Environmental Benefits of Restoring Sediment Continuity to the Kansas River

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Outline

- Dramatic changes to the Kansas River
- The need for turbidity
- The environmental problem with sediment accumulation in the lakes
- Removing the “dam footprint”
- One practical idea
Dramatic Changes to the Kansas River

Pre-dam Sediment Load: 44 million tons per year

Post-dam Sediment Load: 13 million tons per year

A 70% reduction in sediment transport
Dramatic Changes to the Kansas River

Pre-dam Sediment Load: 44 million tons per year

Post-dam Sediment Load: 13 million tons per year

A 70% reduction in sediment transport

So what?
Tuttle Creek Lake: 1957 to 2010
Tuttle Creek Lake

Graph showing elevation (feet) versus distance from the dam (miles) for various years, including Normal Pool, 2010, 2000, 1983, 1962, Dam, and Low Flow Gate.
Supply – Demand Graphs

2% drought condition

Kansas Basin Projected Water Supply Storage and Demand

- Supply (Available - MGD)
- Supply (State-Owned - MGD)
- Demand (MGD)

Graph showing projected water supply and demand for the Kansas Basin under 2% drought condition, with specific data points for the years 2000, 2025, 2031, and 2064.
Trick Question: Which is Better Water Quality for Riverine Environments?
Sediment should not be universally considered as a pollutant, especially in historically-turbid river systems. To the contrary, the transport of sediment is a natural function in river ecosystems, and a lack of sediment can be deleterious to aquatic habitats and organisms.
- **Turbid-water Fish**
  - Smaller eyes
  - Smaller optic lobes of brain
  - Electro-sensory and chemo-sensory organs
  - Non-sight feeding
  - Thrive in naturally high-turbidity environments

- **Clear-water Fish**
  - Larger eyes
  - Larger optic lobes of brain
  - Site-feed
  - Out-compete native Kansas River fish in the current, unnaturally clear Kansas River environment
Shovelnose Sturgeon

- Once abundant in the Kansas River, no longer present in much of Kansas

Imperiled Due to Increased Water Clarity and Predation and Competition from Sight-Feeding Fish

- Formerly found in the lower Kansas River. Not found for 20 years. Considered “extirpated, or nearly so, in Kansas.”

- Significantly reduced in abundance

Imperiled Due to Increased Water Clarity and Predation and Competition from Sight-Feeding Fish

Significantly reduced in range or abundance

Other impacted species showing significant decline or complete extirpation: Silver Chub, Flathead Chub, River Shiner, Carmine Shiner, Sturgeon Chub
The State of Kansas has designated critical habitat in the Kansas River for several state-listed threatened and endangered species including the plains minnow, shoal chub, sturgeon chub, and silver chub.

High clarity = poor quality for Kansas River habitat
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In-reservoir Effects of Sediment Accumulation

Milford Lake 2014 Total Phosphorus

- 4/9/2014
- 5/14/2014
- 6/12/2014
- 7/9/2014
- 8/13/2014
- 9/10/2014
- Site Median

- Hypereutrophic TP = 0.096 mg/L
- EPA Ecoregion Recommended TP = 0.031 mg/L
Effect over time…

- Phosphorus binds to sediment, concentration increases as the sediment accumulates in the reservoir

- Nitrogen dissolves in the water, residence time decreases as the sediment accumulates in the reservoir

- TN:TP ratio = VERY LOW
In-reservoir Effects of Sediment Accumulation

- Shift in fish species composition from desirable sport fish (primarily piscivores) to less desirable benthivores (Egertson and Downing 2004)

- Increased biomass of common carp
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What is the dam footprint?

The sediment deficit caused by the presence of the dams.

<table>
<thead>
<tr>
<th>Month</th>
<th>Suspended Sediment (tons)</th>
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<tr>
<td>January</td>
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<tr>
<td>February</td>
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<td>November</td>
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<td>December</td>
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</tbody>
</table>

- Kansas River Wamego (Current Conditions)
- Tuttle Creek
- Milford
- Harlan
- Wakunda
- Kanapolis
- Wilson
What is the dam footprint?

The sediment concentration deficit caused by the presence of the dams.
Removing the “dam footprint”

- An environmental lift for the Kansas River
- An environmental lift for the reservoirs
- Benefits human uses of the reservoirs (water supply, recreation, etc.)
- But is it practical?
Dredging

- Dredging Tuttle Creek Lake at the natural rate of incoming sediment and recharging sediments to the downstream channel
  - Costs estimated at $40 million/year
  - Tremendous fuel consumption
Option employed on Fall Creek Reservoir in Oregon
Option employed on Fall Creek Reservoir in Oregon

“The entire food web downstream of the reservoir will see a great benefit over time from the liberation of the trapped material.”

http://www.nwp.usace.army.mil/Missions/Current/FallCreekdrawdown.aspx
Removing the “dam footprint”

- A novel, less-expensive idea…
A novel, less expensive idea...
A novel, less expensive idea…
Demonstration
Summary

- Connecting the Kansas River with its watershed is a good thing

- Practical, cost-effective methods are available for accomplishing this objective
Questions?