The Floodplain Explorer

An Online GIS Tool for Floodplain Prioritization in the Mississippi River Basin

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The Problem

• The Mississippi R. basin no longer functions as a healthy system

• Widespread degradation, conversion, and hydrologic disconnection of natural floodplains

• Excess nutrient loading contribute to hypoxic conditions in Gulf & impaired local waters

• >$50B in flood damage since ~1993
(Part of) the Solution

• Floodplains have multiple benefits
  • Improving \textit{water} quality
  • Supporting \textit{fish} nurseries and \textit{wildlife} habitat
  • Storing and conveying \textit{water} to \textit{mitigate} flood damage

• Protecting floodplain lands is \textit{\sim 2.5x cheaper} than anticipated property damage from flooding

• Resources are limited, and we must \textit{target} \textit{investments} \textit{wisely}

• The \textit{Floodplain Explorer} can help
A Comprehensive U.S. Flood Model

- Based on high-precision terrain model
- Models flows based on thousands of USGS gaging stations + NOAA rainfall data
- Multiple return periods (1-in-5-year, -100-yr., -500-yr.)
- Explicit representation of Army Corps National Levee Database
- High validation rate against FEMA and USGS data
- No gaps!
Floodplain Explorer Essentials

• Precision about where to work
• Transparency about why to work there
• Clarity about how to work there

• Key features:
  – Comprehensive floodplain data
  – Dynamic footprint of sites based on multiple criteria
  – Multiple spatial scales: basinwide, regional, local
  – Framework for building locally relevant spinoffs
HOW MUCH FLOODPLAIN IS AVAILABLE FOR...

Protection – In forest, wetland, or grassland

Restoration – In ag or pasture
Water Quality

- Nutrient loading to local waters
- Nutrient loading to Gulf of Mexico
- Growing degree days – In conjunction with higher loading, facilitates denitrification
SOIL QUALITY

- National Commodity Crop Productivity Index – A measure of soils’ inherent capacity to produce commodity crops
- Draw restoration efforts to relatively less desirable soils
Human exposure to flooding ...

- Current population in the floodplain
- Future population (2050) in the floodplain
- Future property damage (2050) from flooding

Population Exposure
- Current population
- Projected population (2050)

Future Economic Asset Exposure
- Economic asset exposure (2050) (SSP2)
- Economic asset exposure (2050) (SSP5)
OTHER RISK LAYERS

SOCIAL VULNERABILITY INDEX

- Census tract scale
- Index of social vulnerability to disaster based on 22 variables from American Community Survey
  - E.g. per-capita income, % pop. <20 and >64 yrs. old, % Native American, % with less than 12th-grade education, % Hispanic, etc.

AG LOSSES FROM FLOODING

- Census block group scale
- $ value of row-crop losses assuming 100-year flood of 24 hrs. duration on June 1, modeled with HEC-FIA
5-year floodplain in ag or pasture land totaling 1 million acres

Criteria:
- At least 25,000 acres in watershed
- Top 50% for nutrient loading
- Top 65% for growing degree days

Floodplain goal: 1 mil. acres
5-year floodplain in ag or pasture land totaling 2.7 million acres

Criteria:

- At least 6,200 acres in watershed
- Top 40% for nutrient loading
- Top 85% for growing degree days

Floodplain goal: 2.6 mil. acres
Available Floodplain Area
- Area of floodplain in agriculture or pasture land totaling 1.8 million acres

Criteria:
- At least 6,200 acres in watershed
- Top 40% for nutrient loading
- Top 85% for growing degree days
- Soil productivity index ≤ 0.8
- 1,000+ ppl. in 5-yr. floodplain by 2050
- $10M+ projected damage by 2050

Floodplain goal: 1 – 2.6 mil. acres

Consider soil productivity
Consider future population
Consider future property damage

5-year floodplain in ag or pasture land totaling 1.8 million acres

Core areas for 1M-acre floodplain goal
Additional areas for 2.6M-acre goal, including non-nutrient criteria
5-year floodplain in ag or pasture land totaling 1.8 million acres

Criteria:
- At least 6,200 acres in watershed
- Top 40% for nutrient loading
- Top 85% for growing degree days
- Soil productivity index ≤ 0.8
- 1,000+ ppl. in 5-yr. floodplain by 2050
- $10M+ projected damage by 2050

Floodplain goal: 1 – 2.6 mil. acres
5-year floodplain in agriculture or pasture land totaling 340,000 acres

Criteria:
- At least 500 acres in watershed
- Top 50% for nutrient loading
- Top 65% for growing degree days
5-year floodplain in ag or pasture land totaling 200,000 acres

Criteria:
• At least 500 acres in watershed
• Top 50% for nutrient loading
• Top 65% for growing degree days
• Soil productivity index ≤ 0.6
• 100+ ppl. in 5-yr. floodplain by 2050
• $10,000+ projected damage by 2050
5-year floodplain in ag or pasture land totaling 200,000 acres

Criteria:
- At least 500 acres in watershed
- Top 50% for nutrient loading
- Top 65% for growing degree days
- Soil productivity index ≤ 0.6
- 100+ ppl in 5-yr. floodplain by 2050
- $10,000+ projected damage by 2050
5-year floodplain in ag or pasture land totaling 44,000 acres

Criteria:
- At least 250 acres in watershed
- Top 50% for nutrient loading
- Top 65% for growing degree days
5-year floodplain in agriculture or pasture land totaling 44,000 acres

Criteria:
- At least 250 acres in watershed
- Top 50% for nutrient loading
- Top 65% for growing degree days
- Soil productivity index ≤ 0.6
- In an Important Bird Area

Consider soil productivity
Consider bird habitat

In Bayou de View Raptor Area
In Cache / Lower White R. bottomlands
Upcoming Data and Development

• This tool will be a “living” product, growing and changing as we work hand in hand with partners across the basin in floodplain conservation planning

• Updated data from USGS SPARROW model
• Places resilient to climate change
• Improved dataset of levee locations – beyond NLD, using remote sensing
• Estimate of C sequestration in floodplain
• Development of spinoff tools for local geographies – e.g. lower Meramec River in Missouri