

# Wetlands (11:25-11:45)

Joanna Lemly, CNHP

Lindsay Reynolds, BLM

Kate Dwire, USFS

Page Weil, Lynker Technologies



# CNHP's Wetland Team



***Joanna Lemly***

**Wetland Ecologist and  
Team Leader**

- Wetland monitoring and assessment
- Protocol development
- Landscape-scale sampling
- Wetland mapping
- Wetland field guides and educational resources



***Sarah Marshall***

**Ecohydrologist**

- Wetland restoration
- Wetland functions and services
- Spatial modeling
- Landscape analysis of watershed priorities



***Laurie Gilligan***

**Wetland Ecologist**

- Wetland condition / function assessment
- Front Range and Eastern Plains wetlands
- Groundwater-dependent wetlands
- Wetland botany
- DEI in conservation



***Gabrielle Smith***

**GIS Analyst and Wetland  
Mapping Specialist**

- National Wetland Inventory (NWI) mapping
- Fen mapping for USFS
- ESRI ArcGIS Online tool development
- DEI in conservation



***Lewis Messner***

**Wetland Ecologist**

- Wetland monitoring and assessment
- Wetland botany



# CNHP's Wetland Team – BLM AIM Support



***Tess Webb***

**Aquatic Ecologist  
(Salt Lake City, UT)**

- Stream monitoring
- Data analysis
- Crew management
- Electronic data capture tool development
- Survey123 / Field Maps



***Ruth Whittington***

**Wetland Data Analyst**

- Data analysis
- Data management
- Survey designs
- ESRI ArcGIS Online tool development
- Wetland soils



***Katrina Castro***

**Aquatic Ecologist  
(Salt Lake City, UT)**

- Wetland monitoring
- Stream monitoring
- Crew management
- Training
- Logistical support



***Alexa Armstrong***

**Wetland Ecologist**

- Wetland monitoring
- Crew management
- Training
- Logistical support



***Alex Binsfeld***

**Aquatic Ecologist**

- Stream monitoring
- Aquatic macro-inverts
- GIS analysis

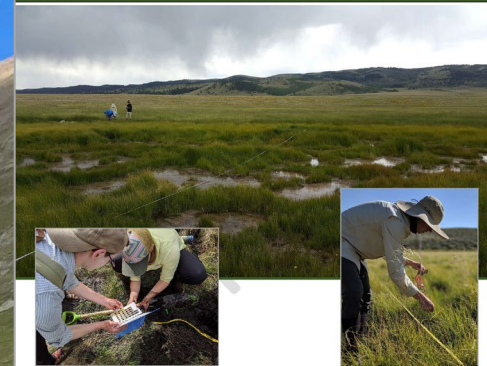




# Wetland Monitoring and Assessment

- BLM Riparian and Wetland AIM (wetland monitoring)
- BLM Lotic AIM (stream monitoring)
- EPA National Wetland Condition Assessment
- Ecological Integrity Assessment (EIA)
- Front Range Wetland Assessments
- Groundwater-Dependent Wetlands on the Plains

AIM National Aquatic Monitoring Framework:  
Field Protocol for Lentic Riparian and Wetland Systems  
2021 REVIEW DRAFT



Technical Reference 1735-X  
January 2021



## Ecological Integrity Assessment for Colorado Wetlands Field Manual, Version 2.1



March 2016

Colorado State University

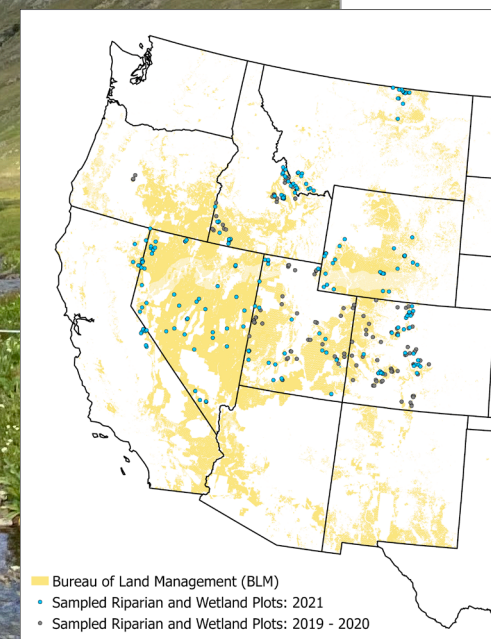


U.S. Environmental Protection Agency  
Office of Water  
Washington, DC  
EPA 843-B-21-002

## National Wetland Condition Assessment 2021

### Field Operations Manual

Version 1.0, April 2021





# Online Wetland Maps and Tools

Colorado Wetland Information Center

Managed bookmarks Bookmarks Case data | Colorad... Larimer County Pos... Home - COVID-19... Disney+ | Movies a... CNHP NWCA Field... AmazonSmile

Other bookmarks Reading list

Colorado Wetland Information Center

About CWIC Wetland Types Wetland Condition Working in Wetlands Data & Tools Library CNHP Home

Collaborations & Partnerships

- U.S. Environmental Protection Agency
- Colorado Parks & Wildlife
- CO Department of Transportation
- NatureServe
- U.S. Forest Service
- Bureau of Land Management
- U.S. Fish & Wildlife Service
- GOCCO Great Outdoors Colorado

CNHP is currently working with eight state agencies to craft a joint strategic plan for managing and protecting wetlands in Colorado.

[Read More »](#)

## Colorado's Source for Comprehensive Wetland Information

The Colorado Wetland Information Center (CWIC) is a resource developed by the **Colorado Natural Heritage Program** through funding from the **U.S. Environmental Protection Agency** and **Colorado Parks & Wildlife**.

## Featured Topics

Colorado Wetland Information Center

About CWIC Wetland Types Wetland Condition Working in Wetlands Data & Tools Library

Wetland Plots Database

Welcome to the **Wetland Plots Database**. This database contains field-collected data from nearly 3,000 plots in wetlands and riparian areas across Colorado. The data were collected through multiple projects over 30 years, starting in the 1990s. Data types include detailed vegetation data, soil profiles, water chemistry measurements, and condition and stressor metrics. Not all data are available for every plot, but all plots contain at least a species list. Plots collected on public land can also be viewed through the **Colorado Wetland Inventory Mapper**, but plots collected on private land are not shown on the mapper.

[Search Wetland Plots »](#)

[Create Species Lists »](#)

By clicking on **Search Wetland Plots**, the plots can be filtered and searched by wetland type, county, watershed, and many other characteristics. From the search results, users can click to view details of a particular plot and can download a PDF of all collected data.

By clicking on **Create Species Lists**, users can set filter criteria and generate a species list that averages the cover and frequency of plant species observed within the filtered plots. For example, by setting the filter criteria to include the Rocky Mountain Alpine-Montane Wet Meadow Ecological System and Boulder County, a user could see a list of plant species that most commonly occur in wet meadows in Boulder County. To explore further, the list could be constrained to Excellent or Good condition wet meadows or by a certain elevation range, providing a target species list for wet meadow restoration in Boulder County. A subset of the plots in this database has been designated as the **Colorado Wetland Reference Network**. These sites have been selected as reference sites because they possess relatively intact topography, soil, and vegetation and can serve as a reference for high-quality conditions. All reference sites are located on public land.

Database Version Date: October 2018

For information, contact Joanna Lemly.

Wetland Data & Tools

- Wetlands Mapper
- Floristic Quality Calculator
- Landscape Summaries
- Watershed Toolbox

Related Topics

- Wetland Reports
- PCA Reports
- County Survey Reports
- Field Guides and App
- Field Manuals
- Educational Resources
- Watershed Toolbox

Colorado Wetland Inventory

Find address or place

Legend

- River Basins
- River Subbasins
- River Subbasin Boundary

Colorado BRAT Tiles

- None: 0 dams
- Rare: 0-1 dams/km
- Occasional: 1-3 dams/km
- Frequent: 3-15 dams/km
- Pervasive: 15-40 dams/km

Colorado Beaver Restoration Assessment Tool (BRAT)

Download Data

Find address or place

Legend

- River Basins
- River Subbasins
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Colorado BRAT Tiles

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Watershed Planning Toolbox

Find address or place

Legend

- Watershed Planning Toolbox Project Area
- Wetlands & Waterbodies
- Natural Characteristics (LWW)
- Headwater 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
- Water Quality Functions
- Supporting Water Quality Information
- Permitted Mines (CDNR 2018)
- Stream Outstanding Waters (CDPH 2018)
- Mine Tailings (NRCIS SUEGO 2018)
- Environmental Hazard Mine Areas (USFS 2018)
- Restoration Prioritization
- Upper Arkansas Restoration Priority Areas (WPA)
- Highest priority
- Medium priority
- Lower priority

Colorado Wetland Inventory

Find address or place

SIERRA MADRE RANGE

White-Yampa-Green

North Platte

South Platte

Colorado Headwaters

Republican

Gunnison

Dolores

Rio Grande Headwaters

San Juan

Layer List

- ☒ River Basins
- ☒ Counties
- ☐ Vegetation Plots
- ☒ Wetland Mapping
- ☐ Riparian Mapping
- ☐ Fen Mapping
- ☐ Playa Mapping
- ☐ Warm Water Slough Mapping
- ☐ Wetland Data Summaries
- ☐ CNHP Potential Wetland Conservation Areas

Watershed Planning Toolbox

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**Partner: Lindsay Reynolds,  
BLM Assessment Inventory and Monitoring**







Partner: Kate Dwire,  
USFS Rocky Mountain Research Station

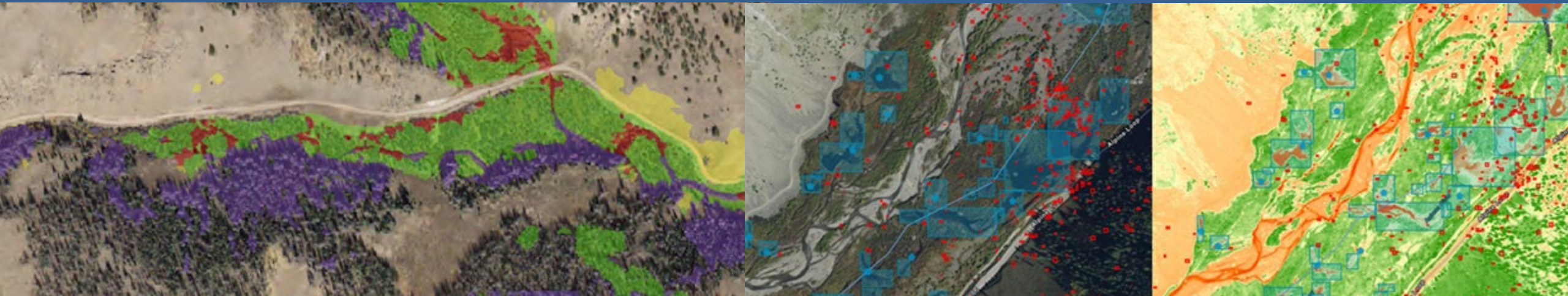




# Wetland / Beaver Pond Mapping with AI

Colorado River Basin

CNHP Partners' Meeting, March 11, 2022





# Project Goals

## **Overall Objective**

Track areal extent of wetlands and presence of beaver dams (real and analogs) over time in the Colorado River basin using **repeatable and low-cost Machine Learning techniques**

## **Specific Metrics to track**

Vegetated, Valley Bottom Wetlands

Beaver Ponds, Beaver “Influenced” Wetlands, Beaver “Complexes”

## **Time Period**

Metrics will be determined over 3 independent time periods using NAIP imagery and LiDAR acquired between 2006 and 2021. These data are freely available. Platform is set up to generate new results as more NAIP imagery is flown (1-3 year repeats)

## **Resolution**

Output wetland maps will be at a 1m resolution

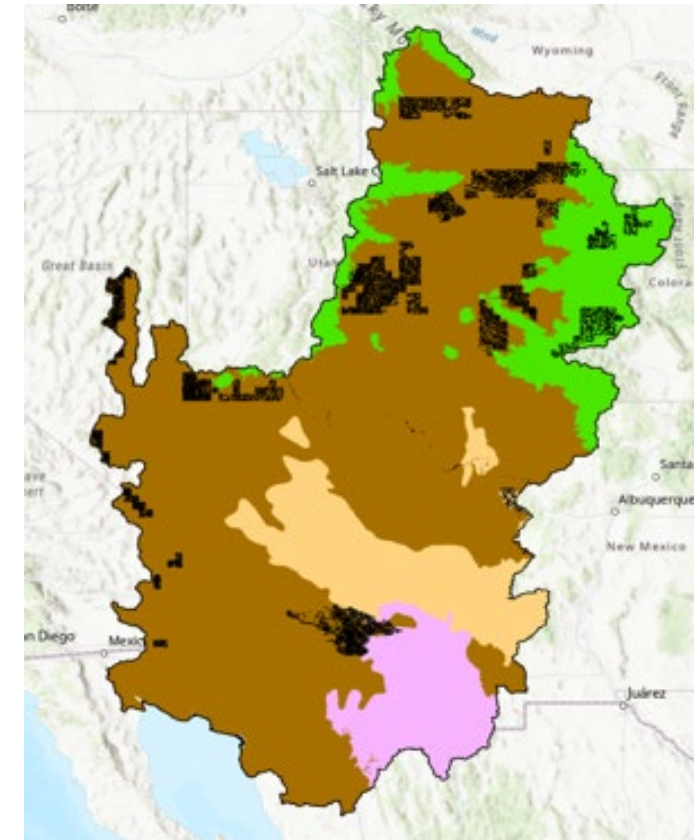
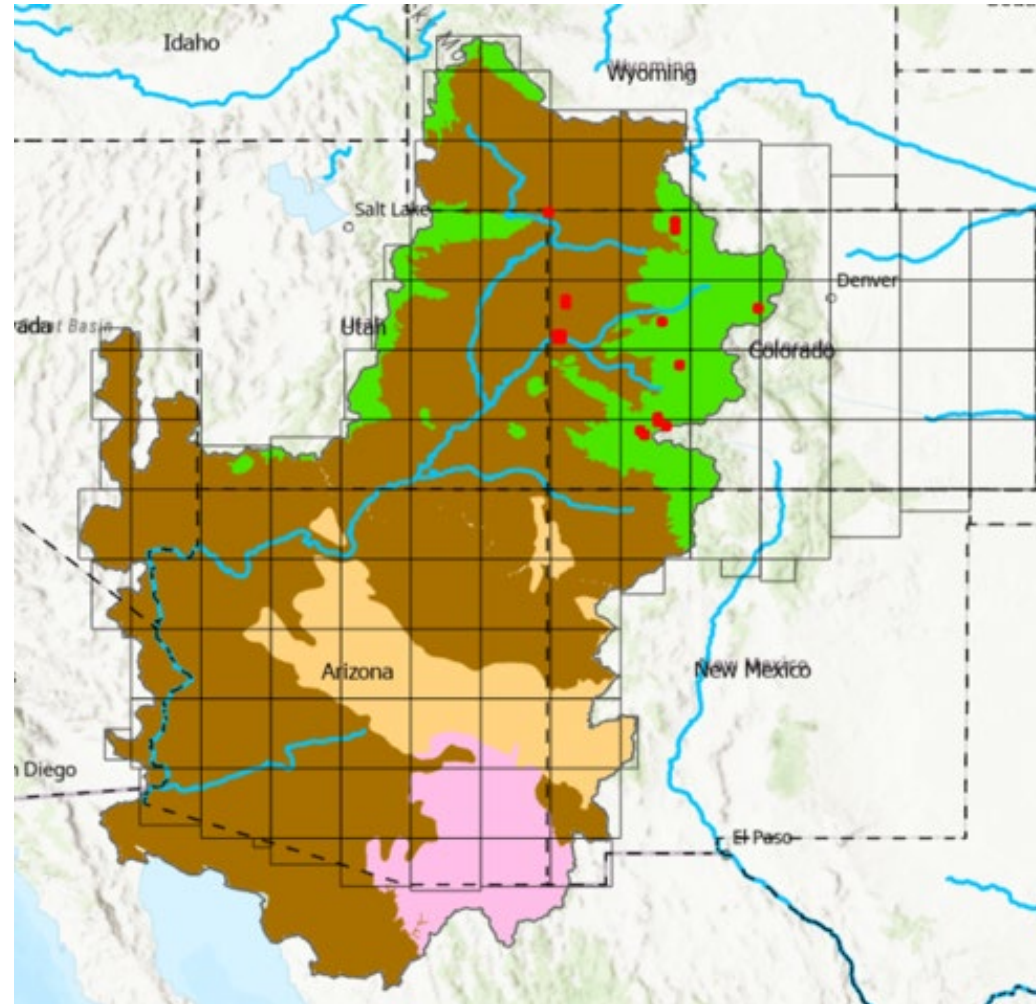
# Study Area: Entire CRB

**Training Areas**

**Model Extent**

WFF and CWCB  
Projects

**Ecoregions**



- 10 NORTH AMERICAN DESERTS
- 12 SOUTHERN SEMIARID HIGHLANDS
- 13 TEMPERATE SIERRAS
- 6 NORTHWESTERN FORESTED MOUNTAINS



# Beaver Pond and Wetland Example from NWI Data

**Location:** Grand County, Colorado

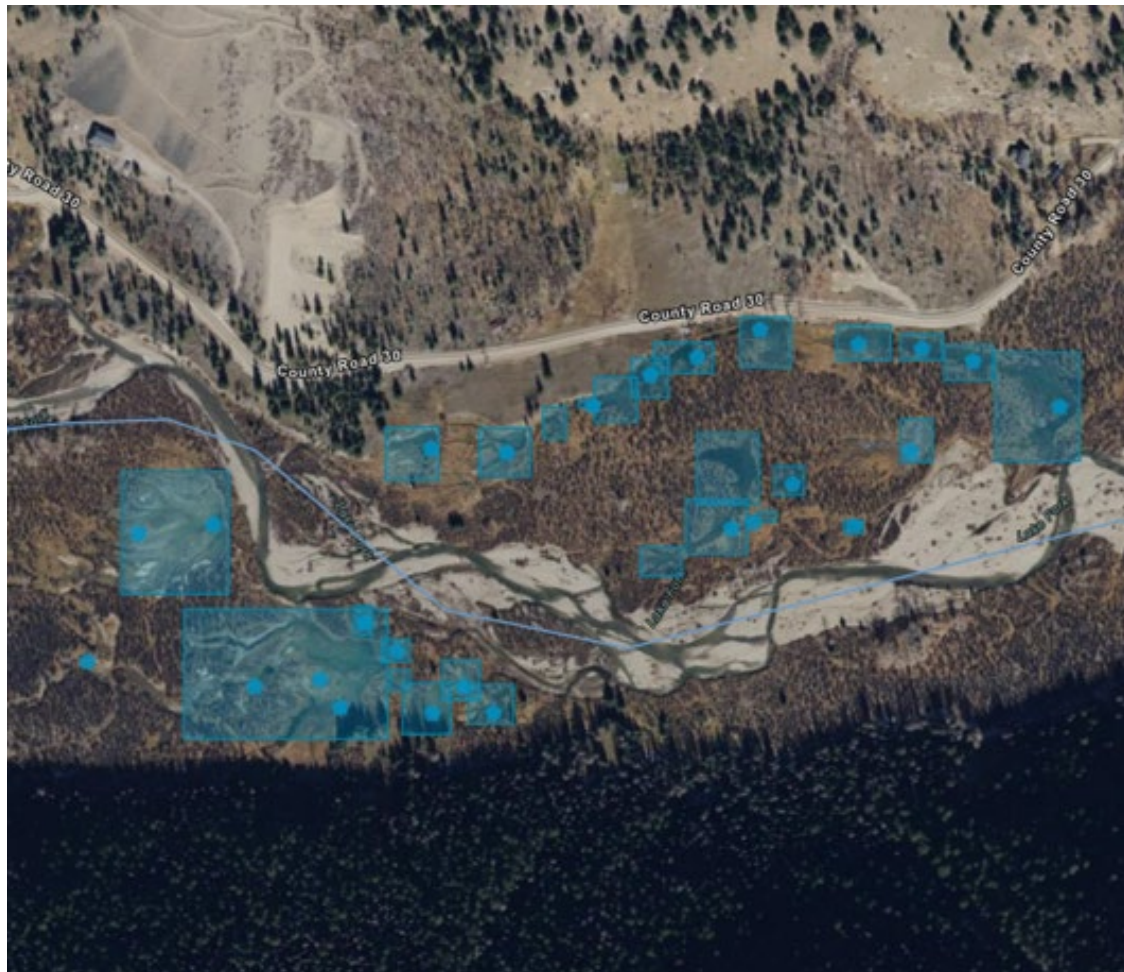
**NWI:** Imagery Year: 2017, **NWI Attribute Codes:** PABFb, PSS1Bb

**NAIP:** Year: 2017, Flight Date: 9/21/2017

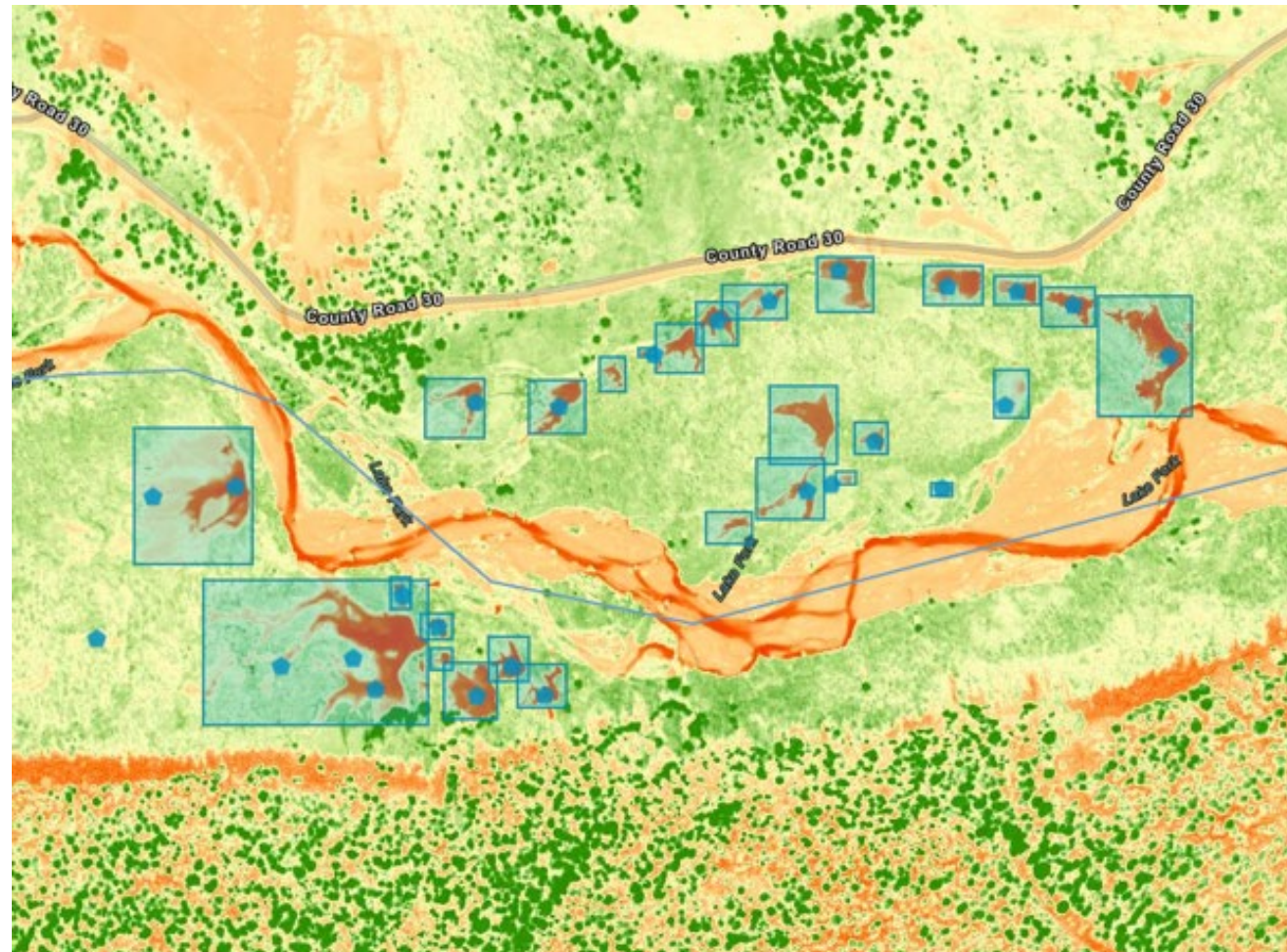




True Color

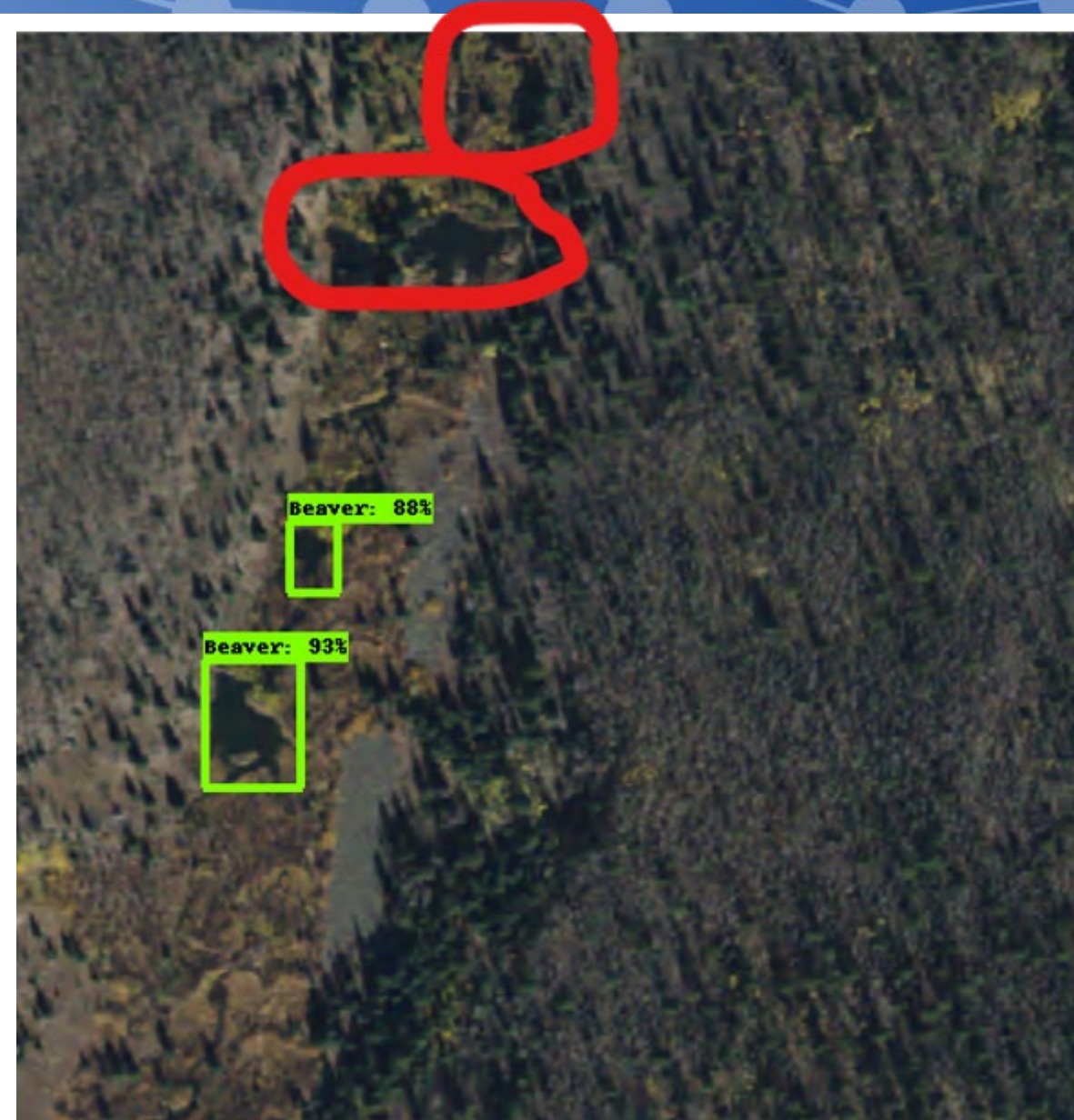
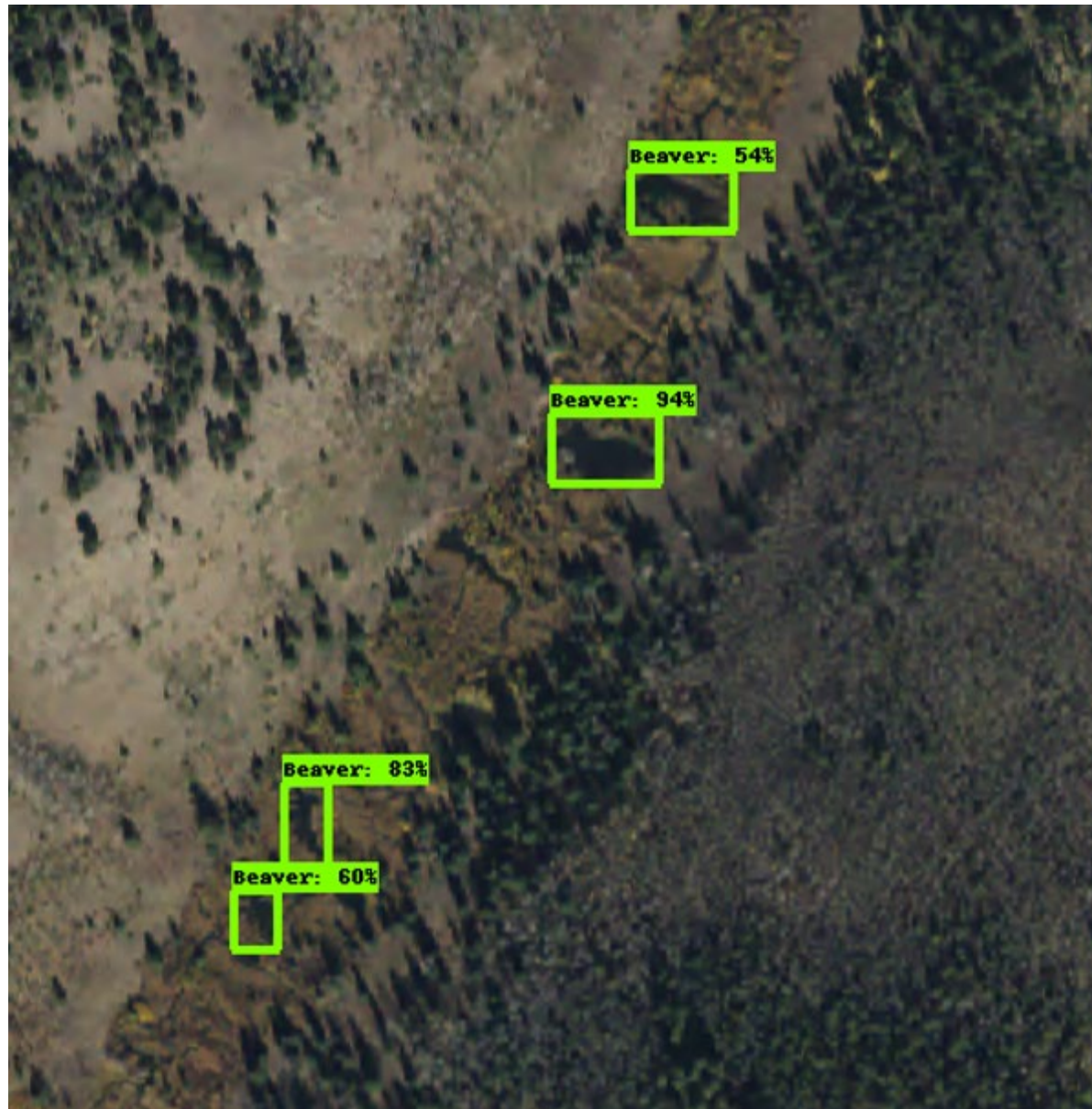


NDVI





# Object Detection Results





# Validation and Performance

## Iterative process

Train, produce results, compare against training data

## Numerical

Training and Test areas

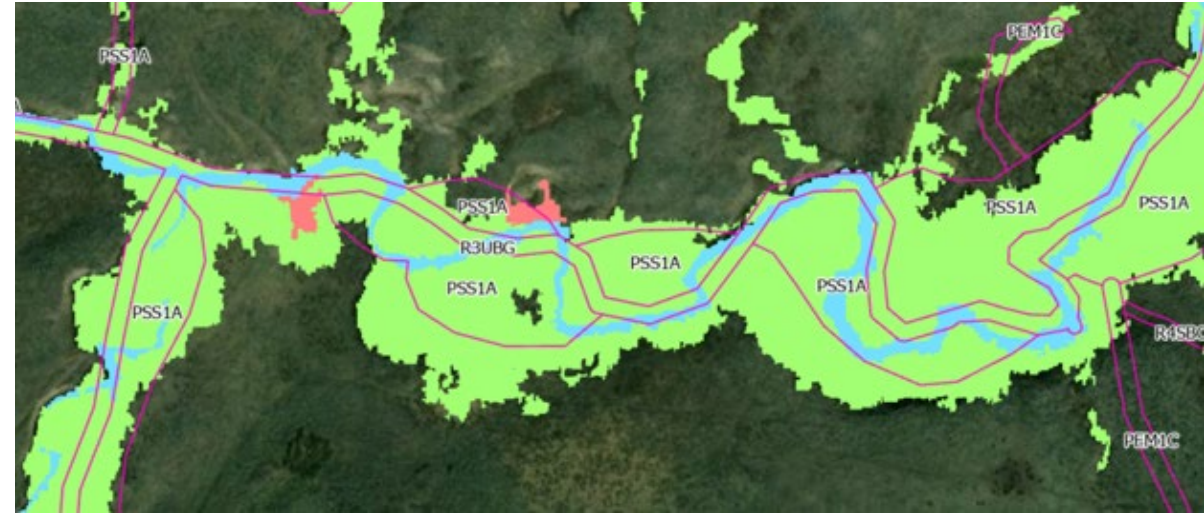
Confusion Matrix showing statistics of model performance against manually-mapped areas

## Visual

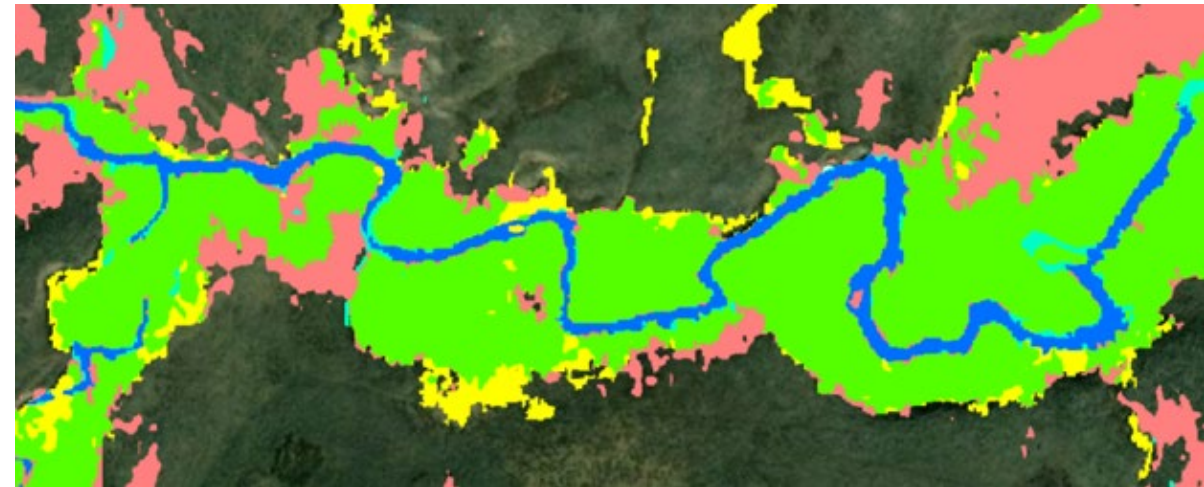
Assess model performance

## Feedback specific issues and improve model

- More training
- Model weightings
- Additional post-processing steps



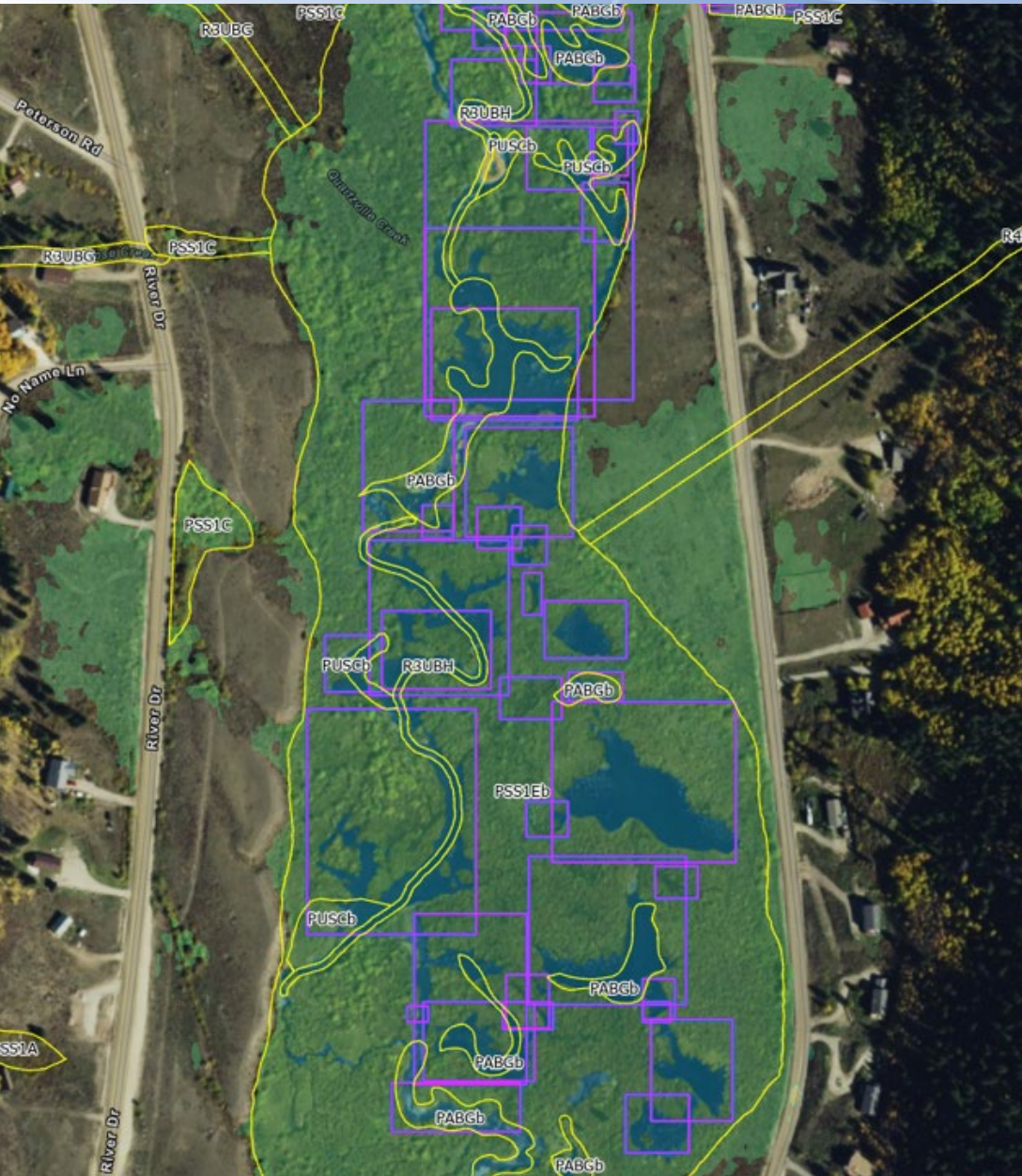
Segmentation Data Trained by CNHP Staff showing NWI



Comparison with Model Output



# End Products



## Maps Hosted by CNHP

### Area and Change Analysis

Total Wetland Area

Change in Wetted Area Across Years

Beaver Pond Count, and Pond Area

### Sensitivity of Wetlands to Key Physical Factors:

Climatology/hydrology

Geology, Elevation

### Comparison with BRAT Model