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# Great Rivers Reference Condition Workshop

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Great River Ecosystems



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# WERF Explores Research Needs for Large Rivers: Focus on Reference Conditions

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# WERF is ...

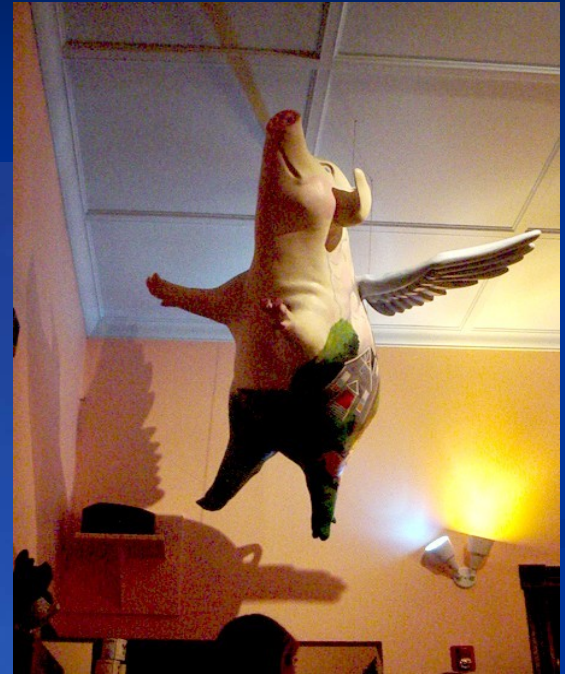
- A Non Profit Research Foundation providing sound science for the water quality community
- Our funding comes from subscribers (municipal utilities, states, industry and corporate) and cooperative agreements and grants (U.S. EPA and others)
- We have Six Research Program Areas:
  - Watershed Management & Water Quality
  - Stormwater
  - Infrastructure Management
  - Conveyance Systems
  - Wastewater Treatment and Reuse
  - Solids Treatment, Residuals and Reuse

# WERF's Interest in Large Rivers

- Significant number of WERF subscribers located on Large River Systems
- Utility subscribers are responsible for a host of water quality management functions, and asked WERF to define research needs
- Large River Systems, particularly the human-altered Great Rivers, do not behave the same as wadeable streams and other water bodies.



Large Rivers, reference conditions..



and flying pigs....

# WERF's Workshop on Large Rivers

- WERF's research team, led by Bruce Lippincott at LMS, developed an annotated bibliography and convened a group of academics, utility and government representatives (USGS, U.S. EPA, NSF, state government)
- Participants developed a list of eleven higher priority research needs and a larger list of needs



Photo: USEPA

# Criteria Used in Considering Research Needs

- Focus: large rivers and floodplains
- Relevance to WERF subscribers and others
- Connection to regulatory policy
- Contribution to understanding large river system function
- Potential for demonstrable products within 10 years
- Contributes to areas of research not currently adequately funded
- Enables changing perspectives (understanding how humans and rivers interact)
- Multiple scale research—temporally and spatially, linking geomorphology, hydrology and ecology.

# Topics For Discussion

- Six broad categories discussed:
  - Biodiversity
  - Restoration
  - Flow, Hydrology and Ecology
  - Scale
  - Drivers of altered states
  - Contaminants



Photo: USCOE



# Framing the Priorities: Research Drivers and Common Themes

- Given that most large rivers have been altered by man, need to define an adequate reference condition
- Large rivers and small rivers are perceived and used differently
- Interest in both history and prehistory to help determine former conditions



# Framing the Priorities: Research Drivers and Common Themes

- Need for large, long term databases—to understand historic condition, and connectivity between habitats, land and water, hyporheos and channels
- Need to identify and measure thresholds of change
- Need for a good mechanistic understanding of population and community characteristics

# Large Rivers “Top Eleven” list...

The top three:

- Large Rivers Status and Inventory
- Historical Records
- Effects of Compression on Ecological Function

All of these strongly tie to the need for reference conditions in large river systems.....

# Large Rivers “Top Eleven” list...

## (cont.)

And those that remain (not in a ranked order)

- Flow Regime Effects on Ecological Processes
- Biological Function and Bio-Information
- Normative—Restoration—Tools
- Assessment Technology Development
- New Technologies for Large Rivers
- Social Values and Relations
- Landscape forecasting Tools
- Trophic Level and Spatial Transfer of Contaminants

# Priority #1: Large Rivers Status and Inventory...

- Develop an inventory of large rivers or natural segments of large rivers
- Identify least impacted reaches
- Will help establish/define reference conditions (least impacted by humans)
- Which human activities most impact large river systems?
- Data exist, but are not synthesized
- Go beyond the Nationwide Rivers Inventory
- Useful for other research endeavors as well



# Priority #2: Historical Records...

- Search historical records—mine and synthesize information regarding former conditions of large river systems
- Could prove useful in help define reference conditions
- Could provide useful insight into restoration end points

# Priority #3: Effects of Compression on Ecological Function...

- What are the effects of spatially compressing (and fragmenting?) ecological function?
- Altering large rivers for navigation and other reasons has spatially compressed ecological function into reduced areas
- Therefore the array of functions and processes must be simulated in these small spaces
- Intensive management activities necessary
- Better understanding would be very useful for planning and designing restoration efforts

# Other Top Priorities: Flow Regime Effects on Ecological Processes...

- Quantify the relationship between flow regime and ecosystem processes: frequency magnitude, duration, relates to sediment transport, etc.
- Determination of ecological services provided by suite of flow regimes
- Eliminating the “seams” between socioeconomic and hydrogeologic models; hydrogeologic and hydrologic models; and hydrologic and ecological models. Presence of “seams” is complicated by issues of scale in large river systems.
- Better understand extreme high and low flow events.
- Identify and mechanistically understand thresholds of change

# Other Top Priorities: Normative— Restoration—Tools

- Normative condition is the goal or endpoint of the effort: what is possible and realistic, given competing human needs?
- What normative is NOT:
  - Pristine, the best, historical, normal
- This topic speaks to “how do we define the normative condition” and then develop the tools needed for restoration
- Link retrospective analysis and ecological theory to describe system potential

# Other Top: Biological Function and Bio-Information...

- Gain an understanding of the basic ecological roles of organisms in large rivers (e.g., trophic dynamics, life histories, influence of exotic species)
- Emphasis on species specific to large rivers
- Critical to understanding baseline conditions and for working on restoration efforts



# Other WERF research...

- Suite of Research examining “multiple stressors” that have application to large river systems
  - Literature Review and Database and Experimental Design to move from identification of impairment and single stressors to working toward the understanding of predicting effects of combinations of stressors.
  - Workshop in September 2004 to work on next steps
    - Much to be done to better predict effects
    - Many tools available that can help, if used with a framework.

# Other WERF research... What if we can't define reference conditions on large rivers?

- WERF Project focused on urban waters, 01-WSM-3  
*Bioassessment: A Tool for Managing Urban Aquatic Life Uses*
- Same kind of challenge with reference conditions in a different context
- Exploring the use of bioassessment for characterizing urban impacts and developing an urban biological indicator
- Developing methods for defining not reference conditions, but BIOLOGICAL POTENTIAL across urban gradients
- Would similar approach work for large rivers?

# Outcomes, Next Steps

- WERF didn't get further specific Large Rivers research off the ground
  - The most pressing needs (inventories and databases) didn't fit well in WERF's usual research approach
- Clearly, it's time to share the results of the workshop with the broader public and see if there are others for whom this type of research is better suited
- Large Rivers are also increasing in interest again, and therefore may be a part of WERF research in the future

**For More Information, please  
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