

Methods in Estimating Outdoor Water Demand

Urban Water Demand Roundtable

Daniel A. Brent

Department of Economics, Monash University

February 9th, 2015

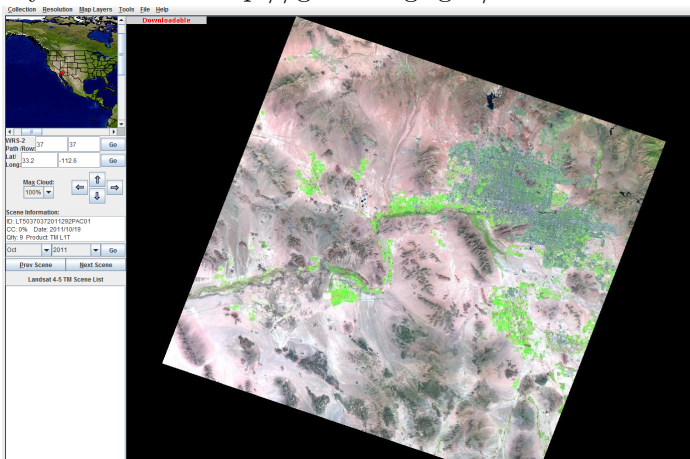
danny.brent@monash.edu

Outdoor Water Demand

- Large aggregate use
- Counter-cyclical to supply
- Discretionary component of demand
- Methods
 - Satellite Data
 - Smart Meters
 - Scarcity Pricing

Landsat

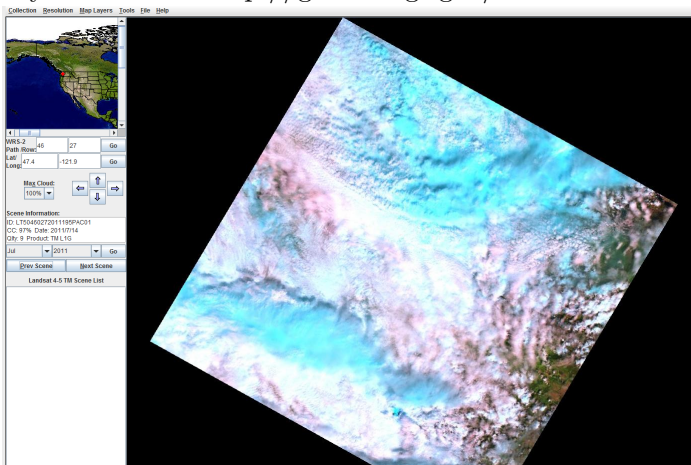
Publicly available @ <http://glovis.usgs.gov/>



Phoenix - October 2011

Landsat

Publicly available @ <http://glovis.usgs.gov/>



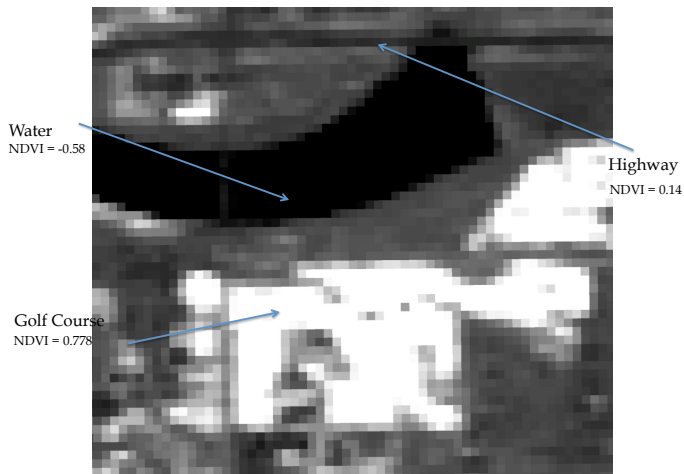
Seattle - July 2011

NDVI



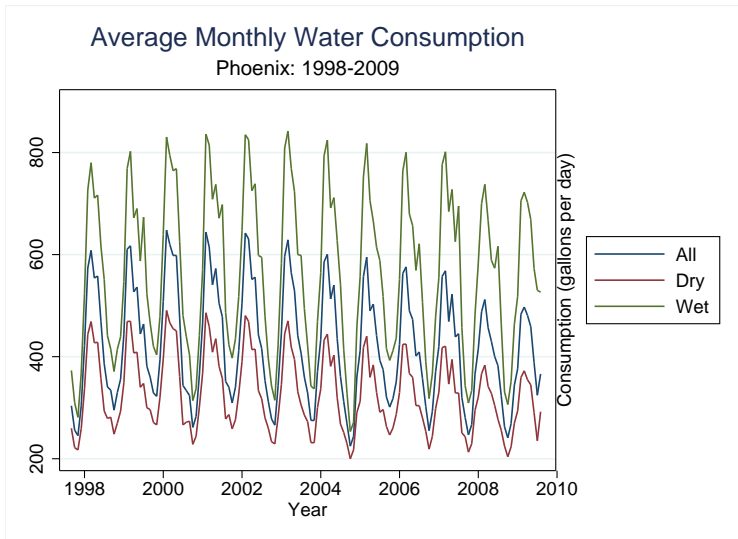
Northwest of ASU - Summer 2003

NDVI



Northwest of ASU - Summer 2003

Water and Landscape

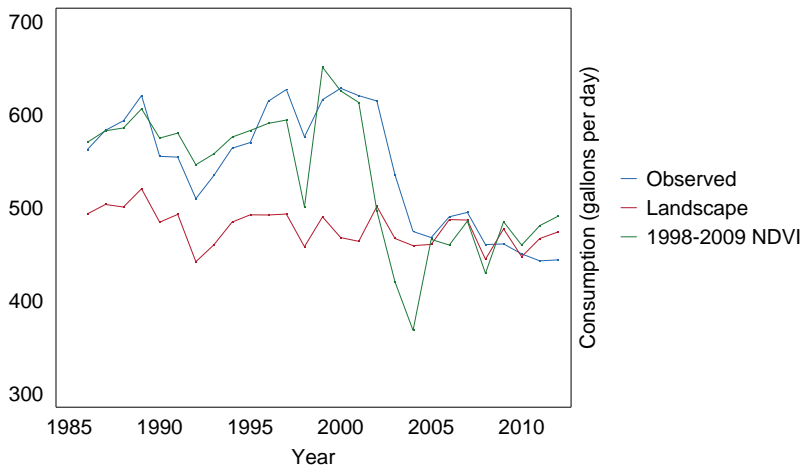


Water Demand and Landscape

	(1) Base	(2) Landscape	(3) Turf	(4) Grass	(5) Static NDVI	(6) NDVI
Time	-0.00882*** (-27.54)	-0.00869*** (-27.20)	-0.00885*** (-27.68)	0.00885*** (-27.69)	-0.00839*** (-26.33)	-0.00169*** (-5.10)
CLDD	-0.00523*** (-5.76)	-0.00514*** (-5.67)	-0.00513*** (-5.65)	0.00522*** (-5.75)	-0.00501*** (-5.54)	-0.000912 (-1.03)
Rainy Days	-0.850*** (-18.69)	-0.851*** (-18.72)	-0.851*** (-18.71)	-0.851*** (-18.72)	-0.850*** (-18.75)	-0.651*** (-14.63)
Static NDVI					4.549*** (41.17)	
NDVI						4.423*** (64.65)
Landscape	No	Yes	No	No	No	No
Turf	No	No	Yes	No	No	No
Grass	No	No	No	Yes	No	No
Observations	65204	65204	65097	65204	65204	65204
R^2	0.0305	0.149	0.153	0.147	0.197	0.219
RMSE	0.551	0.550	0.550	0.550	0.549	0.537

Predicted Average Monthly Water Consumption

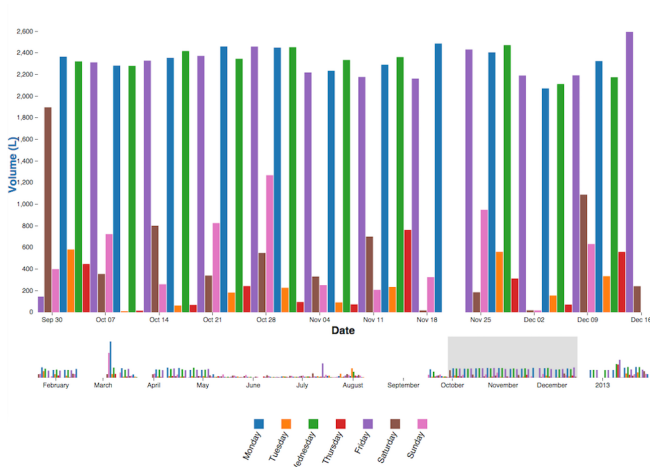
Phoenix: 1986-2012



Smart Meters

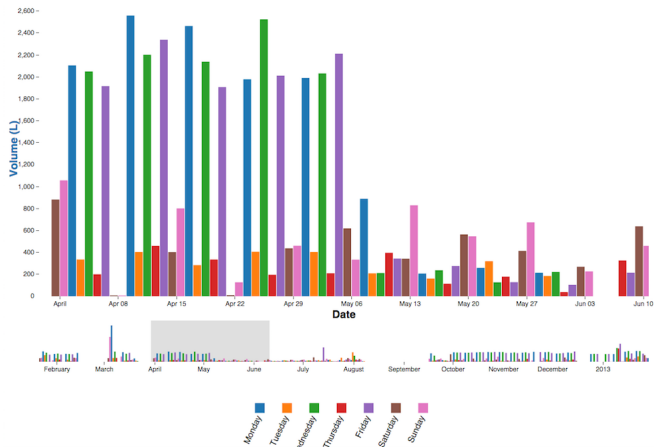
- Smart Meters or Advanced Metering Infrastructure (AMI)
 - Record consumption every 30min or 1hr
- Implementation is beginning but lags electricity smart meters
 - US: Sacramento, Reno, many others
 - Aus: Kalgoorlie, Karratha, pilots in Melbourne
- Can identify patterns in water use
 - Rachel Cardell-Oliver UWA (Cardell-Oliver, WRR 2013)

Data Mining & Pattern Recognition



Cardell-Oliver; Spring/Summer

Data Mining & Pattern Recognition



Cardell-Oliver; Fall/Winter

Scarcity Pricing

- Temporary price increases
 - Tied to water scarcity
 - May not change water infrastructure (e.g. landscape)
 - Keep benefits of urban vegetation
 - Urban heat island effect
 - Additional source of supply
- More research is needed
 - How do consumers respond to temporary price increase?
 - Similar to critical peak pricing in electricity?
 - Funds for experiment w/ Michael Ward
 - Looking a utility partner for collaboration
- Daily price tiers
 - May better target outdoor water use