CNHP Fen Mapping and Inventories

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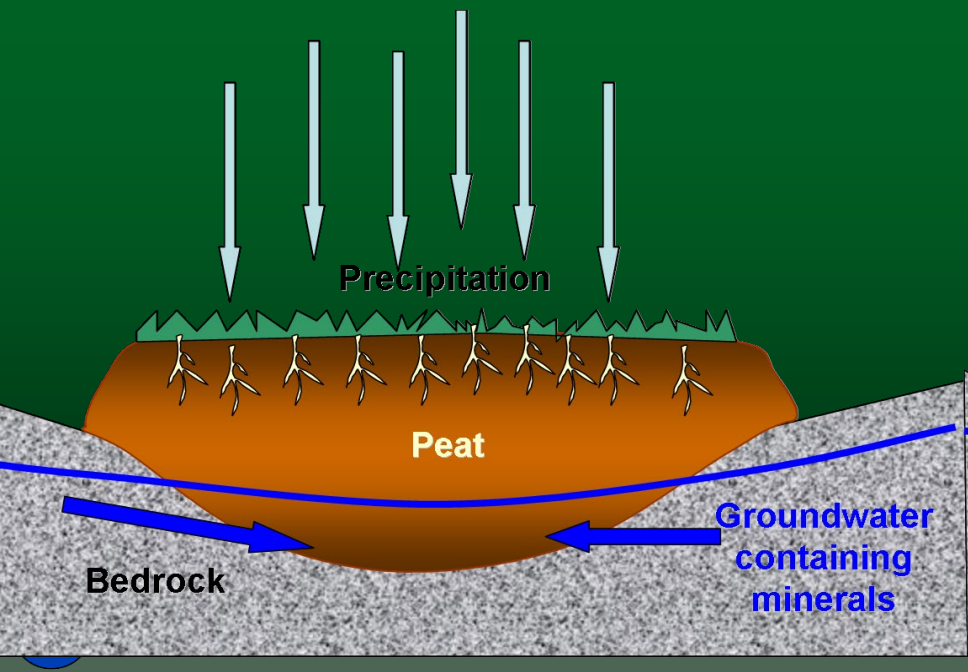
Fens vs. Bogs

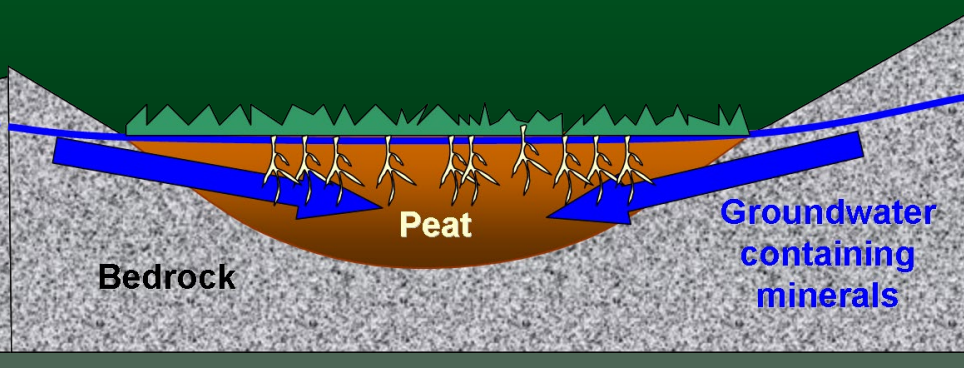
Bogs

- Ombrotrophic (rainwater-fed)
- No contact with groundwater
- Low pH (<4.5)
- Low ionic concentrations
- Dominated by *Sphagnum* moss
- Low species diversity

Fens

- Minerotrophic (groundwater-fed)
- Source water determines chemistry
- Wide range of pH (<4 to >8)
- Wide range of ionic concentrations
- Vegetation in Rocky Mountains often dominated by sedges
- Low to high species diversity





Bogs

Grand Teton Fen

- Unlike bogs, fens are generally open areas on the landscape, often with shallow standing water
- Fens are commonly sedge dominated like this one (*Carex lasiocarpa*) with an assortment of forbs
- Fens are rare in the west and are often home to rare plants

White River National Forest Fen

- Some fens are basin fens, others are sloping fens
- Fens have higher nutrient levels than bogs, but not as high as swamps or other wetlands
- Fens can often have a shrubby component (often willows), and they can even have sparse trees, which are generally located near their margins

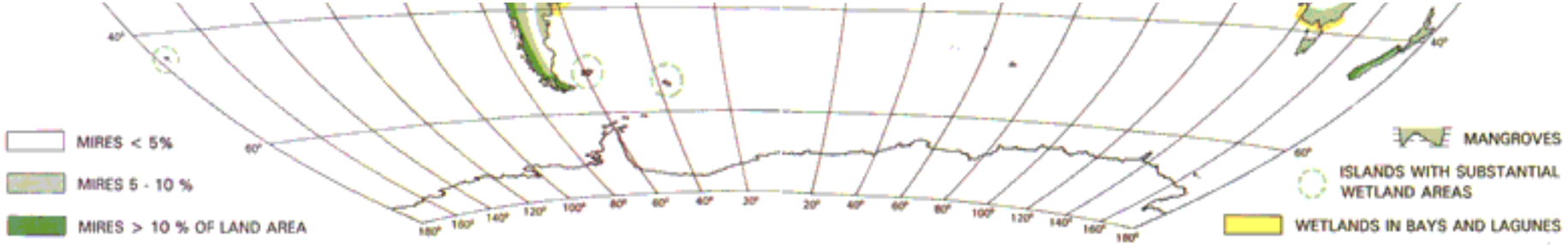
Peat Soil

- Soils can be organic or mineral
  - Peat soil is organic, meaning the rate of biomass production is greater than the rate of biomass decomposition, leading to slow accumulation over time.
- In fens, peat should measure at least 40 cm in within the upper 80 cm of soil

Taking a look at soils

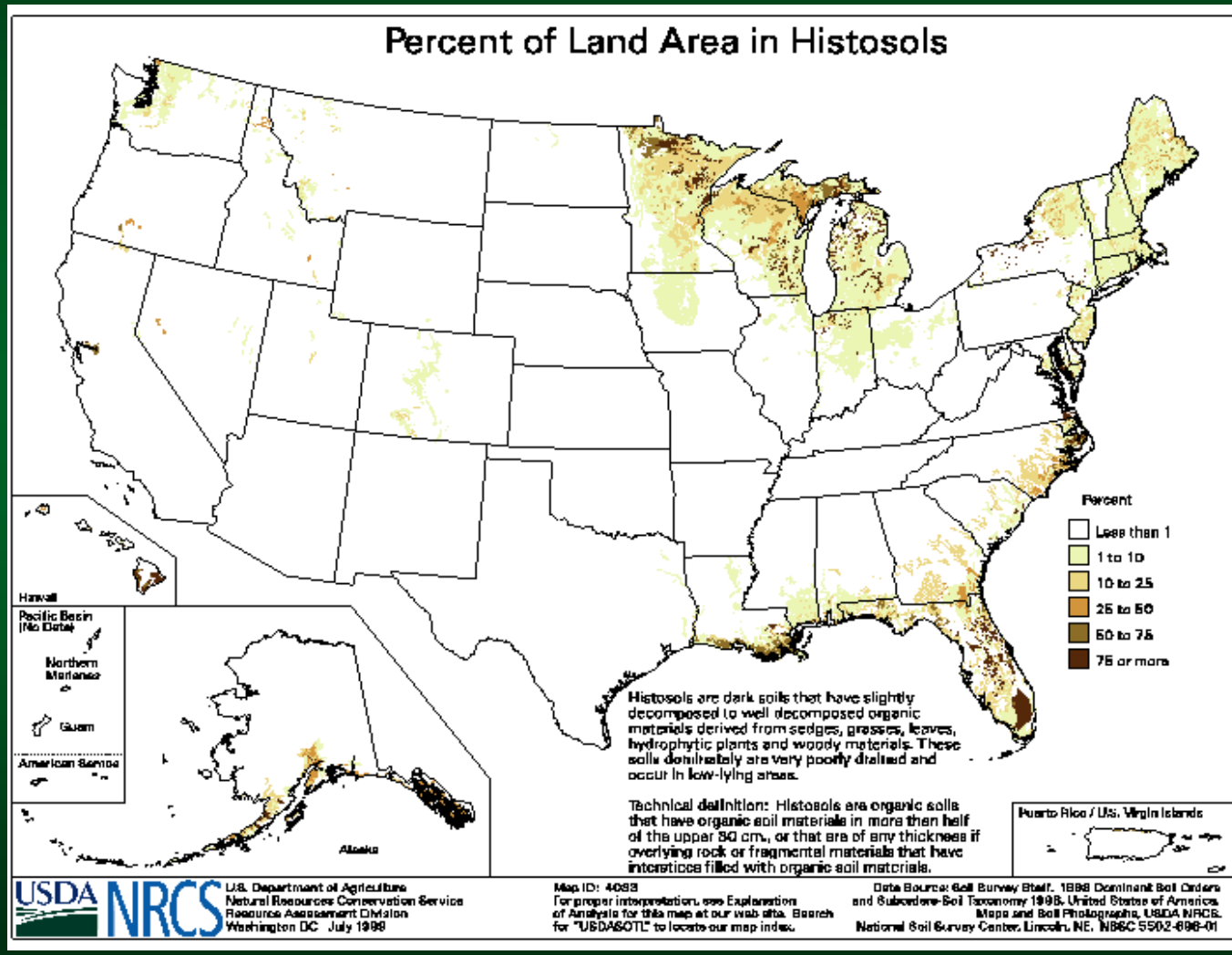
Distribution of Peatlands Globally

Estimated that 80% of world's peatlands occur in cold, northern climates - boreal and northern temperate regions.

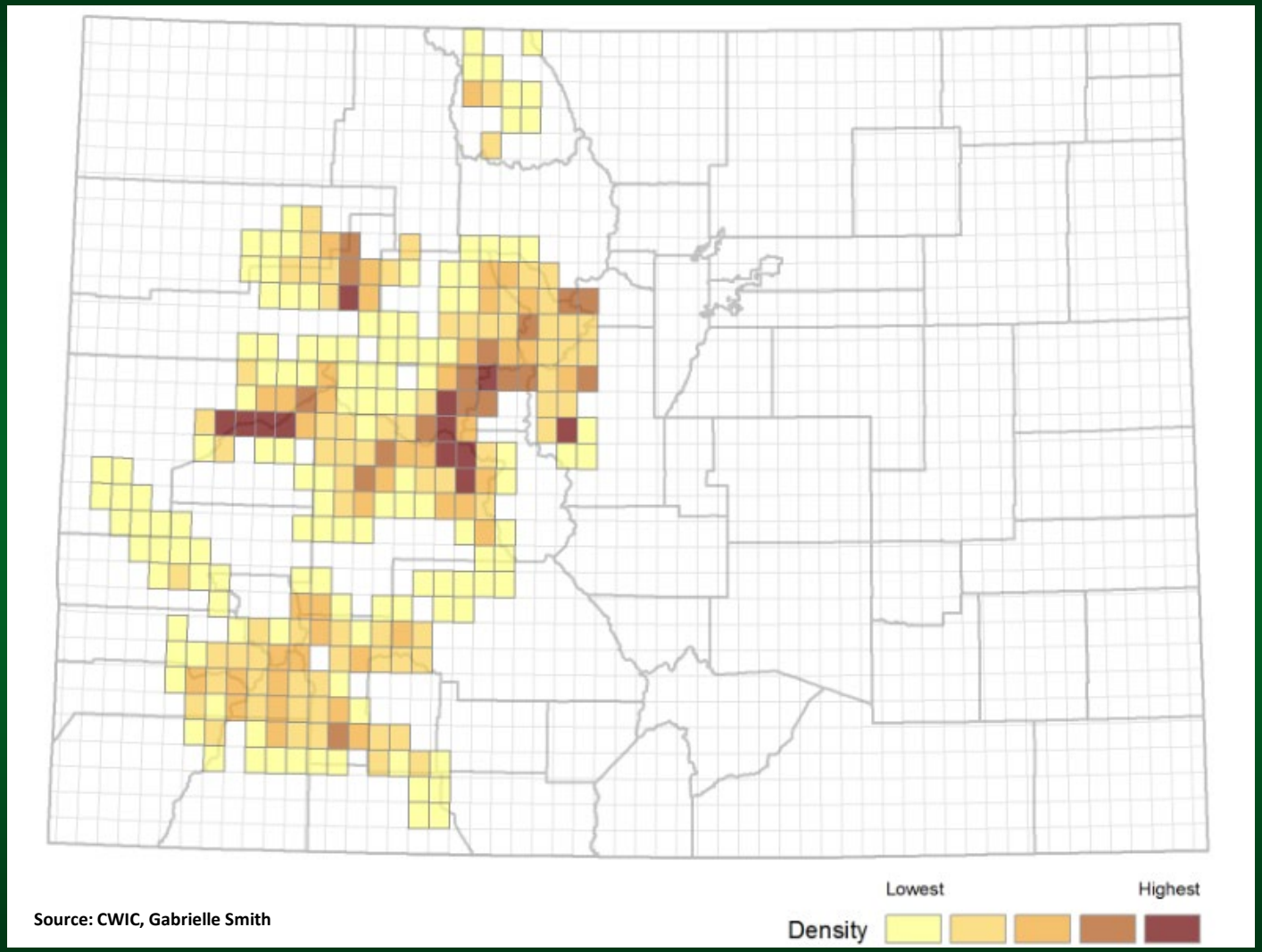


Distribution of Peatlands in the US

- Upper Midwest
- Upper Northeast
- Coastal Southeast
- Pacific Northwest
- Southern Alaska
- Rocky Mountains



Fen Density in Colorado



Source: CWIC, Gabrielle Smith

Land Manager's Interest in Fens

- CNHP's first fen mapping and inventory project was in 2007 in Sun Juan National Forest.
- Since then, USFS policy advises including GDE inventories, assessments in Land Management Plans (Forest Plans) and Forest Prescribed Fire Plans have all increased research interest in fens.
- Most Forests lack baseline information on fen distribution.
- Quote*: "I think we have a few fens on the Forest."*

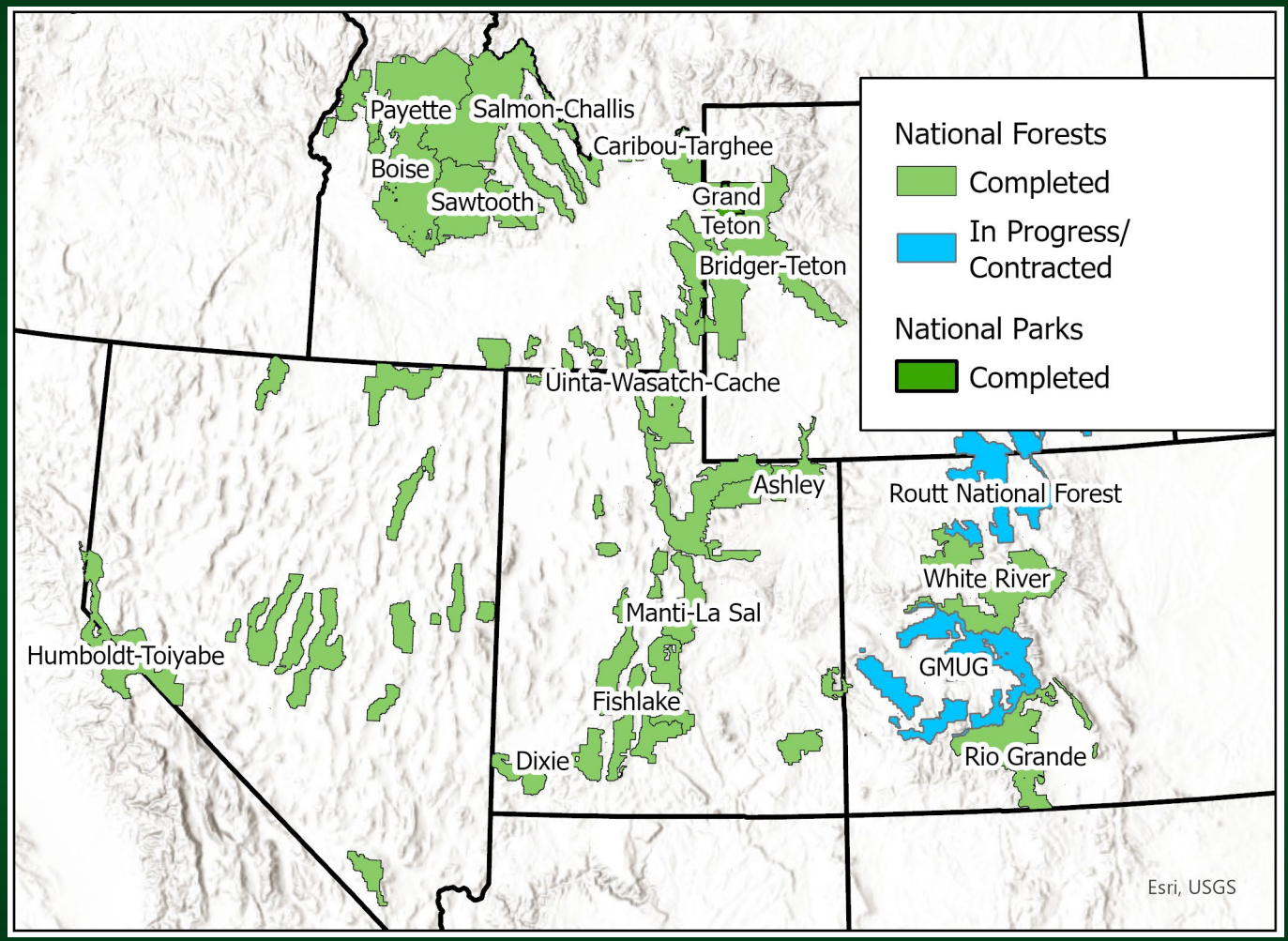
Fen Mapping Projects

National Forests:
- Ashley
- Boise
- Bridger-Teton
- Caribou-Targhee
- Dixie
- Fishlake
- Humbolt-Toiyabe
- Manti-La Sal
- Payette
- Rio Grande
- Salmon-Challis
- Sawtooth
- Uinta-Wasatch-Cache
- White River

National Parks:
- Grand Teton National Park & John D. Rockefeller Jr. Memorial Parkway

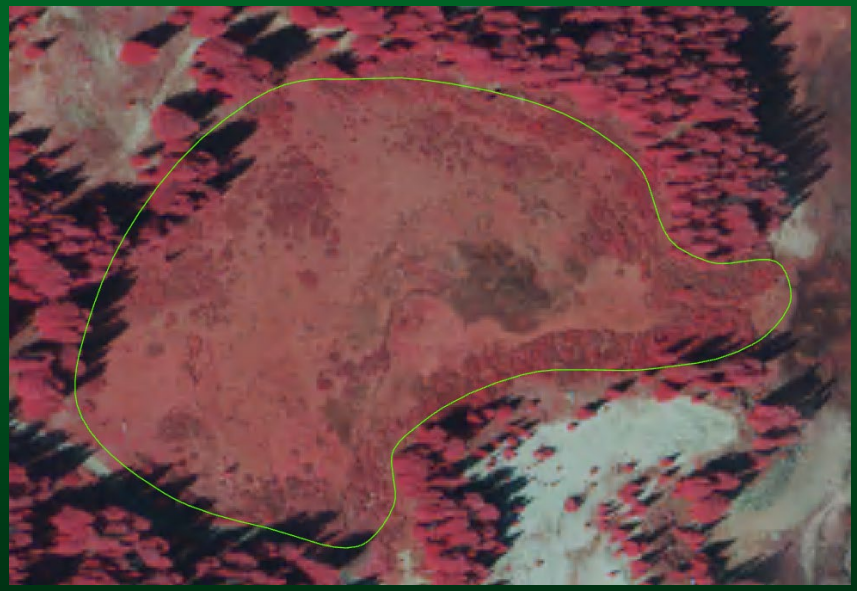
Colorado:
- Colorado Department of Transportation Roadside Fen Inventory

Contracted/In Progress:
- Gunnison, Grand Mesa, Uncompahgre (GMUG) NF
- Routt NF



Fen Mapping Methods

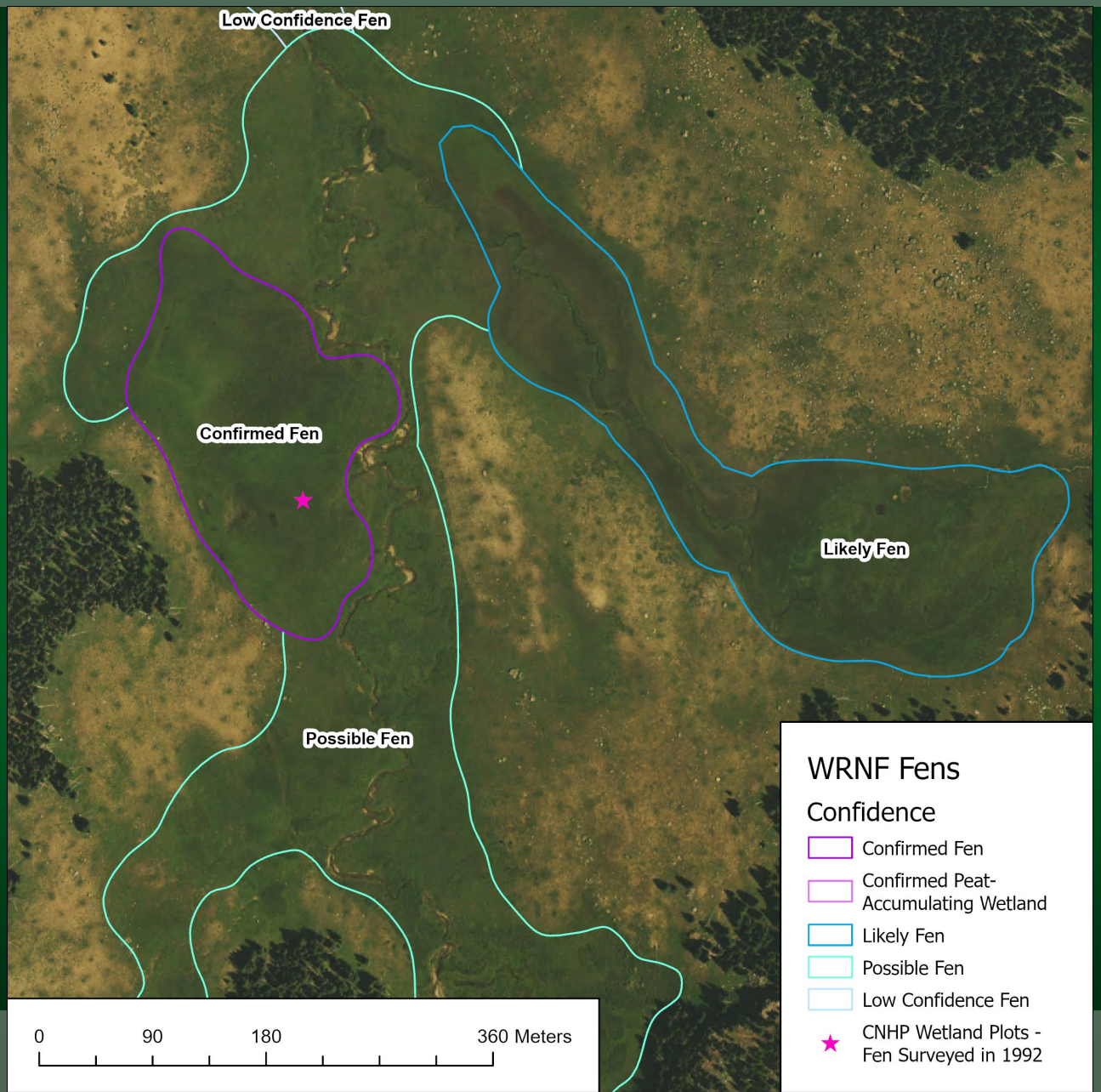
- Aerial Photo interpretation – both true color and color-infrared imagery
- Fen characteristics that can be observed in aerial imagery:
  - Topographic position
  - Indications of groundwater discharge
  - Evidence of low-energy hydrology
  - Color
  - Vegetation
  - Apparent surface texture
  - Separation from adjacent areas
- Ancillary data – topographic maps, spring locations, soil core locations, fen associated element occurrences, vegetation mapping, etc
- Fen confidence levels
  - Confirmed fens
  - Confirmed peat accumulating wetlands
  - Likely fens
  - Possible Fens
  - Low-confidence fens
- Special characteristics
  - Beaver influence
  - Spring Influence
  - Floating mat fens
  - Iron fens



Ashley National Forest

Large Fen Complex Rio Grande National Forest

Field Verification Informs the Mapping



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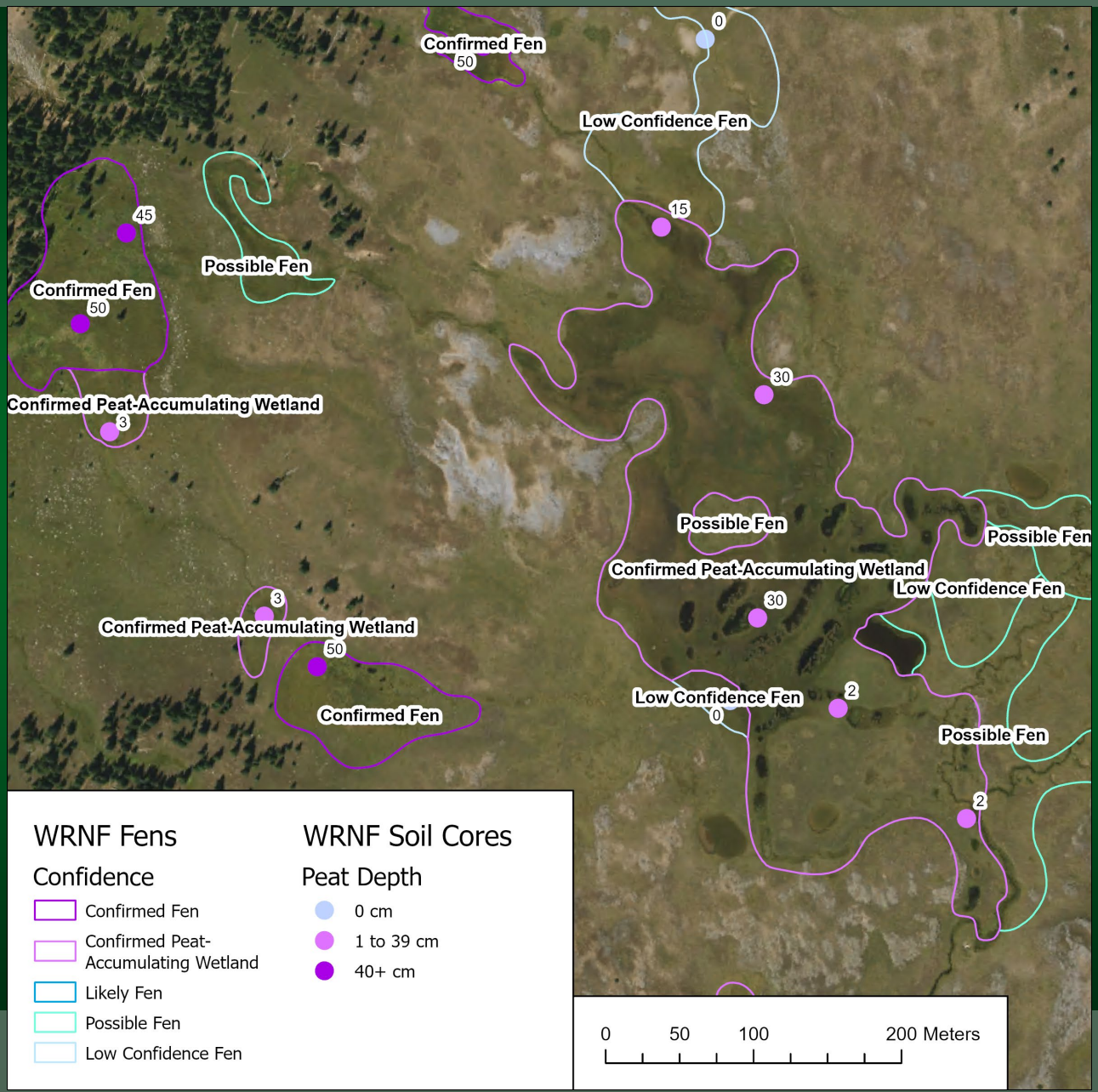
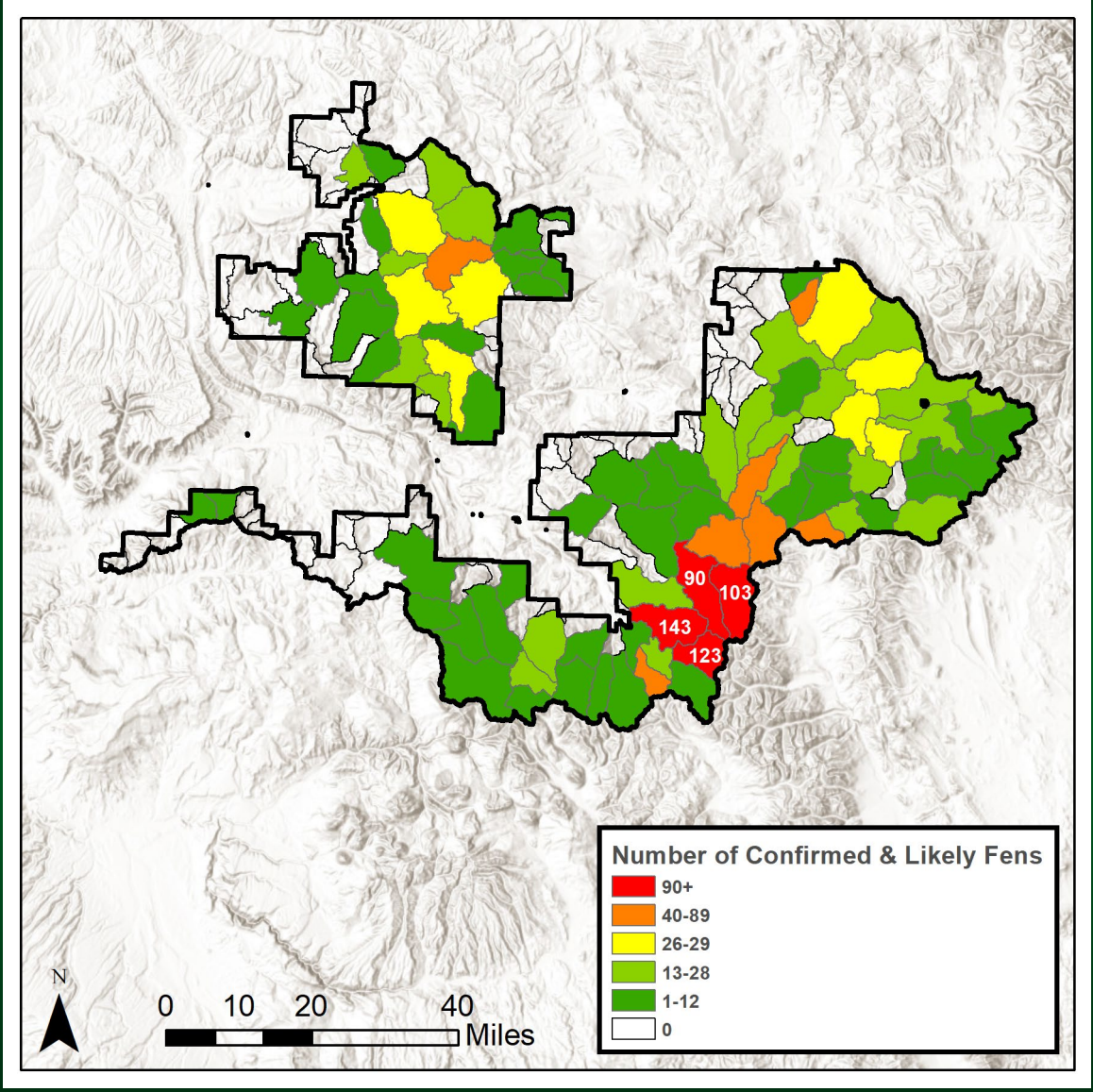


Results: Fens by Watersheds in White River

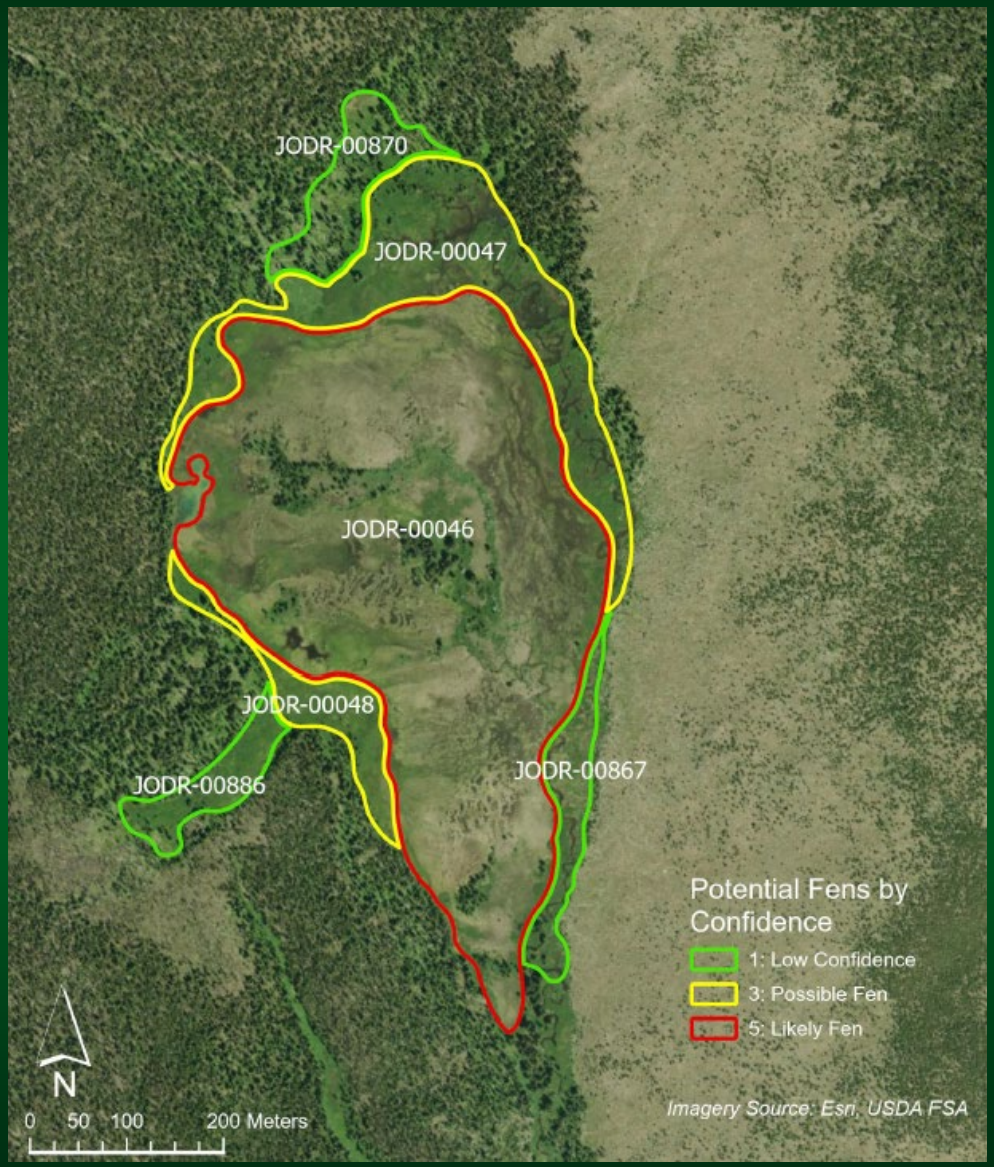


Results: Summary Fen Counts

Project Name	Year Completed	Confirmed Fen	Confirmed Peat-Accumulating Wetland	Likely Fen	Possible Fen	Low Confidence Fen	Project Total
White River NF	2025	271	75	1,366	2,664	4,570	**8,946**
Grand Teton NP/JODR	2025	41	28	75	230	503	925
Uinta-Wasatch-Cache NF	2023			879	2,508	7,065	10,452
Payette NF	2022			359	734	2,698	3,709
Sawtooth NF	2021			392	824	2,273	3,489
Boise NF	2021			218	500	1,573	2,291
Fishlake NF	2020			199	604	1,520	2,323
Caribou-Targhee NF	2020			130	369	1,280	1,779
Humboldt-Toiyabe NF	2019			223	661	1,552	2,436
CDOT Roadside Fens	2018	241		155	401	653	1,450
Bridger-Teton NF	2018			2,966	2,863	3,674	9,503
Dixie NF	2018			62	237	585	884
Ashley NF	2017			4,019	2,765	1,830	8,614
Manti-La Sal NF	2017			30	336	752	1,118
Salmon-Challis NF	2017			385	1,037	1,979	3,401
Rio Grande NF	2016			2,532	2,374	1,502	6,408
Grand Total		553	103	13,990	19,107	34,009	**67,728**

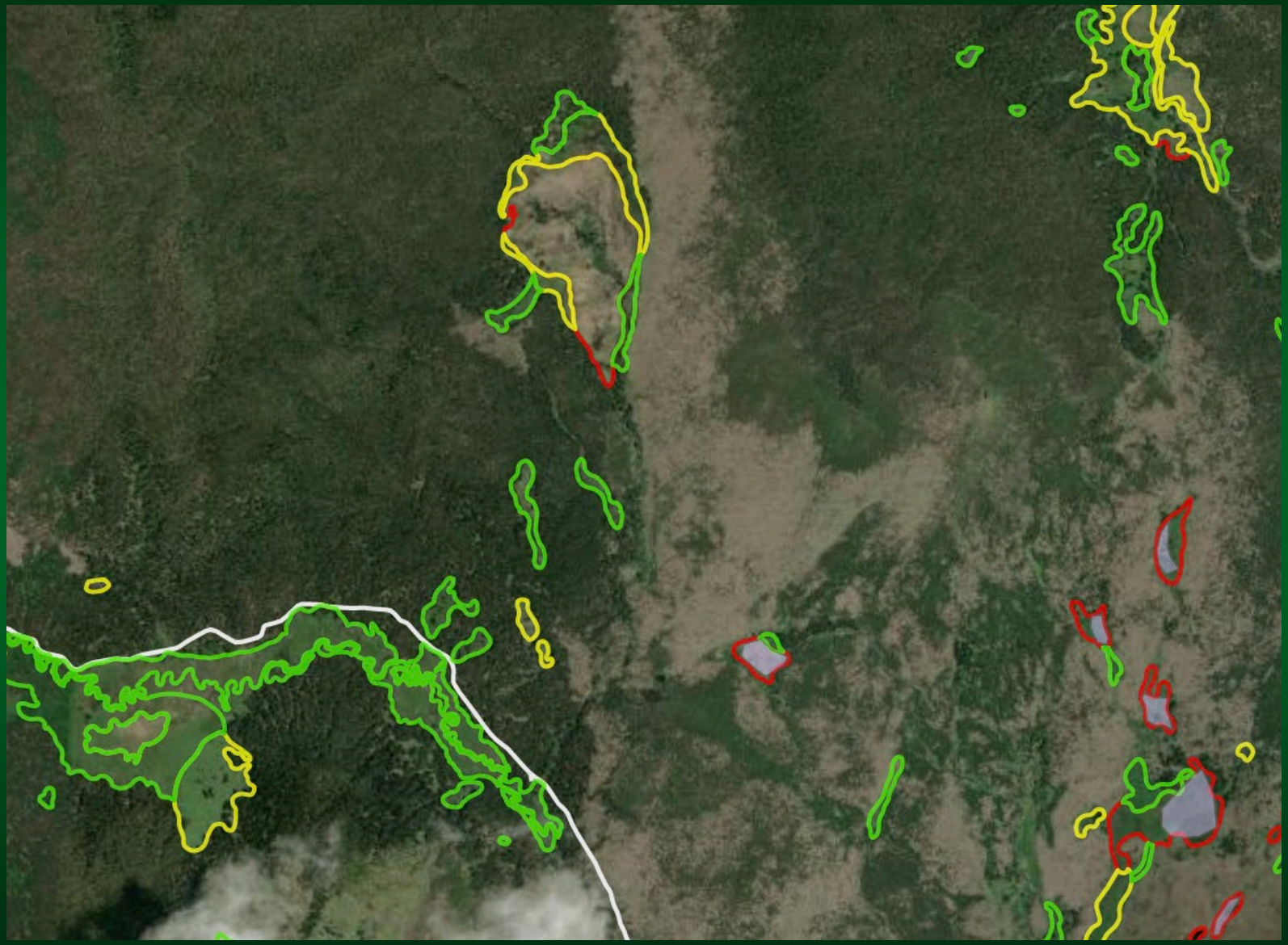
Fen Mapping in Grand Teton National Park

Preliminary Mapping



- Preliminary mapping took place in winter of 2022 to 2023 and resulted in 906 polygons covering a total of 5,208 acres
- With that preliminary mapping for the Grand Teton Fen Project, we had fens categorized into 3 confidence levels
- Over four 8-day hitches, we spent our days confirming the polygons on the ground

Navigating to the site



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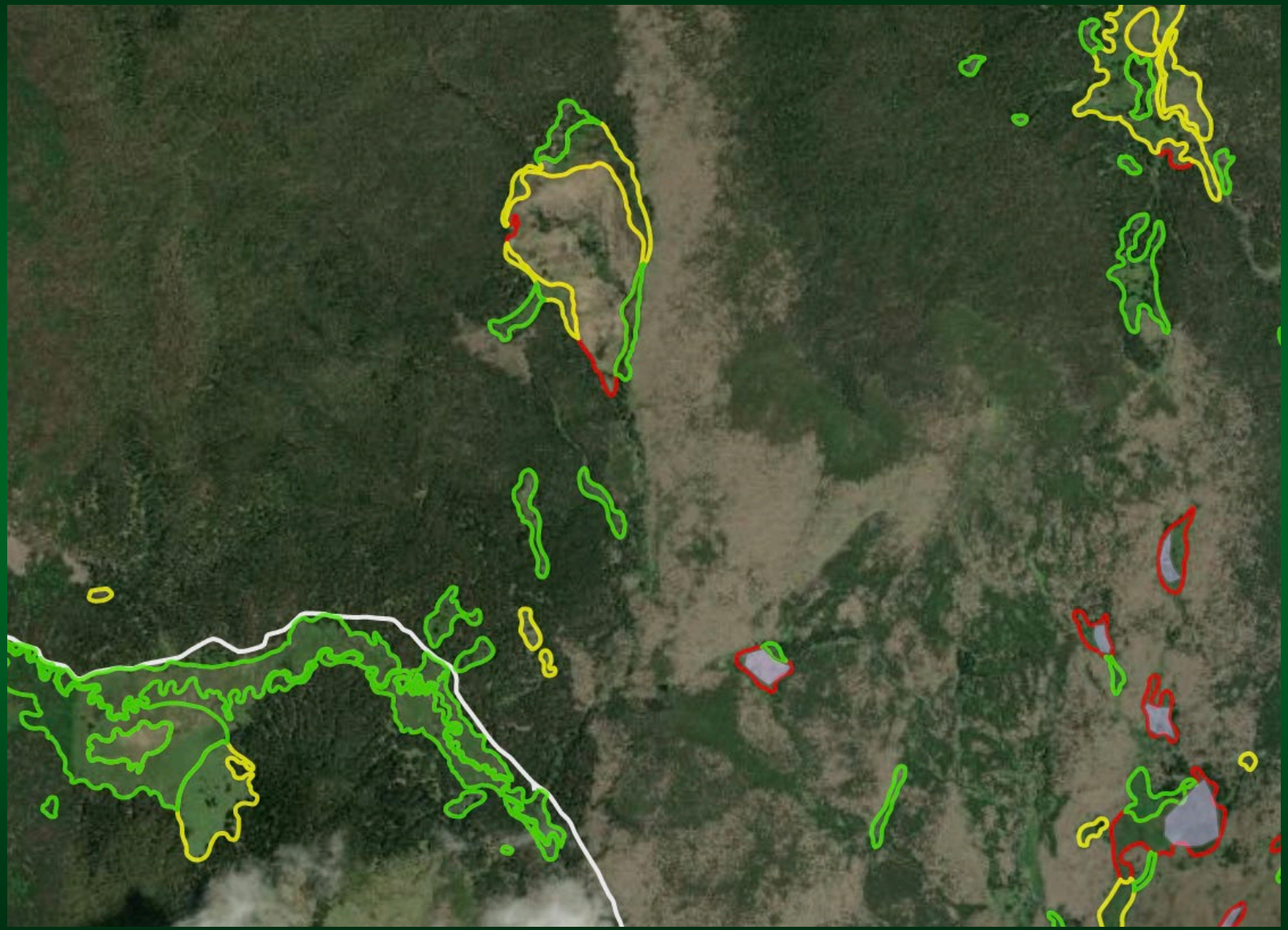

Navigating to the site

Field Confirmation

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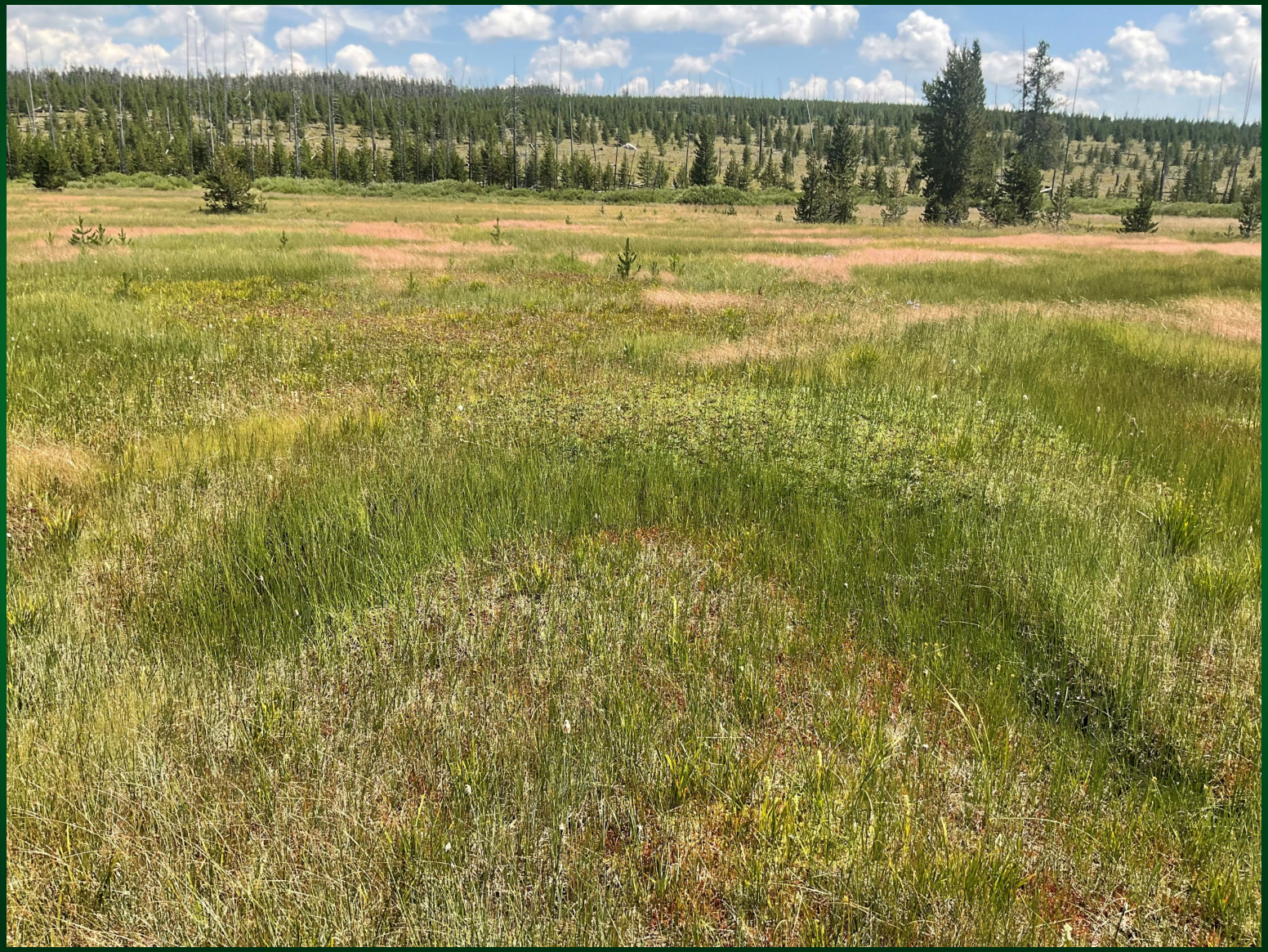

Rare Plants

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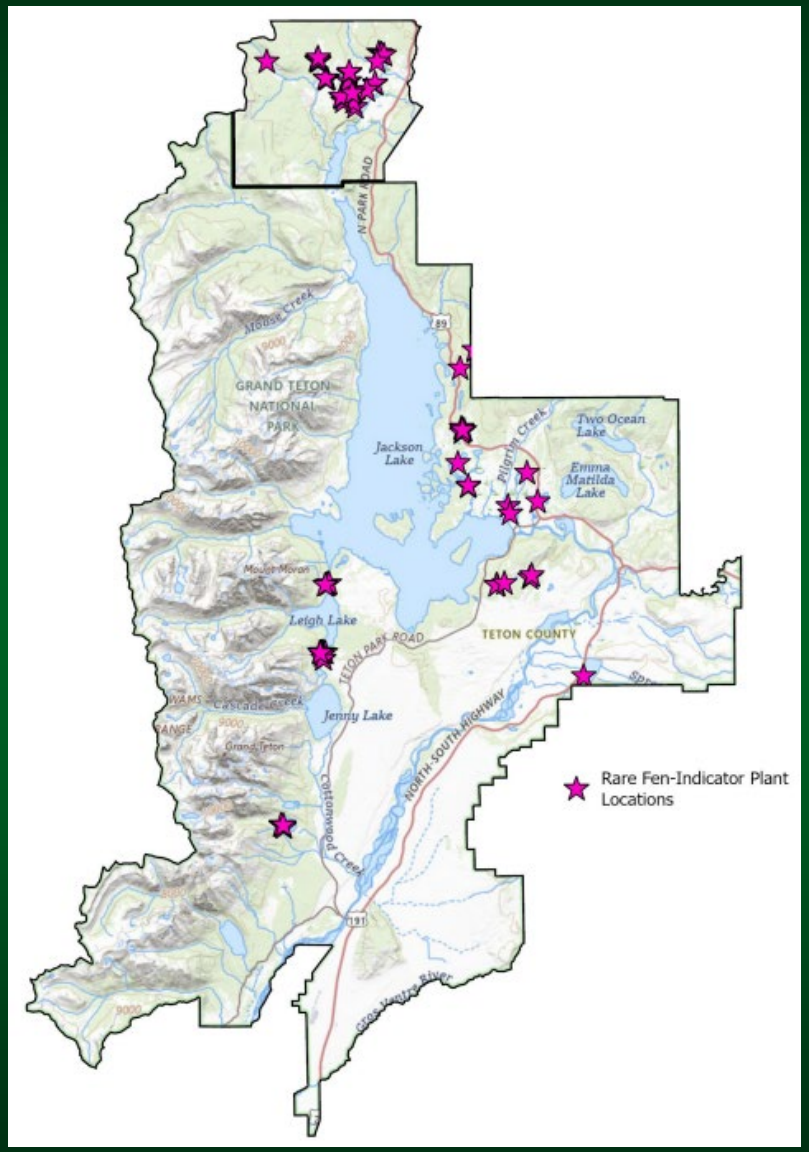
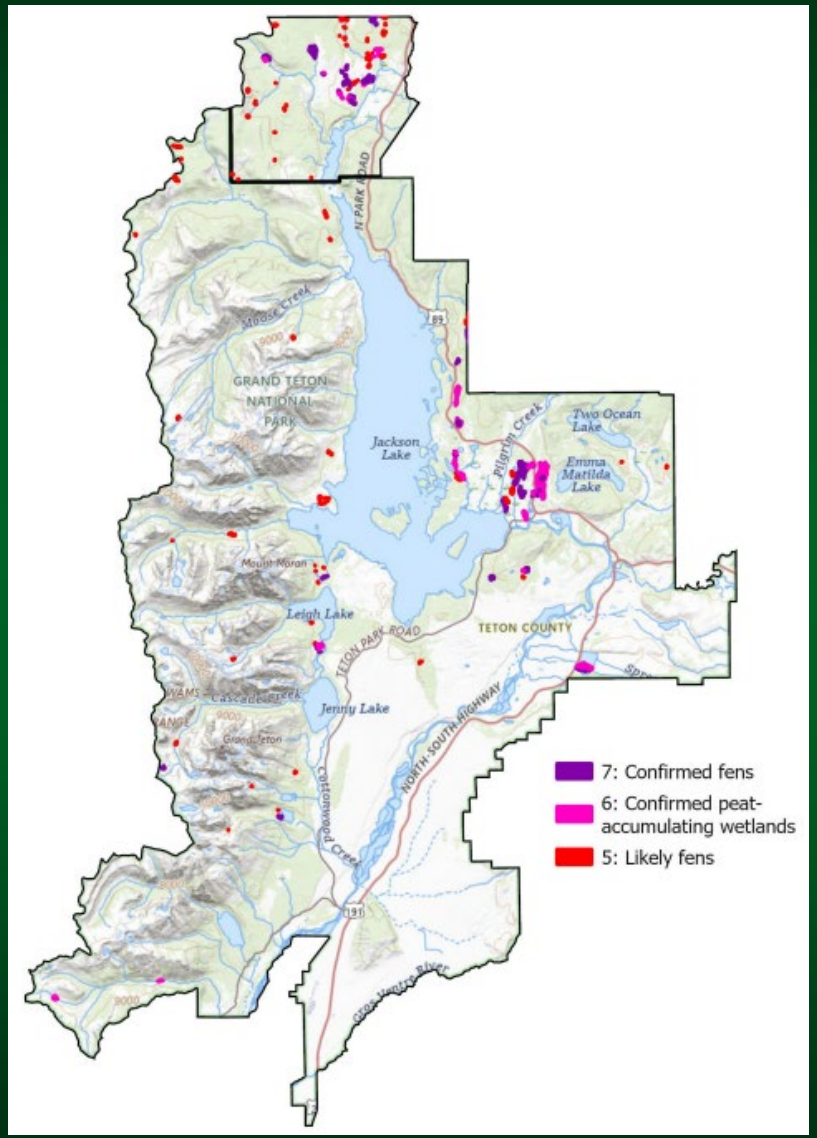


- 127 populations of 23 different rare fen indicator species were found
- All species found are considered globally secure (G5), but since fens are a rare ecosystem in the west, the species were rare in the state of Wyoming (S1, S2, and S3)
- The most common rare species we saw were:
  - Purple marshlocks (*Comarum palustre*) – 18 populations
  - Woolyfruit sedge (*Carex lasiocarpa*) – 16 populations
  - Buxbaum's sedge (*Carex buxbaumii*) – 13 populations

Grand Teton Results

- 41 confirmed fens covering 458 acres
- 28 peat accumulating wetlands covering 345 acres
- 75 likely wetlands covering 213 acres
- (not pictured) Another 733 polygons covering 2,415 acres were considered possible or low confidence fens



Grand Teton National Park and John D. Rockefeller Jr., Memorial Parkway

Mountains Fens: Irreplaceable Resources

Some take home messages about fens:

- Fens are groundwater wetlands with organic soils
- Near permanent saturation slows decomposition
- In the Rocky Mountains, typically high elevations (9,000 to 12,000 feet)
- Practically *irreplaceable* due to extremely slow peat formation
- Fens have high conservation value!
  - Habitat for rare plant species
  - Maintain stream base flows
  - They store carbon

For More Information

- Fen Mapping page on the Colorado Wetland Information Center
  - https://cnhp.colostate.edu/cwic/wetlandtypes/fen-mapping/
  - This page includes links to the reports

- CNHP Wetlands Plots Database: https://cnhp.colostate.edu/cwic/tools/plot-database/

- To read the NPS article published on the Grand Teton Fen Project visit: https://www.nps.gov/articles/fen-wetlands-in-grand-teton-and-john-d-rockefeller-jr.htm

- To read the Grand Teton Fen Project report, visit: https://irma.nps.gov/DataStore/Reference/Profile/2313526

Questions?

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