Decision Making Under Uncertainty: Ranking of Multiple Stressors on Central Arizona Water Resources





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Arizona State University

Our goal in this research is to provide a sensitivity analysis of multiple factors that influence water resources in the Central AZ

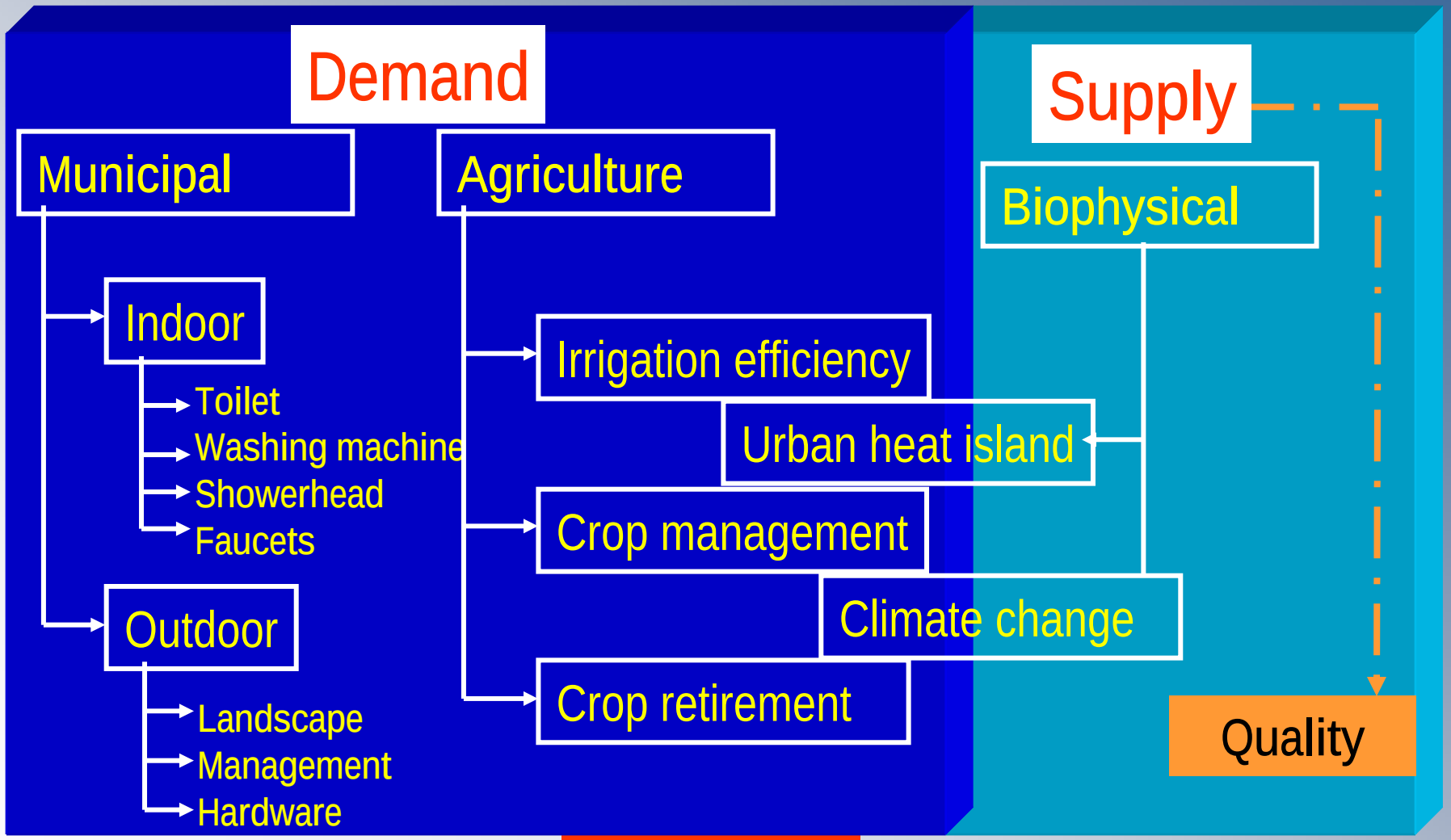
- To provide scientific basis for study of multiple stressors on the water resources of the Phoenix AMA;
- assess the significance of each stressor in its relation to the vulnerability of water systems; and
- present the value of multiple stressor analysis as a support for decision making under uncertainty

Methods

First we reviewed the effects of multiple factors that stress water resources at present, and, used available information to extend this analysis to 2025;

Secondly, we ranked the stressors, the time frame in which they could challenge the supply of water resources, and their potential societal impacts.

Identification of stressors

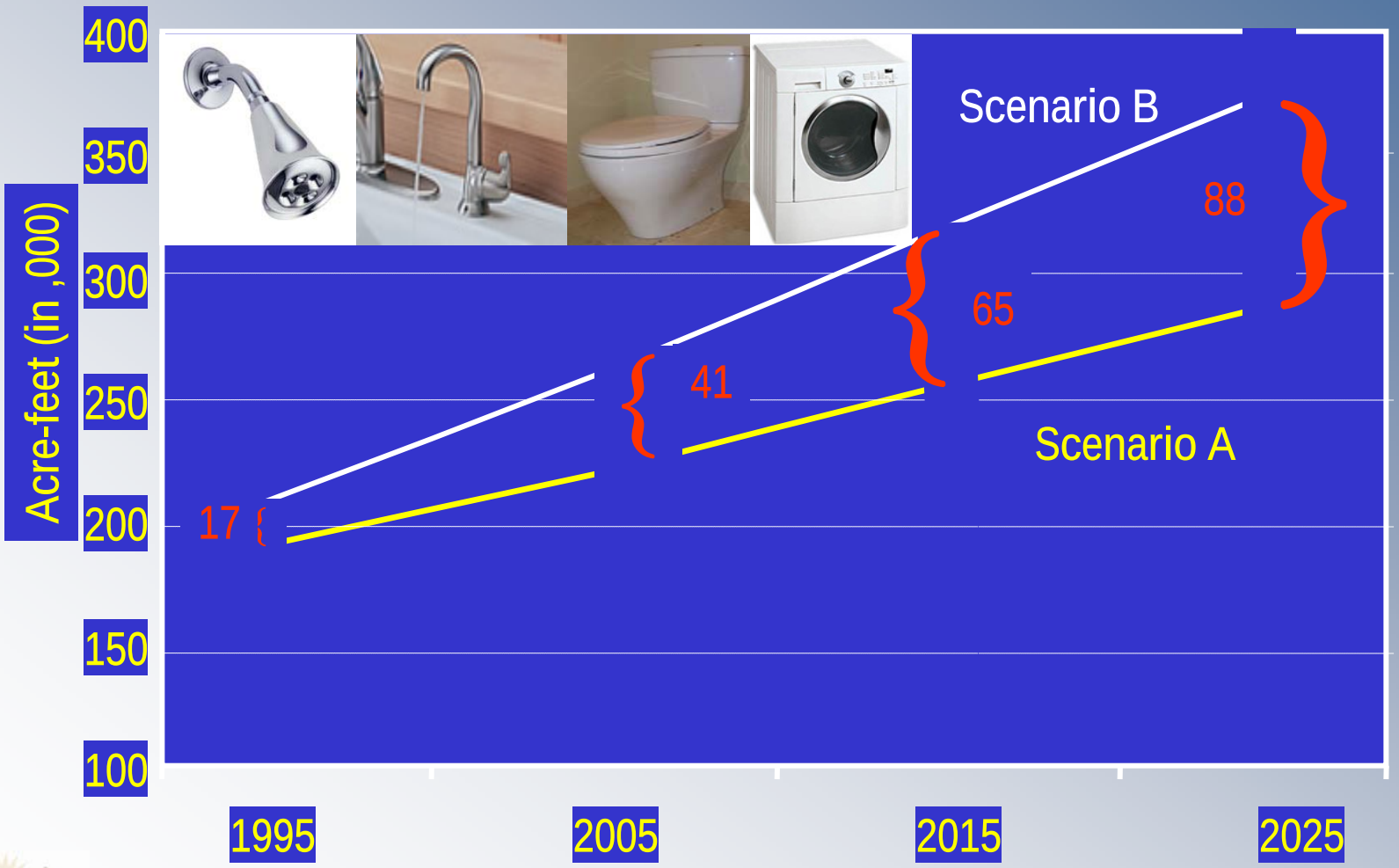


Municipal – Indoor




Factors affecting indoor water use

Differences in indoor water use for single family residence – illustration of two scenarios



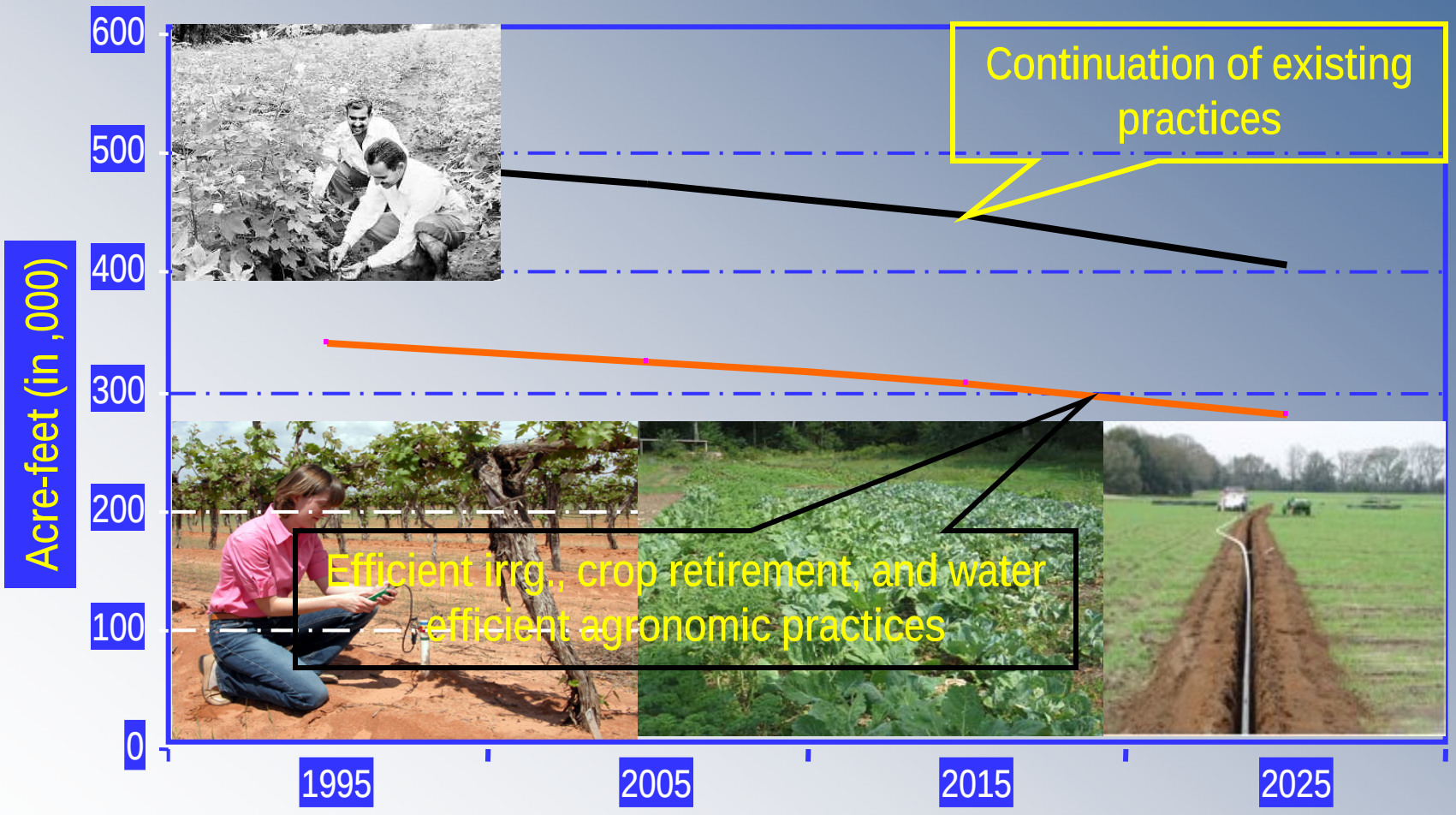
Municipal – Outdoor

Factors affecting residential outdoor water use

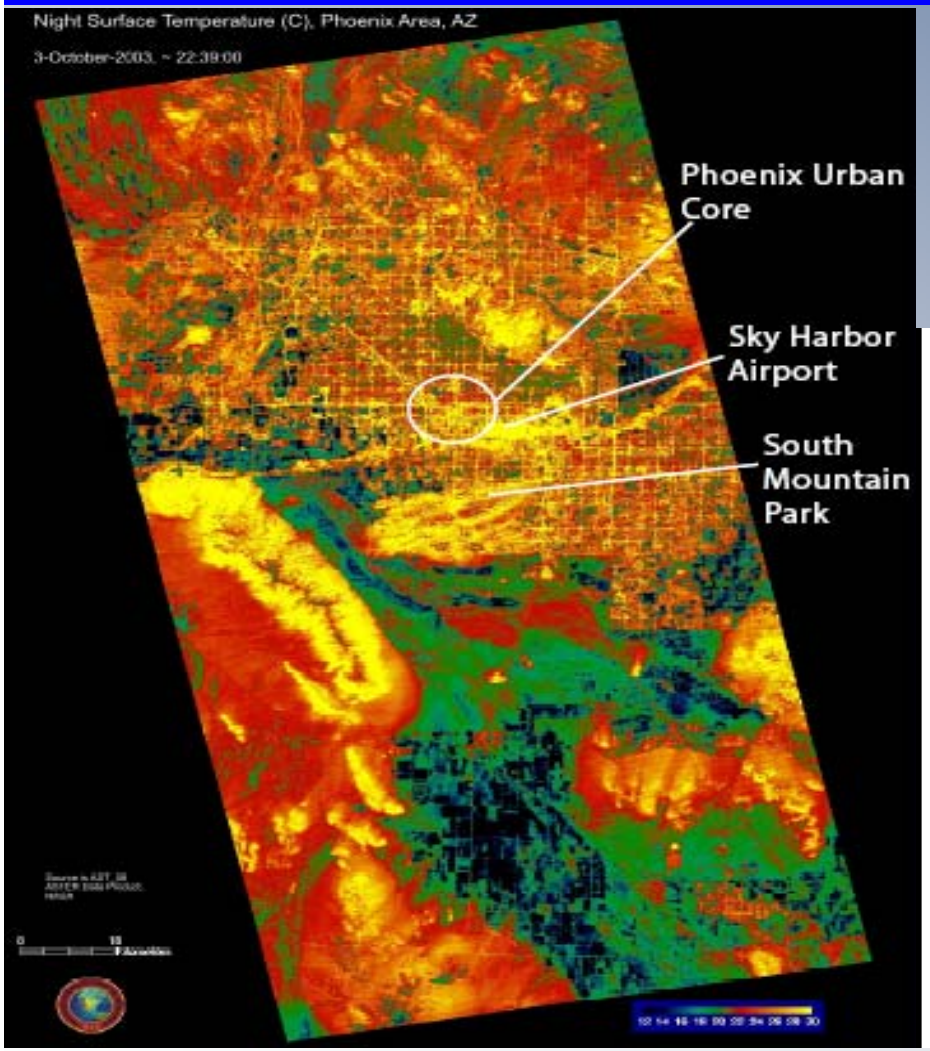
Difference in outdoor water use between scenarios, 1995-2025

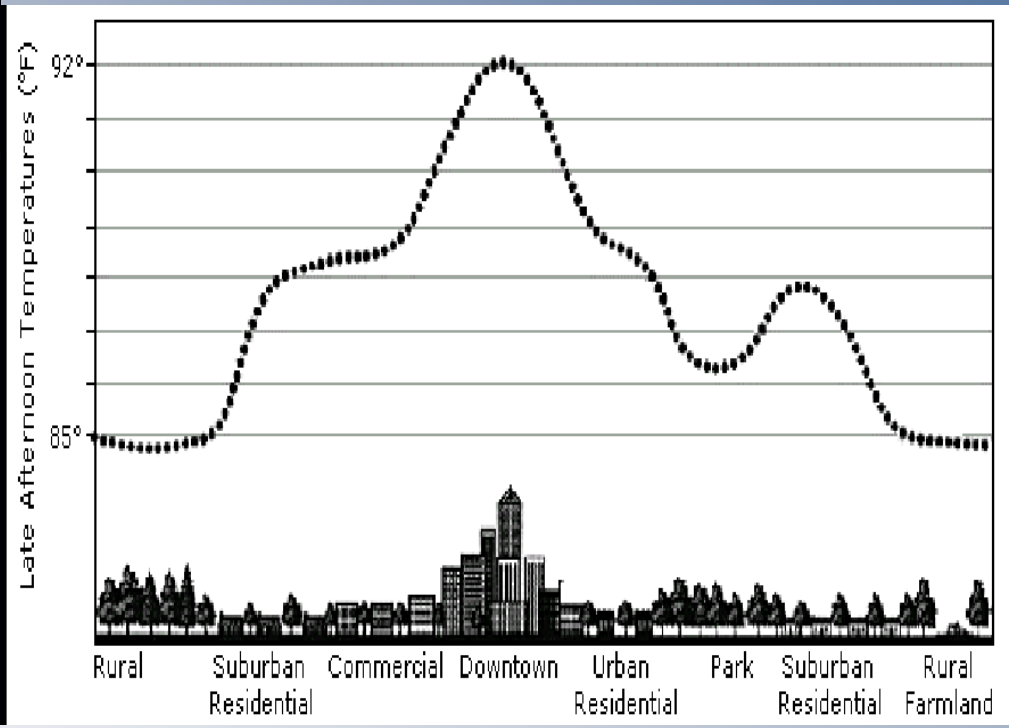
Agriculture

Water efficient agricultural practices results in significant saving



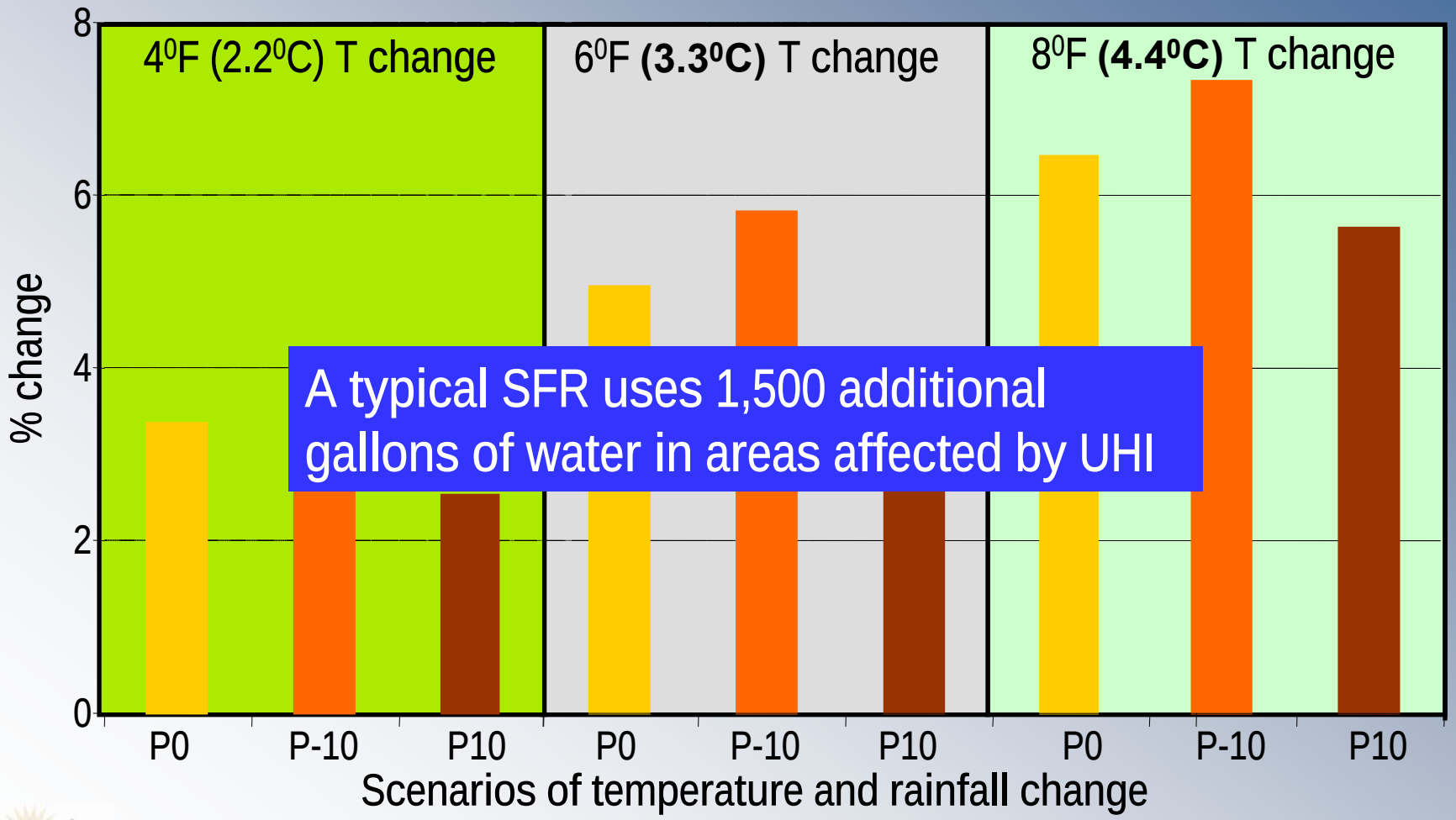
Biophysical: effects of UHI





About 6.2 af/year is lost through evaporation for each acre of surface area under water.

Residential water demand is sensitive to changes in temperature and rainfall

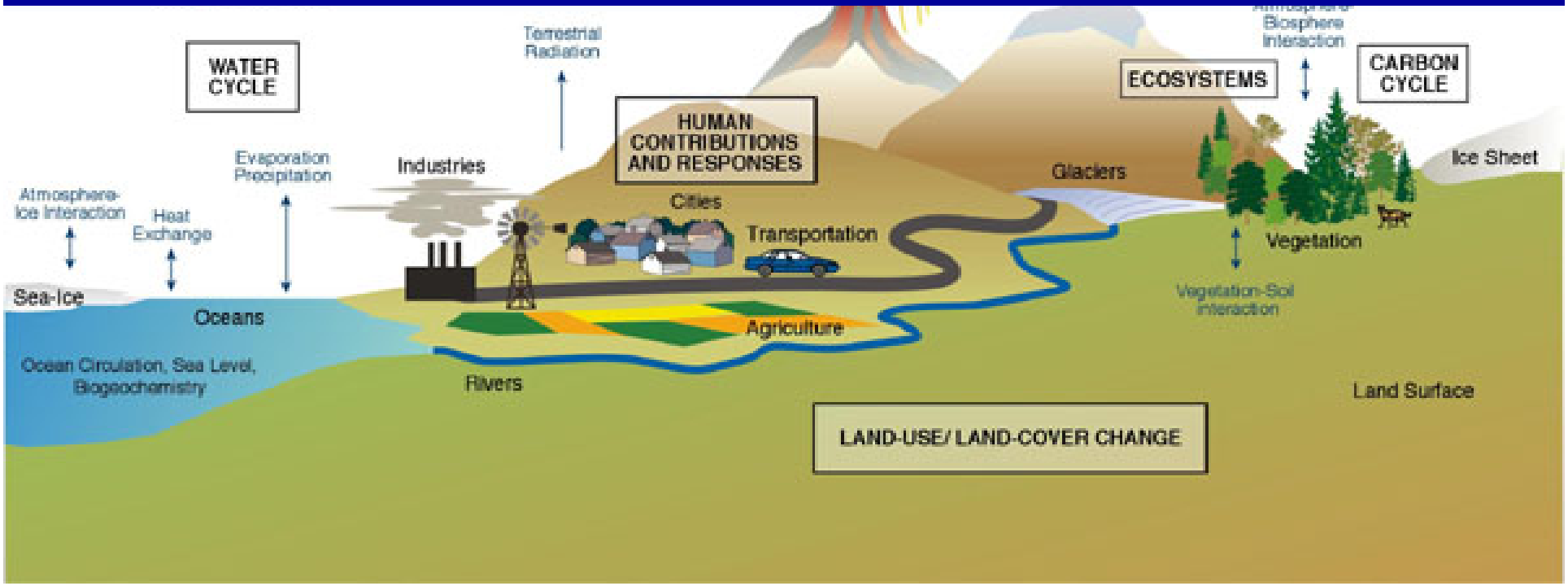


A typical SFR uses 1,500 additional gallons of water in areas affected by UHI

Source: Miller, 1997

Biophysical: climate change

consequences of climate change in the supply of water



Sensitivity of river flows to change in temperature & precipitation: Lower Colorado River Basin

Temperature (^{0}C)	Δ in Precipitation (-)		Δ in Precipitation (+)	
	% Δ (PPT)	% Δ (inflow)	% Δ (PPT)	% Δ (inflow)
+1	-1 to -10	-10 to -15	0 to 5	0.0 to 0.7
+2	-6 to -10	-17 to -56	8 to 10	0.6 to -33
+4	-10 to -20	-31 to -41	10 to 20	2 to -9.7

Ranking of water stressors

Stressors		Difference between baseline & standard cases by 2025 (af)
Inefficiency	Municipal	328,180
	Indoor water use	88,830
	Outdoor water use	239,350
	Agriculture	127,022
Biophysical stress	Biophysical	241,551
	Additional demand due to UHI	25,357
	Reduction of surface water flow in the lower Colorado basin due to the effects of climate change	216,194

Water demanding landscape, water inefficient technologies, and water-intensive agricultural practices are seen to influence water resource much more strongly than climate

Beyond the uncertainty associated with possible alteration of hydrological cycles due to climate change, there are significant other sources of uncertainties that can have more direct impacts on the water resources of central Arizona where discussion should occur for appropriate policy action.

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Thank you

Does price regulate the consumption?

Cause to use less water	Measures			
	SA	A	U	D
Water shortages	40	52	6	2
Environmental concerns	23	50	21	8
Water price	26	45	15	14
City regulation	16	57	16	11
H_2O conservation info	15	51	25	9

Note: ranking is based on least squares means, Source: Spiti et al., 2004