Lower Santa Cruz River Basin Study

Study Background and Process Overview

Eve Halper
Water Resources Planner
Bureau of Reclamation Phoenix Area Office
Groundwater Modeling Results Presentation
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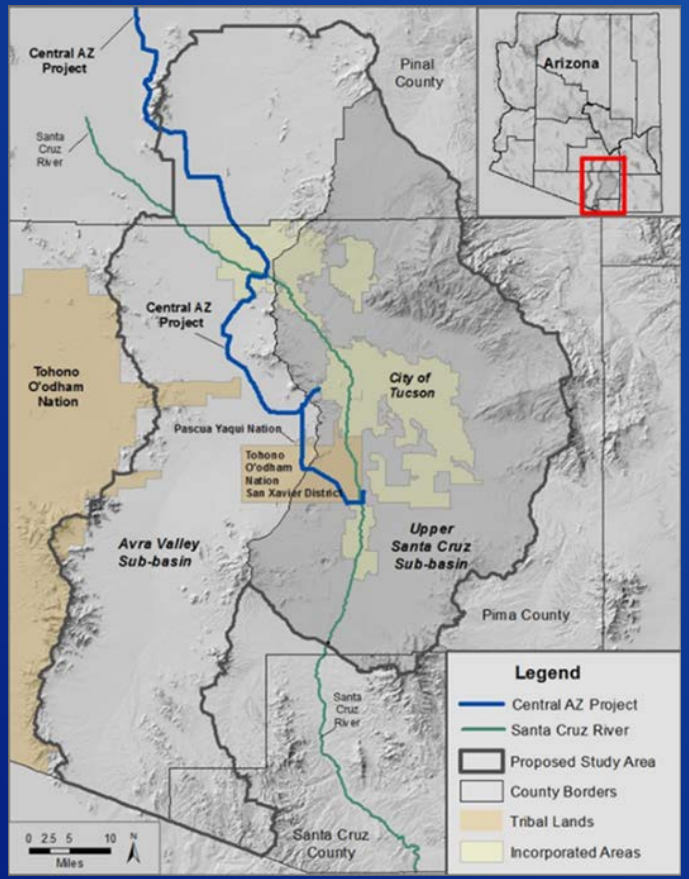
Lower Santa Cruz River Basin Study Background



- Study area is the Tucson Active Management Area (TAMA) defined by the AZ Department of Water Resources
- Under state law, the goal of the TAMA is “safe-yield” by 2025 or earlier
- Safe-yield requires a long-term balance between the amount of water pumped and the amount recharged annually ***over the entire TAMA***
- The safe-yield goal does not address the problem of imbalances within the TAMA
- Regulations do not address water for the environment

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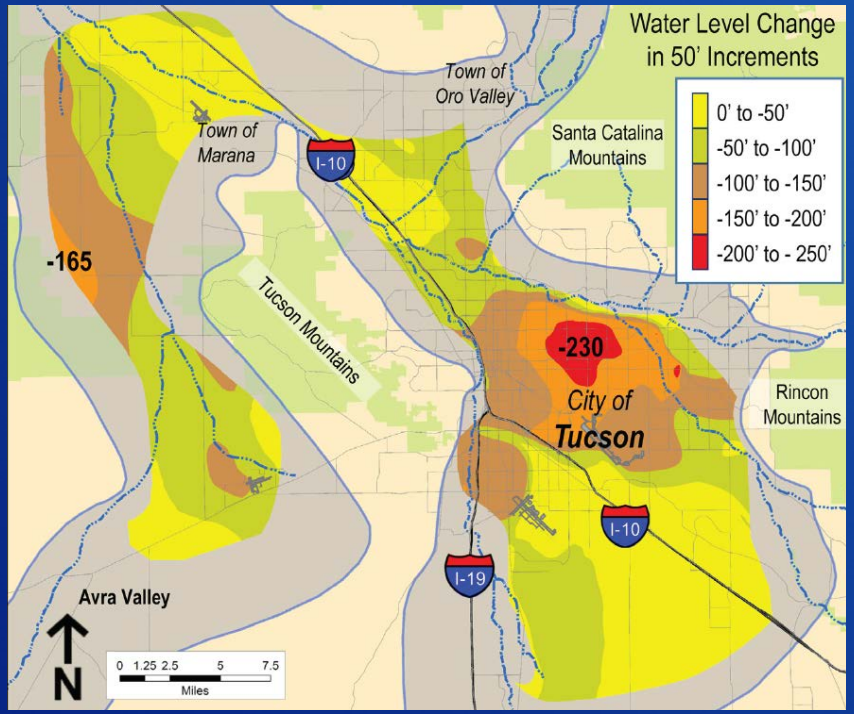
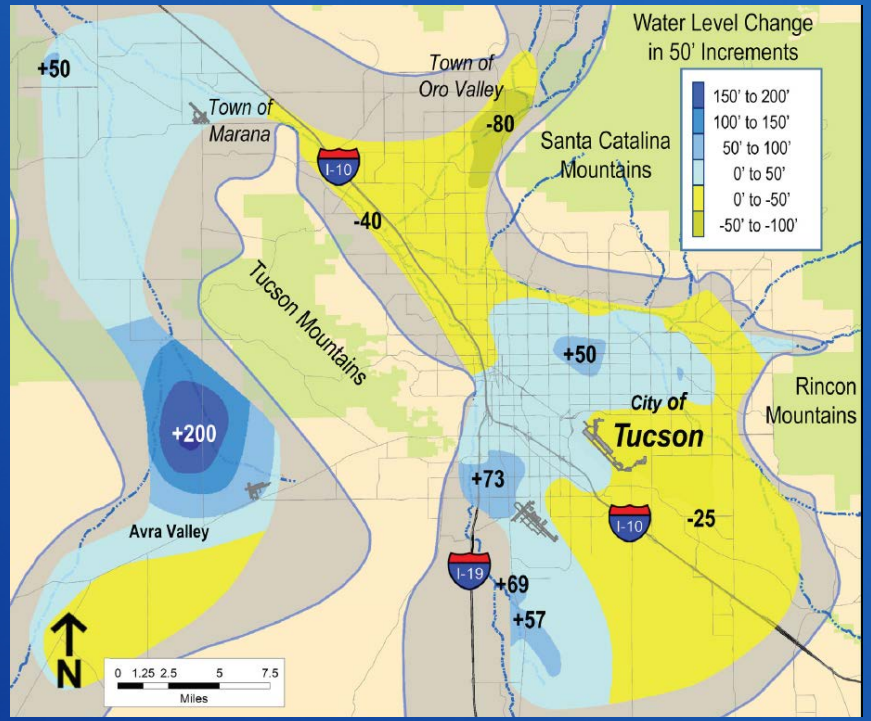
Impact of Central Arizona Project (CAP) Water



1940 - 1998



2000 - 2016

Tucson Basin Water Level Changes

Source: Tucson Water 2018 Status and Quality of the Aquifer Report

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Water Management Challenges

- Climate Change
- Population and Economic Growth

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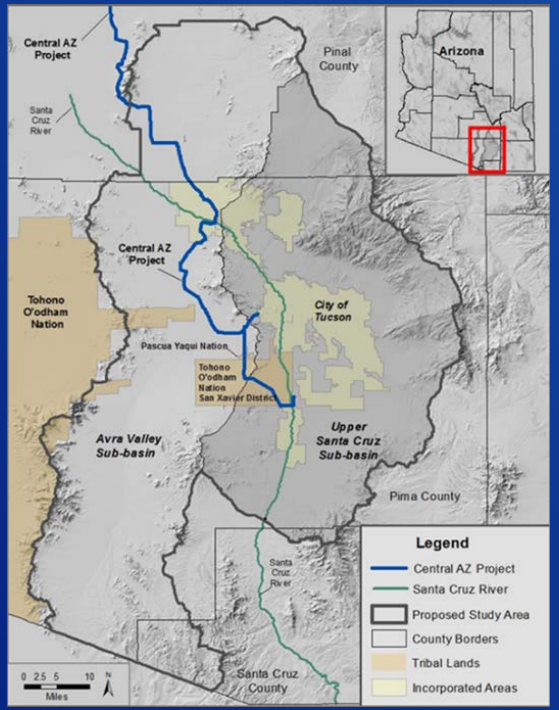
LSCR Basin Study Summary



- Addresses the impacts of changing climate, population and other factors on water supplies and demands
- Focuses on spatial distribution of water resources ***within*** the Tucson Active Management Area
- Includes analysis of impacts on the environment (riparian areas)
- Estimates a range of possible futures through the use of scenario planning

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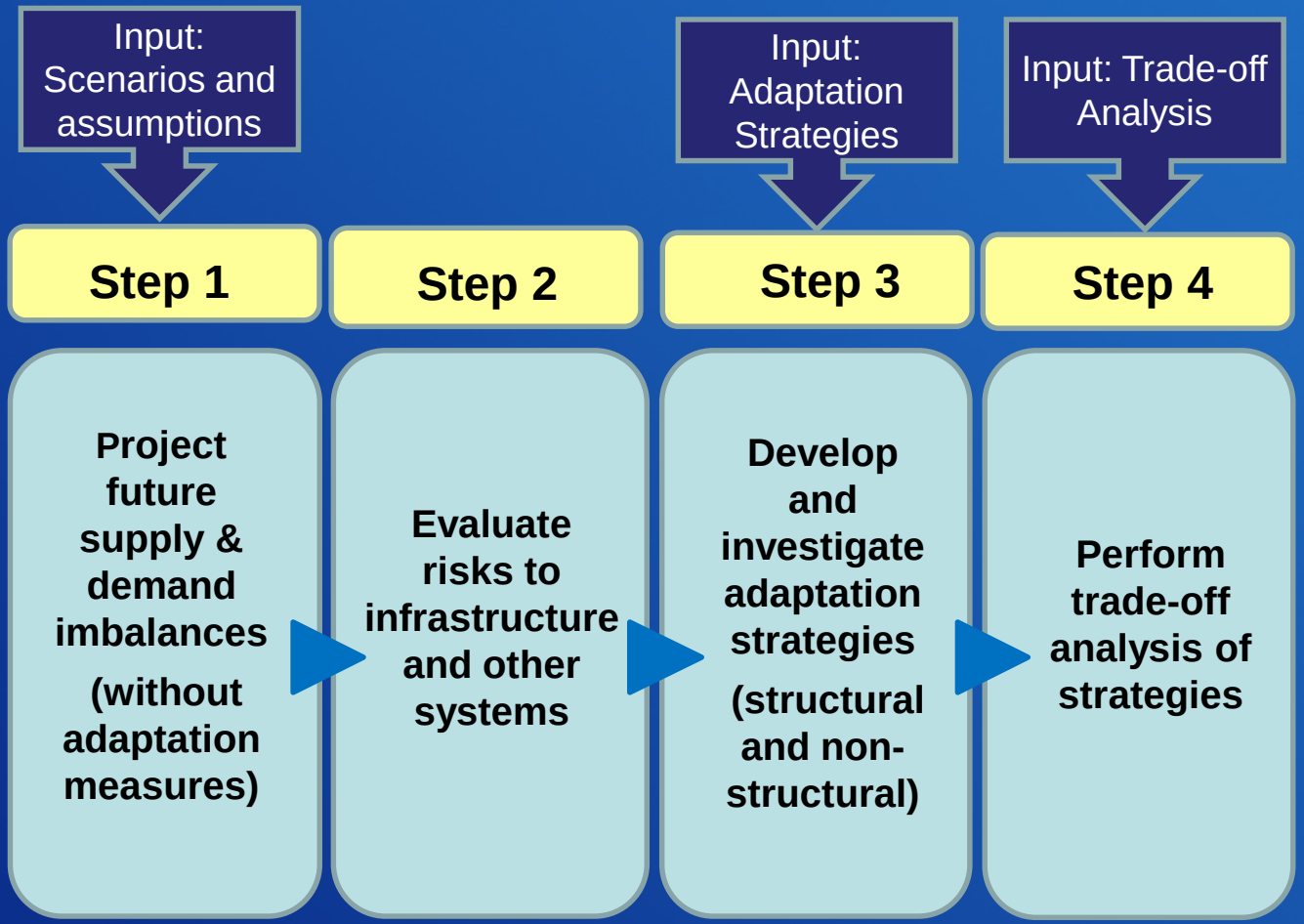
Reclamation Basin Study Components



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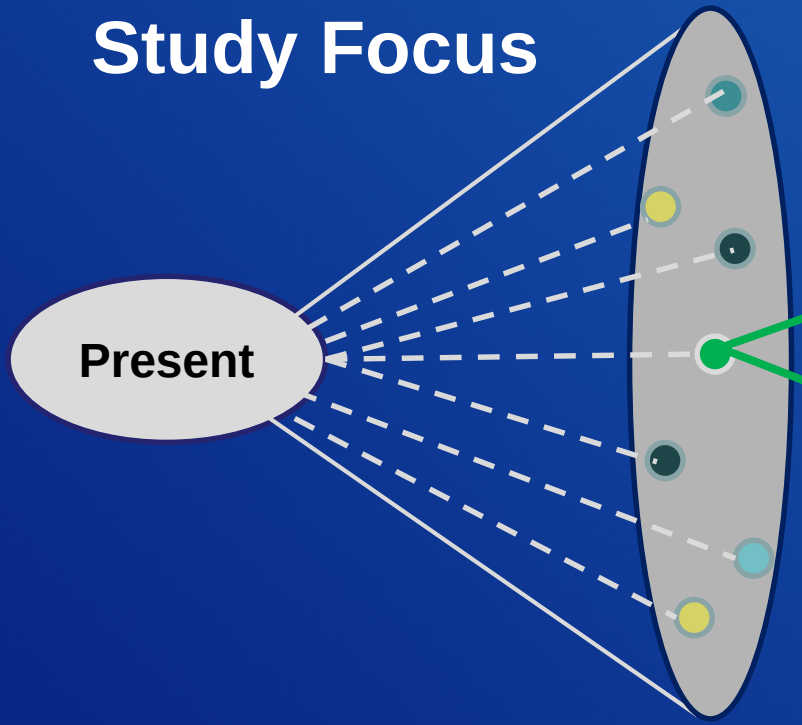
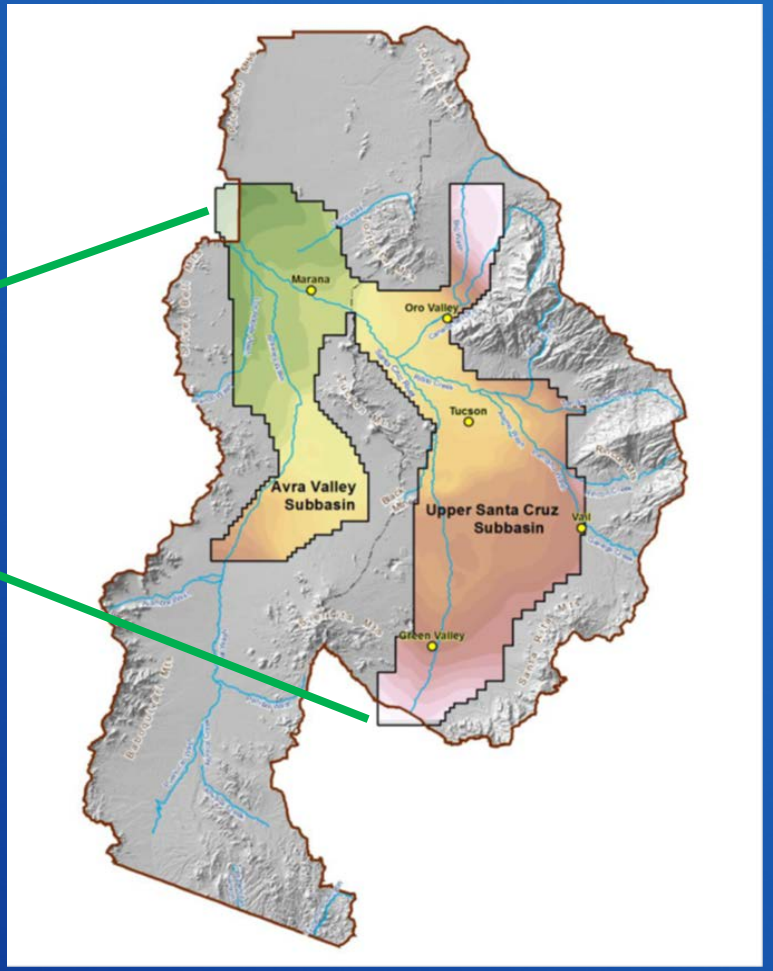
Study Focus





Estimating future groundwater levels using ADWR's TAMA Groundwater Model under a range of scenarios

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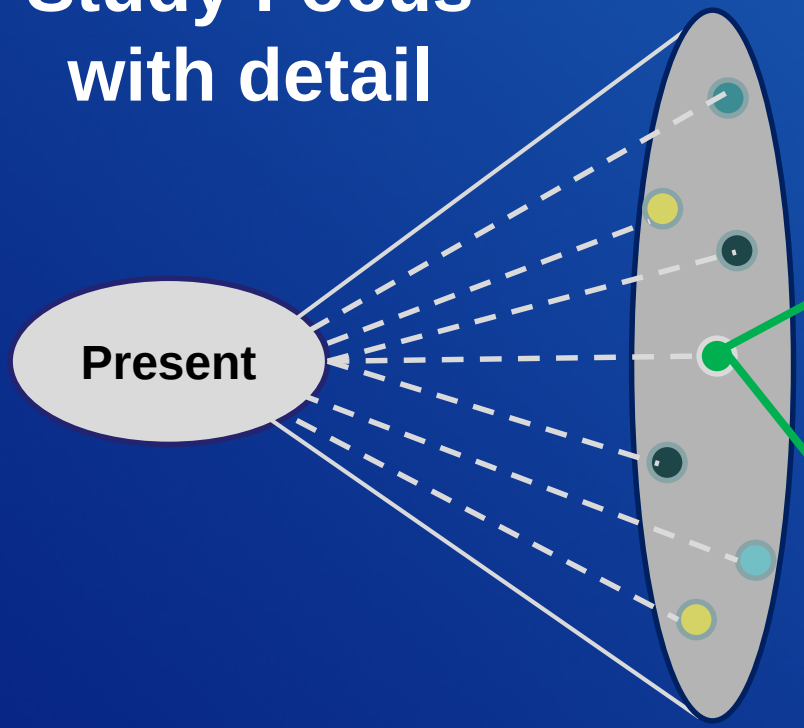
Study Focus with detail



Supply and Demand

CAP Deliveries	Municipal
Local Ground and Surface Water	Industrial
Recycled Water	Agricultural
Stormwater	Environmental (*Riparian ET*)

Estimating future groundwater levels using ADWR's TAMA Groundwater Model under a range of scenarios

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2 climate scenarios based on future emissions levels

3 socio-economic scenarios based on population and growth type

Tucson AMA Groundwater Model

Climate Driving Forces (Precipitation, Temperature)

GLOBAL CLIMATE MODELS

SURFACE HYDROLOGY MODEL

Socio-Economic Driving Forces (Demographics, Economics, Technological, Regulatory)

CAP SERVICE AREA MODEL

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Future Climate Scenarios

Worse: Based on **RCP 8.5** data

Dynamically Downscaled with the WRF Model from University of AZ

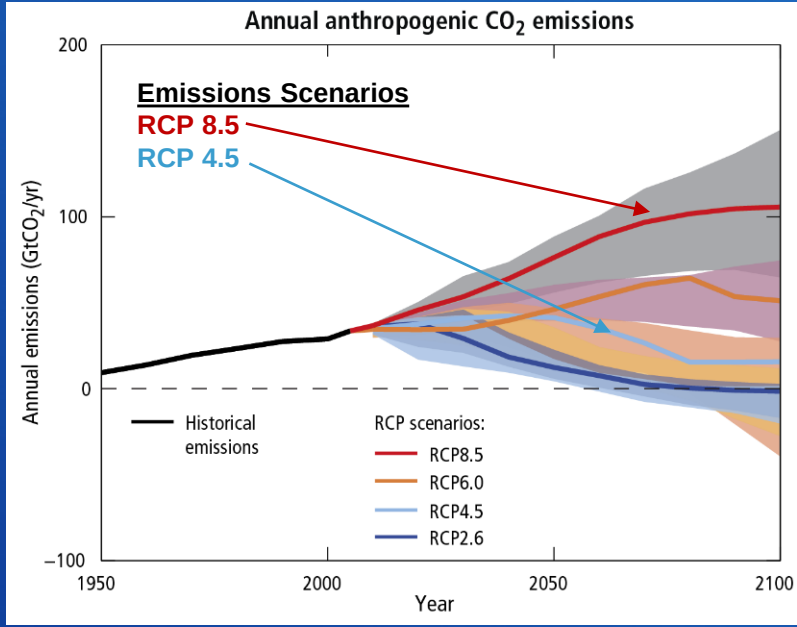
Weather Research and Forecasting Model (https://www.mmm.ucar.edu/weather-research-and-forecasting-model)

Best: Based on **RCP 4.5** SD data

Statistically Downscaled (SD): LOCA

Localized Constructed Analogs (http://loca.ucsd.edu/)

DD not available for RCP 4.5



RCP = Representative Concentration Pathways

From CMIP5 climate model intercomparison

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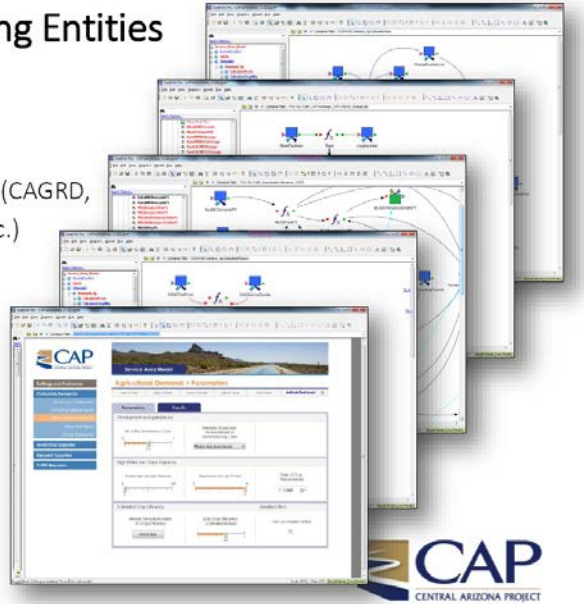
Socio-Economic Forces - CAP Service Area Model

CAP Service Area Model (CAP:SAM)

- All Major Water Using Entities
  - 80 Municipal Providers
  - 23 Irrigation Districts
  - 12 Tribes and Districts
  - 20+ other user categories (CAGRD, AWBA, Industrial users, etc.)
- 16 Water Supply Types
  - Includes Surface Water, Effluent, CAP, LTSC, Groundwater, Recovered Water, etc.
  - Incorporates shortage scenarios from Colorado River Simulation model (CRSS)



- Models municipal, agricultural and industrial demands
- Demand estimated by water provider
- Matches each demand with supplies in order of preference

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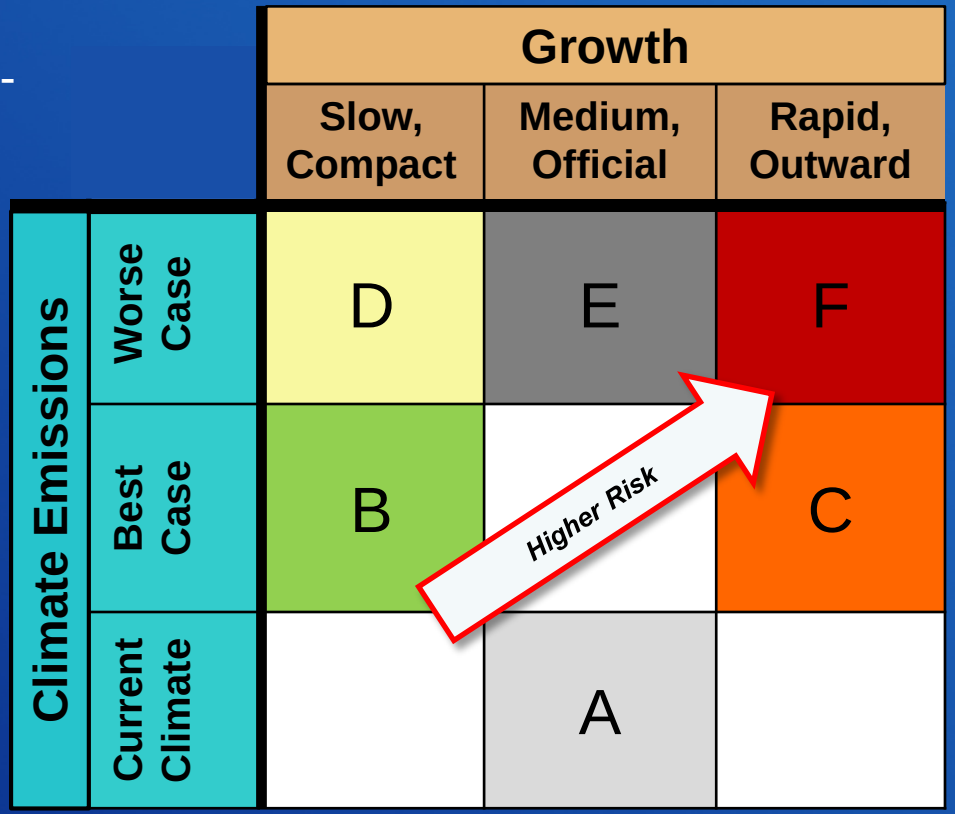
Supply-Demand Scenarios

A. Official Projections: Medium, mixed-density growth and current climate
B. Slow, compact growth and Best Case climate
C. Rapid, outward growth and Best Case climate
D. Slow, compact growth and Worse Case climate
E. Official Projections and Worse Case climate
F. Rapid, outward growth and Worse Case climate



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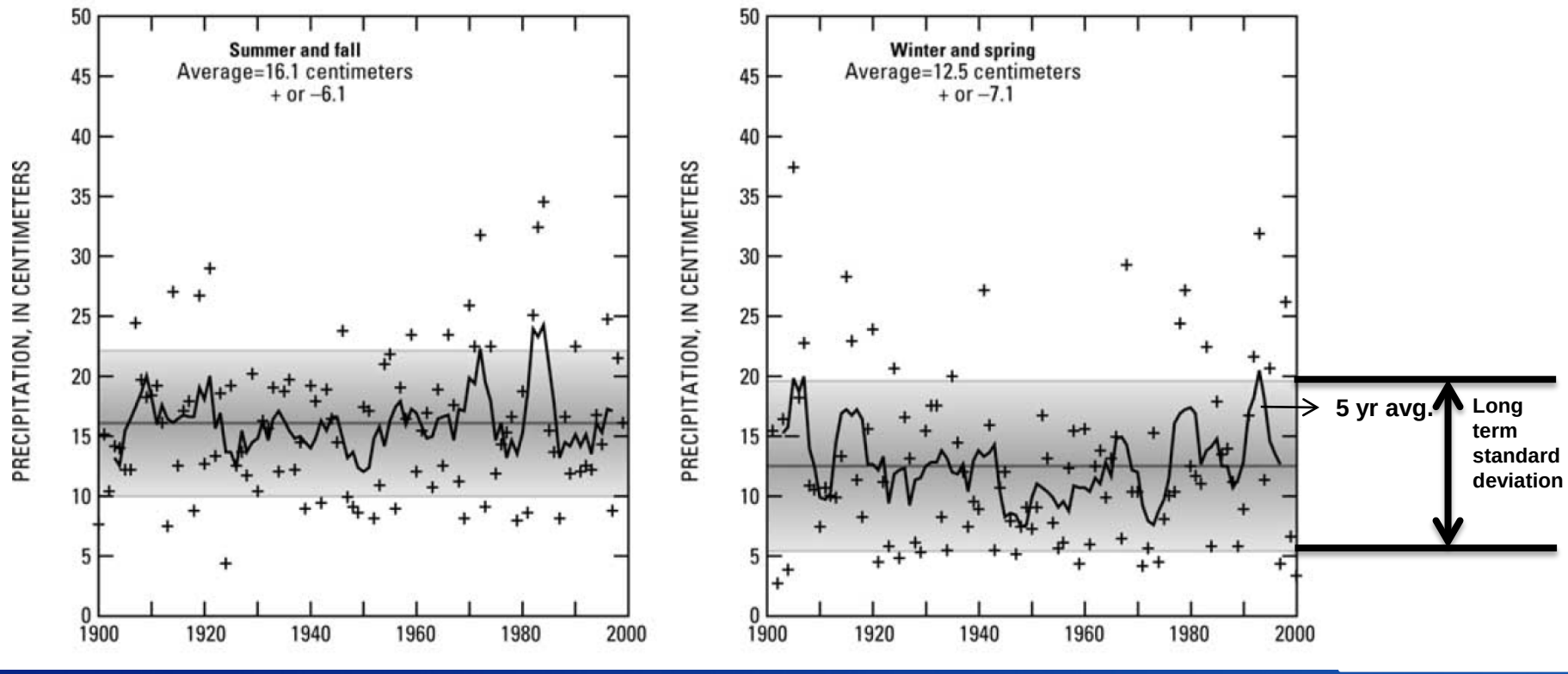
Precipitation Variability in the Tucson Area



Seasonal precipitation at the the University of Arizona Campbell Road Farms, 1900 - 2000

Source: Pool, D.R., Variations in climate and ephemeral channel recharge in southeastern Arizona, U.S. Water Resources Research, Volume 41, W11403, 2005.

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Incorporating Variability - Key Points

- Variability is a defining characteristic of the Tucson area climate
- Water managers need to understand future variability in addition to averages
- Climate models projections do not reproduce this variability
- The LSCR Basin Study used a computer program (weather generator) to simulate the local variability of precipitation and temperature
- The weather generator produces a set of 100 possible outcomes from one daily climate model projection
- This allows us to express the future in terms of **probabilities**