Prioritizing Investments in Natural Infrastructure to Deliver *Multiple Benefits* for People and Nature

RIOS
resource investment optimization system

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Watershed Planning for Multiple Benefits: Upper Cedar River, Iowa

- Iowa Nutrient Reduction Strategy
- Watershed planning
- Targeting activities for nutrient reductions and co-benefits

WHICH activities and WHERE to deliver multiple benefits?
Upper Cedar: Objectives for Analysis

Identify priority areas for activities to improve...

Water Quality
- Nitrogen retention
- Phosphorous retention
- Erosion control

Flood Mitigation

Crop Production

Provision of Habitat

Overlays
Upper Cedar Watershed Planning

WHICH activities to invest in and WHERE to capture multiple benefits?

- Flood risk reduction
+ Nutrient retention
- Erosion control
+ Habitat for biodiversity

Systematic spatial analysis
A science-based approach to prioritize watershed investments by identifying where protection, restoration, or improved management activities are likely to yield the greatest benefits for people and nature.
http://www.naturalcapitalproject.org/RIOS.html
Targeting Investments in Water Funds

Cauca Valley, Colombia
RIOS portfolios up to 6x’s more effective than typical investments
Multiple Benefits Approach

Watersheds
- Sediment retention
- Nitrogen retention
- Phosphorous retention
- Flood mitigation
- Groundwater recharge
- Terrestrial biodiversity
- *Recreation and tourism

Coastal
- *Coastal protection
- *Fisheries (habitat dependent)
- *Recreation and tourism
- *Marine biodiversity
  * = in development

Flexibility to add additional objectives for specific decision contexts (e.g., target vulnerable communities, avoid high opportunity cost areas)
RIOS Modeling Framework

How effective is each activity at achieving each objective across the entire watershed?

Cover Crops

Examples of Upper Cedar Activities:
1. Agricultural vegetation management practices (e.g., cover crops, no till)
2. Fertilizer management practices (e.g., nitrogen side-dress)
3. Habitat protection
4. Habitat restoration (e.g., riparian buffers)
RIOS Data Inputs

**Land use/Land cover + Coefficients**
Vegetation retention, land practice and management

**Topography**
Digital elevation model, slope threshold

**Rainfall Erosivity**
Based on intensity and kinetic energy of rainfall

**Soil Properties**
Depth, erodibility, texture

**Watershed Areas**
Catchment areas, beneficiaries

**Stakeholder Input**
Activities, budget, preferences, restrictions

And other inputs...
RIOS Data Inputs

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- **And other inputs...**

**OUTPUT:** Relative ranking scores of activity effectiveness for each pixel
RIOS: Example Outputs

Activity Portfolio for Budget Allocation (e.g., Water Fund)

“Wall-to-Wall” Activity Effectiveness Maps (e.g., project screening)

Fertilizer Management

Habitat Protection

Darker colors are higher priority areas
Tool Enhancements
Beta releases in Winter 2015

- Floodplain Reconnection Screening Tool
- RIOS Coastal
- Habitat Suitability Index
Tool Enhancements
Beta releases in Winter 2015

• Floodplain Reconnection Screening Tool
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Floodplain Reconnection Screening Tool

Screen floodplain to identify areas where **flood water storage and conveyance** may be enhanced by modifying built features to reconnect parts of the floodplain.

**Collaborators**
Kris Johnson (TNC)
Chris Konrad (USGS)
Ginger Kowal (NatCap)
Modifying Built Features in the Floodplain
Tool Enhancements
Beta releases in Winter 2015

- Floodplain Reconnection Screening Tool
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Watershed + Coastal Planning for Multiple Benefits: Perdido & Pensacola Watersheds (FL)

- Healthy watersheds for resilient communities
- Address root causes of major issues
- Across jurisdictions and funding sources
Coastal protection from storms and sea level rise

Near-shore fisheries: habitat dependent

**WHICH activities and WHERE to deliver multiple benefits?**

Recreation and tourism

Marine biodiversity (user input)
Habitat Suitability Index

Where are conditions favorable to restore habitats?
Habitat Suitability Index

Where are conditions favorable to restore habitats?

- Salt marsh
- Oyster reefs
- Seagrass
Draft results for Perdido & Pensacola Watersheds (FL)
RIOS Coastal: Activity Effectiveness Maps
Draft Results for Perdido and Pensacola Watersheds

**Objectives**
- Coastal protection
- Recreation
- Red drum fishery
- Oyster fishery

**Salt Marsh Protection**
Green = preferred areas
Purple = Not preferred

**Seagrass Restoration**
RIOS: Examples of Decision Contexts

Targeting Investments in Water Funds

Natural Infrastructure: Risk Reduction + Co-Benefits

Multi-objective planning: Watershed + Coastal

Ecosystem Services Priority Areas: National Land-Use Plan in Gabon
WHERE matters

http://www.naturalcapitalproject.org/RIOS.html