Great Plains Water Resources

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Only nation-wide network focused on applied water resources research, education and outreach.

The 54 institutes are at the land-grant universities in each of the 50 states, the territories and the District of Columbia.

- Federal Program – Water Resources Research Act
- Historically, we were an authorized program (re-authorization pending).
- 104G Program – National Competitive Grants
  - less than 10% funding rate
- 104B Program – Base Institute Funding
  - 92,355$ per institute
- Board of Directors
  - executive committee
  - regional representation
NIWR’s 8 REGIONS

- Pacific Northwest
- Powell Consortium
- Great Plains
- Great Lakes
- Northeastern
- Mid-Atlantic
- Southeastern
- Islands & Oceania

(Are there any jobs open there?)
GREAT PLAINS REGION

- Montana
- Dakotas
- Nebraska
- Iowa
  (We are here)
- Missouri
- Kansas
- Oklahoma
- Arkansas
  (I am from here)
Great Plains Water Resources

WHAT DO WE HAVE IN COMMON ACROSS OUR REGION?

WHAT ARE THE EMERGING RESEARCH PRIORITIES ACROSS THE GREAT PLAINS?
Why not look at the NIWR 104B funding?

**ARKANSAS**

**104B Project Themes 2012**
- Drinking Water Treatment & Disinfection Byproducts
- Effect of Climate Variability on Algae & TOC in Drinking Water Supply Reservoirs
- Nutrient Runoff Reduction Measures for Poultry Houses

**FOCUS**
- Quality – Nutrients
- Quantity – Water Treatment
Why not look at the NIWR 104B funding?

- OKLAHOMA
- 104B Project Themes 2012
  - Effluent Impacts on Nitrogen Cycling in Streams
  - Effect of Climate Variability & Land Use on Stream Flow
  - Identifying Nutrient Pathways into Streams
- FOCUS
  - Quality – Nutrients
  - Quantity – Stream Flows
Why not look at the NIWR 104B funding?

- **KANSAS**
- **104B Project Themes 2012**
  - Sediment Core Analysis to Understand Reservoir History
  - Impacts of Dredging on the Kansas River Morphology
  - Evaluation of the Kansas Phosphorus Index
  - Investigation Recharge into the High Plains Aquifer
  - Extracting Hydrostatic Information for Drilling Logs
- **FOCUS**
  - Quality – Nutrients & Sediment
  - Quantity – Ground Waters
Why not look at the NIWR 104B funding?

- MISSOURI

- 104B Project Themes 2012
  - Urban Water Quality & the Value of Green Roofs
  - Membrane Biofouling in Sewage Treatment Reactors Operated for Nitrification

- FOCUS
  - Quality – Nutrients & Wastewater Treatment
  - Quantity – Stormwater
Why not look at the NIWR 104B funding?

- **NEBRASKA**
- **104B Project Themes 2012**
  - Analysis of Potential Ground Water Trading Programs
  - Developing a 2-tier Screen to Evaluate Wetland Health
  - Direct Monitoring of Knickpoint Progression
- **FOCUS**
  - Quality – Aquatic Health, Erosion & Geomorphology
  - Quantity – Ground Water Law, Economics, & Policy
Why not look at the NIWR 104B funding?

- **IOWA**
- **104B Project Themes 2012**
  - Community Wide Urban Stormwater Planning using LIDAR, GIS & Modeling
  - Dielectric Measurement of Soil Nitrate Concentrations
  - Field Water Balance & Minimizing Agricultural Impacts to Water Quality
- **FOCUS**
  - Quality – Nutrients
  - Quantity – Stormwater
Why not look at the NIWR 104B funding?

- **DAKOTAS**
- **104B Project Themes 2012**
  - Agricultural Drainage, Nutrients, and Pathogens
  - Bioavailability of Estrogen Bound to Soils & Manure
  - Algal Dynamics across Lake Physical & Chemical Changes
  - Water Treatment Process & Disinfection Byproducts
  - Wastewater Treatment & Bioreactor Nitrate Removal
- **FOCUS**
  - Quality – Nutrients, BMPs, & Wastewater Treatment
  - Quantity – Runoff & Water Treatment
Why not look at the NIWR 104B funding?

- **MONTANA**
- **104B Project Themes 2012**
  - Stream & Hyporheic Water Temperature Response to Restoration Activities
  - Nutrient Dynamics & Ecosystem Function in Coupled Aquatic-Terrestrial Systems
  - Student Research Fellowships
    - Snowmelt, Spawning Habitat, Natural Treatment Systems, River Treaty Negotiations, Invasive Species, etc.
- **FOCUS**
  - Quality – Nutrients, Water Temperature & Habitat
  - Quantity – Snow Melt, Stream Flow, plus Water Law & Policy
The 104B Program allows institutes to address emerging issues in a timely manner, also perceived state centric.

104B Program
- USGS external contract
- annual appropriations
- 3 or more state projects
- state advisory councils
- regional networks
- national network
The 104B Program gives a good sense of the water issues we face across the Great Plains Region.

COMMON THEMES
- Disinfection Byproducts
- Wastewater Treatment
- Stormwater Management
- Agricultural & Water
- Nutrients [Water Quality]
- Stream Geomorphology
The end points of projects for faculty might not be the end points measured of federal programs.
Like all federal programs, the 104B Program is evaluated annually and every three to five years.
It is critical that we (faculty) have the ability to communicate our results to our stakeholders.

The state water resources research institutes like Iowa’s Water Center play an important role in information transfer.

We need to be communicating our success stories, showing improvements in water quantity and quality.

Water supply increases *might* be quantified and communicated a little easier than water quality.
I wanted to focus on water quality changes...

**SCALE DEPENDENT**

- It matters where we are monitoring for WQ changes?
  - Large Watersheds (HUC8-)
  - Small Watershed (HUC12+)
  - Edge-of-field (landscape)

- The time required to see WQ changes increases with size, i.e. catchment area.

- We often have a lag in watershed response to the implementation of BMPs.
  - Sediment (8-50+ years)
  - Nitrate (5-50+ years)
  - Phosphorus (1-15+ years)
  - Bacteria (1 year)
  - Biology (2-25 years)
I wanted to focus on water quality changes...

**MONITORING STRATEGIES**

- It also matters how we are monitoring for WQ changes?
  - Small watershed to edge-of-field requirements [differ]
  - Large watersheds needs

- Strategies need remove exogenous variables that influence WQ.
  - Stream flow, i.e. discharge
  - Seasonality, i.e. bioprocesses
  - Pesticide applications

- Techniques need to have solid statistical base, but easy to communicate to everyone.
  - Parametric, i.e. regression
  - Non-parametric, i.e. Kendall

[Graph of Illinois River, Arkansas – Oklahoma Line]
We know that nutrients cycle in aquatic systems, and that the cycles are displaced downstream, i.e. nutrient spiraling.

So, nutrients move downstream in the dissolved form before being removed from the water column.

The particulate forms also may be transported downstream, especially in more turbid systems and during storm events.

WHY DO WE SEE A LAG IN WATERSHED RESPONSE?
Let’s move from the river system upstream to some point on the landscape.

In large rivers, nutrient uptake lengths are in the order of 1,000 to 10,000 m (1-10 km).

In smaller streams, uptake lengths range from <100 to 1,000 m.

These distances are based on river km, and influence by discharge and in-stream processes.
WATERSHED NUTRIENT SPIRALING

But, how far do nutrients move on the landscape, i.e. runoff?

There is not much data on this, in terms of distances – however, we could look at past filter strip studies.

These studies suggest nutrients, especially phosphorus, are moving 10 m or less...

SHORT DISTANCES!
Watershed Nutrient Spiraling

• Nutrient uptake lengths need to be considered across the watershed.
  ➢ Landscape distances are short, and storage capacity high (especially phosphorus)
  ➢ Stream distance relatively longer, but storage capacity and time is important

TAKE HOME MESSAGE

• We can make changes at the landscape level, but patience is required at watershed-scale.
  ➢ Monitoring required at multiple scales, i.e. field to watershed