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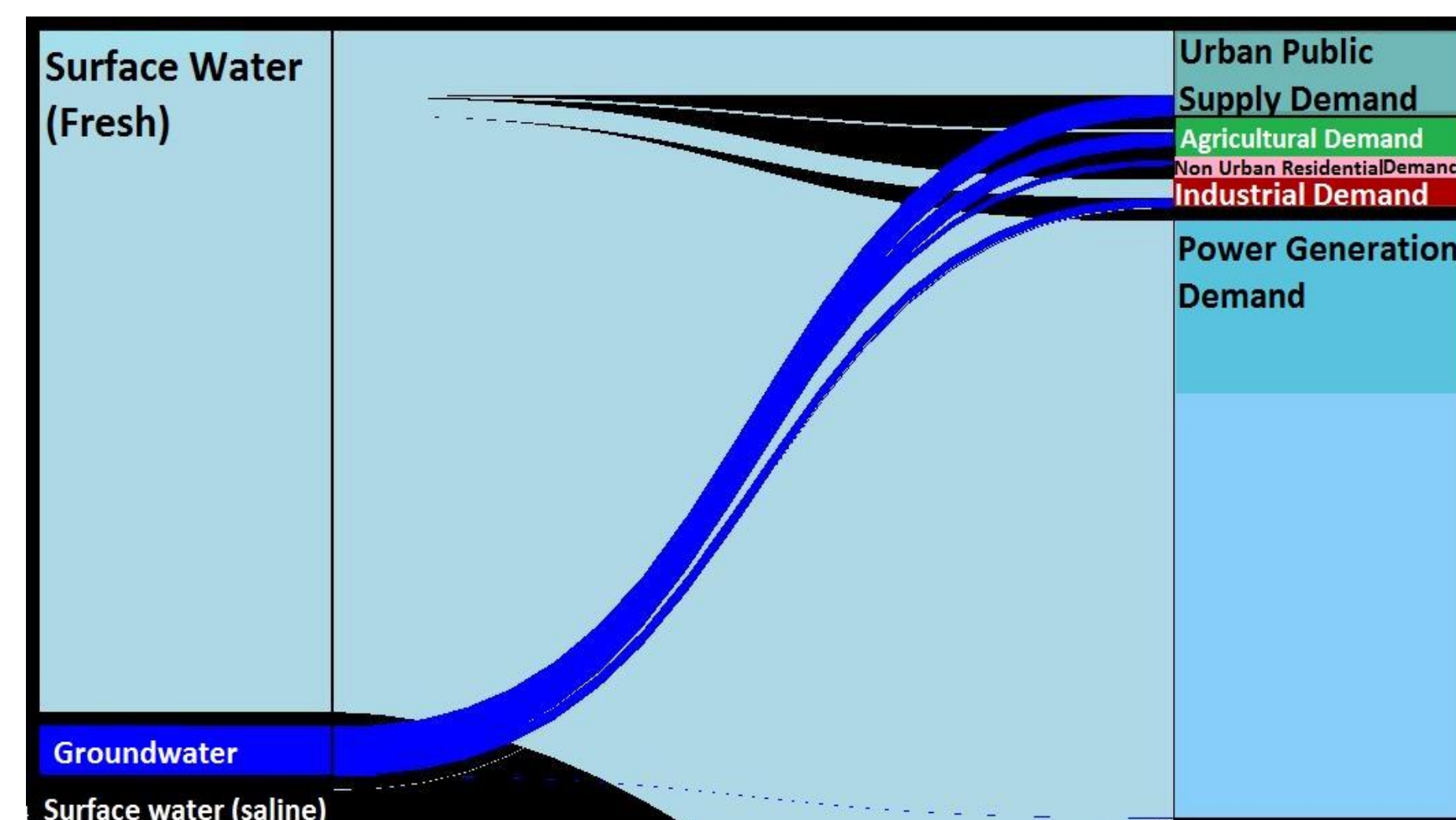
BACKGROUND

Educational tools expand the public's awareness and their ability to understand the complexity of water systems and their management. With support from the **Smithsonian Institution travelling exhibition**, a simple water use model is designed for small and rural museums at five states in the USA (Florida, Idaho, Illinois, Minnesota and Wyoming).

OBJECTIVE

The model is designed for the general public to access and explore how various combinations of water policies, population growth and climate change impact the water balance of supplies and demands by evaluating stress indicators at the state level.

Concept of the model



METHOD

Data collection

- Discharge points of Wastewater Treatment Plants (WWTPs) (Clean Watershed Needs Survey 2008)
- Stream networks (National Hydrographic Data set Plus)
- Surface intake points of Drinking Water Treatment Plants (DWTPs) (Environmental Protection Agency Permit Compliance System)

Data analysis

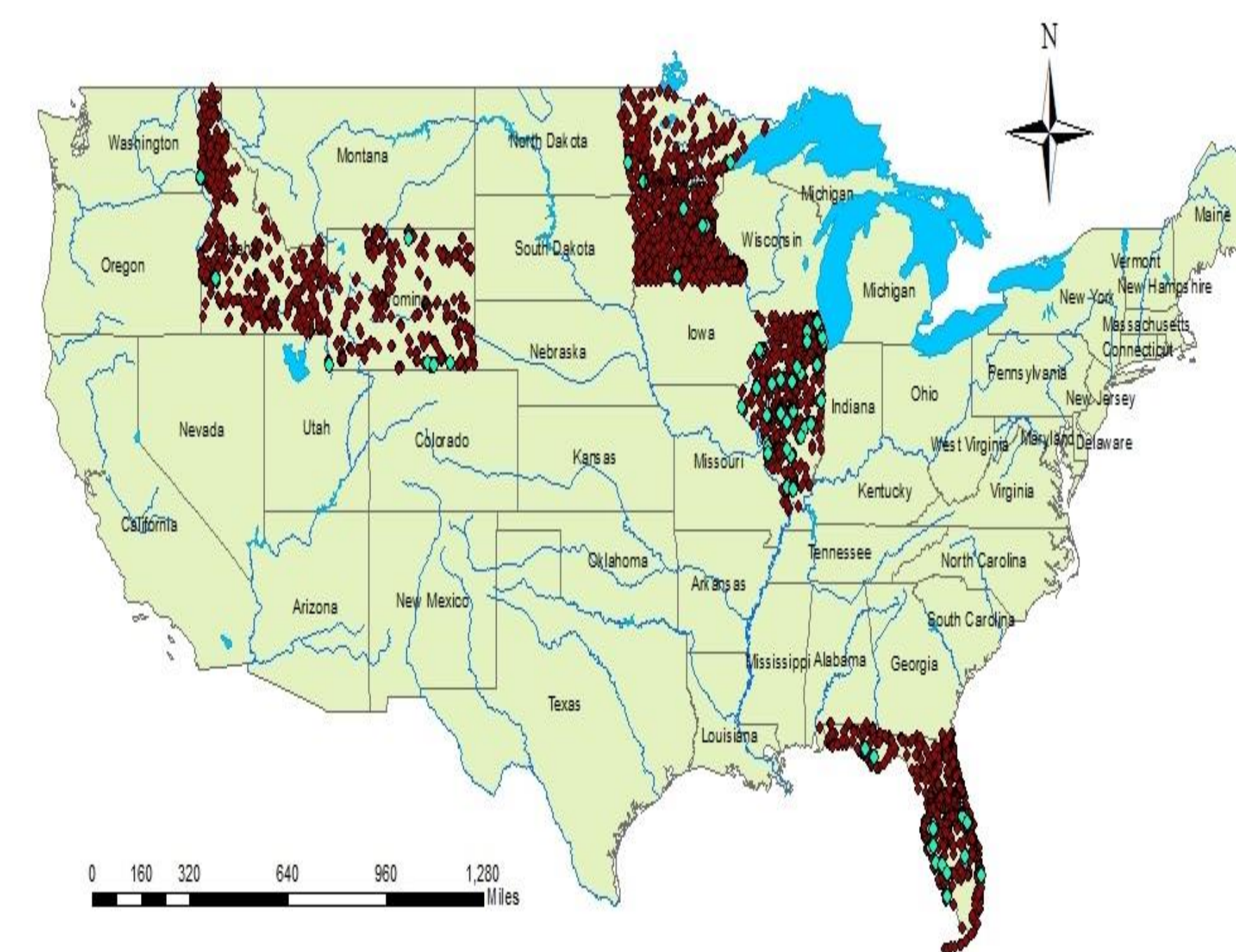
- ArcGIS model is used to perform spatial analysis of DWTP intakes, WWTP discharges and the stream networks [1]

Reference

[1] 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.

RESULTS

Geospatial distribution of DWTP serving more than 10,000 people and WWTPs at five states



Legend:
● Surface water intake points
● Wastewater discharge points
— Major rivers
■ Lake

Four core ArcGIS layers and numerous attributes of the data-related layers:

- Layer of WWTP discharge locations including the population served, design capacity
- Layer of surface water intakes that provide water to DWTP serving population > 10,000
- A base layer from the national atlas
- Layer of hydrography data with stream locations and stream flow data

Concept of the model

To illustrate the model, the stress indicators are being developed. In terms of water demand and supply for Urban public, the indicators are:

Environmental Indicator

Reflect the potential stress on riverine ecosystem when discharges from WWTPs occur.

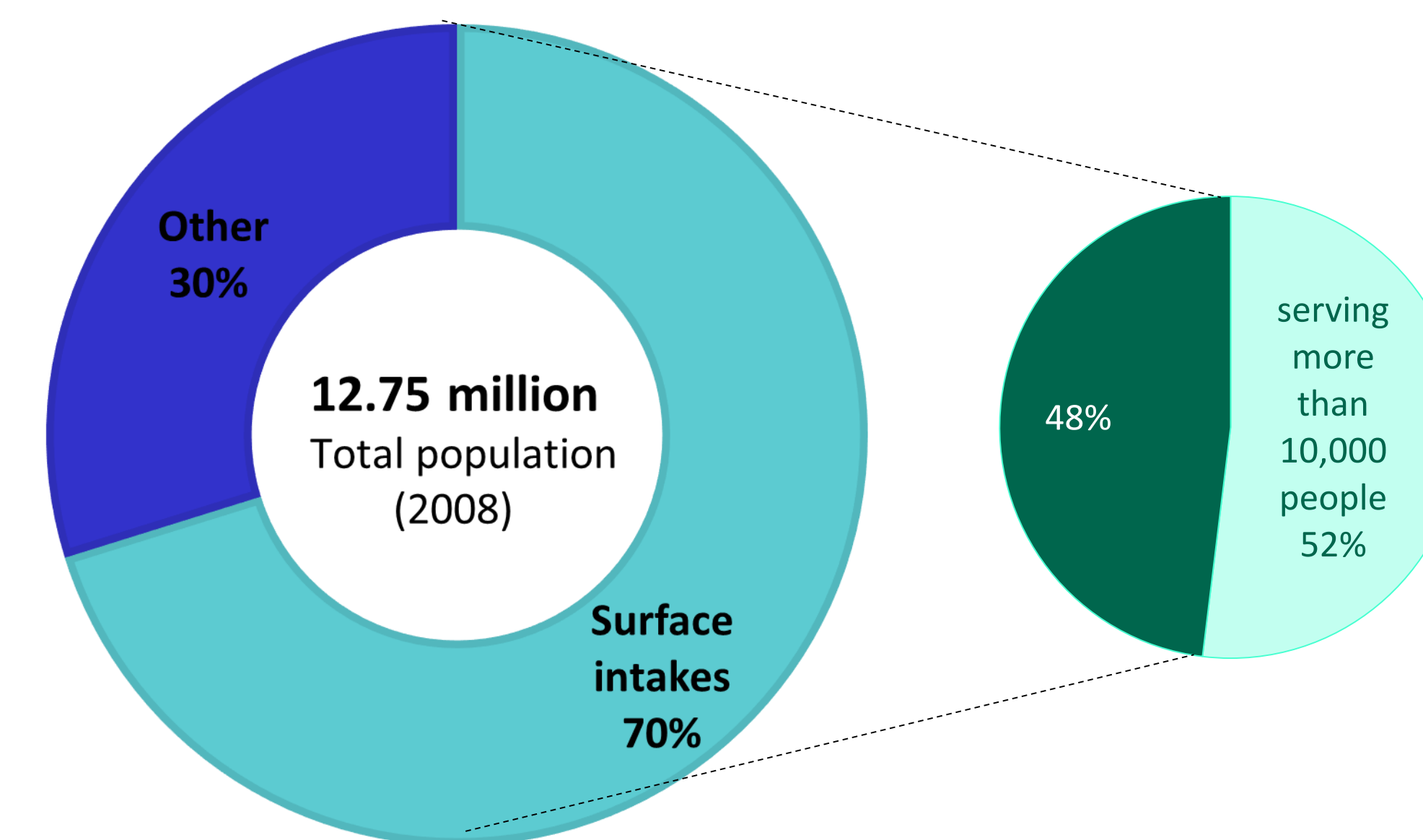
This factor is estimated for each WWTP in the state based on the total volume of wastewater discharge and the mean annual flow of the river.

Surface water Indicator

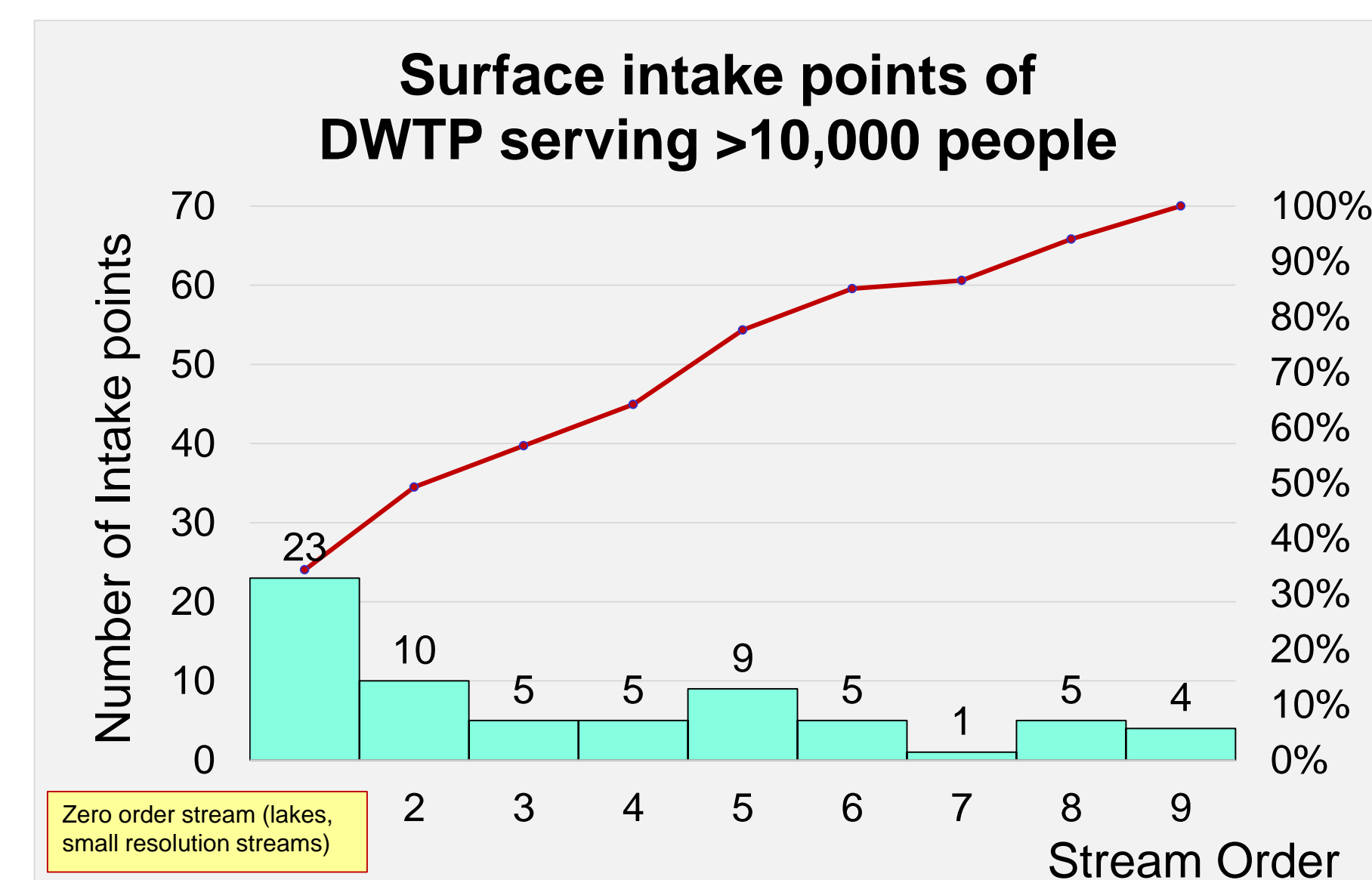
Reflect the stress on surface water resources which is the amount of surface water withdrawn by DWTPs from the stream networks.

STATE OF ILLINOIS

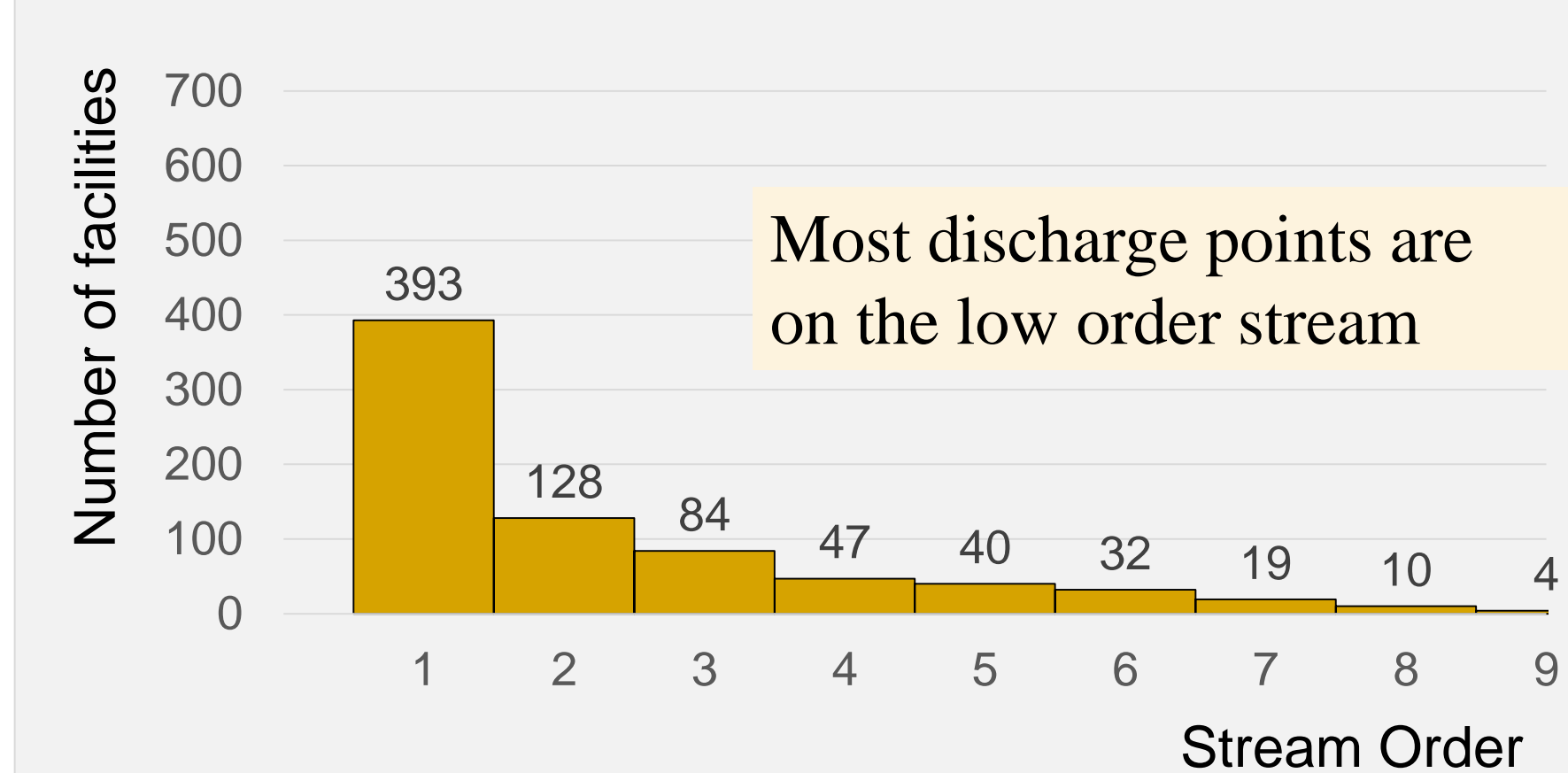
Percent distribution of population served by DWTP



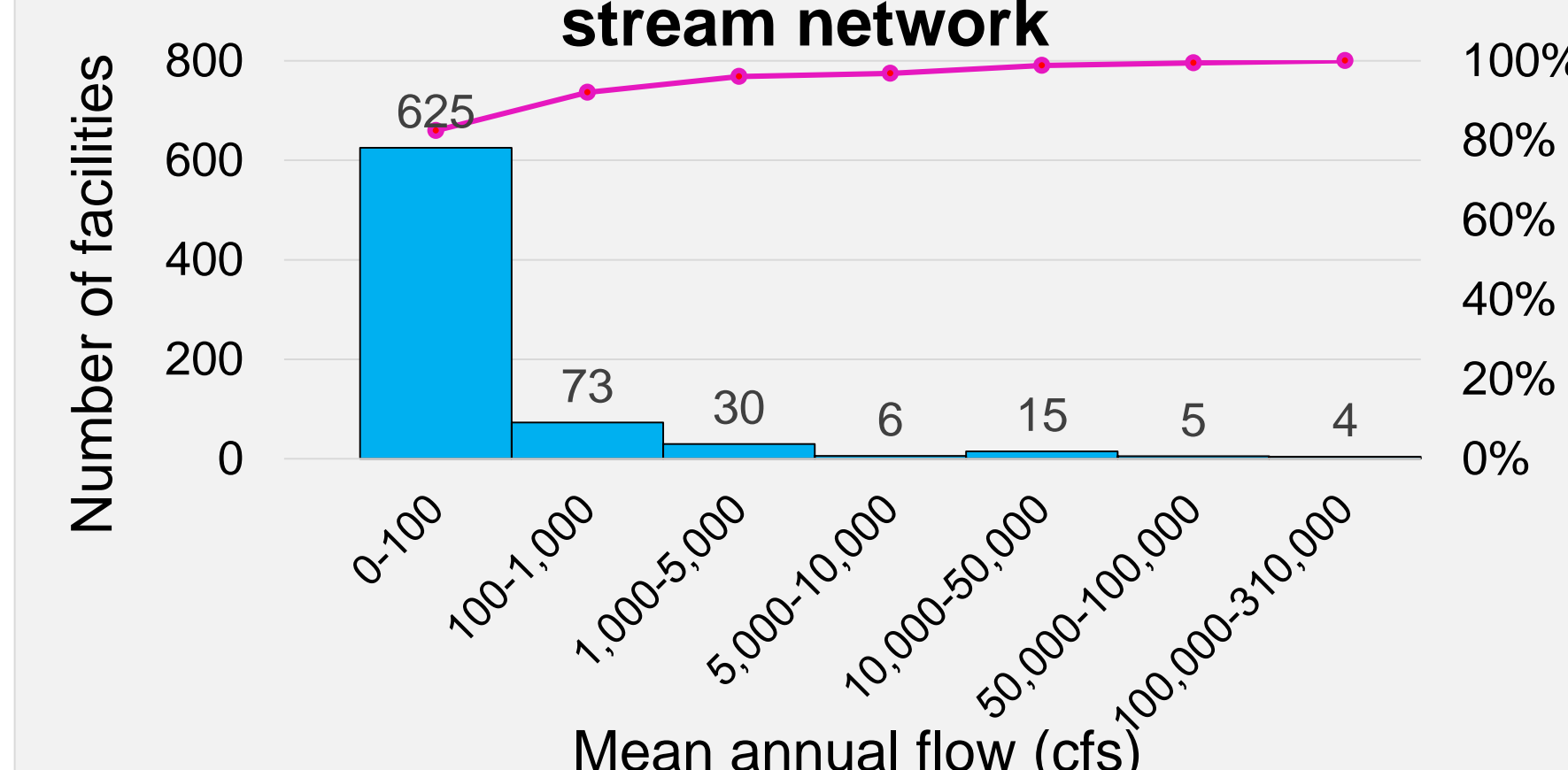
Impact of streamflow variability



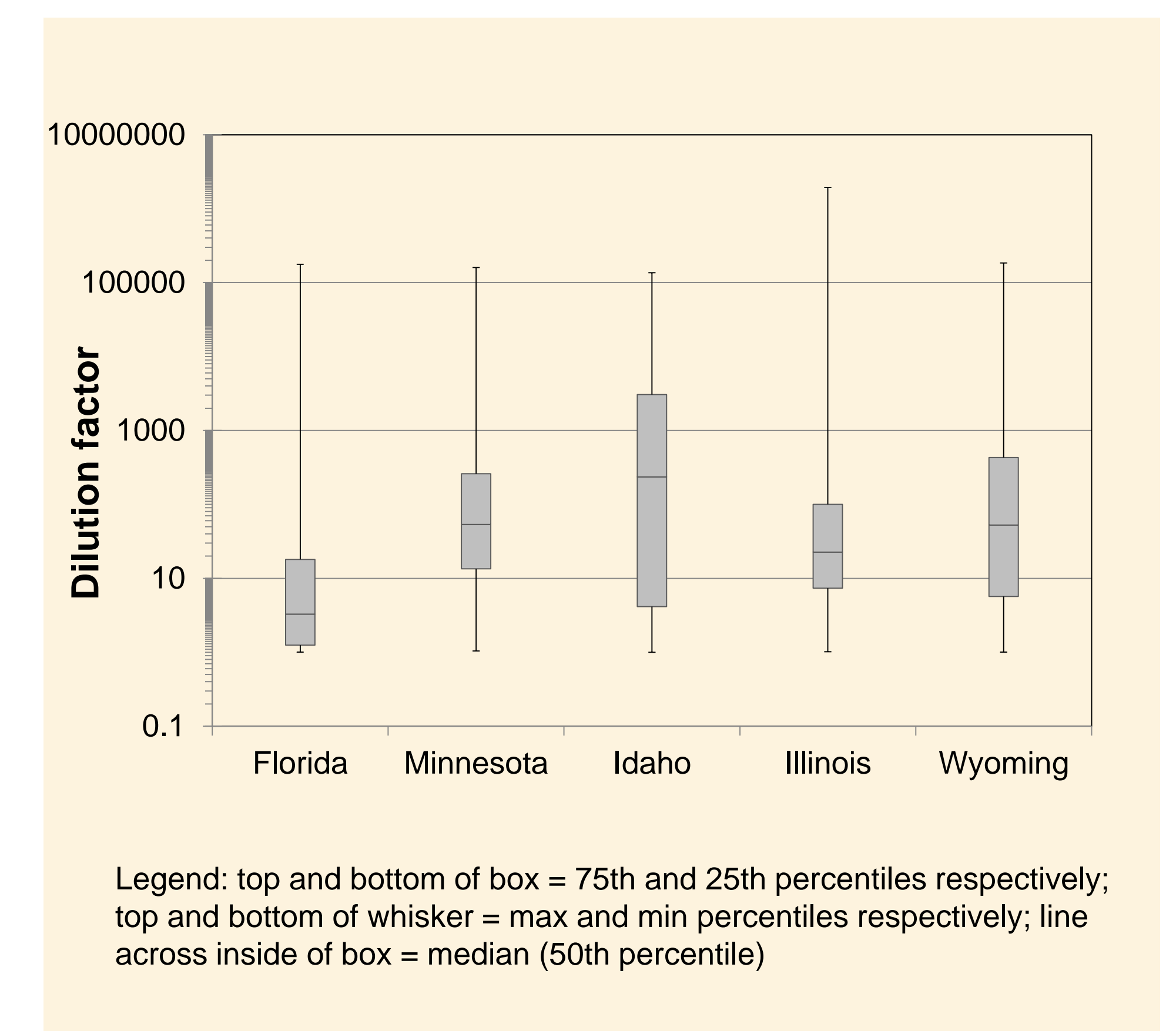
Wastewater discharge points



Wastewater discharge locations and stream network



Environmental Indicator



- Variation in the dilution factor due to changes in stream flows and size of WWTPs
- Illinois has low dilution factor among other states

CONCLUSION

- Environmental indicator is a well approach to illustrate the simple water model
- Illinois is a case study of high population state and high surface water demand
- Environmental indicator for Illinois is relatively low because of small WWTP discharge and flow stream networks
- Policy choice (water reuse schemes) or external factor, depending, e.g., by favorable economic development (population growth) can affect the wastewater discharge
- Climate change can have impact on the riverine system (low or high low condition)
- Variation of Environmental indicator among states
- Surface water indicator is being developed for the ongoing approach

Acknowledgement

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