Quenching our Thirst: Future Scenarios of Water in Phoenix

Lauren Withycombe Keeler, Arnim Wiek, Dave White, Ray Quay, John Quinn

ASU School of Sustainability
ARIZONA STATE UNIVERSITY

A research agenda to link stakeholder values with WaterSim, a quantiative, supply-demand model of water in the Phoenix region

This research project explores the potential consequences of stakeholder values (what stakeholders want) regarding water resources in the greater Phoenix area. This is done through an innovative qualitative-quantitative approach to scenario construction. Key research questions include:

I. According to stakeholders, how should water be governed and used in the greater Phoenix area in the future?
II. What are the consequences of different stakeholder values should they be realized?

Methodological challenges in the research approach

- Once stakeholder values are known, these **values need to be translated into model variables** with two or more future projections.
- **Systemic relationships** between the variables and **consistency** of future projections need to be analyzed.
- Stakeholder value-based **variables and future projections needs to be linked to WaterSim variables**

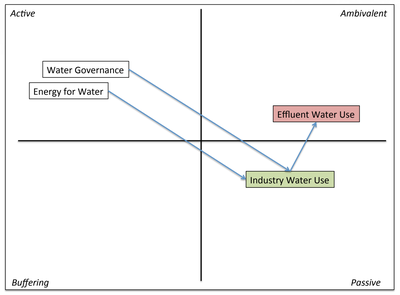
I. Understanding what stakeholders want

- **Stakeholders (n=106)** who influence decisions about water resources in the greater Phoenix area were surveyed (online).
- Participants **ranked (1-5 scale) the desirability of a series of statements** about the future of water in the study area.
- The survey contained **68 statements** across the 5 domains of the water system: **Supply, Delivery, Demand, Outflows and Cross-cutting** (Wiek and Larson, 2011)

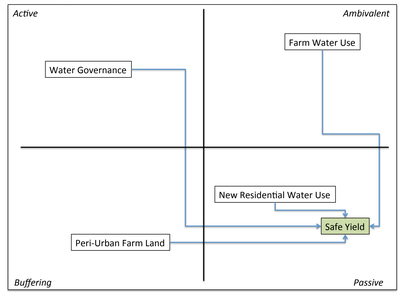
Analysis

We conducted factor analyses for each domain. “We used a principal components analysis to form uncorrelated linear combinations of the observed variables and Varimax rotation to simplify interpretation of the factors” (White et al., in prep).

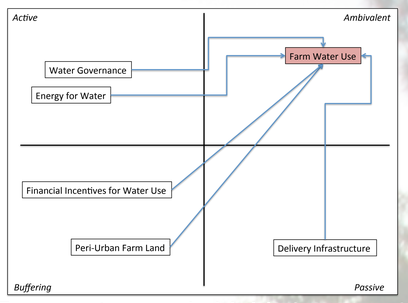
Understanding Systemic Relationships between Stakeholder Values



Industrial water use is highly impacted by water governance and the price of energy and also highly impacts effluent use.



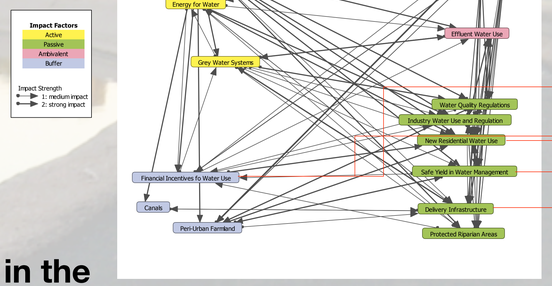
Safe yield is highly impacted by agriculture and new residential water use.



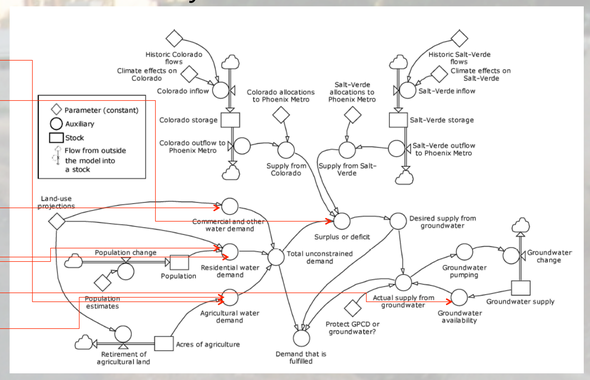
Farm water use is highly impacted by delivery infrastructure, financial incentives, and the price of energy.

Linking qualitative systems model of variables to variables in WaterSim

Qualitative System Analysis



WaterSim Dynamic Quantitative Model



Gober et al. 2011

II. Exemplary scenarios of water in the greater Phoenix area in 2040

Impact Factor / Characteristic	Scenario Number 1	Scenario Number 634	Scenario Number 657	Scenario Number 956
Scenario name				
New water sources	Acquired	Not Acquired	Acquired	Not Acquired
Protected Riparian areas	Protected	Protected	Protected	Not protected
Safe yield in water management	Achieved	Achieved	Achieved	Achieved
Delivery infrastructure	Built	Not built	Built	Not built
Energy for water	100% renewable	Mix of renewable and non-renewable	Mix of renewable and non-renewable	Mix of renewable and non-renewable
Water Quality regulations	Limited	Restrictive	Limited	Restrictive
Canals	Trees and walking paths	Trees and walking paths	Mixed development	No development
Grey water systems	In place and used	Not in place, not used	Not in place, not used	In place and used
Peri-urban Farmland	Developed for urban use	Maintained as buffer	Maintained as buffer	Developed for urban use
Farm Water Use	Regulated	Regulated	Regulated	Not regulated
Industry Water Use and Regulation	Regulated to achieve conservation targets	Regulated to achieve conservation targets	Regulated to achieve conservation targets	Regulated to achieve conservation targets
New residential water use	Growth controled	Growth controled	Growth controled	Growth controled
Financial incentives for water use	Provided by cities	Provided by cities	Provided by cities	Provided by cities
Effluent Water Use	Riparian and groundwater recharge	Riparian and groundwater recharge	Riparian and groundwater recharge	Riparian and groundwater recharge
Water governance	Manages, citizens and scientists	Manages, citizens and scientists	Manages, citizens and scientists	Manages, citizens and scientists
Multiplicative Consistency (Mult)	10319560704	86973087744	1528823808	331776
Additive Consistency (Add)	37	38	33	20
Number of inconsistencies (Inko)	0	0	0	0
Consistency Level (KonL)	-1	-1	-1	-1

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