Levee Removal/Setback for Flood Risk Reduction in the Upper Mississippi River Basin:

Policy, Funding and Implementation Issues

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Implementing Nonstructural Solutions for Flood Management in the Upper Mississippi River Basin – Project Tasks

• Policy Evaluation
• Funding Evaluation
• Success Stories
• Surveys of Floodplain Regulators and Floodplain Managers
• Modeling Analysis
Upper Mississippi Watershed

- Portions of eight states
- 190,000 mi²
- Floods driven by rainfall and/or snowmelt
- Generally low gradient, wide flat floodplains
Benefits of Levee Setbacks

• Removal of structures from at-risk areas
• Hydrology
  – flood flow storage
• Hydraulics
  – reduced constriction reduces flood levels
General Nonstructural Floodplain Management Policy Observations

• Primary Federal policy drivers are FEMA (NFIP and Hazard Mitigation) and USACE (PL 84-99 and Comprehensive Plan)

• Floodplain regulations and responsibilities vary from state to state, but state regulators feel their are appropriate – no desire to try to revise
Identified Funding Mechanisms

- Federal
  - FEMA (grant programs)
  - NRCS (WRP)
  - USACE (PL 84-99, PAS)
  - USFWS (Partners, NAWCF)
  - HUD (CDBG)
  - EPA (WPDG, 319(b))
Identified Funding Mechanisms

• Private
  – Nature Conservancy
  – The Conservation Fund
  – Iowa Natural Heritage Foundation
  – Sand County Foundation
  – Local or Regional Land Trusts and Conservancies
  – Wildlife Conservation Groups
  – Industry
Identified Funding Mechanisms

• State
  – Illinois
    • Partners for Conservation Ecosystems Program
    • Water Resources Planning Program
  – Minnesota
    • Flood Damage Reduction Program
  – Wisconsin
    • Municipal Flood Control Grant Program
FP Manager Survey Results

• General public not generally tuned in, not aware of their risk
• Opportunities exist immediately after floods
• Federal program processes do not foster the use of nonstructural practices (timelines, B/C protocols)
• Need to incentivize private participants
• Important to consider local economic impacts
Implementing Nonstructural Projects in the UMRB

• Plan Ahead
• Capitalize on Multiple Benefits
• Act when the Opportunity Arises
Implementing Nonstructural Projects in the UMRB

Plan Ahead

• Identify potential projects
• Coordinate with potential stakeholders
• Identify requirements and limitations of various programs
• Develop an implementation plan
Example #1 - Planning Ahead
Pershing State Park/Locust Creek Floodplain (Linn County, MO)

- Levee Setback
  - 1428 acres adjacent to state park
  - Previously identified in multiple plans
  - Landowner eventually expressed interest
  - Multiple funding sources
  - Coordinated by NGO
Example #2 - Planning Ahead
Milwaukee MSD Watercourse Planning and Green Seams Program (WI)

- Flood Management
  - Buy out flooded structures
  - Implement ordinance
  - Regional storage
  - Structures in developed areas
  - Specific open area (floodplain) acquisition
Implementing Nonstructural Projects in the UMRB

Capitalize on Multiple Benefits
– Risk Reduction
– Natural Resources
– Recreation
– Open Space
– Water Quality

Expands the pool of potential partners and/or funding sources
Example #3 - Multiple Benefits
Vermillion River Corridor Plan
(Dakota County MN)

• River Corridor Planning
  – Comprehensive approach
    • WQ
    • Recreation
    • Habitat
    • Resiliency
  – Meander belt serves to reduce at-risk structures

Dakota County, MN
Example #4 - Multiple Benefits
Emiquon Preserve (Havana IL)

- **Floodplain Restoration**
  - Historically leveed former drainage district on Illinois River
  - TNC developed partnerships with USFWS, NRCS, USACE
  - Economic analysis
  - Provide habitat, recreation and ultimately reconnection
Implementing Nonstructural Projects in the UMRB

Act when opportunity arises

– Coordinate interested parties

– Utilize capabilities of various stakeholders
  • Flexibility of NGOs
  • Objectives of government agencies/programs
  • Technical expertise to deliver projects
Example #5 - Timely Response
Gays Mills Recovery (WI)

- Relocation out of Floodplain
  - Village of 600 endured repeated flooding, 2008 event was last straw
  - FEMA developed LTCR plan
  - Communicated a coherent vision
  - Assistance from state staff
  - HGMP used to acquire 32 structures
Example #6 - Timely Response
Louisa Levee District 8 (Wapello IA)

- Levee Removal
  - Response to repeated flooding
  - Acquisition by wildlife refuge
  - Multiple interested parties
  - NGO facilitated transactions
Encouraging Levee Setbacks and NSFM Projects in UMRB

• Encourage Local Practices that “Live with the River”
  – agricultural production
  – local ordinances
  – modeling tools

• Develop a Framework that Supports Project Implementation in the Wake of Future Flood events
  – planning and coordination
  – information clearinghouse
  – reform Federal B/C analysis approaches
  – strengthen effectiveness of FEMA post-disaster programs
Additional Slides - Modeling
Motivation

• American Rivers was looking for a method to quantify flood reduction benefits of restoring floodplain volume (removing levees) in Upper Mississippi River Basin

• Looked at three different watersheds (MRBI focus)
  – Spoon River, IL
  – Middle Minnesota River, MN
  – Cedar River, IA
Model

- Hydrologic Simulation Program Fortran (HSPF)
  - Meteorologic records input
  - Flow generated from land surface
  - Routed through stream reaches
- Continuous, generates synthetic gage records (hourly time step) which can be analyzed similar to gage records
Model

- **Hydrologic Simulation Program Fortran (HSPF)**
  - Meteorologic records input
  - Flow generated from land surface
  - Routed through stream reaches
- **Continuous, generates synthetic gage records (hourly time step) which can be analyzed similar to gage records**
- **Watersheds identified had existing HSPF models developed and calibrated by others (Cedar River TMDL)**
Methodology

- Run the model, develop “baseline hydrographs” throughout watershed
- Add representation of storage areas to model (various scenarios)
Conceptual Scenario
Methodology

- Run the model, develop “baseline hydrographs” throughout watershed
- Add representation of storage areas to model
- Rerun model, look at hydrograph changes
Methodology

• Run the model, develop “baseline hydrographs” throughout watershed
• Add representation of storage areas to model
• Rerun model, look at hydrograph changes
• For flood study, used annual peak flow analysis
Results

• Relevant factors –
  – Volume storage vs. stream flow
  – Location of storage vs. benefit observed
  – Elevation of restored floodplain
Reduction in Annual Flows

- Scenario 1: $y = 0.1977x$, $R^2 = 0.6438$
- Scenario 2: $y = 0.1521x$, $R^2 = 0.7806$
- Raised Scenario 2: $y = 0.0865x$, $R^2 = 0.9638$
Results

• Relevant factors –
  – Volume storage vs. stream flow
  – Location of storage vs. benefit observed
  – Elevation of restored floodplain

• Benefits primarily for small to moderate events (<20 year recurrence), with some exceptions

• Minimum restored subbasin area ~1-2% to see benefits

• Seem to be generally applicable in investigated watersheds
Frequent (2-10 year) Floods

\[
y = 0.0705x \\
R^2 = 0.7873
\]
What We’d Like to Do Next

• Cedar River
  – Try in other subwatersheds
  – Use actual project locations
  – Develop other benefit analysis techniques
    • Habitat
    • Water quality

• Elsewhere in Midwest to investigate general applicability