How to Balance Competing Interests?

With the Missouri River you never know whether you are going to harvest corn or catfish.

- George Fitch, 1907
MISSOURI RIVER RECOVERY PROGRAM

130 Years of Change
A Map of Society’s Impact on the Landscape
Topics

- **Missouri River Recovery Program**
  - What is it?
  - Why do we need the Program?

- **River History**
  - Pre-European Settlement (to 1800)
  - European Settlement (1800-1875)
  - Post-European Settlement (1875-1930)
  - Modern Era

- **Landscape Change**
  - St. Louis to Three Forks, MT
  - Overton Bottoms Case Study
A Brief History of the Missouri River
Pre-European Settlement (to 1800)

- The River Controls Society
  - The post-Wisconsin glacial age established the course and basic characteristics of the Missouri River.
  - The Missouri changed frequently.
  - Great Mound Builders were the first to settle in the Missouri River Valley.
  - The Mound Builders were superseded by the Plains Indians.
  - Early claims in the Missouri River Valley by France and Spain were often disputed and tenuous at best.
European Settlement

A new nation first explores, then travels through, and finally settles the basin

1800 to 1875
European Settlement (1800-1875)

- Society starts to view the River as both a friend and a foe.
  - Friend – Navigation  Foe - Flooding
  - Lewis and Clark expedition is first American involvement with the river valley.
  - In 1815, after the end of the war of 1812. American Settlers begin to head west into the Missouri River valley.
  - In 1819 the first steamboat, the Independence ventures up the Missouri River.
European Settlement (1800-1875) - cont.

- In 1822 the first settlers head west out of Franklin, Missouri and onto the Santa Fe trail.

- Great floods were witnessed in 1785, 1811 and 1826 but the great flood of 1844 fills the river valley from bank to bank. This is still the flood of record for the Kansas City metro area.

- 1858 – The height of steamboat traffic on the Missouri. Steamboats encounter many hazards on the treacherous Missouri. Over 300 will be lost from 1819 to the late 1880’s.

- 1869 – The Railroads reach from the mouth of the Missouri to Omaha, Nebraska. This rapidly speeds development in the valley and marks the beginning of the end of the steamboat era.
Post-European Settlement (1875-1930)

• Society seeks ways to control the River

  In 1879 Major Charles Suter leads an expedition that maps the Missouri River from the mouth to Fort Randall, Dakota territory. He returns convinced that he has a plan for “pegging the river down in place.” This is to help create a river suitable for modern navigation. Other expected benefits will be accretion of arable land and flood control.

• In 1884 Congress creates the Missouri River Commission. The five man commission is headed by Colonel Charles Suter. They lobby for funds and begin to lock the river down. Their efforts are thwarted by local Congressmen who lobby for localized flood control projects instead. By 1902 the Commission demands that Congress take a wholesale approach to the river. They are disbanded later that year.

• 1888 – Steamboat navigation on the Missouri effectively ends.
Post-European Settlement (1875-1930) cont.

- 1902 – Congress creates the Board of Engineers for Rivers and Harbors. Piecemeal work continues on the Missouri.

- 1903 – Worst flood since the flood of 1844 for the lower Missouri Valley. There is massive damage to the river towns.

- 1905 and 1906 – More severe floods.

- 1906 – Private associations are formed comprised of influential citizens who lobby congress for river improvements. They seek flood control and navigation.

- 1907 – U.S. Army Corps of Engineers Kansas City District is formed. Its main purpose is to address Missouri River issues.

- 1925 – Secretary of Commerce Herbert Hoover addresses the Missouri River Navigation Association and proposes a nine foot deep navigation channel that will run from the mouth of the Missouri to Sioux City, Iowa.
Pre-Modern Era (1930 to 1986)

1930 to 1986
Pre-Modern Era (1930-1986)

- Society seizes opportunities to utilize the River.
  - The Great Depression starts in 1929. It debuts with the Wall Street crash known as Black Tuesday.
  - By 1930 thousands of men are put to work building control structures on the Missouri River, trial navigation runs are started. A decade long drought makes navigating the river a difficult task.
  - During the war years floods would devastate the Missouri River destroying valuable crops needed at a critical time. Three boatyards on the Missouri build 251 LST’s (Landing Ship - Tanks) that were critical to the war effort.
The Flood Control Act of 1944 is passed (Pick Sloan). This act calls for the creation of several dams to be built along the main stem and tributaries of the Missouri River. The goal of this construction is to have flood control along the Missouri and to achieve a constant minimal channel during times of drought.

In 1951 and 1973 there are severe floods along the Missouri.

In 1981 the Army Corps of Engineers declares that the Bank Stabilization and Navigation Project (BSNP) is finished. A nine foot navigation channel now exists from the mouth to Sioux City, Iowa.

In 1986 The Water Resources and Development Act is passed. Congress decries that the Corps mitigate 10% of the natural habitat back to its original condition.
Modern Era (1986 to 2008)
Modern Era (1986-Present)

- Society begins to address environment and habitat alongside navigation and flood control
  - In 1993 the Corps purchases land for the first mitigation Site, Benedictine Bottoms located north of Atchison, Kansas.
  - In 1993 and again in 1995 the Missouri River floods in the lower basin, extending from bank to bank. The 1993 flood is the flood of record for St. Louis.
  - At the present time the Corps has mitigated 59 sites and over 54,000 acres of land.
Landcover Change 1879 to 2008
Missouri River Floodplain
Missouri River Surveys 1879 and 1894

- Major Charles Suter led an expedition in 1879 to map the Missouri River. His team’s efforts created excellent period maps that were used to derive landcover.

- In 1884 Congress created the Missouri River Commission headed by now Colonel Charles Suter. The commission remapped the river in 1894.

- Changes in landcover, river channel and settlement within these 15 years is phenomenal.
Settlement-Era Landcover

Scale, 1 mile to 1 inch.

1879
Landcover Datasets

**Legend**

**Category**
- 20 Developed
- 30 Barren
- 40 Deciduous Forest
- 50 Shrubland
- 70 Grassland
- 80 Cultivated
- L1 Lakes, Ponds and Scour Holes
- PEM Emergent Wetland
- PFO Forested Wetland
- PSS Scrub Shrub Wetland
- R2UBG Backwaters
- R2UBH Side Channels

**1879** – St. Louis to Fort Randall, Dakota

**1894** – St. Louis to Three Forks, MT

**1996-2008** – Multiple epochs per site
- Mitigation site at time of purchase
- 2003 baseline
- Five-year update
- Desired future state

**1928-2006** Multiple epochs, pilot site
- Overton Bottoms, near Columbia, MO

**Methods**
- ArcGIS 9.x
- Digitize from scanned historic maps
- Photo interpretation

**Landcover Schema**
- Composite of NLCD and NWI

**1879 to 2008**
Missouri River Mitigation Sites

- Fifty-nine sites as of 2009
- The sites are located in Missouri, Kansas, Iowa and Nebraska
- Over 54,000 acres under management
- Have been called a “string of pearls”
### Missouri River Recovery Program (MRRP) Mitigation Sites

#### Missouri River Recovery Program - Mitigation Sites

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<tr>
<th>State</th>
<th>Mitigation Site Name</th>
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<th>Mitigation Site Name</th>
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**Map and Table Data Prepared and Produced by the U.S. Army Corps of Engineers Kansas City District**
Landcover Mapping for the Mitigation Project

- There are four separate mapping series.

  1. Baseline Series – All sites mapped to current conditions in 2004. The first of these maps were created in 2004.

  2. Time of Purchase Series – Created if baseline series were not representative of initial condition.

  3. Desired Series - Desired end state landcover condition.

  4. Current Series – Sites remapped approximately every five years.
The above diagram and map reflect the changes that are needed to move the project to its desired end state from the baseline. Yellow map areas denote regions that will be converted to a different Land Cover category.
BNSP Bank Stabilization and Navigation Program (BSNP)

- The BSNP was created through the River & Harbor Acts of 1912, 1927 & 1945.

- Structures were built to channelize the river.

- The result is a deeper channel of consistent width.

- Benefits: accreted land, navigation, protection of flood control structures.

- Costs: reduction of natural landcover and decline of native species.
Bank Stabilization & Navigation Program (BSNP)

1894 overlay with 2003
Deroin Bend Example of Restoration Efforts

- The previous slide shows the 1894 channel at the Deroin Bend site superimposed over the CIR NAIP photography of 2003.

- Note the radical swing of the original channel due to natural forces and the effects of the BSNP.

- Note also the natural channels that existed in 1894 and the engineered side channels shown in the 2003 imagery.
Mitigation Program Statistics - 2006

### Mitigation Acres By Land Cover Classification

<table>
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<tr>
<th>Land Cover Class</th>
<th>Total Acres</th>
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<td>Total</td>
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<td>Grassland</td>
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<td>Emergent Wetland</td>
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<td>Shrubland</td>
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<td>Forested Wetland</td>
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<td>Scrub Shrub Wetland</td>
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<td>Tributary Rivers and Streams</td>
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<td>Disturbed</td>
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<tr>
<td>Shallow Water</td>
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- **Deciduous Forest**: 24.5%
- **Grassland**: 25.1%
- **Cultivated**: 28.5%
- **Emergent Wetland**: 7.0%
- **Shrubland**: 5.7%
- **Other**: 9.2%
Landcover Change 1879 to 2008
Detailed Study of Overton Bottoms
Overton Bottoms Statistics - 2006

View Overton Bottoms Location Map

<table>
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<tr>
<th>Land Cover Class</th>
<th>Total Acres</th>
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Grassland, 42.1%

Forested Wetland, 31.8%

Deciduous Forest, 11.1%

Shrubland, 4.7%

Scrub Shrub Wetland, 4.7%

Other, 5.7%
Overton Bottoms Landcover Analysis

- Reviewed available maps and imagery 1879 to 2006
- 12 epochs—georeferenced imagery & digitized landcover
- Consistent landcover classes throughout; 1,600 acres

**Overton Bottoms - Percent of Acreage Under Cultivation**

- MRC Surveys
- US Agriculture Programs
- BSNP Begins
- ‘93/’95 Floods; Site enters Mitigation Program
- WRDA 1986
- MRRP & WRDA 2009

*BSNP = Bank Stabilization and Navigation Project
MRC = Missouri River Commission
WRDA = Water Resources Development Act
MRRP = Missouri River Recovery Program
Landcover Changes over Time

- The following slides demonstrate the effects of landcover change at the Overton Bottoms North Mitigation site.

- The time period extends from 1879 to 2006.
Overton Bottoms-Missouri River Commission (MRC) Survey

Comparison area (faint yellow) is shown on all maps and images.
Overton Bottoms Study Area-MRC Survey
1928 vs 1930 Comparisons of Landcover Change

- Note in the left frame (1928) that no river structures have been created to date.

- In the right frame note that the brand new river structures (1930) are already forcing the river to accrete sediment in a gap that was previously occupied by a flowing channel.
Overton Bottoms Study Area-1928 to 1930 Comparison

Proposed structures drawn over 1928 imagery have yielded considerable sedimentation by 1930.
1944 - 1958

- The brown and striped areas in the next slide represent riparian forest and shrub areas where none existed 16 years before.

- Observation of the above mentioned areas in the next three slides show the invasion of agriculture upon the newly created landscape. Observe in particular the east and west sides of the riparian forest.
Overton Bottoms Study Area

1958
1968 - 1989

- Due to accretion and a newly constructed levee the forest is now moved into upland category.

- The forested areas steadily diminish.
The Floods of 1993 and 1995

- The 1993 and 1995 floods inundated the valley from bank to bank. The changes to the landcover were far reaching. Cultivated areas were especially hard hit as scour holes and sand deposits altered the landscape.

- The Corps began to acquire this land in 1994 and would own the entire site by 1999.
Overton Bottoms Study Area – Extent of 1990’s Floods
1989 - 2006

- The following slide shows the dramatic effects of pre- and post-flood landcover.

- Note the changes in woodland vs forested areas and the addition of the new scour holes that bracket I-70. There is also a large sand deposit next to the SE scour hole.
Overton Bottoms Study Area – Post Flood Event
Post Flood Site Management

- The next three slides show the site under post flood management. The Corps has created two channels that separate the forested areas from the rest of the site. Doing so has reverted the area to a riparian forest again something not seen since the 1958 imagery.

- The Overton Bottoms North site is now managed by the Fish and Wildlife Service.
Overton Bottoms Study Area
## Missouri River Data Holdings
### St. Louis to Rulo, NE

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