Colorado Watershed Planning Toolbox
Visualizing wetland and stream functions, stressors, and restoration priorities at the basin scale

Sarah Marshall and Joanna Lemly
Colorado Natural Heritage Program
www.cnhp.colostate.edu
Watershed Planning Toolbox – What is it?

An online, interactive mapping tool to help stakeholders evaluate, protect, manage, and restore wetlands and streams at the landscape scale.
Why do we need a Toolbox?

- Millions of dollars spent on stream and wetland restoration, watershed planning in CO (billions spent on a national level) each year
  - Mixed restoration outcomes
  - **Where are** the most suitable sites for conservation, restoration?
  - **How do we prioritize limited** resources (land, money, water rights...)?
- So many restoration resources available; so little time to review them!
- **Disciplinary barriers** – are engineers, regulators, scientists, planners, NGOs, using the (same) best-available science and data?
- **Colorado’s future:** more people, less water
Remaining South Platte Gap for 2050 intermediate development scenario: 195,900 acre feet/year = covering ~306 square miles with a foot of water
Toolbox Objectives

1. **Help users visualize** different types of wetlands, wetland functions, stressors, and prioritized restoration and conservation areas at the basin scale

2. **Enhance Colorado NWI data set** by adding landscape, landform, water flow path, and water body attributes (LLWW)

3. **Provide a gateway to data and resources**, from funding opportunities to technical guidance, to facilitate more holistic, science-based aquatic restoration work
Related Efforts and Considerations

1. **Connections** between wetlands and downstream water quality and quantity

2. **Colorado Water Plan** and basin implementation plans

3. Numerous local and regional watershed planning efforts for **water quality** improvement
Potential Toolbox Uses

- Incorporating wetlands into watershed planning efforts
- Optimizing restoration and enhancement
- Prioritizing projects for funding
- Finding technical guidance for aquatic restoration and BMPs
- Finding species lists for reference wetlands
- Identifying mitigation sites that are most likely to compensate for lost functions
Stakeholder and Partner Input and Support

https://www.surveymonkey.com/r/Y3NT2PW

And Consultants & Landowners!!
Potential Toolbox Uses – Survey Feedback

• “...To find priorities, compare with existing projects in the area, and bring continuity to restoration methodology.”

• “...Better understand managed wetlands and streams, and how they function in providing habitat and other ecosystem services.”

• “Evaluating merit of potential conservation and restoration sites”

• “To identify areas that would benefit from streamflow restoration projects”

• “Location of reference sites”

• “Tracking functional lift and decline”

• “...Support assessment of aquatic resources and...assist practitioners in evaluating potential restoration sites or compiling data for federal, state and local permit submittals”

• “...Improve management of river and stream segments with high recreational and ecological value.”
Existing Mapping Tool

http://www.cnhp.colostate.edu/cwic/location/viewSpatialData.asp
Toolbox Base Layers

- Updated NWI data
- CNHP Potential Conservation Areas
- Land management
- Added LLWW attributes to NWI
- National Hydrography Dataset
- Hydric soils (where available)
- Land use
- 303(d) listed streams
- Instream flow reaches and lakes
- Water infrastructure (dams, major diversions, etc.)
- Irrigated lands
Attributing NWI with LLWW

- **Landscape, Landform, Water Flow Path, and Waterbody**
- **Goal:** Add hydrogeomorphic information to the NWI

...LLWW codes are cumbersome. We will use more intuitive terminology in the Toolbox.


(Tiner 2014)
LLWW Attribution: Modifiers

**LEGEND**

- **LLWW Modifiers**
  - Beavers
  - Partial drainage
  - Excavated
  - Fen
  - Impounded

Sources: Esri, HERE, DeLorme, Intermap, increment M Corp., GEBCO, USGS, FAO, NPS, NRC, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, OpenStreetMap contributors, and the GIS User Community
Mapping (Likely) Functions at the Catchment Scale

**Challenge:** providing a scientific basis for functional attribution (without an intensive field study)
Ecological Functions: Biodiversity Support

Is the wetland currently supporting high biological diversity, or a unique biotic community? Is the wetland surrounded by other unique wetlands?

- Potential Conservation Areas
- All least-altered fens
- Intact riparian areas
- Other known biodiversity hotspots
Hydrologic Functions: Surface Water Storage

Is the wetland (or complex) storing a large volume of surface water?

- Ponds and depressions
- Lakes and reservoirs
- Some beaver complexes
Hydrologic Functions: Moderating Highs and Lows

Flood Attenuation
• Storing and delaying surface water flow during storm events
• Floodplains, terrene ponds and depressions (with available storage capacity during storms)

Base Flow Augmentation
• Sustaining streamflow during the driest part of the year
• Groundwater-fed wetlands with connections to streams

Beaver wetland complexes

Image: Sarah Koenigsberg 2014
Does the wetland store sediment (and organic matter, adsorbed chemicals) delivered from upstream/upslope areas?

- Beaver complexes
- Floodplain wetlands
- Some depressions
- Other impounded riverine systems, or features associated with sediment deposition and storage
Does a wetland help remove, transform, or store nutrients, metals, and other potential pollutants?

- Fens
- Depressions serving as nutrient sinks
- Floodplain wetlands (especially wetlands with longer hydraulic retention time)
- Riparian buffers (between NPS pollution and streams)
Other Functions and Values

- Temperature regulation
- Carbon storage
- Recreational values
- Fish habitat
- Amphibian habitat
- Mammal habitat
- Shorebird habitat
- Songbird habitat
- Waterfowl habitat

Uland Thomas 2016

Colorado Whitewater
Some wetlands are superheroes! Ex. headwater stream flowing through a fen complex, with beavers

- High biodiversity support
- Peat $\rightarrow$ carbon storage
- Sediment storage
- Surface water storage
- Flood attenuation
- Base flow augmentation
- Temperature regulation
- Water quality maintenance
Mapping (Likely) Condition at the Catchment Scale

**Challenge:** combining landscape-scale and local stressors with field data

- Field Data and Literature Review
- NWI + LLWW
- Mapping Likely Functions
- Hydrologic Modifications
- Stressors
- Wetland Condition

**Legend**
- LLWV Modifications
  - Reavies
  - Partial drainage
  - Excavated
  - Ten
  - Impounded

**Color legend**
- No Observable Stress
- Low Stress
- Moderate Stress
- High Stress
- Severe Stress
From Function and Condition to Prioritization

Field Data and Literature Review

Mapping Likely Functions

NWI + LLWW

Hydrologic Modifications

Landscape Stressors

Wetland Condition

Potential Conservation

Potential Enhancement

Potential Restoration
Potential Conservation Priorities

- Sites that have no formal protection, but have:
  - High known or likely biodiversity support, with rare, or otherwise unique plant communities
  - Location within, adjacent to, or connecting larger wetland complexes (“missing puzzle piece”)

Legend:
- River Basins
- Major River Basins
- River Subbasins
- Counties
- County Boundary
- Wetland Mapping
- Emergent/Herbaceous; Freshwater Emergent Wetland
- Forested
- Pond
- Lake
- Other
- Riparian
- Rivers and Streams; Riverine
- Shrub-Scrub
- Colorado Wetlands Greyscale
- Wetland
- Potential Wetland Conservation Areas
  - B1: Outstanding Biodiversity Significance
  - B2: Very High Biodiversity Significance
  - B3: High Biodiversity Significance
  - B4: Moderate Biodiversity Significance
  - B5: General Biodiversity Interest
Potential Enhancement Priorities

• Locations across the landscape that are wetlands today, but are in poor condition
  • Example: riparian area that is currently a hay meadow but used to be a willow thicket

• High-priority sites: minimal inputs, maximum benefit
  • Example: install fencing along riparian area to prevent livestock grazing and provide off-channel water source for cattle; control invasive species and plant native riparian plants

• Medium-priority sites: higher inputs or less certain outcome
Potential Restoration Priorities

- Wetlands that have been partially or entirely converted to upland, but are known or likely historic wetlands

- *Could support wetland hydrology and vegetation again*
  - **Example:** fen complex with ditches that are causing groundwater drawdown and peat oxidation
    - Fill ditches
    - Revegetate bare areas
    - Plant native species as needed, particularly if plant community has shifted to a more disturbance-tolerant, low-diversity, or non-native plant community

- **High-priority sites:** “Low hanging fruit”; few inputs for high likelihood of meeting project objectives

- **Medium-priority sites:** More costly or more uncertain outcome for restoration activities
As we develop the Toolbox... 

- Our goal: create the most useful tool possible for you!
- **Your feedback** is invaluable
- Please fill out our survey to help guide Toolbox development

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