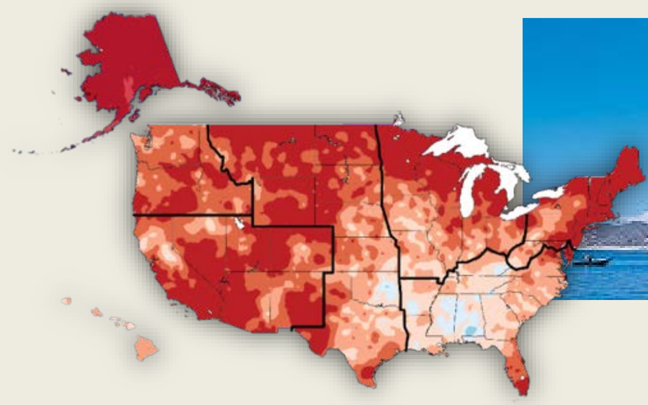
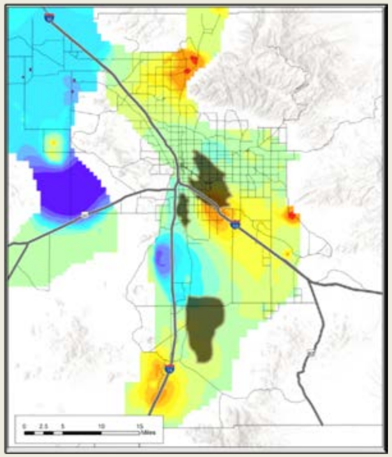
November 21, 2019



Lower Santa Cruz River Basin Study: Overview of Adaptation, Risk-based Framing and Climate Metrics



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College of Agriculture and Life Sciences

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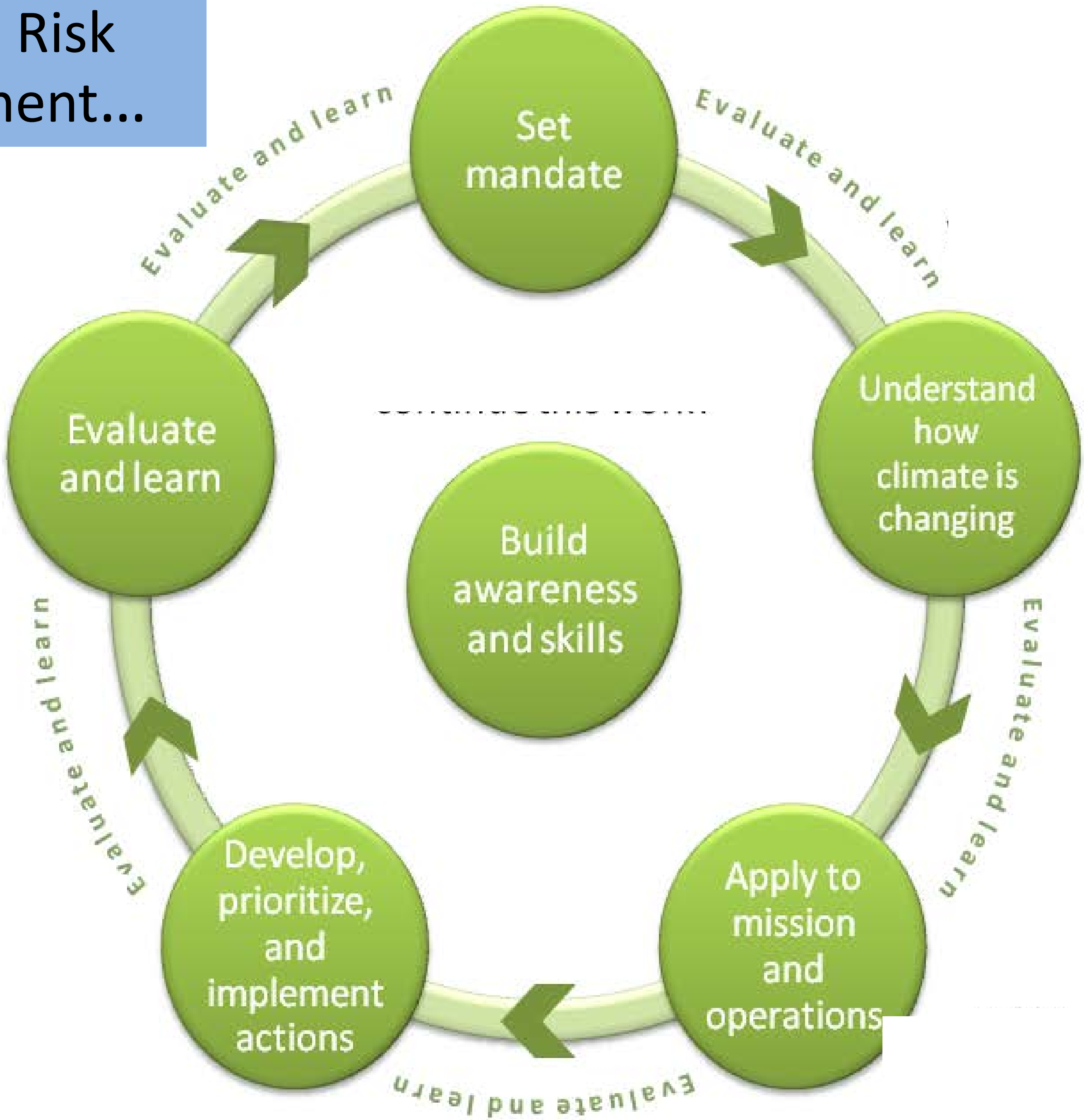
Adaptation is Iterative Risk Management…



Risk-based Framing

- Climate change may not be the major driver of future change, but we need to effectively integrate the risks associated with future climate in the context of our understanding of existing and future stressors.

- Because climate change has such pervasive effects, and our understanding is still evolving, surprises WILL happen

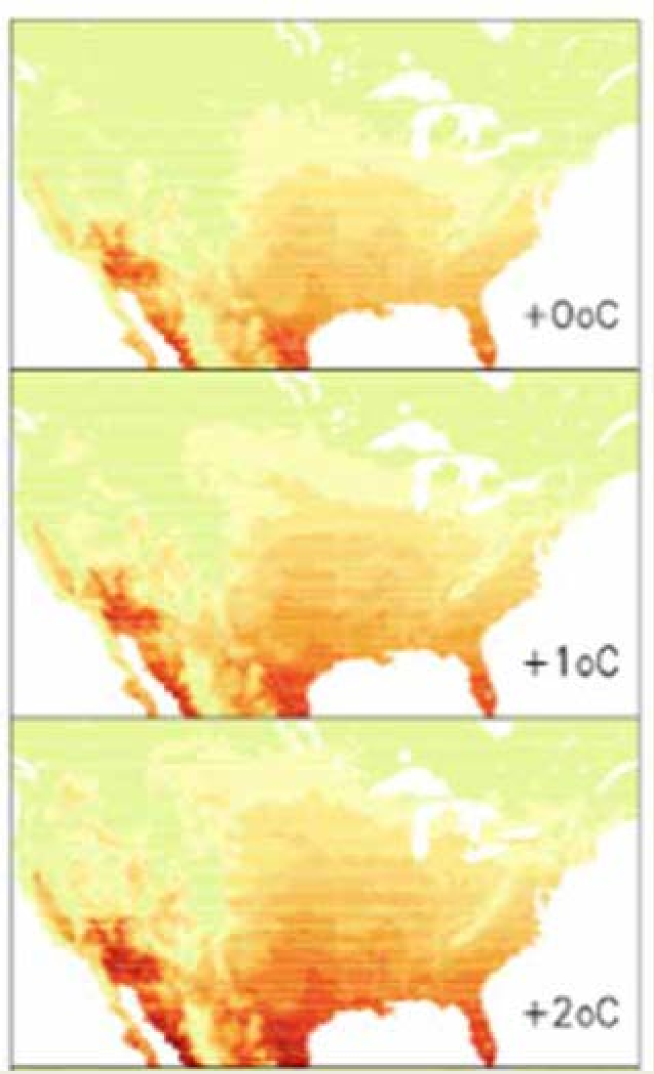
Risk-based Framing continued

- We don’t want to focus on average or normal future conditions because we want to manage risk, including the low probability/high consequence kind

- If we are prepared for the worst, (or at least the “worse” case) scenario we will certainly be ready for the “best” case and hopefully be pleasantly surprised

Approach to Future Scenarios

- There is no intrinsic reason a mid-range scenario is more likely than a higher or lower one
- A higher emissions scenario (e.g., the “worse case”) provides insight into the impacts avoided by reducing emissions and provides potential upper limits to adaptation needs
- A lower scenario (e.g., the “best case”) establishes a minimum requirement for adaptation, even if reductions in emissions were to occur



(adapted from Linda Mearns)

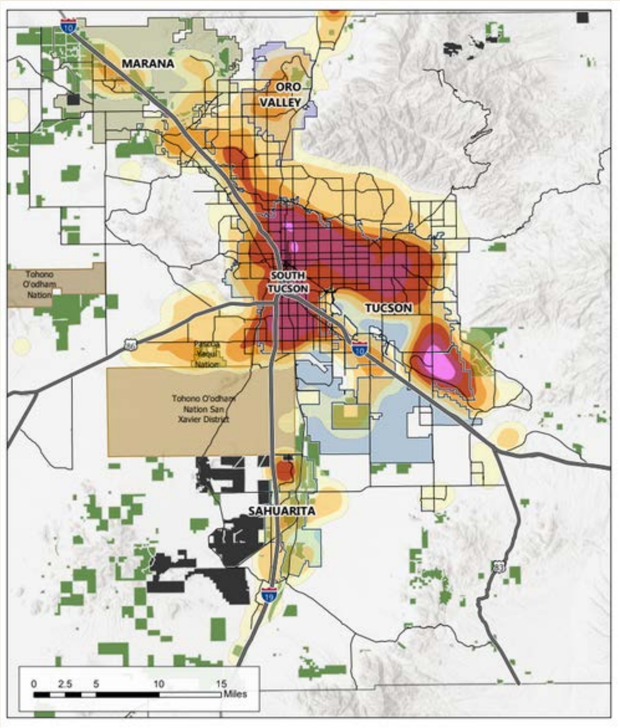
What does it mean to adapt to climate change?

- Acting to reduce vulnerability and enhance preparedness for climate and extreme weather related impacts

- Responsible risk management and use of resources

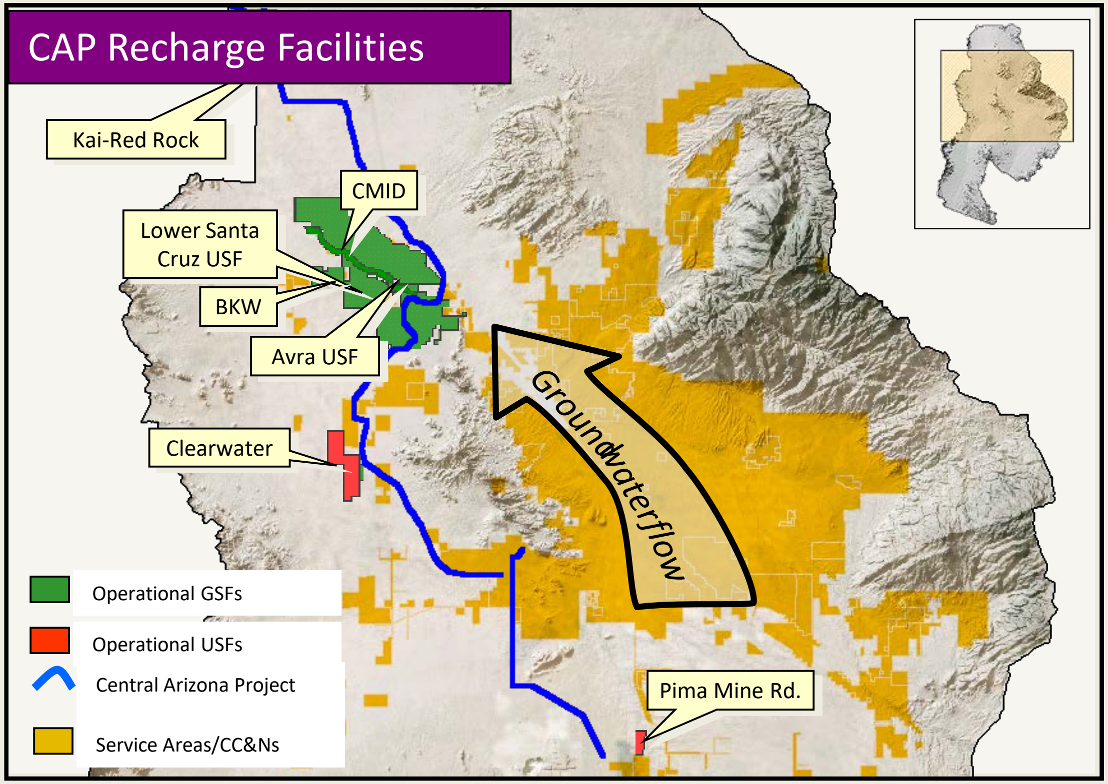
- Common-sense planning to protect our health, safety and prosperity

- *We all manage risk as part of our everyday decision-making*



Renewable supply use and local impacts: moving beyond safe-yield (a basin-wide balance)

- Physical access to renewable supplies varies
- There are unmet infrastructure needs
- Environmental resources are at risk
- Need for local area water management (flooding, water quality, subsidence)



Tucson AMA – Seasholes (CAP)

Example local water adaptation options:

- Integrated Water Resource Management (IWRM) matching quality to use (also "One Water")
- Aquifer storage and recovery (multiple permutations)
- Conservation - water use efficiency
- Stormwater capture and storage/ rainwater harvesting
- Groundwater withdrawal limitations
- Dry year options
- Recycling, reuse of wastewater
- Environmental enhancement projects
- Green infrastructure

Simplifying climate impacts for LSCRBS

- It is going to get hotter
- Streamflow is likely to be reduced (impacting local supply)
- ET will (generally) increase (impacting demand)
- Drier on average but with intense rainstorms
- Likelihood of cascading effects increasing (eg heat waves, brown outs, forest fires, air quality)
- Reductions in Colorado River flows = our imported supply (CAP) is at risk
- Serious implications for ecosystems, human health and historically disadvantaged populations

Climate Impact Metrics

Objective	Example Climate Impact	Example Metrics
• Reliable water supply (for muni, ag, industrial, private wells)	• Total volume of groundwater recharge in vicinity of demand • Impact of temperature and precipitation on demand	• Temperature/ET • Total annual precipitation • Runoff volume/location • Length of dry period • Onset of monsoon
• Flood control	• Intensity of precipitation/runoff • Frequency/duration of runoff	• Precipitation intensity and frequency • Runoff volume/location
• Environmental protection/res-toration	• Frequency of precipitation/intensity • Runoff volume and duration	• Temperature/ET • Length of dry period • Onset of monsoon • Precipitation intensity and frequency • Depth to groundwater

Extra slides

Climate Impacts on Groundwater Recharge depend on…

- Basin structure, depth to water
- Aquifer recharge type: streambed, mountain front recharge, agricultural and municipal return flows, etc.
- Groundwater/surface water interactions
- Temperature, ET
- Intensity and seasonality of precipitation and resulting runoff
- Channel morphology, erosion, flooding
- Changes in land use and technology
- Changes in vegetation

Includes material from Meixner et al., 2015, Journal of Hydrology