This presentation premiered at WaterSmart Innovations

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INNOVATIONS

A SYSTEM DYNAMIC MODEL AND VISUALIZATION TOOL FOR WATER USE IN THE UNITED STATES

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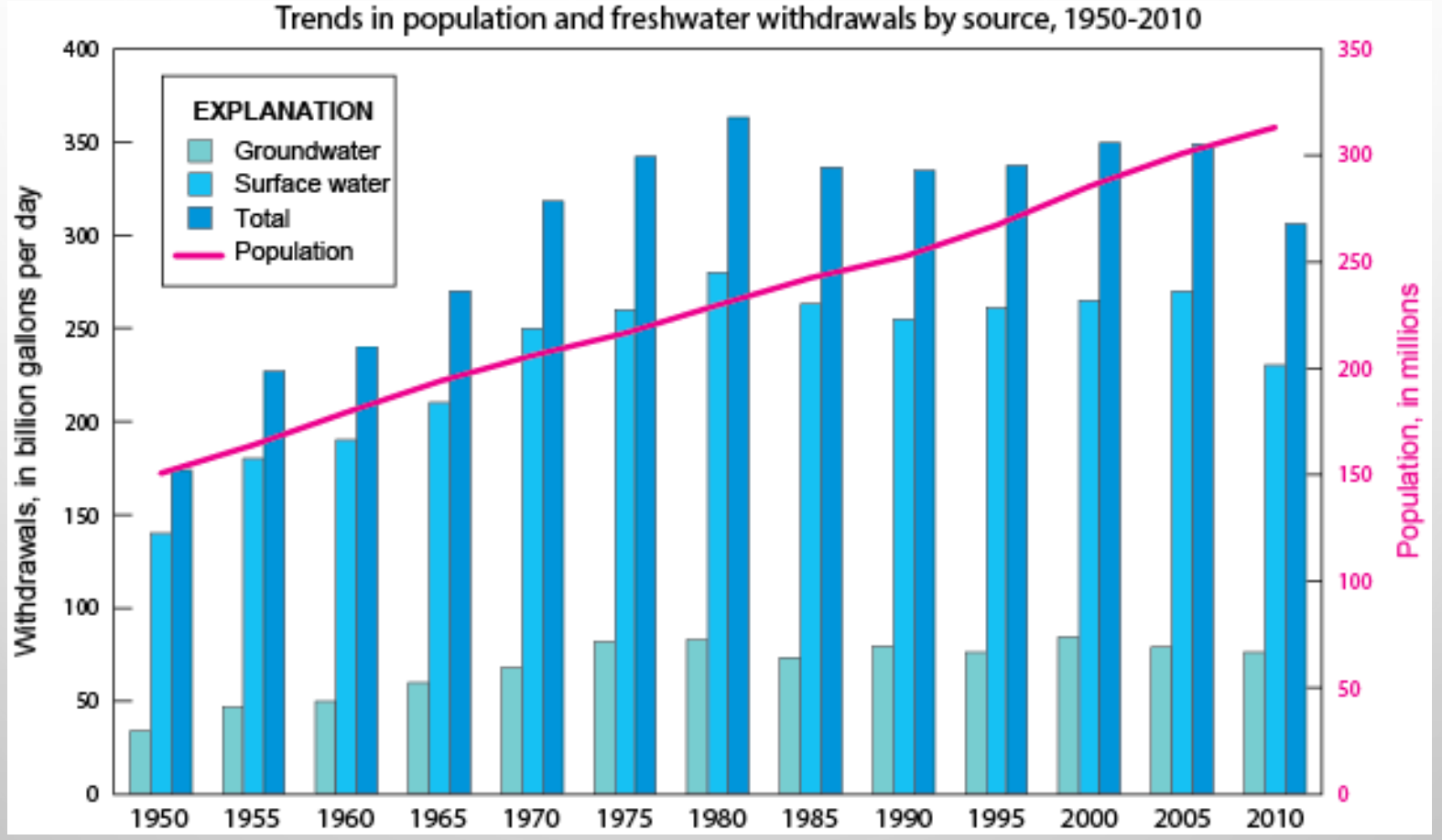
Smithsonian

WATER | WAYS

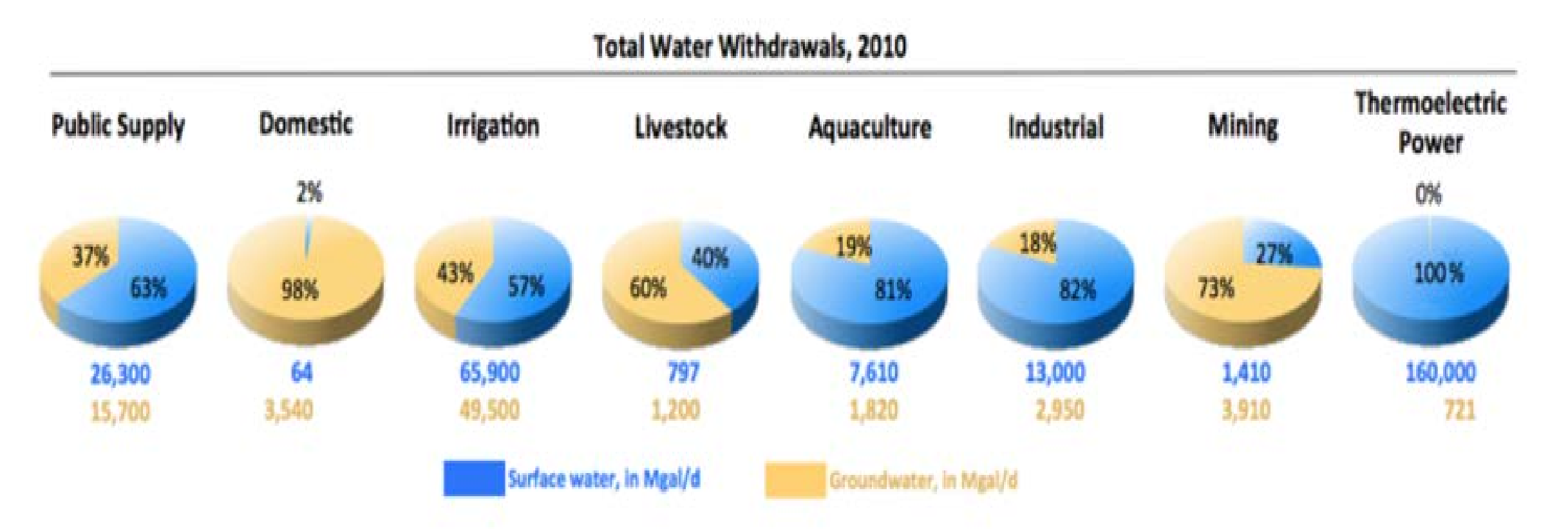
Las Vegas, October 2017

THE US WATER USE TREND IN POPULATION AND FRESHWATER WITHDRAWALS BY SOURCE, 1950 - 2010



Source: Maupin, M. A., Kenny, J. F., Hutson, S. S., Lovelace, J. K., Barber, N. L., & Linsey, K. S. (2014). Estimated use of water in the United States in 2010 (No. 1405). US Geological Survey.

TOTAL WATER WITHDRAWALS BY CATEGORY OF USE, 2010



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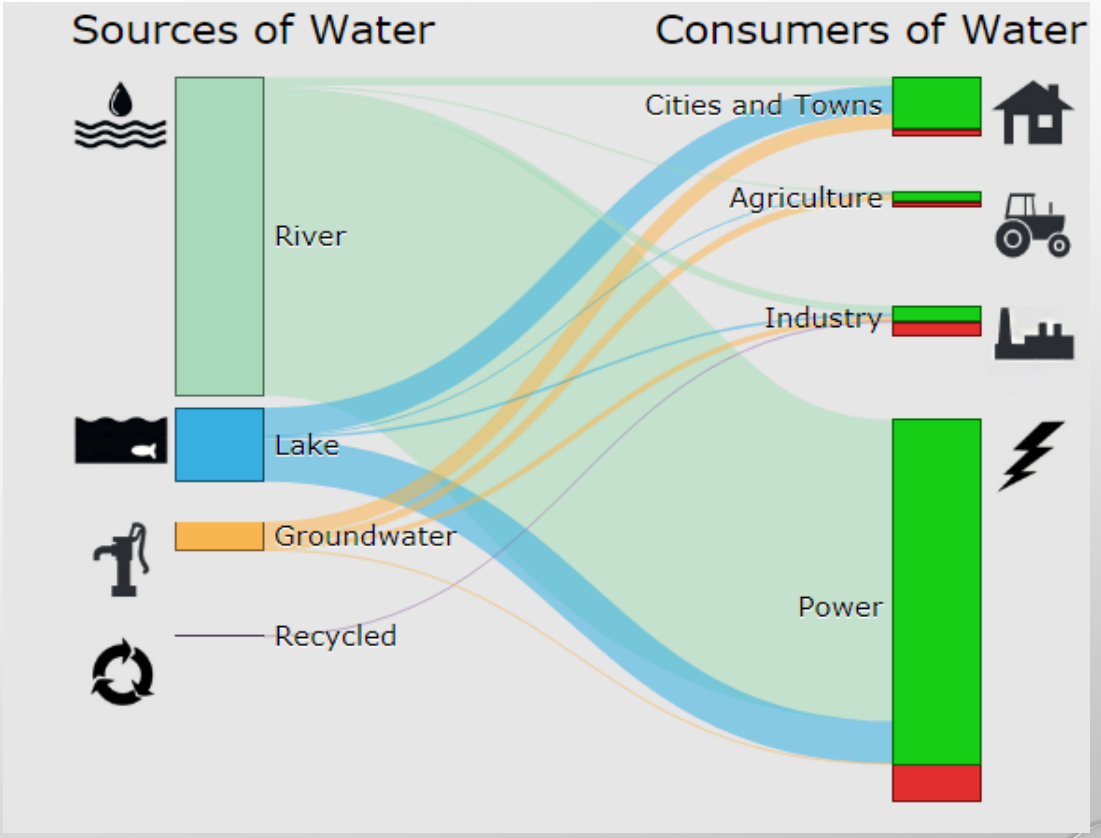
WATERSIM AMERICA MODEL

- Display an interactive computer simulation of the complexity of water supply and demand at a state level
- Within Smithsonian Institution's water ways exhibition traveling to 30 states and 180 rural communities from 2016 to 2020

Source: https://sustainability.asu.edu/dcdc/watersim/

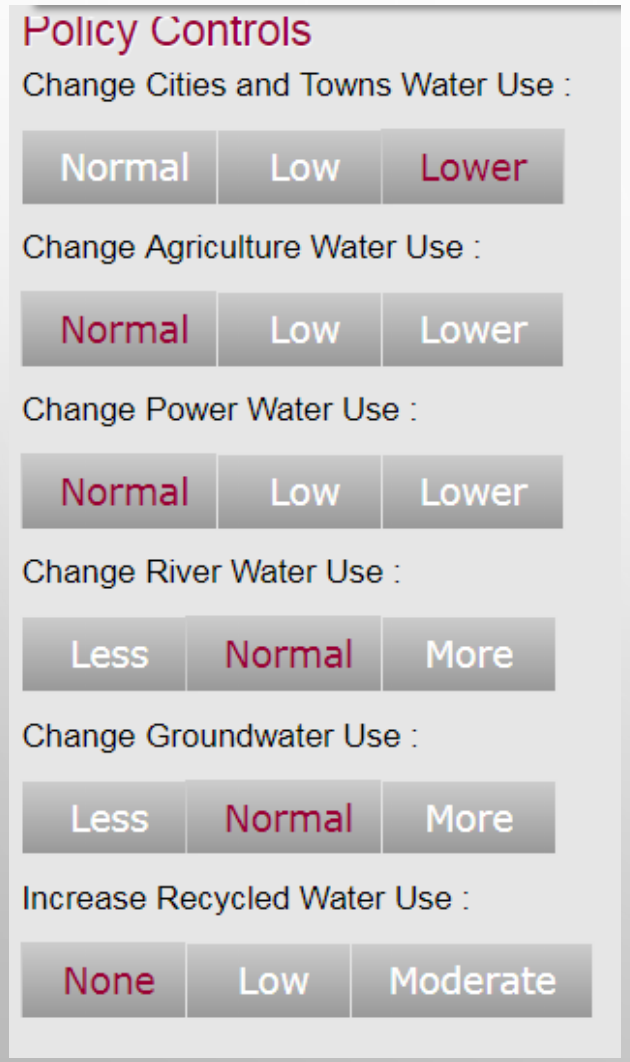
MODEL COMPONENTS

Source: https://water.usgs.gov/edu/wups.html



Source: http://america.watersim.org/Ipad?state=Illinois

CLIMATE CHANGE AND POLICY ACTION SCENARIOS



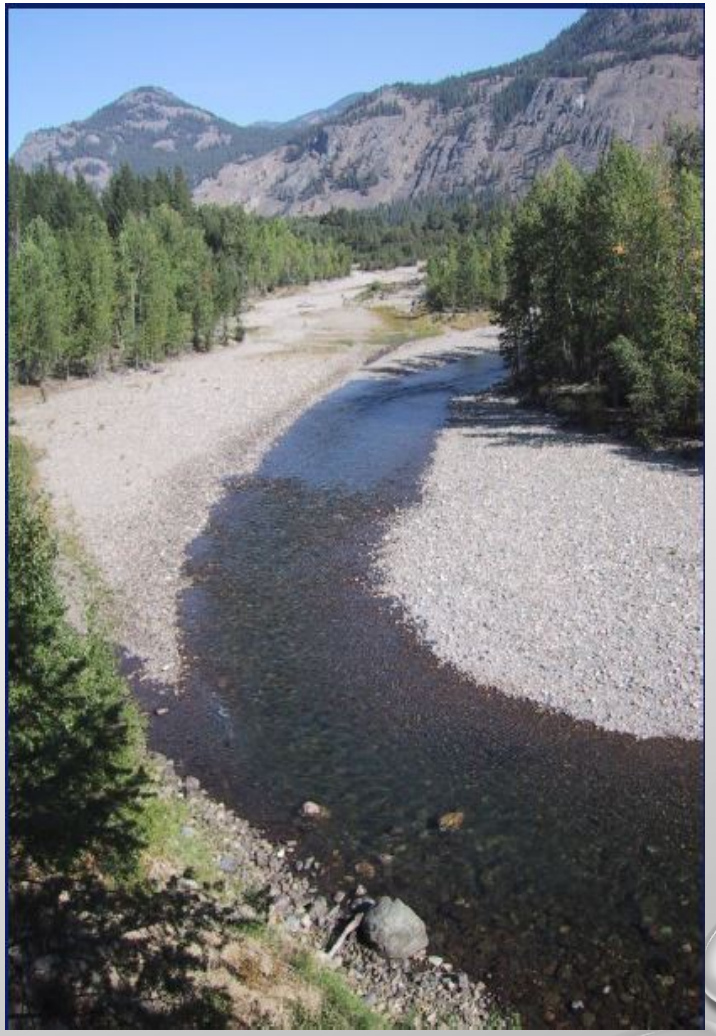
Water Supply – How much water is available, and where does it come from?

Water Demand – primarily influenced by policy and population growth

Climate Change – look at past patterns – decades with high flows, low flows or high variability from year to year

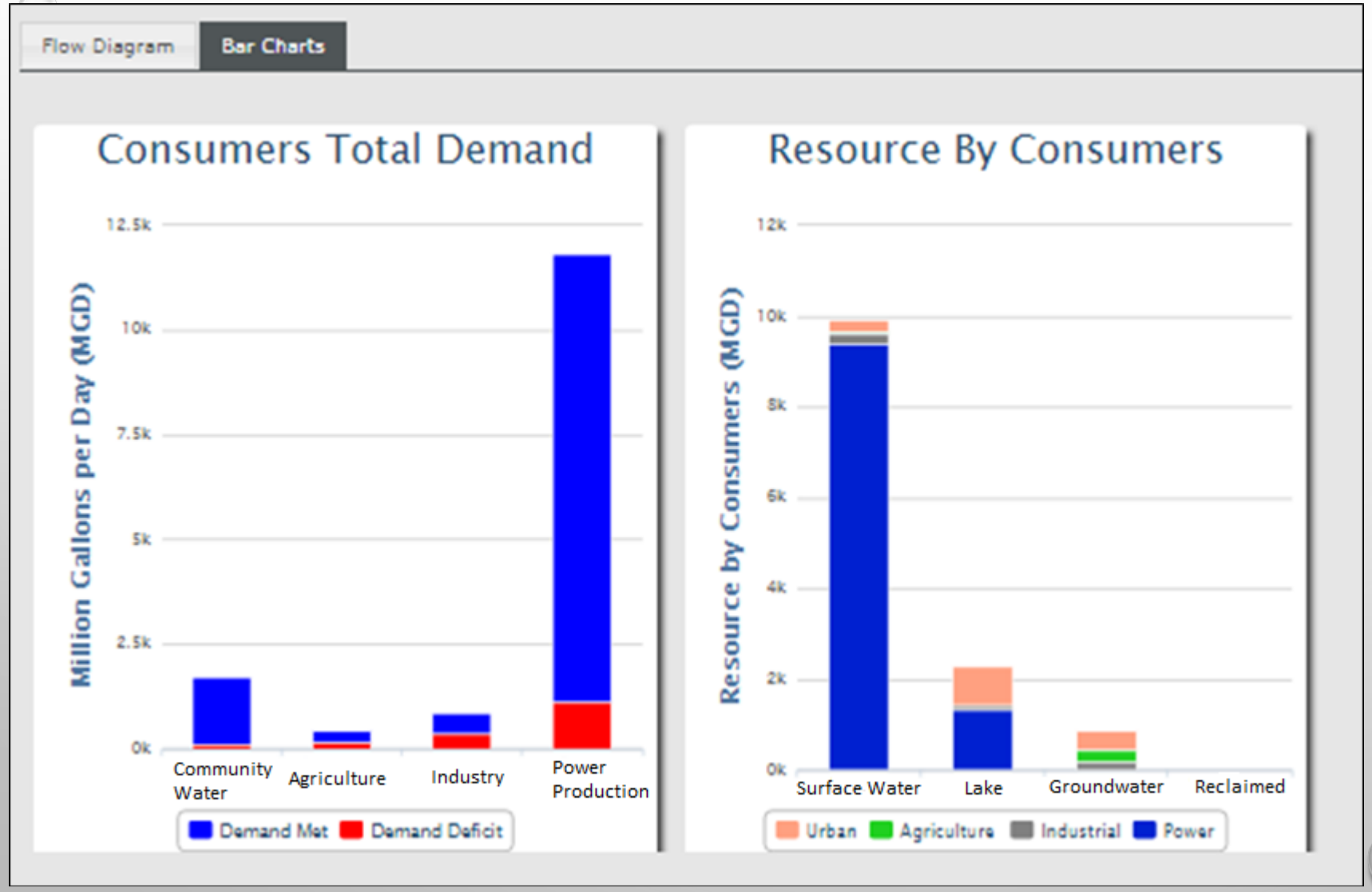
Population Growth - change in water demand

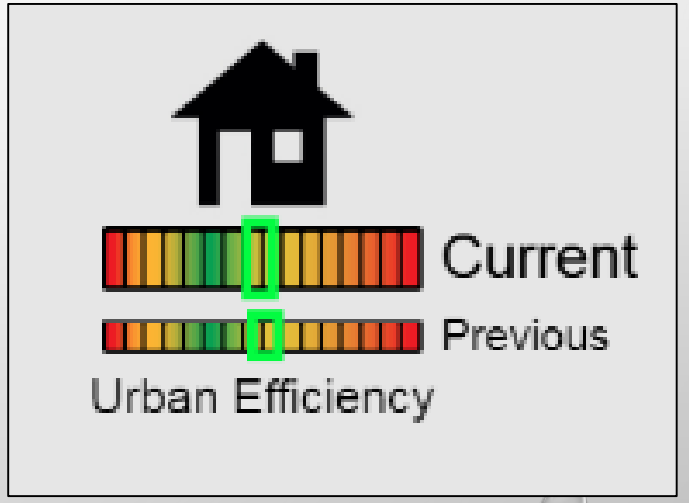
Policy Decisions – Who gets to use the water that is available?



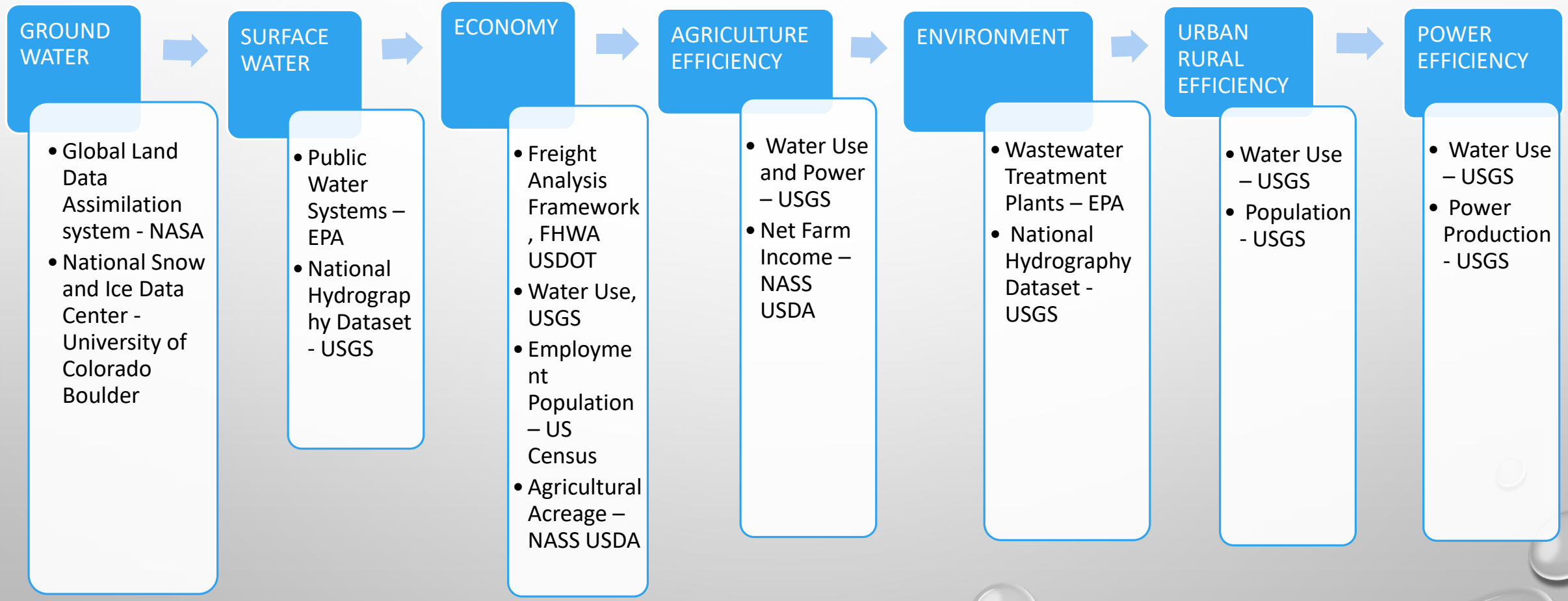
https://www.nwcouncil.org/news/blog/drought-and-streamflow-research-may-2016/

VISUALIZATION TOOL





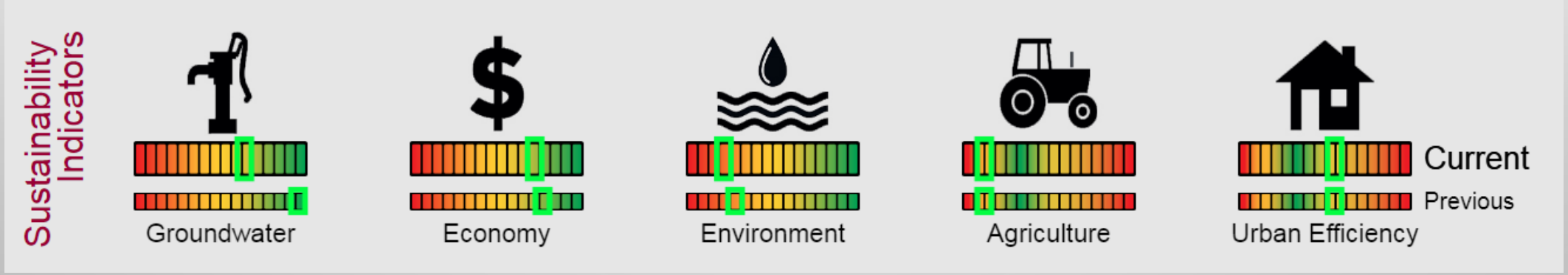
DATA COMPILATION



SUSTAINABILITY INDICATORS

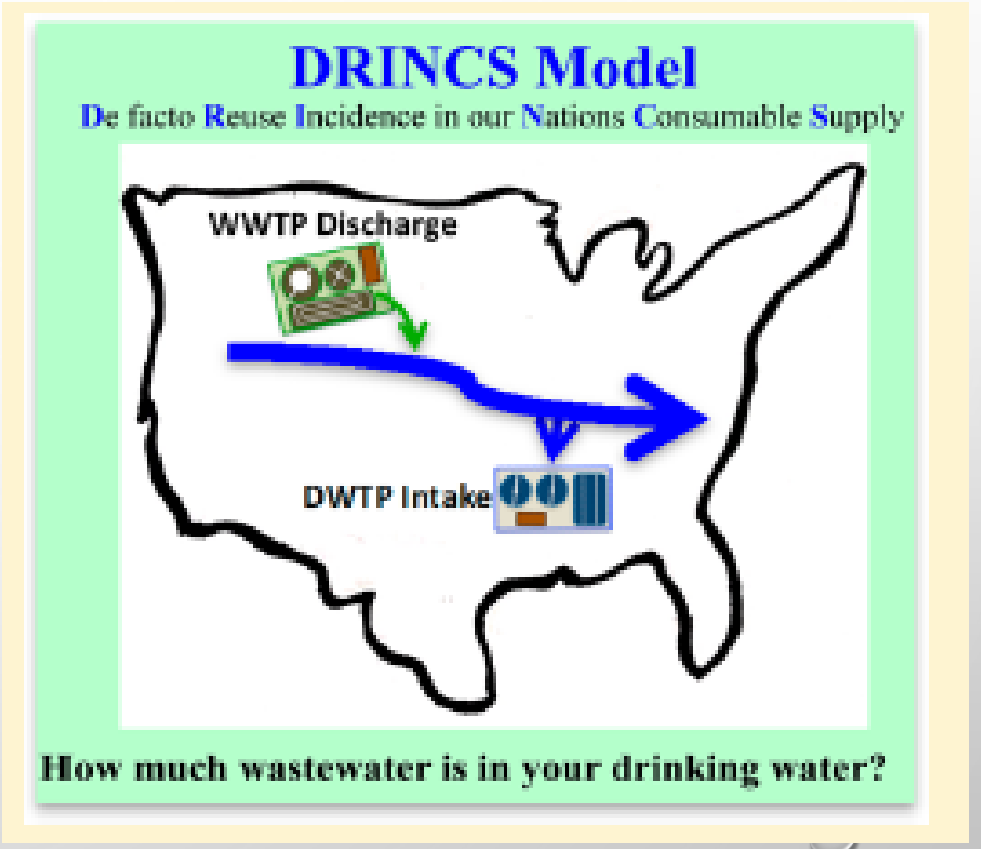
Help users to understand the trade-offs between

- water conservation
- agriculture
- economic development
- environmental preservation



SUSTAINABILITY INDICATORS

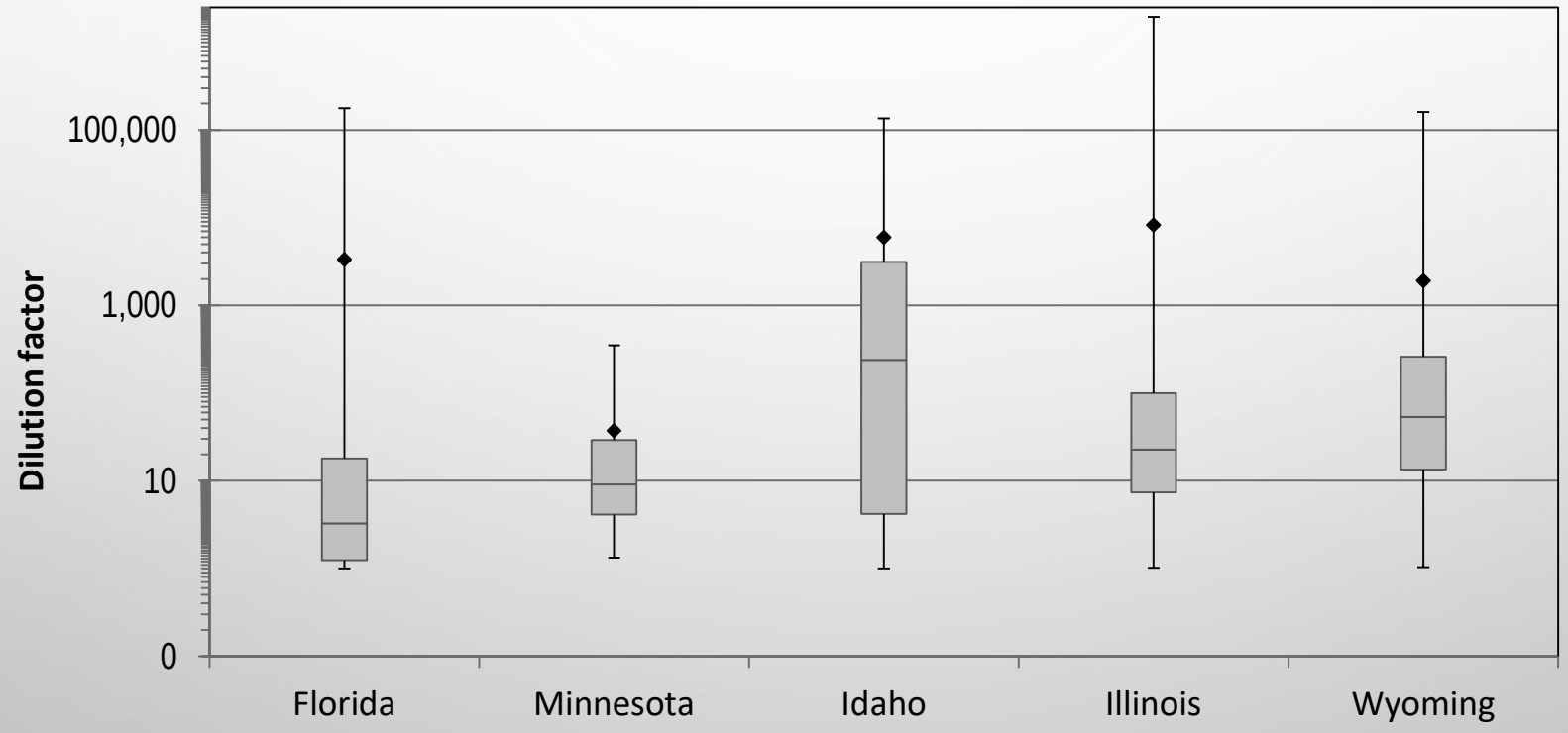
- GROUNDWATER INDICATOR
  - Total groundwater withdrawal
- ECONOMY
  - Local water used for goods production as a % of total water use
- AGRICULTURE EFFICIENCY
  - Gallons per dollar of agriculture production per day
- URBAN EFFICIENCY
  - Gallons per capita per day
- **ENVIRONMENT**
  - Wastewater discharge as a % of total stream flow
- **SURFACE WATER**
  - Withdrawal by water treatment plants as a % of stream flow



Rice, J., & Westerhoff, P. (2014). Spatial and temporal variation in de facto wastewater reuse in drinking water systems across the USA. Environmental science & technology, 49(2), 982-989.

ENVIRONMENT INDICATOR

$$Dilution factor = \frac{Wastewater + Streamflow}{Wastewater}$$



Legend: top and bottom of box = 75th and 25th percentiles respectively; top and bottom of whisker = max and min percentiles respectively; line across inside of box = median (50th percentile); black dot = average

SURFACE WATER INDICATOR (SWI)

$$SWI = \frac{ITS}{WA} * 100$$

- ITS= intake surface water withdrawal by DWTP serving more than 10,000 people (gallons/day);
  ITS = SURPC * Population served;
  SURPC = surface water withdrawal per capita (gallon per person per day);
- WA = the surface water available (gallons/day);
  WA = k* $\sum_{j=1}^{n} Q0001\, E_j$;
  Q0001E = mean annual stream flow (cubic feet per second);
  k = conversion constant (from cfs to gallons per day)
- SWI (in percentage or gallons per day/gallons per day)

STATE	SWI (%)
ILLINOIS	0.001
MINNESOTA	0.01
IDAHO	0.31
FLORIDA	1.54
WYOMING	3.43

CONCLUSION

- WaterSim America model for the first five states in the United States (Florida, Idaho, Illinois, Minnesota and Wyoming)
- Directly engage small town audiences and bring new attention to underserved rural communities
- Explore how water sustainability is influenced by various scenarios
- General access among the public via a web browser interface and through ipad devices
- Enjoy the model as a game for entertainment but also as an educational tool to better understand water resource sustainability

http://america.watersim.org/Ipad?state=Illinois

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THANK YOU!

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