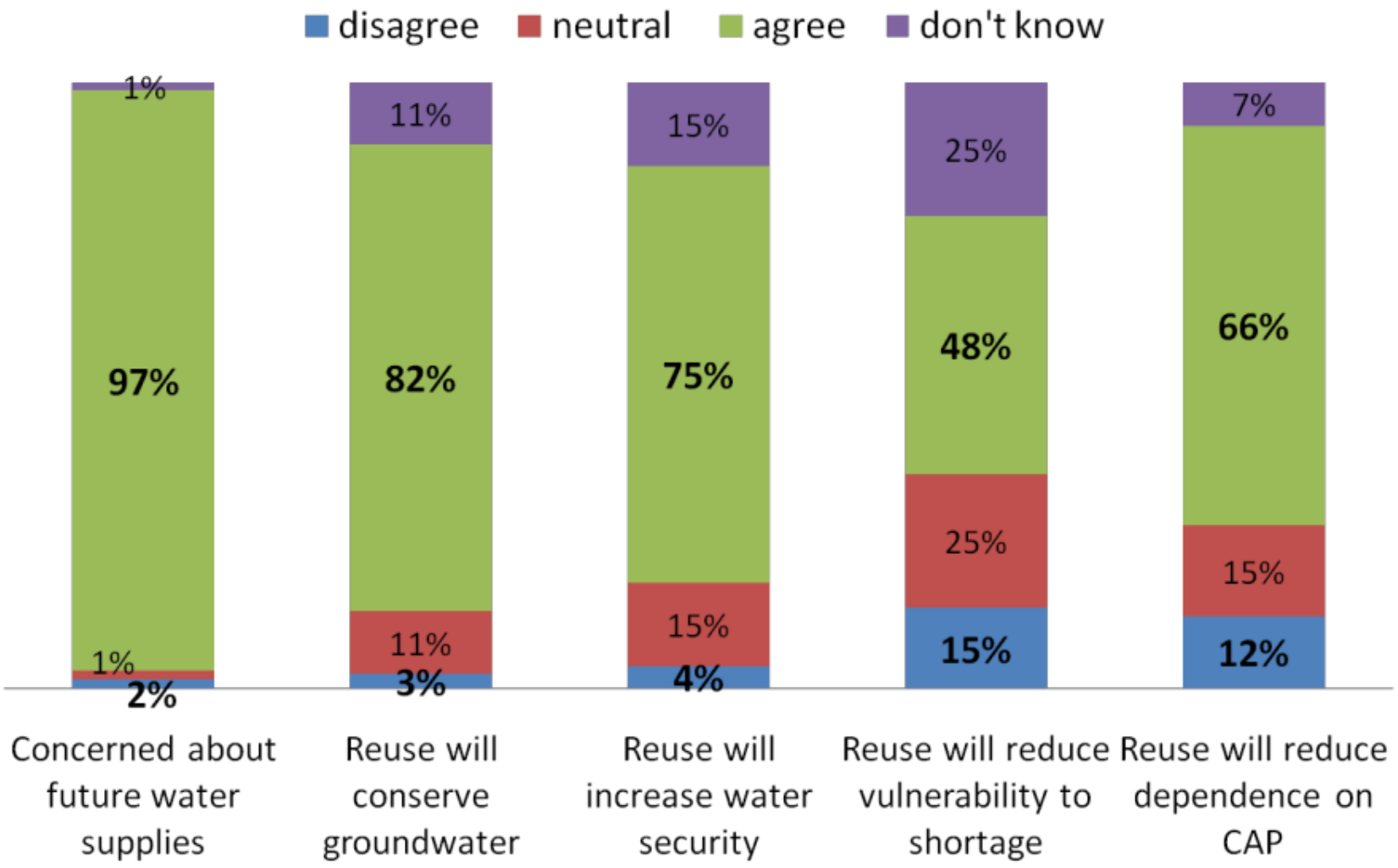
Urban vulnerability to climate change/prolonged drought

- **….Concerns:**
  - Refurbishment of existing infrastructure
  - Equitable distribution
  - Lack of access to funding or technology
  - Larger institutional framework of water management, esp. water rights
  - Length of current drought
  - Need for regional scale data and planning

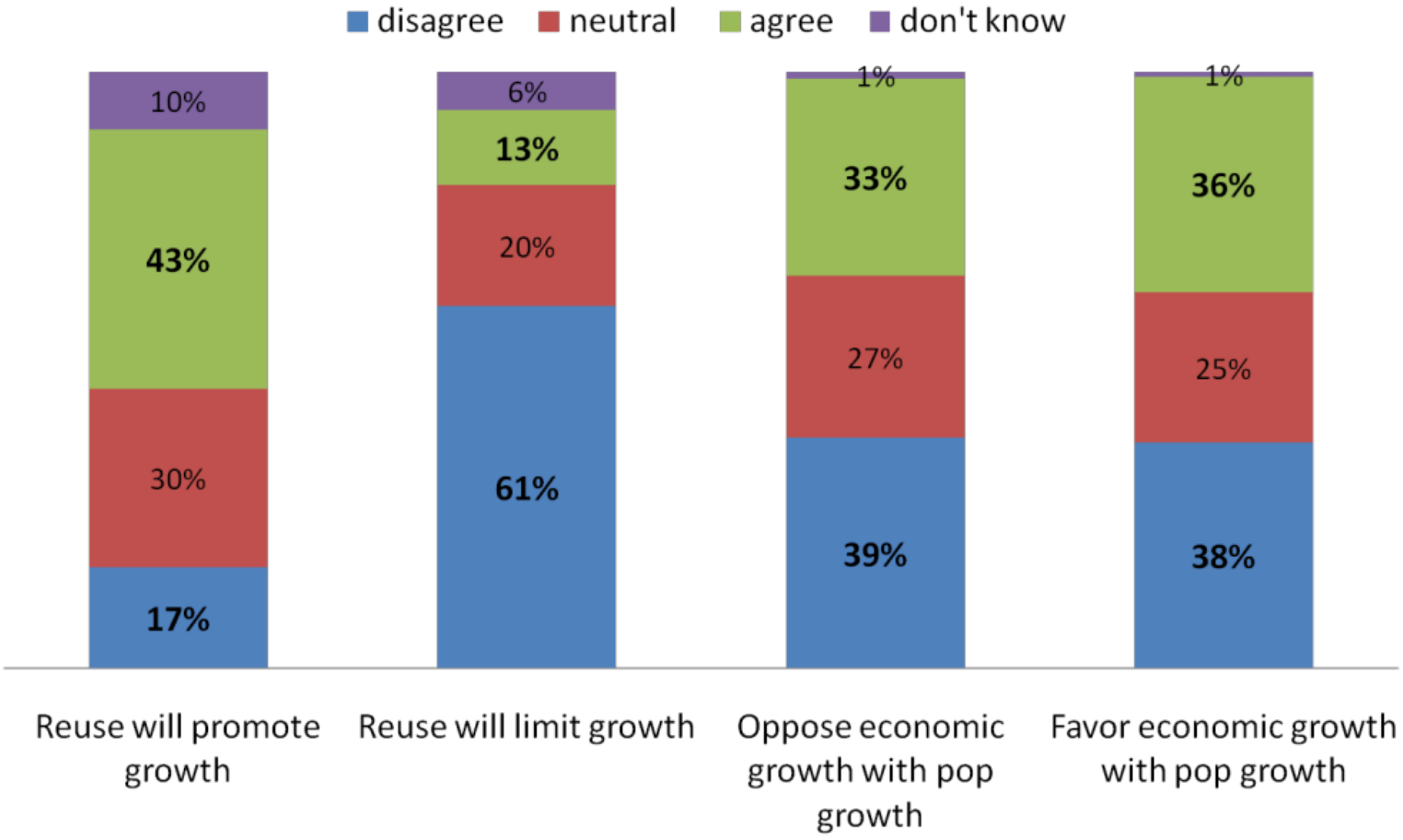
How do we build resilience?

- To facilitate key water and water reuse strategies:
  - Consider public perceptions
  - Understand managers' priorities
  - Enhance local and regional planning

Public perceptions on water reuse and water security



Public perceptions on water reuse and regional growth



Managers interviews

Interviews professional profile

Managers/directors	19
Advisors/advisory groups	17
Planners	9
Regulators	1
Total	**46**

Managers and planners frame the problem:
"We need a vision of our future"

- "Establish a secure water future that applies statewide as an operating plan."
- "Figure short and long term goals and use adaptive management to absorb new information."
- "Growth will occur regardless of the status of water or water reclamation. Having or not having reclaimed water will not promote growth, but it will enable water managers to deal with it."
- "Build where the infrastructure is available or planned."

Willingness to invest continued. . .

- **“We face a vulnerability we never dealt with in the past; we need to make certain our infrastructure will sustain us.”**
- **“We encounter increasing competition for dwindling traditional water supplies.”**
- **“Climate change impacts, e.g. decreasing snow pack, impact both quality and quantity of water available.”**
- **“Infrastructure system is aging and not designed for drought stress.”**

Managers and planners frame the problem: We need to reduce uncertainty

- "We acknowledge global warming and drought, but we continue to depend on groundwater and CAP [major infrastructure] —what happens if drought continues or gets worse?"

If we [water providers, planners, managers] use a regional approach, this would bring regulatory issues up to date.

Synthesis: water reuse & growth

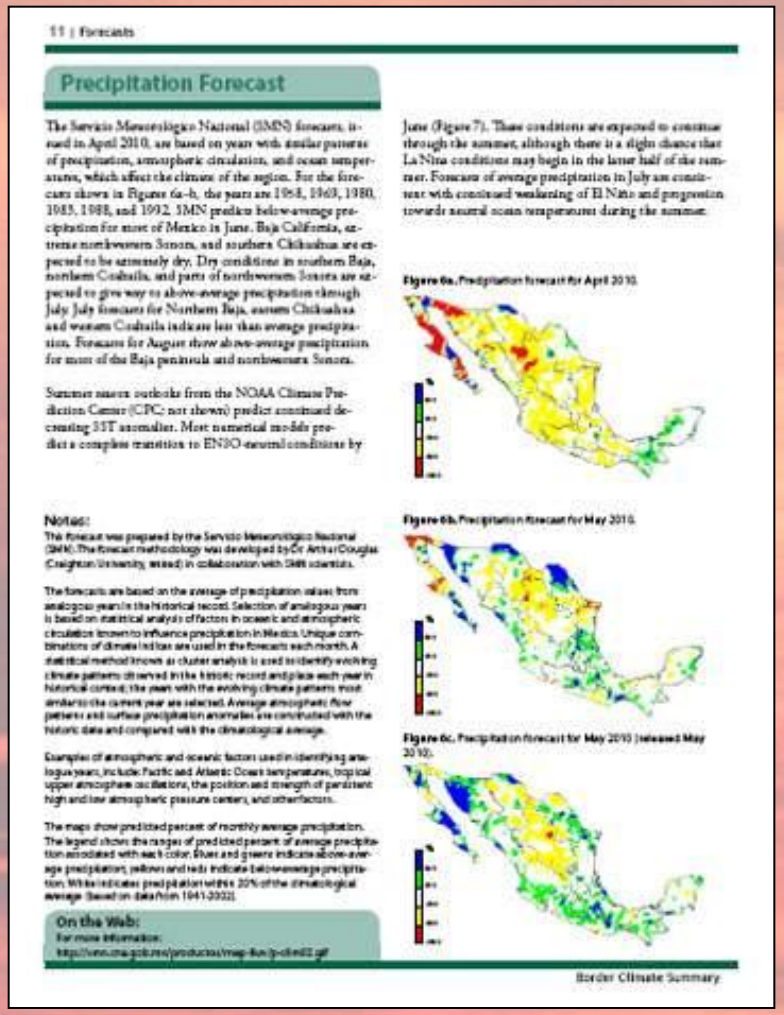
- reclaimed water viewed as a source of new supply despite groundwater mining (negative water balance)
- habitat and riparian area uses of reclaimed water likely to be affected
- public perception is increasingly amenable to indirect potable reuse with safeguards
- patterns and rates of growth are unlikely to be significantly affected by public perception, and minimally so by regulatory controls on water reuse

Resilient Cities

- Those that foresee future trends:
  - Population and economic growth, including spatial patterns
  - Water supply (from where, variability in amount, quality)
  - Water demand (changing consumption, quality for use)
- Those that build institutional capacity for resilience, to face multiple changes not just climate

Climate Information & Policy Product

Border Climate Summary (BCS)



11 | Forecasts

Precipitation Forecast

The Servicio Meteorológico Nacional (SMN) forecasts, issued in April 2010, are based on years with similar patterns of precipitation, atmospheric circulation, and ocean temperatures, which affect the climate of the region. For the forecasts shown in Figures 6a–b, the years are 1968, 1969, 1980, 1985, 1988, and 1992. SMN predicts below-average precipitation for most of Mexico in June. Baja California, extreme northwestern Sonora, and southern Chihuahua are expected to be seasonally dry. Dry conditions in southern Baja, northern Coahuila, and parts of northwestern Sonora are expected to give way to above-average precipitation through July. July forecasts for Northern Baja, eastern Chihuahua and western Coahuila indicate less than average precipitation. Forecasts for August show above-average precipitation for most of the Baja peninsula and northwestern Sonora.

Summer season outlooks from the NOAA Climate Prediction Center (CPC; not shown) predict continued decreasing SST anomalies. Most numerical models predict a complete transition to ENSO-neutral conditions by June (Figure 7). These conditions are expected to continue through the summer, although there is a slight chance that La Niña conditions may begin in the latter half of the summer. Forecasts of average precipitation in July are consistent with continued weakening of El Niño and progression towards neutral ocean temperatures during the summer.

Figure 6a. Precipitation forecast for April 2010.

Figure 6b. Precipitation forecast for May 2010.

Figure 6c. Precipitation forecast for May 2010 (released May 2010).

Notes:

The forecast was prepared by the Servicio Meteorológico Nacional (SMN). The forecast methodology was developed by Dr. Arthur Douglas (Creighton University, retired) in collaboration with SMN scientists.

The forecasts are based on the average of precipitation values from analogous years in the historical record. Selection of analogous years is based on statistical analysis of factors in oceanic and atmospheric circulation known to influence precipitation in Mexico. Unique combinations of climate indices are used in the forecasts each month. A statistical method known as cluster analysis is used to identify evolving climate patterns observed in the historic record and place each year in historical context; the years with the evolving climate patterns most similar to the current year are selected. Average atmospheric flow patterns and surface precipitation anomalies are constructed with the historic data and compared with the climatological average.

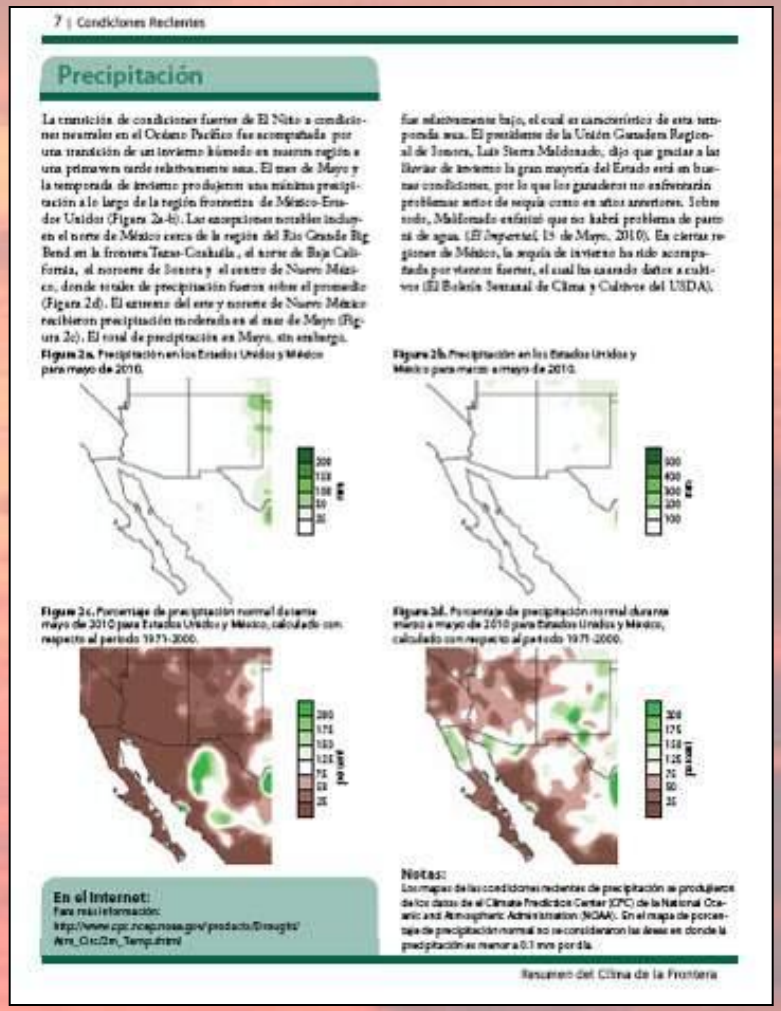
Examples of atmospheric and oceanic factors used in identifying analogue years include Pacific and Atlantic Ocean temperatures, tropical upper atmosphere oscillations, the position and strength of persistent high and low atmospheric pressure centers, and other factors.

The maps show predicted percent of monthly average precipitation. The legend shows the ranges of predicted percent of average precipitation associated with each color. Blues and greens indicate above-average precipitation; yellows and reds indicate below-average precipitation. White indicates precipitation within 20% of the climatological average (based on data from 1941-2002).

On the Web:

For more information:
http://smn.cna.gob.mx/productos/map-flux/p-clim02.gif

Resumen del Clima de la Frontera



7 | Condiciones Recientes

Precipitación

La transición de condiciones fuertes de El Niño a condiciones neutrales en el Océano Pacífico fue acompañada por una transición de un invierno húmedo en nuestra región a una primavera cada relativamente seca. El mes de Mayo y la temporada de invierno produjeron una mínima precipitación a lo largo de la región fronteriza de México-Estados Unidos (Figura 2a-b). Las excepciones notables incluyen el norte de México cerca de la región del Río Grande Big Bend en la frontera Texas-Coahuila, el norte de Baja California, el noroeste de Sonora y el centro de Nuevo México, donde totales de precipitación fueron sobre el promedio (Figura 2d). El extremo del este y noreste de Nuevo México recibieron precipitación moderada en el mes de Mayo (Figura 2c). El total de precipitación en Mayo, sin embargo, fue relativamente bajo, el cual es característico de esta temporada seca. El presidente de la Unión Ganadera Regional de Sonora, Luis Serra Maldonado, dijo que gracias a las lluvias de invierno la gran mayoría del Estado está en buenas condiciones, por lo que los ganaderos no enfrentarán problemas serios de sequía como en años anteriores. Sobre todo, Maldonado enfatizó que no habrá problema de pastura ni de agua. (*El Imparcial*, 15 de Mayo, 2010). En ciertas regiones de México, la sequía de invierno ha sido acompañada por vientos fuertes, el cual ha causado daños a cultivos (El Boletín Semanal de Clima y Cultivos del USDA).

Figura 2a. Precipitación en los Estados Unidos y México para mayo de 2010.

Figura 2b. Precipitación en los Estados Unidos y México para marzo a mayo de 2010.

Figura 2c. Porcentaje de precipitación normal durante mayo de 2010 para Estados Unidos y México, calculado con respecto al período 1971-2000.

Figura 2d. Porcentaje de precipitación normal durante marzo a mayo de 2010 para Estados Unidos y México, calculado con respecto al período 1971-2000.

En el Internet:

Para más información:
http://www.cpc.ncep.noaa.gov/products/Drought/Amr_Clim/Tem.shtml

Notas:

Los mapas de las condiciones recientes de precipitación se produjeron de los datos de el Climate Prediction Center (CPC) de la National Oceanic and Atmospheric Administration (NOAA). En el mapa de porcentaje de precipitación normal no se consideraron las áreas en donde la precipitación es menor a 0.1 mm por día.

http://www.climas.arizona.edu/outlooks/bcs

Questions or comments?

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