

# Enhanced Wetland Mapping: Opportunities for Tribes



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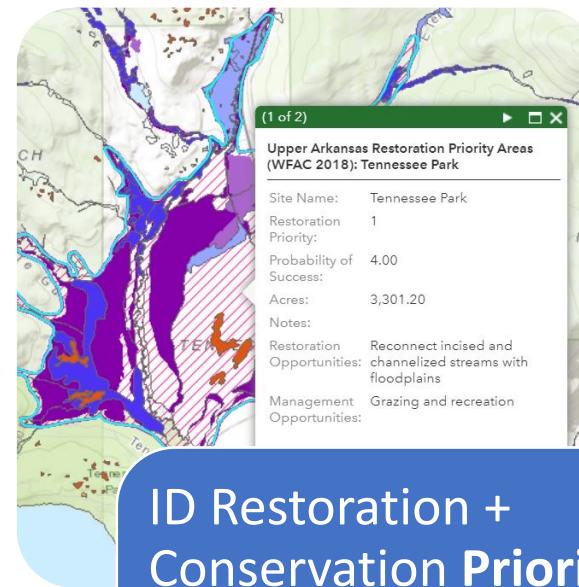


# Enhanced Wetland Mapping as a Tool for Watershed Planning

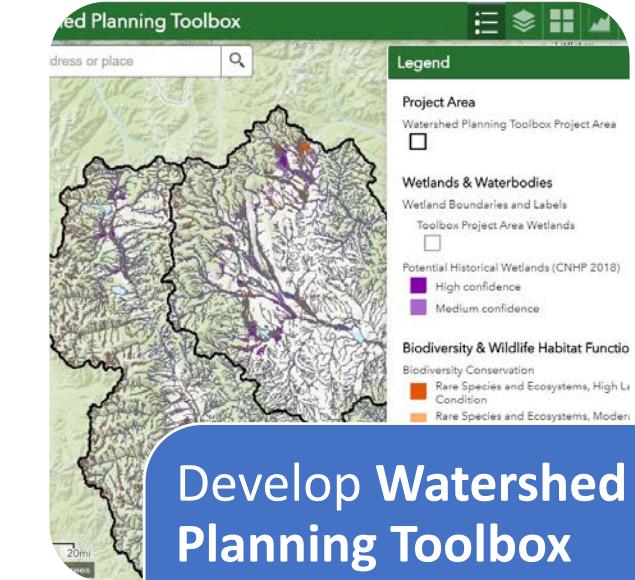


## Focused Wetland Mapping Updates

- Improves accuracy
- Major land use changes
- Functional attributes
- Add wetland type and land use attributes



- Large-scale or fine-scale
- Propose potential areas based field-level information
- Stakeholder collaboration and review



## Develop Watershed Planning Toolbox

- Several examples in various states
- Multiple data layers to support restoration and conservation activities



# USFWS National Wetland Inventory (NWI) Mapping

- National Wetland Inventory (NWI) is a program of the USFWS.
- Goal is to map wetlands across U.S. and track changes over time.
- Classification based on Cowardin et al. 1979. and 2013 revision.
- Original mapping was all on paper at lower resolution.



FWS/OBS-79/31  
DECEMBER 1979  
Reprinted 1992

## Classification of Wetlands and Deepwater Habitats of the United States



U.S. Department of the Interior  
Fish and Wildlife Service



# USFWS National Wetland Inventory (NWI) Mapping

Wetlands Mapper    +

fws.gov/wetlands/data/mapper.html

Apps Managed bookmarks Bookmarks AmazonSmile COVID-19 Home | Colorado C... Larimer County Pos... Other bookmarks

National Wetlands Inventory surface waters and wetlands

ABOUT GET DATA PRINT FIND LOCATION

BASEMAPS > Measure

MAP LAYERS >

Wetlands  
 Riparian  
 Riparian Mapping Areas  
 Data Source  
 Source Type

Wetlands Status

- Digital Data
- No Data

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub
- Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Legend

1:18,489,298  
45° 8' 40" N 112° 7' 27" W

U.S. FISH & WILDLIFE SERVICE  
DEPARTMENT OF THE INTERIOR

# USFWS National Wetland Inventory (NWI) Mapping

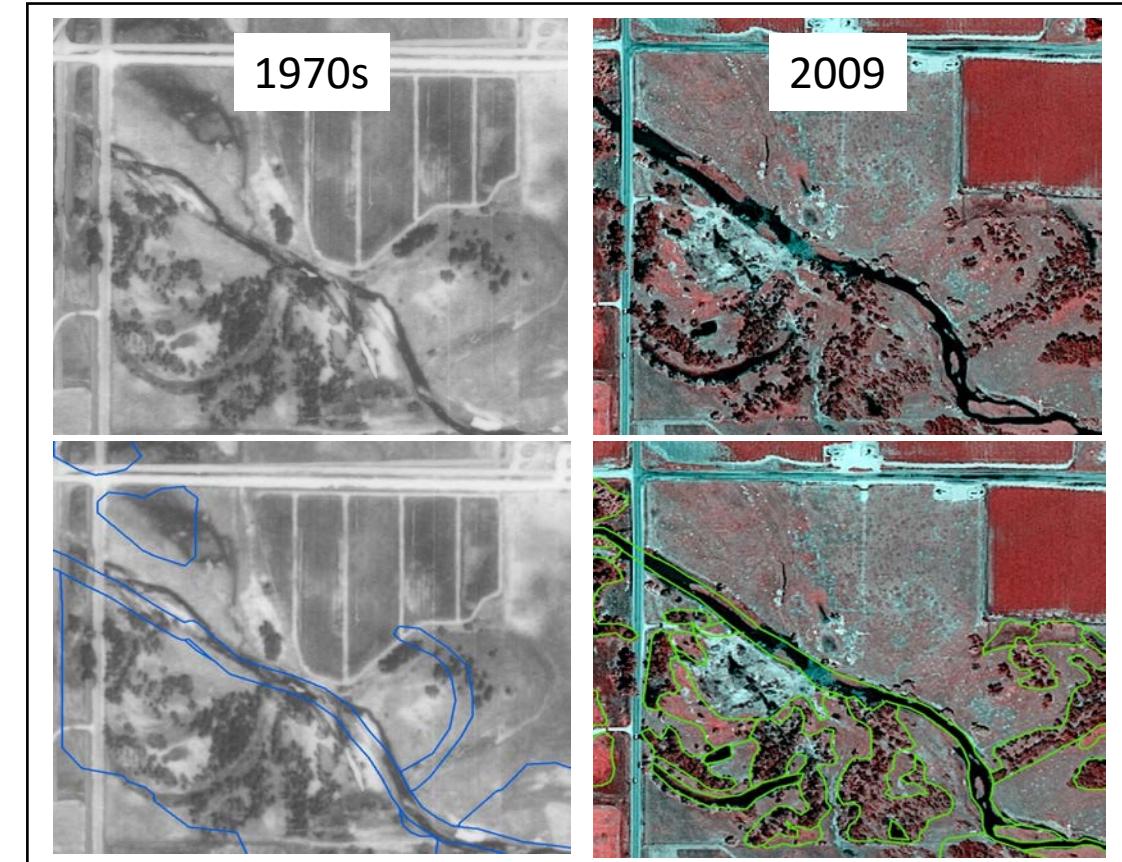
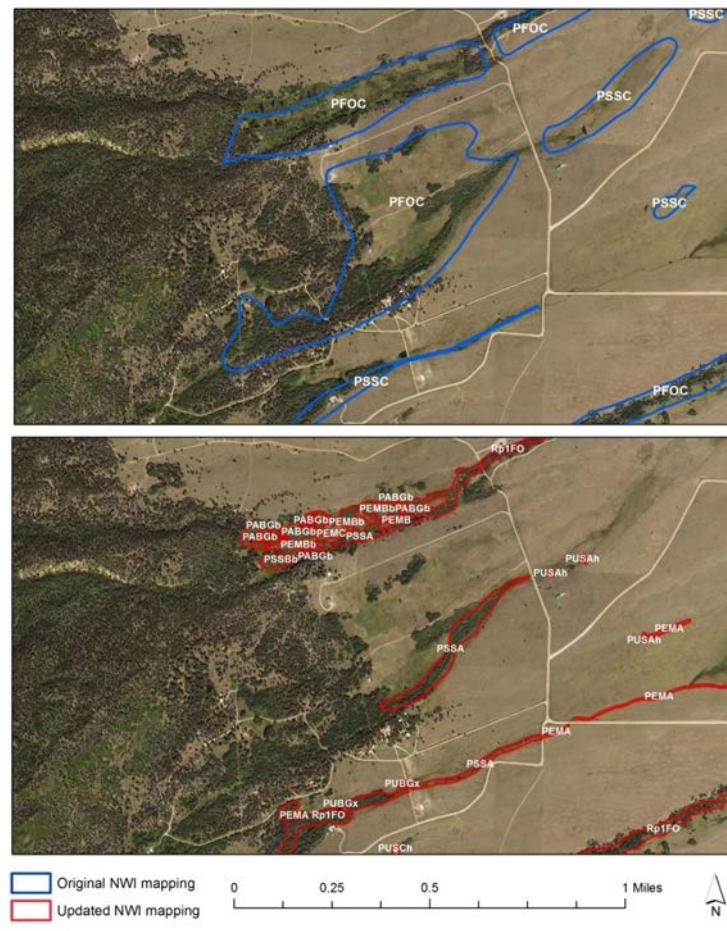
The screenshot shows a map of the Western United States with various wetland mapping projects highlighted. Projects from 2019 are shown in light blue, and those from 2020 are shown in dark blue. The map includes state boundaries, major cities, and national forests. A legend on the right side titled 'Mapping Projects' provides a key for the project status: 'Recent' (light blue), '2019' (light blue), and '2020' (dark blue). The 'Active' status is indicated by a small icon with a checkmark.

- NWI Projects Mapper tracks ongoing updates.
- Extensive updates currently underway across the West, funded by the BLM and others.
- Updates on tribal land can be funded by EPA WPDGs.
- Several strong wetland mapping partners with successful track records working with tribes.

**U.S. FISH & WILDLIFE SERVICE**  
DEPARTMENT OF THE INTERIOR

# Updated NWI Mapping Increases Accuracy

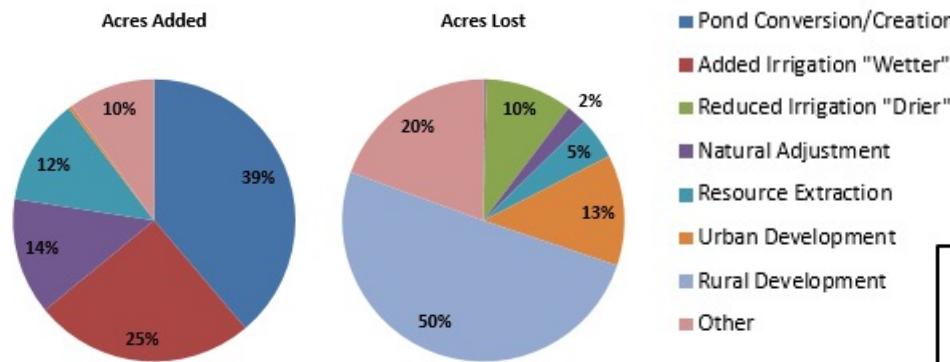
- Updated mapping used higher resolution imagery and maps at a finer scale.
  - Original NWI mapping can both over and under map wetlands on the landscape.
  - Original polygons are often large blocks that incorporate both upland and wetland.
  - Original mapping can also miss small features.



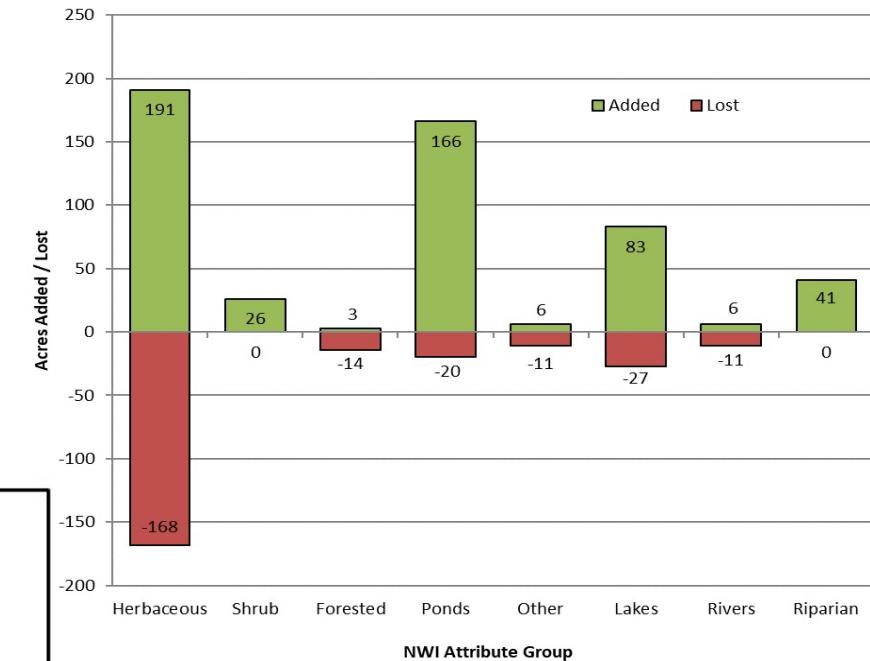
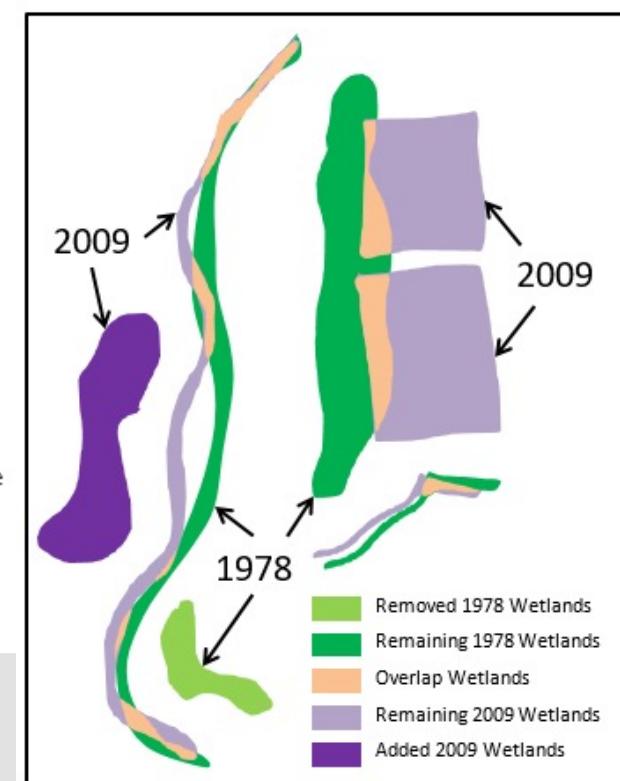
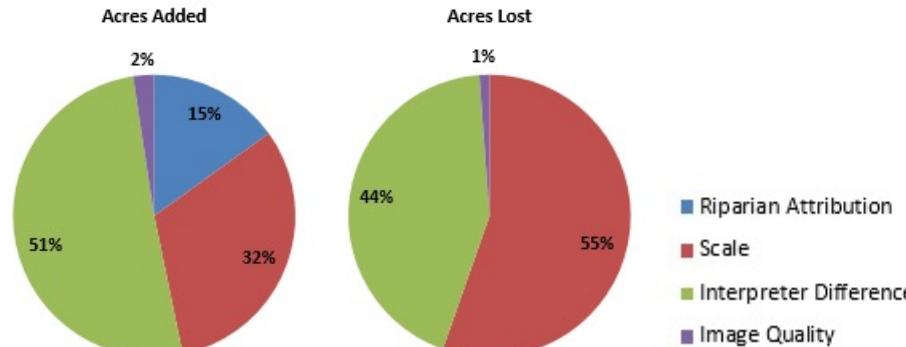
# Updated NWI Mapping Increases Accuracy

- Intensive studies can detect change over time in wetland area, but this requires identifying changes in mapping methods and changes on the landscape.

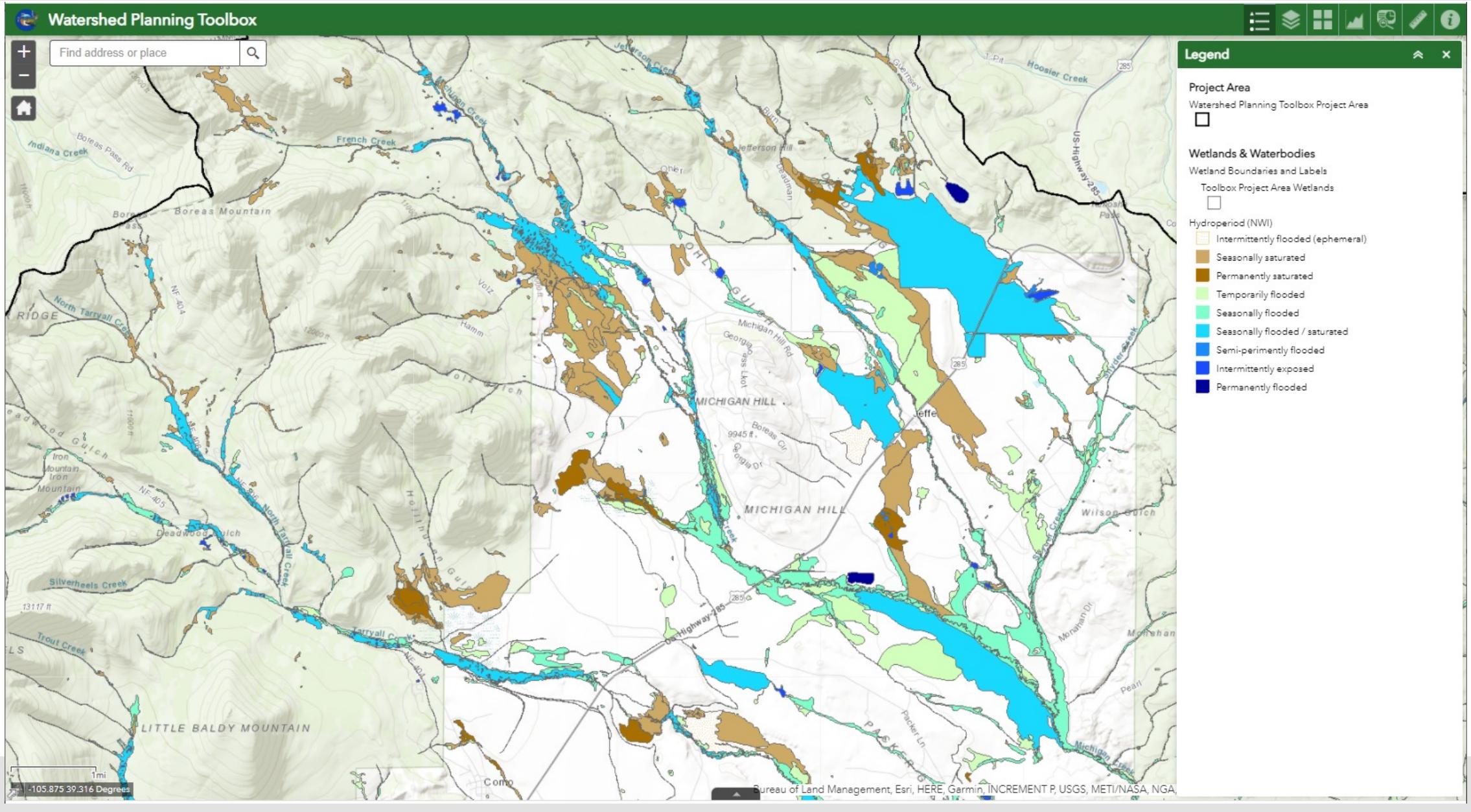
LANDSCAPE CHANGES



MAPPING CHANGES



# Updated NWI Mapping Increases Accuracy - Hydroperiod



# Linking NWI Mapping to Common Wetland Types

## Wet Meadow



## Riparian Shrubland



## Fen



## Riparian Forest



# Linking NWI Mapping to Common Wetland Types

## Wet Meadows



## Riparian Shrublands



- May occur on wide, low-gradient **valley bottoms and floodplains**
  - May occur in **headwater basins** that feed into streams
    - Often snowmelt-driven with groundwater inputs
    - Often occur together (adjacent or mosaic)
    - Often associated with **beaver activity**

Fen

Wet Meadow

Marshes, Riparian Wetlands

Least

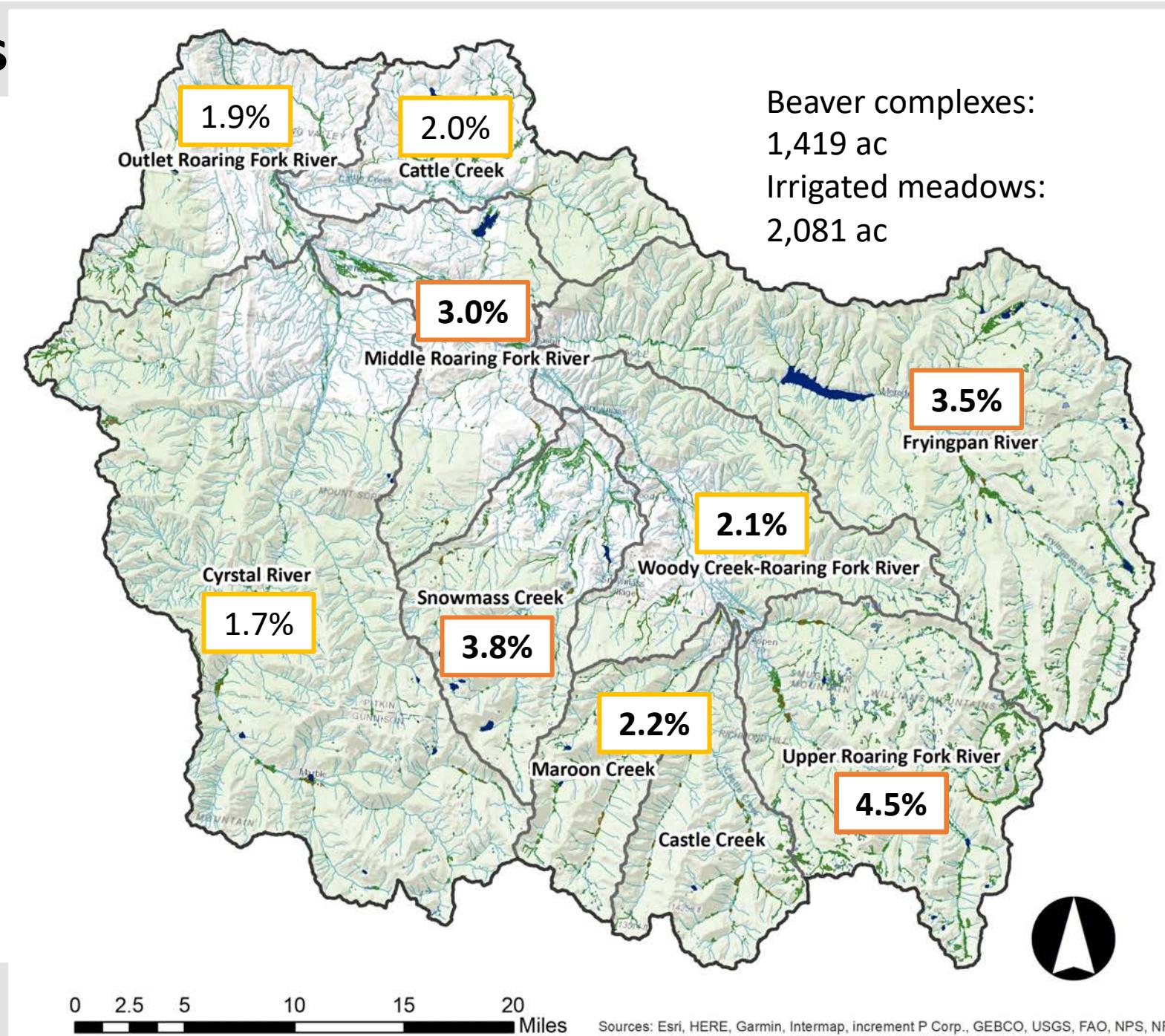
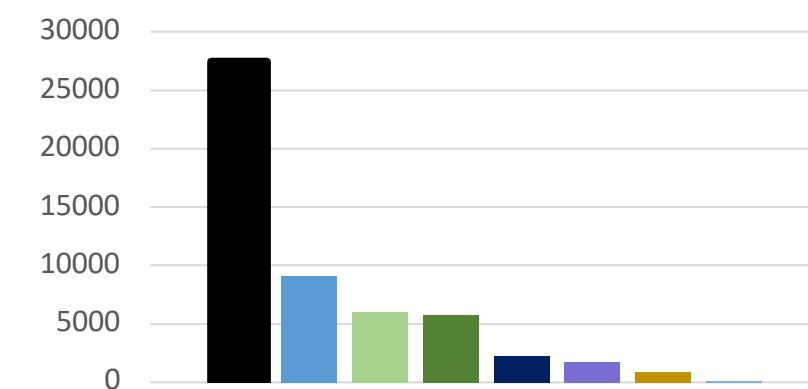


Most Dynamic Hydrology

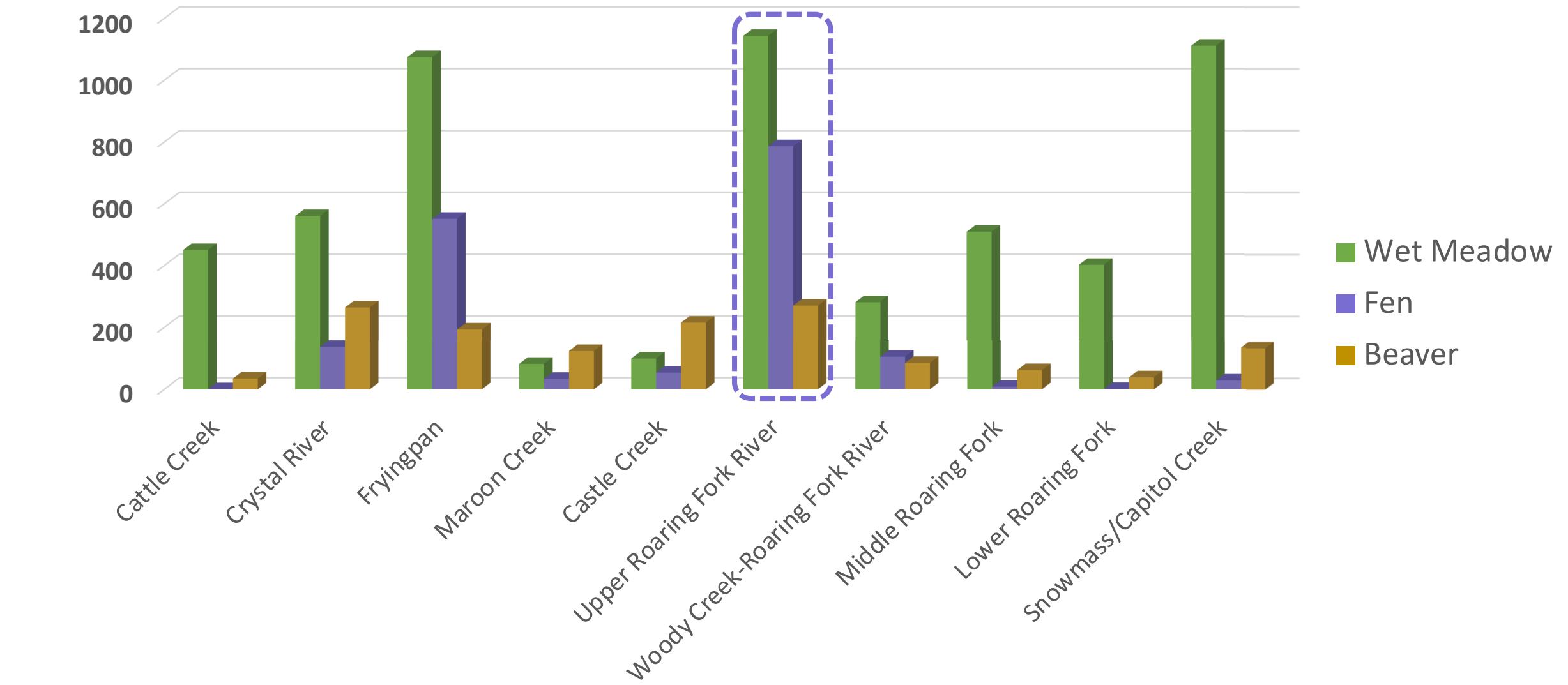


# Wetland Mapping Updates

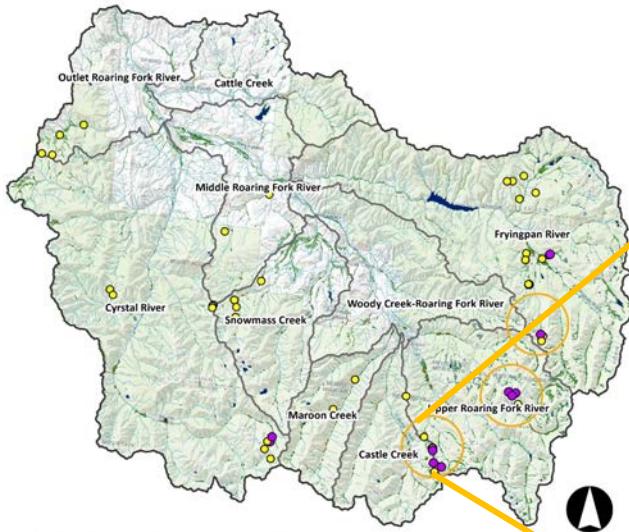
Total	27,416 ac
Stream channels + bars	9,102 ac
Wet meadows	6,049 ac
Riparian Shrublands	5,765 ac
Lakes	2,221 ac
Fens	1,731 ac
Emergent Marshes	901 ac
Riparian Woodlands	96 ac



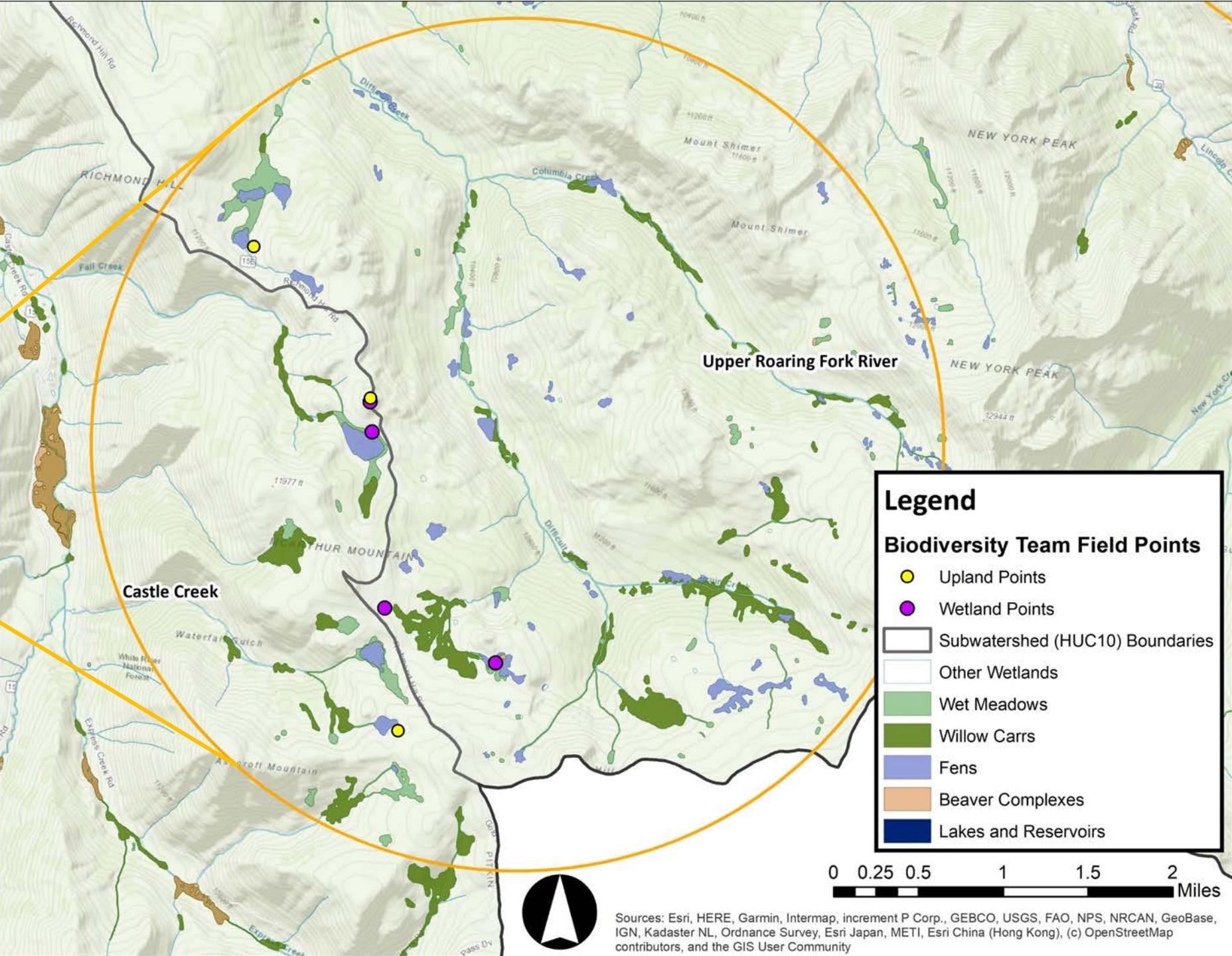
# Wetland Acreage by Type and Subwatershed (HUC10)



# Upper Roaring Fork River



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors.



## Legend

### Biodiversity Team Field Points

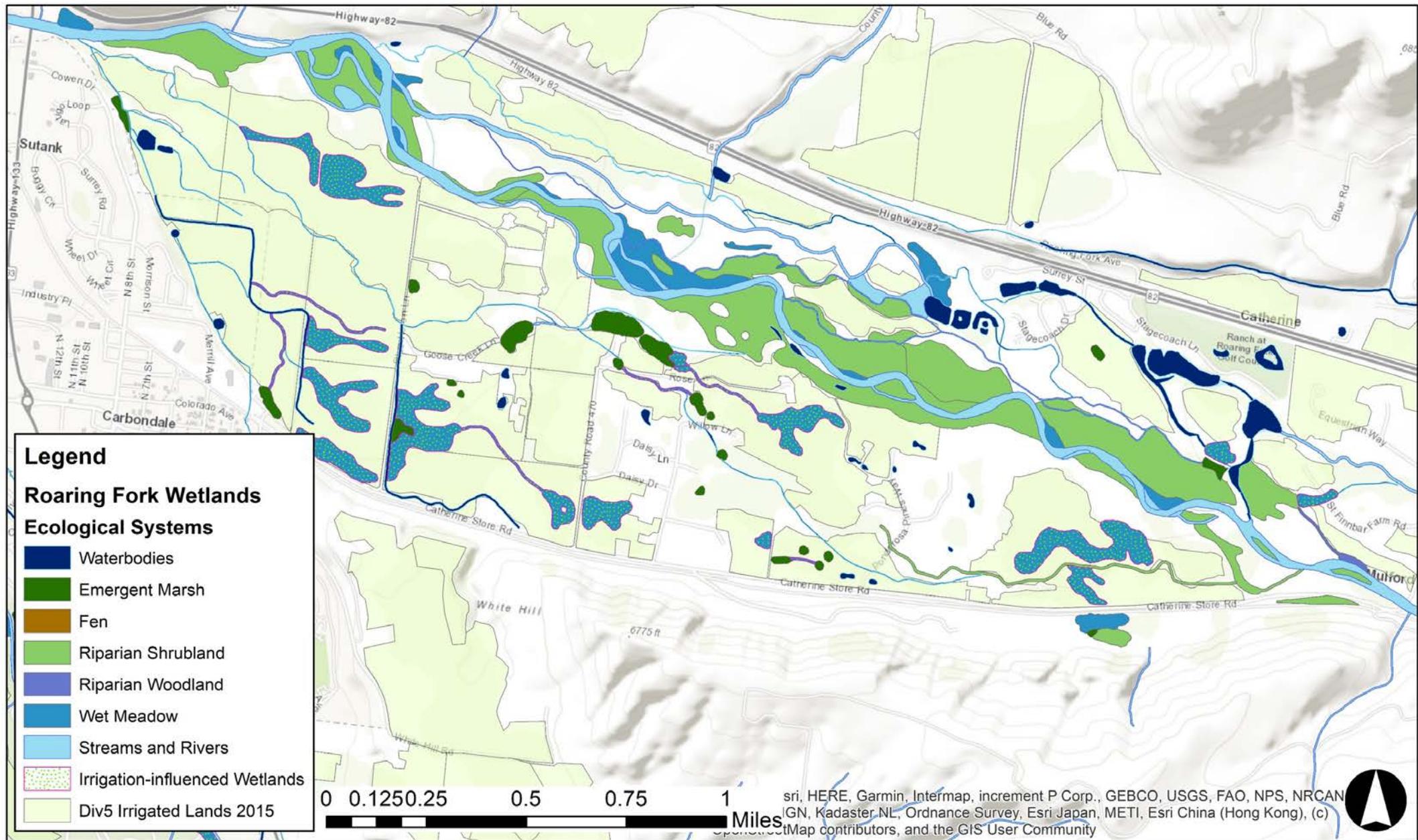
- Upland Points (Yellow dot)
- Wetland Points (Purple dot)
- Subwatershed (HUC10) Boundaries (Black line)
- Other Wetlands (Light blue)
- Wet Meadows (Light green)
- Willow Carrs (Dark green)
- Fens (Medium blue)
- Beaver Complexes (Orange)
- Lakes and Reservoirs (Dark blue)

0 0.25 0.5 1 1.5 2 Miles

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



# Interaction between Wetlands and Irrigation



# Enhancing NWI Mapping with Functional Attributes

## LLWW Classification

### Landscape position:

Lotic (LO), Lentic (LE), Terrene (TE)

### Landform:

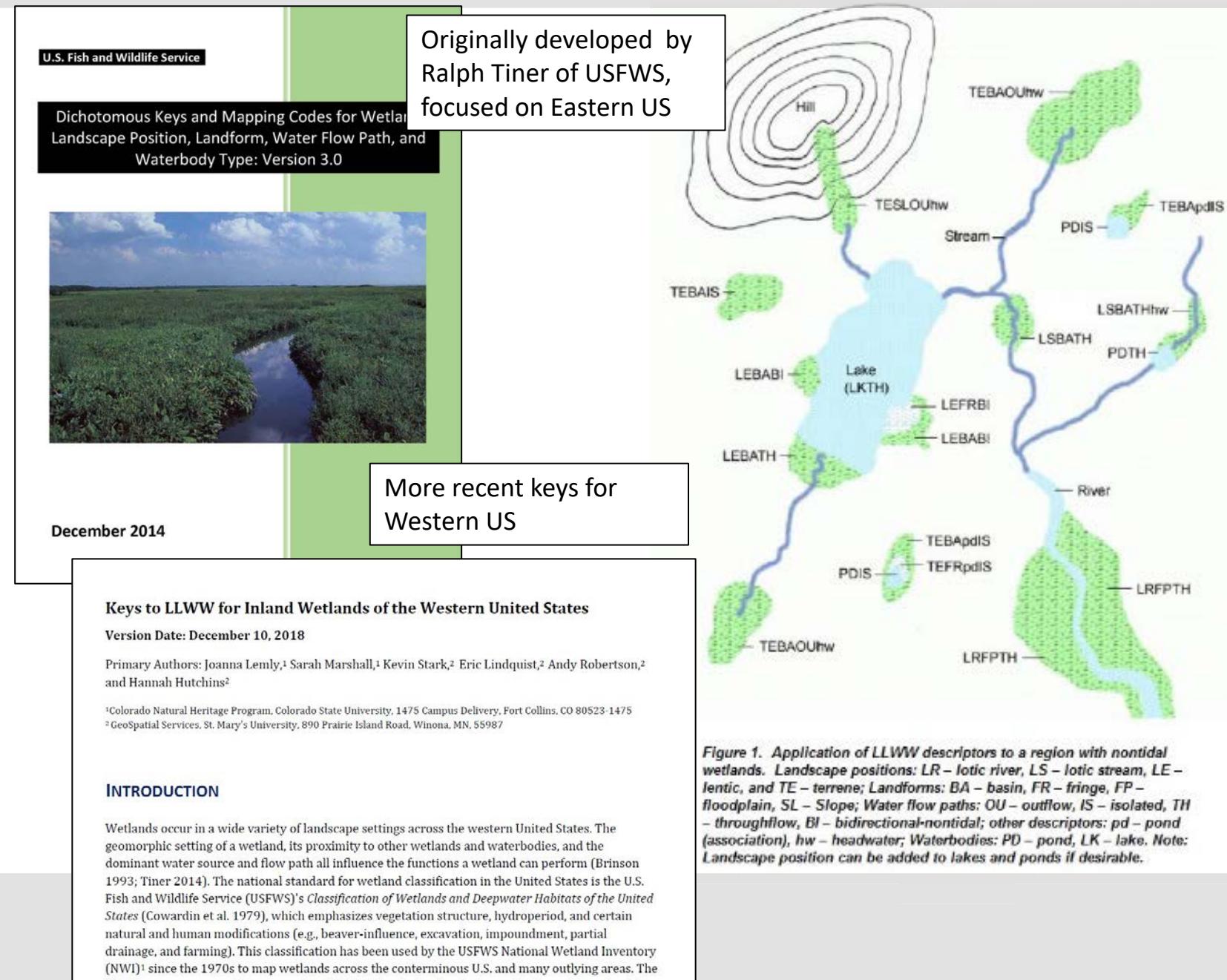
Basin (BA), Slope, SL), Floodplain (FP), Fringe (FR), Flat (FL)

### Waterbody type:

River (RV), Stream (ST), Lake (LK), Pond (PD)

### Water flow path:

Inflow (IN), Outflow (OU), Vertical flow (VR), Throughflow (TH), Bidirectional (BI), Throughflow-Bidirectional (TB)



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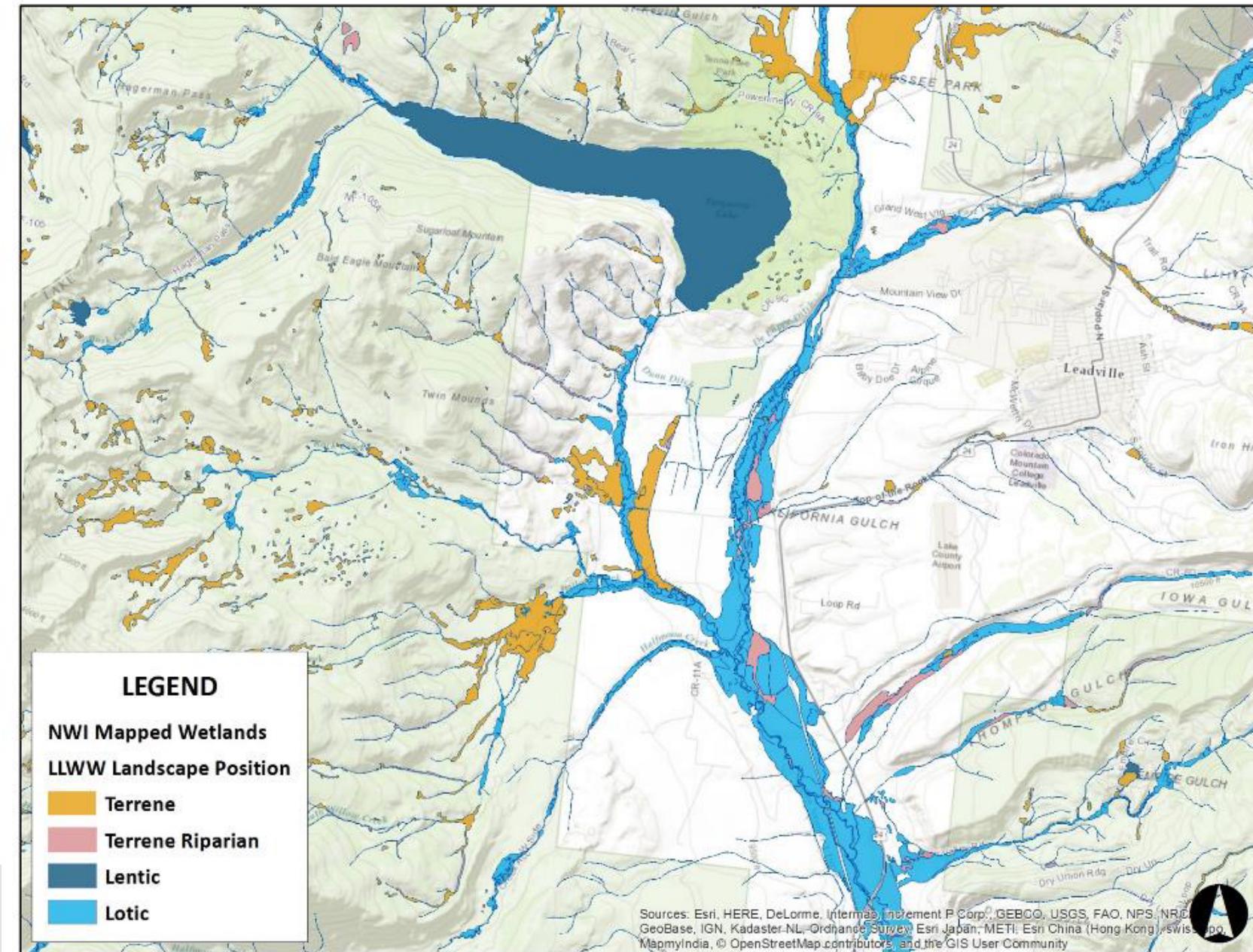
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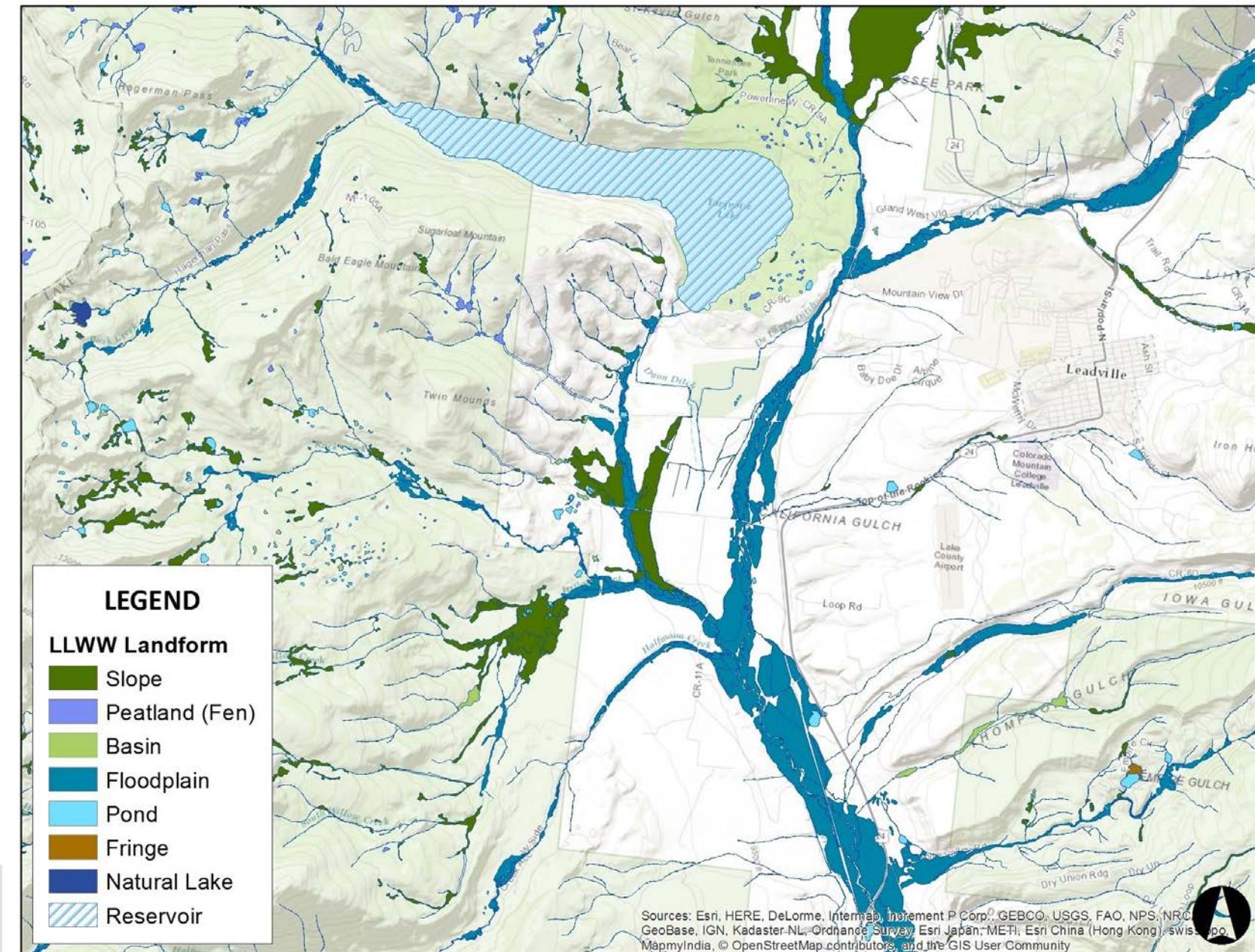
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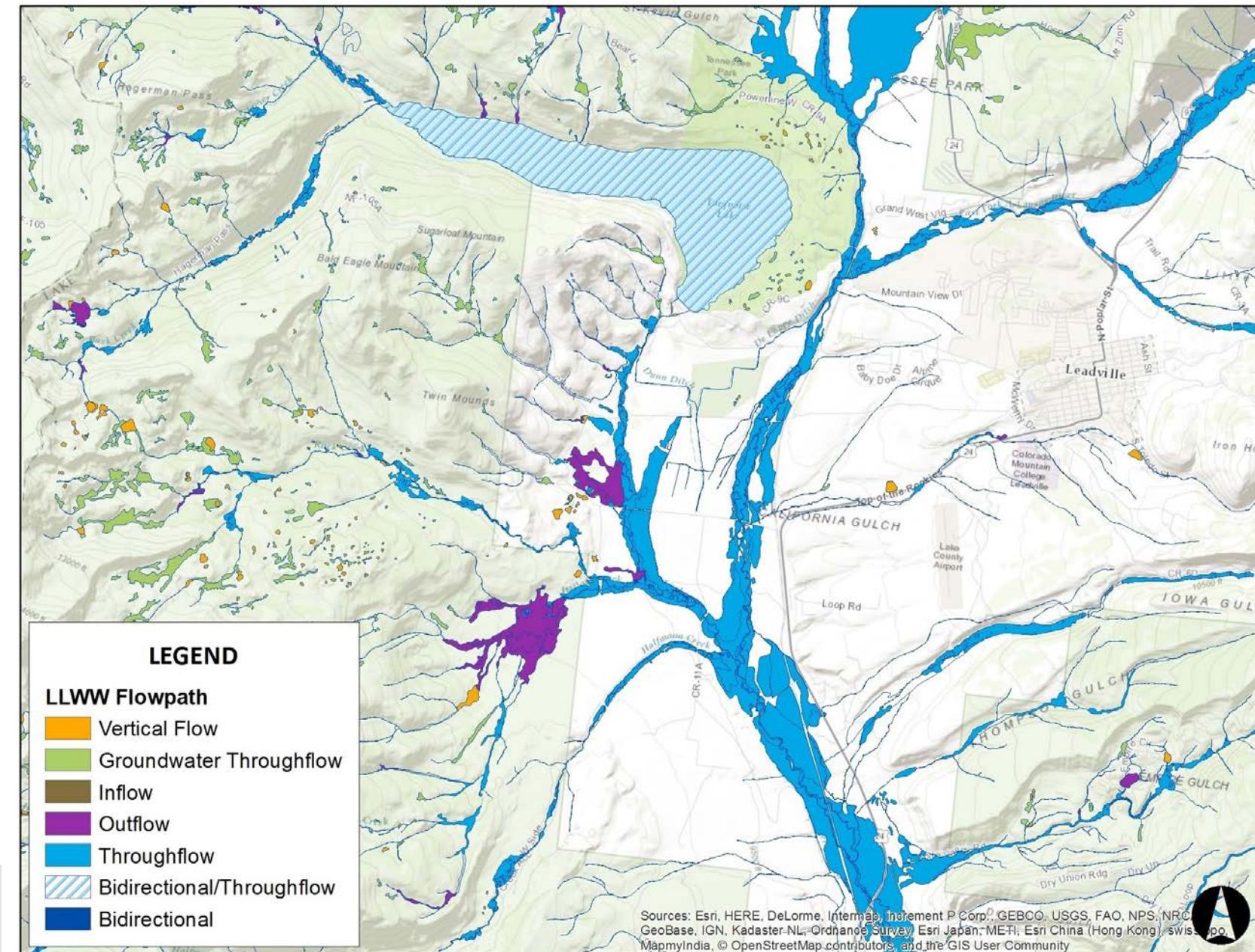
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# Enhancing NWI Mapping with Functional Attributes

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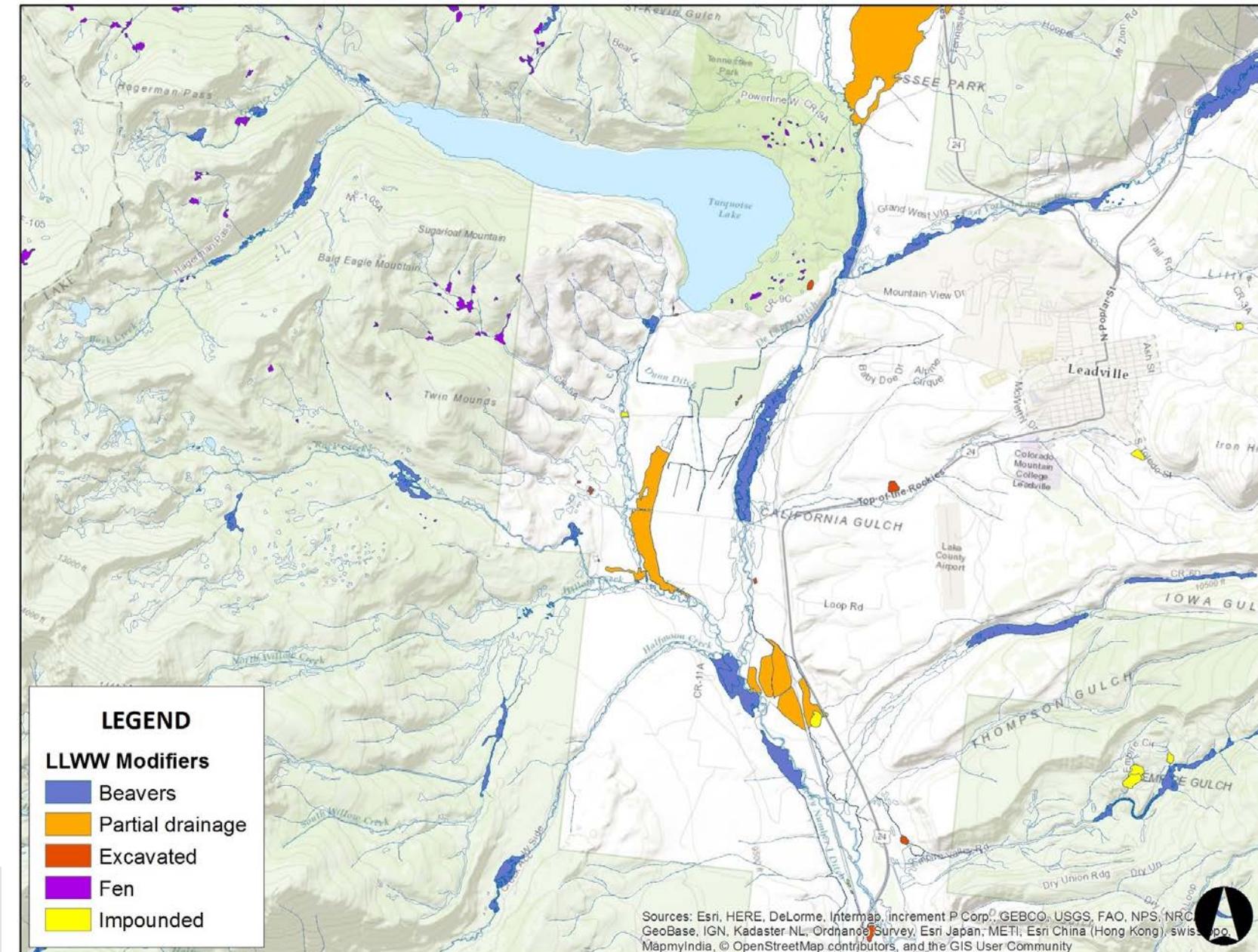
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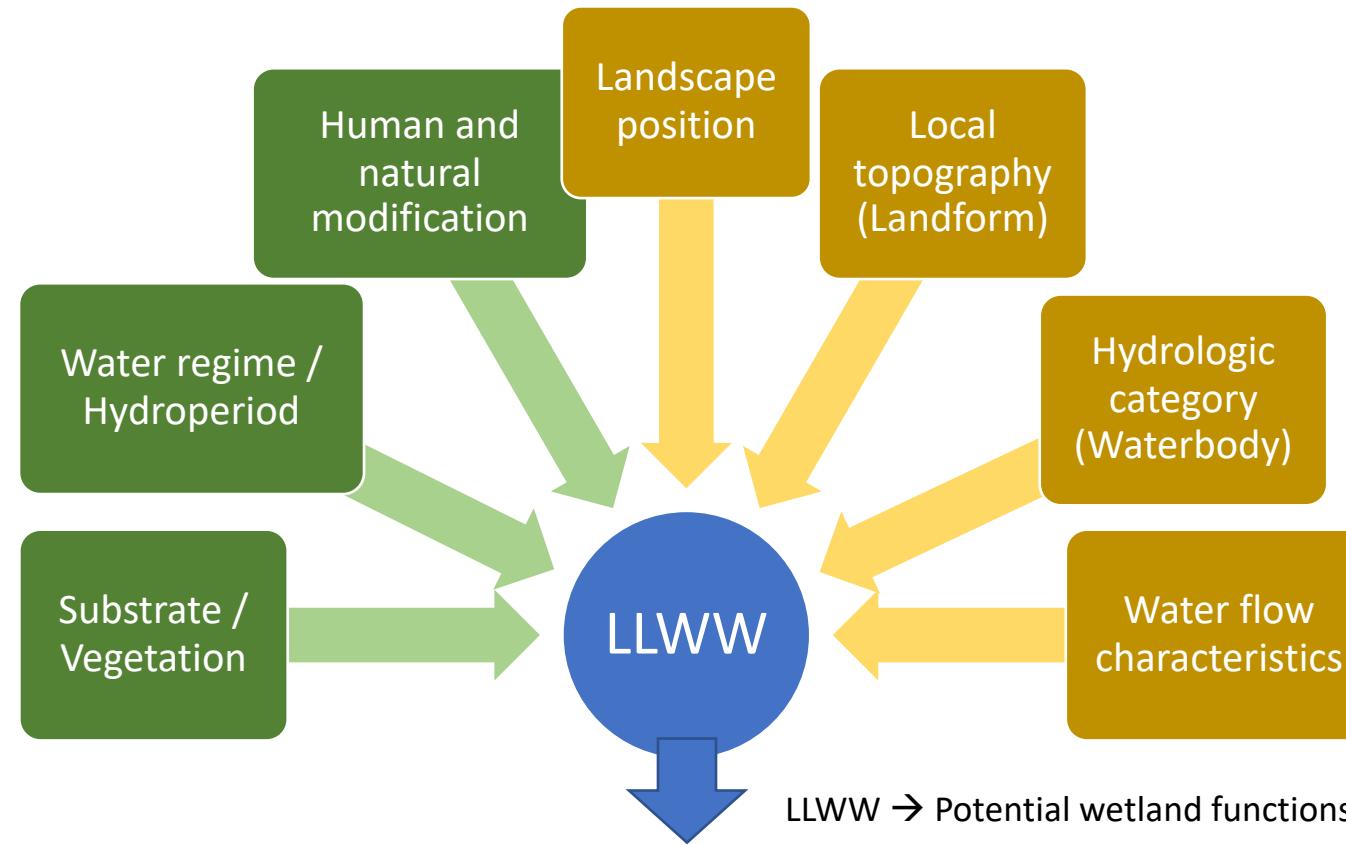


# Mapping Wetland Functions

Slide adapted from Sara Owen,  
University of Montana

NWI

HGM



Surface water storage	Nitrogen uptake and removal	Biodiversity conservation
Flood attenuation	Phosphorus removal and storage	Aquatic invertebrate habitat
Sediment capture and retention	Metals removal and storage	Shorebird habitat
Stream flow maintenance	Carbon storage	Waterfowl habitat
Groundwater recharge	Temperature regulation	
Bank and shoreline stabilization		



# Mapping Wetland Functions: Nitrogen Uptake and Removal

**Watershed Planning Toolbox**

Find address or place

**Legend**

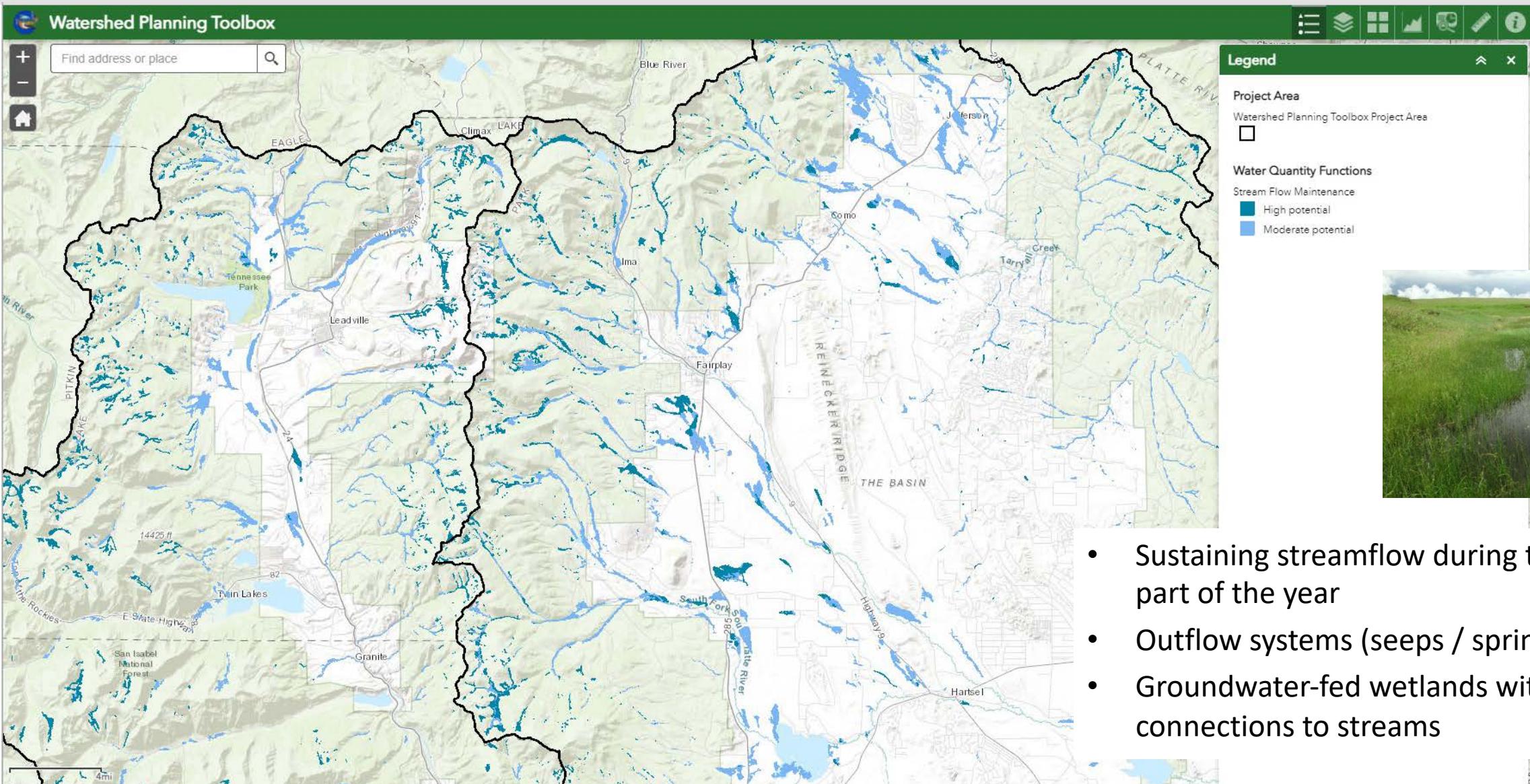
Project Area  
Watershed Planning Toolbox Project Area

Water Quality Functions  
Nitrogen Uptake and Removal  
High potential (dark red)  
Moderate potential (light red)

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

4mi

# Mapping Wetland Functions: Stream Flow Maintenance



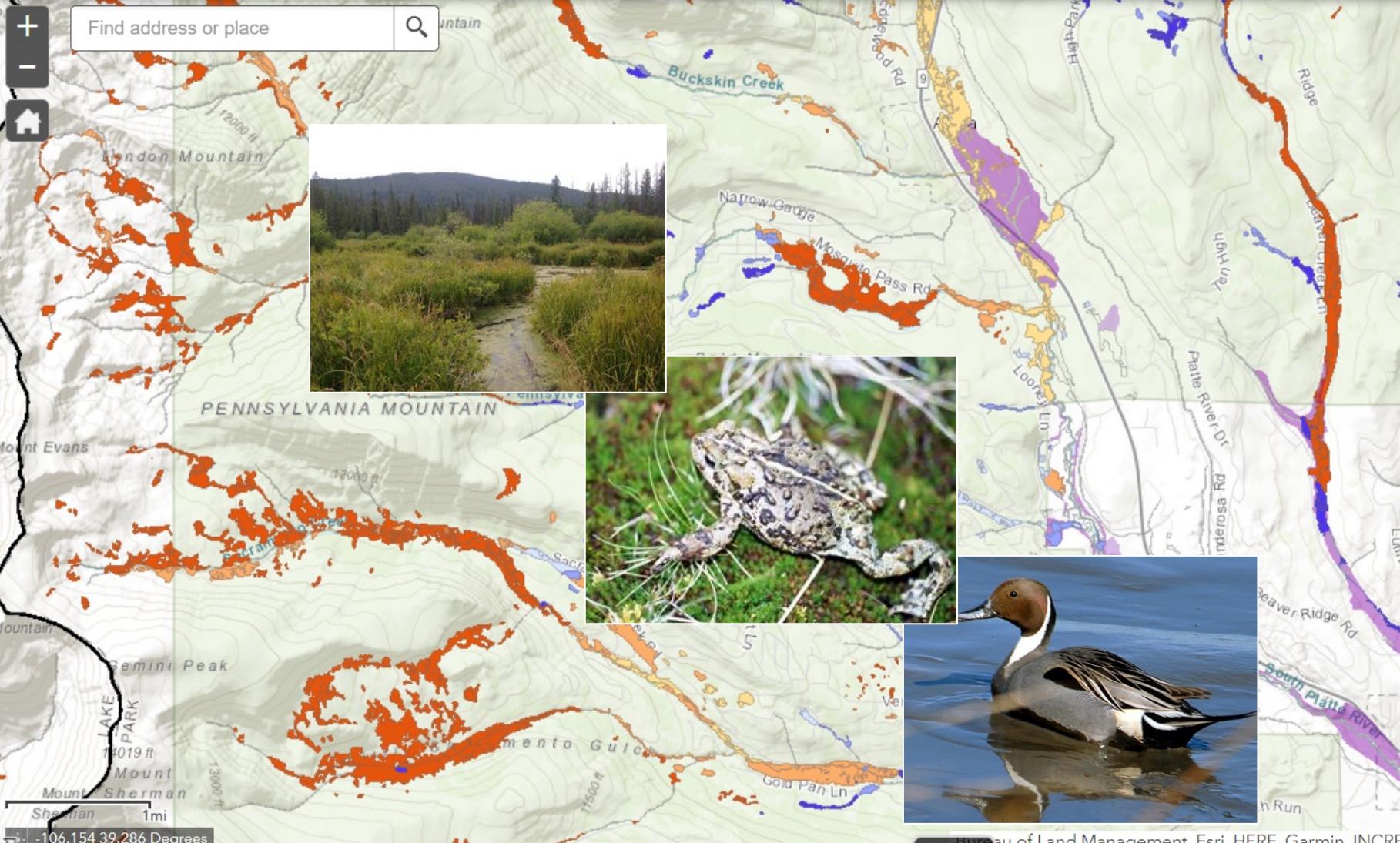
- Sustaining streamflow during the driest part of the year
- Outflow systems (seeps / springs / fens)
- Groundwater-fed wetlands with connections to streams



# Mapping Wetland Functions: Biodiversity Hotspots

**Watershed Planning Toolbox**

Find address or place 



**Legend**

**Project Area**  
Watershed Planning Toolbox Project Area

**Wetlands & Waterbodies**  
Wetland Boundaries and Labels  
Toolbox Project Area Wetlands

Potential Historical Wetlands (CNHP 2018)  
■ High confidence  
■ Medium confidence

**Biodiversity & Wildlife Habitat Functions**

**Biodiversity Conservation**

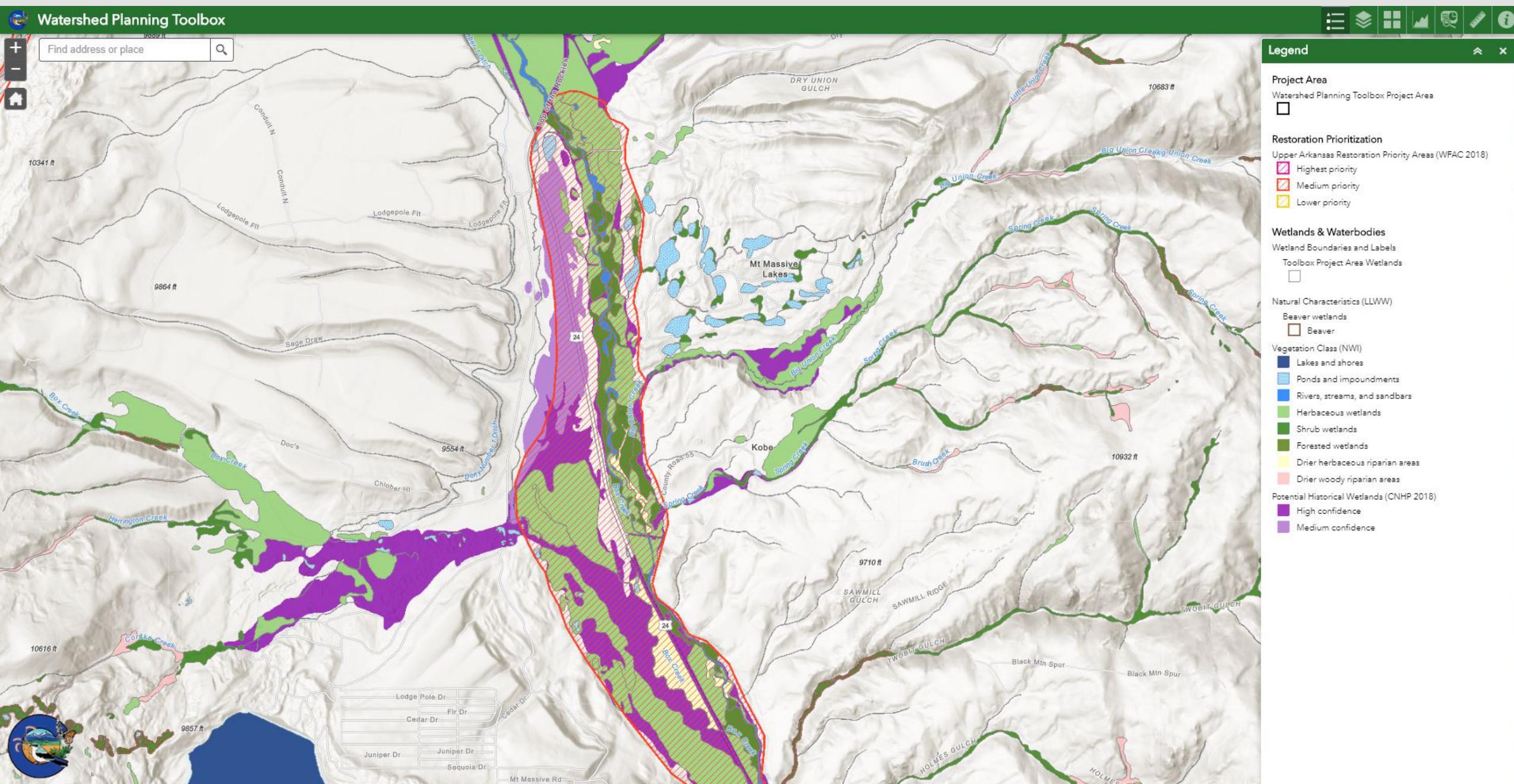
- Rare Species and Ecosystems, High Landscape Condition
- Rare Species and Ecosystems, Moderate Landscape Condition
- Rare Species and Ecosystems, Poor Landscape Condition
- High Biodiversity Support, High Landscape Condition
- High Biodiversity Support, Moderate Landscape Condition
- High Biodiversity Support, Poor Landscape Condition


-106.154 39.286 Degrees

Bureau of Land Management, Esri, HERE, Garmin, INCREM

# Identifying Restoration Priorities: Mapping Historical Wetlands



# Identifying Restoration Priorities: Stakeholder Involvement

## Watershed Planning Toolbox

The screenshot shows a map interface for watershed planning. At the top, there's a search bar labeled "Find address or place" with a magnifying glass icon. To the right are several icons for map navigation and analysis. The main map area shows a river system with several gulches and lakes, including Porcupine Gulch, St. Kevin Gulch, and Turquoise Lake. A large area of purple shading represents wetland priority areas. A callout box titled "(1 of 2) Upper Arkansas Restoration Priority Areas (WFAC 2018): Tennessee Park" provides the following details:

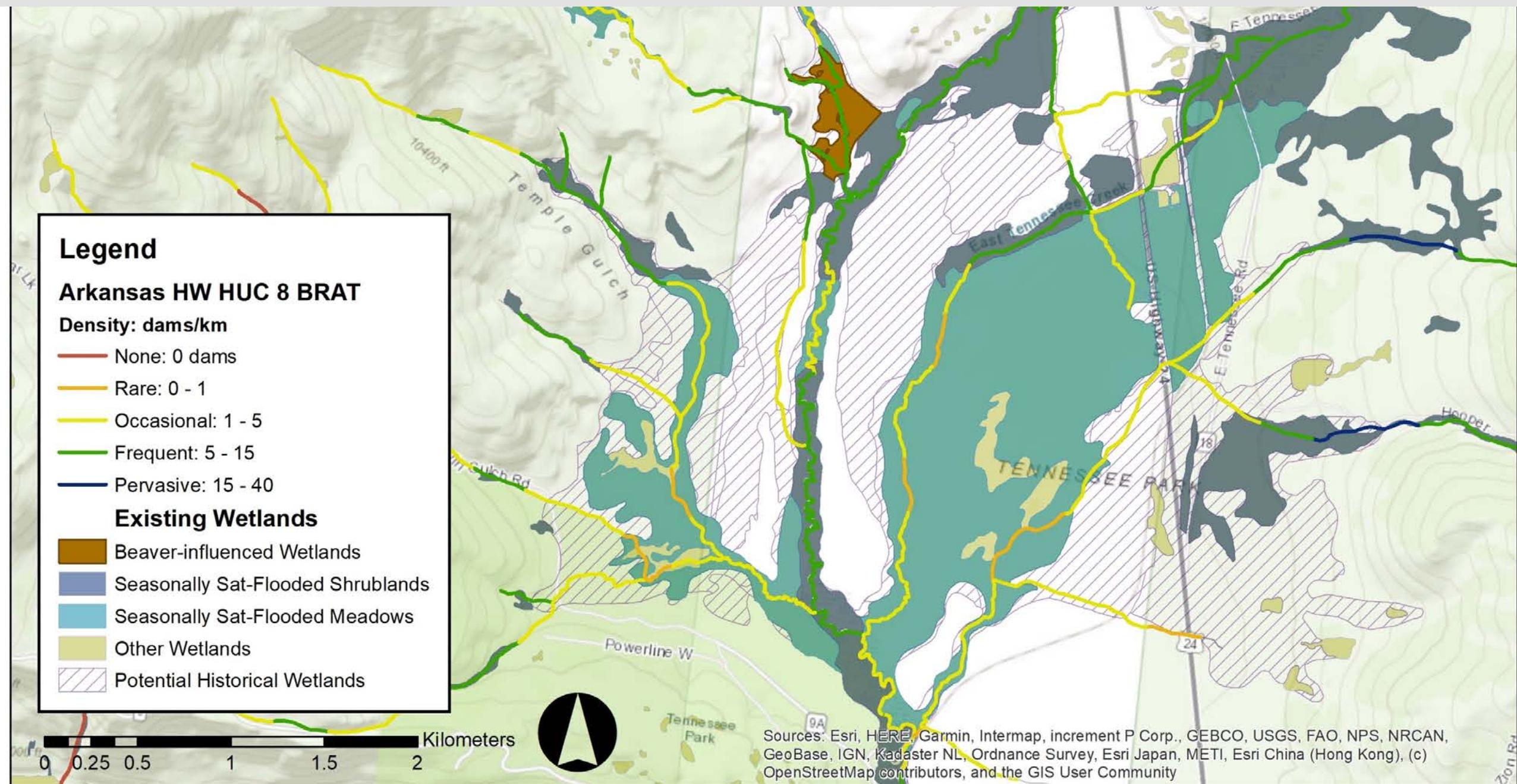
Site Name:	Tennessee Park
Restoration Priority:	1
Probability of Success:	4.00
Acres:	3,301.20
Notes:	Reconnect incised and channelized streams with floodplains
Management Opportunities:	Grazing and recreation

Below the map, there's a legend section with the following entries:

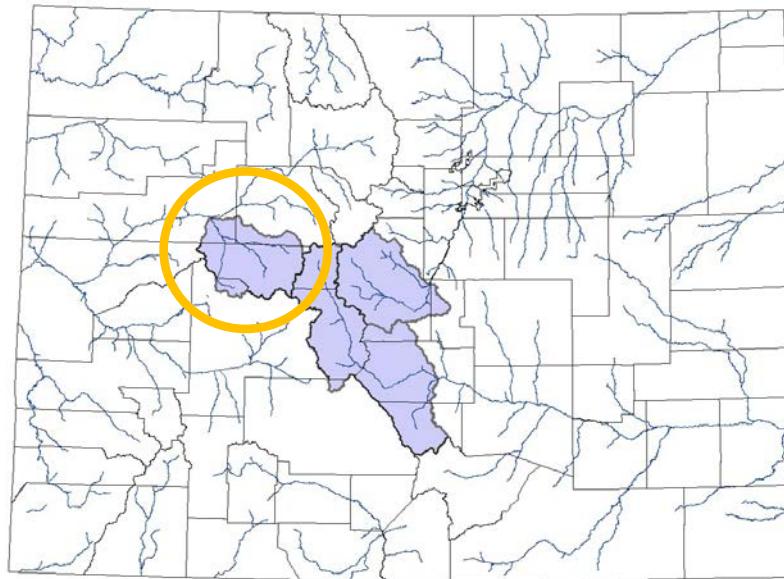
- Project Area:** Watershed Planning Toolbox Project Area (represented by a white square)
- Wetlands & Waterbodies:** Wetland Boundaries and Labels (represented by a white square)
- Toolbox Project Area Wetlands:** Toolbox Project Area Wetlands (represented by a white square)
- Potential Historical Wetlands (CNHP 2018):**
  - High confidence (dark purple square)
  - Medium confidence (light purple square)
- Restoration Prioritization:**
  - Park County Wetland Restoration Priority Areas (EcoMetrics 2016):
    - Highest priority (diagonal lines)
    - Medium priority (solid orange)
  - Upper Arkansas Restoration Priority Areas (WFAC 2018):
    - Highest priority (pink)
    - Medium priority (orange)
    - Lower priority (yellow)

At the bottom left, there's a small circular logo with a bird and the text "839.316 Degrees". The bottom right contains copyright information: "Bureau of Land Management, Esri, HERE, Garmin, INCREM".

# Identifying Restoration Priorities: Opportunities for Beaver

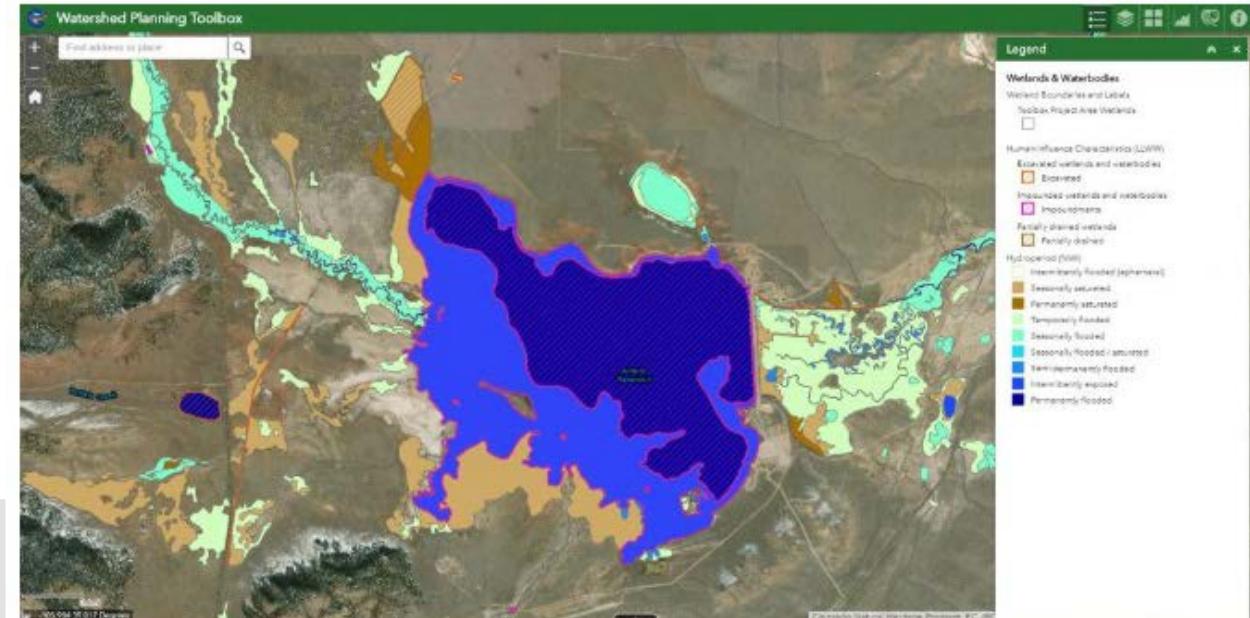


# Developing a Watershed Planning Toolbox



The [Watershed Planning Toolbox](#) is a comprehensive resource for incorporating wetlands and streams into watershed planning, restoring wetlands to improve watershed health, and identifying opportunities for wetland conservation. Many Toolbox data layers have statewide coverage, while some more detailed layers for wetland functions and priority conservation and restoration are building out from the Arkansas and South Platte Headwaters Project Area. The Toolbox includes an interactive mapping platform that allows users to view wetlands, streams, likely aquatic ecosystem functions, ecological stressors, and high-priority sites for conservation and restoration at the landscape scale. Along with geospatial data, the Toolbox includes a gateway to a variety of other restoration and conservation resources via the [Working in Wetlands](#) web pages.

- Launch the [Watershed Planning Toolbox Mapping Tool](#)
- Read the [Watershed Planning Toolbox Report](#)
- Read the [Keys to LLWW for Inland Wetlands of the Western United States](#)



# Developing a Watershed Planning Toolbox

## Watershed Planning Toolbox

Find address or place

Legend

### Water Quality Functions

Supporting Water Quality Information

- Stream Water Quality (WQCD 2018)
  - 1 - Fully supporting for all uses
  - 2 - Some uses have been assessed
  - 3a - Not assessed for any uses
  - 3b - Potential impairment (not enough data)
  - 4a - TMDL completed
  - 5 - Placed on CO 303(d) List; no TMDL

### Water Quantity Functions

Supporting Water Quantity Information

- Natural Seeps and Springs (USGS 2017)
  - SpringSeep
- Active Points of Diversion (CDWR 2018)
  - Seeps and Springs
  - Groundwater Wells
  - All Other Surface Water
- Decreed Instream Flow Stream Reaches (CDWR 2018)
- Compiled Statewide Irrigated Lands (CDWR 2017)
- Flood Hazards (FEMA 2017)
  - Approximate 100-year floodplain (1% annual chance)

2mi  
39.304 Degrees

County of Eagle, Bureau of Land Management, Esri, HERE



# Questions?

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[www.cnhp.colostate.edu](http://www.cnhp.colostate.edu)

