Conserving Mountain Fens in SBEADMR and Taylor Park Treatment Areas

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USDA Forest Service
Rocky Mountain Research Station,
Ft. Collins, CO

SBEADMR/Taylor Park EA Annual Stakeholder Meeting
April 6 , 2023

Overview:

- Fen definition & ecology;
- Fens & other wetlands on the GMUG;
- Challenges of managing fens in SBEADMR and Taylor Park treatment areas;
- Progress to date;
- Science unknowns.

Groundwater-dependent Ecosystems (GDEs)

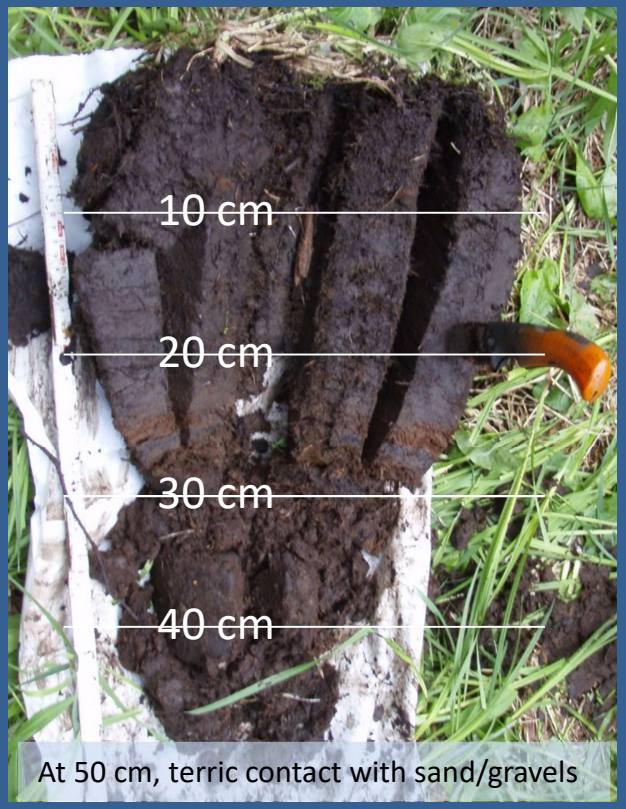
1) Communities of plants, animals, and other organisms whose existence and distribution depends on access to or discharge of groundwater;
2) Includes **springs, fens**, seeps, areas of shallow groundwater, cave & karst systems, hyporheic & hypolentic zones, and groundwater-fed lakes, streams, and wetlands.

Beaver Skull Fen, West Elk Mountains, GMUG NF, CO

Fen Definition (USA)

Fens are peat accumulating wetlands (peatlands):

1) Primarily supported by groundwater (=GDEs);
2) Have organic soils meeting USDA NRCS definition of a histosol or a histic epipedon in at least some part of the contiguous wetland (≥40 cm peat).



US Fish and Wildlife Service (USFWS). 1999. Peatland mitigation policy considerations. Lakewood, CO: USFWS, Region 6.

GDEs on USFS Lands: Wetlands

- Ecosystems that regularly or periodically have **saturated** soils for at least two weeks during the growing season;
- Many wetlands are **groundwater dependent**;
- Hydrologic/geomorphic processes, disturbance regimes, elevation/climate, water/soil geochemistry and flora determine the wetland type.

Characteristics of Mountain Fens: Peat

Peat thickness (depth of peat bed)

Photo by D. D'Amore

Peat composition & extent of decomposition

Willow roots; sedge roots & rhizomes + some hemic soil material

Photo by D. Cooper


Photos by David Cooper

Ecosystem Services of Peatlands/ Fens

Support species (many rare species); including plants, waterfowl, amphibians, invertebrates; high proportion of regional biodiversity.

Peat profiles are archives; containing records of temporal changes in microfossils (e.g. pollen, spores) & macrofossils (plant parts, wood, animal remains). Provide insights into past climates and peatland development.

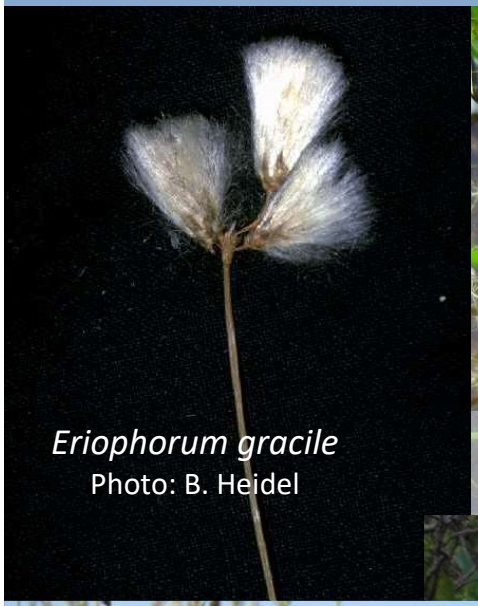
Water storage & quality; fens can behave hydrologically like unregulated, shallow reservoirs; can influence water, sediment and nutrient movement in watersheds.

Carbon storage; peat contains 5-65% carbon (ave: ~50%); large belowground C stores.

~180 cm of fibric peat

gleyed glacial till

Sensitive Plant Species Found in Fens

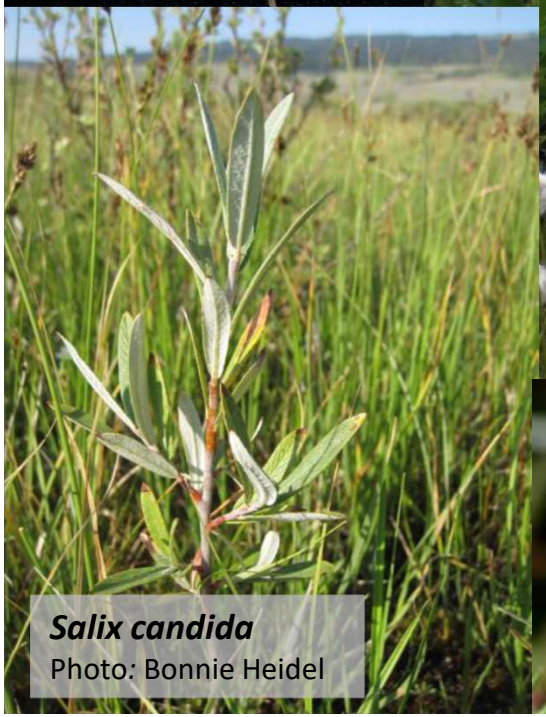


Eriophorum gracile
Photo: B. Heidel

Utricularia minor
Photo: J. Proctor

Carex diandra

Eriophorum chamissonis
Photo: J. Proctor



Salix candida
Photo: Bonnie Heidel

Sphagnum spp.

Drosera rotundifolia
Photo: Andy Kratz

Age of Colorado Fens: Basal Peat Dates

Location	Elevation (m)	Basal Date YBP	Peat Depth (m)	Accumulation Rate (mm/yr)
South Park, CO				
Sacramento Creek (Cooper 1990b)	3,100	**9,820 ± 150**	2.13	0.22
Carpenter's Fen (Cooper 1990b)	3,150	**9,280 ± 180**	3.20	0.34
McMaster's Fen (Cooper 1990b)	3,175	**9,220 ± 110**	3.33	0.36
East Lost Park Fen (Cooper 1990b)	3,100	**10,080 ± 150**	2.64	0.26
High Creek Windmill Fen (Cooper 1990b)	3,010	**8,270 ± 140**	0.90	0.11
Lost Park Fen (Vierling 1992)	3,079	**11,820 ± 100**	3.30	0.28
Gore Range, CO				
Dome Creek Meadow (Feiler and Anderson 1997)	3,146	**7,800 ± 100**	3.62	0.46
Buffalo Pass (Madole 1980)		**7,730 ± 250**	1.93	0.25
Front Range, CO				
Green Mt. Pond (Cooper 1990)	2,865	**11,820 ± 170**	1.50	0.13
Big Meadows (Cooper 1990)	2,865	**11,230 ± 170**	1.50	0.13
Winding River Kettle (Madole 1976)	2,640	**10,320 ± 200**	1.75	0.28
Silver Lake Bog (Pennak 1963)	2,979	**6,190 ± 300**	1.25	0.51
Albion Bog (Pennak 1963)	3,247	**2,470 ± 200**	1.90	0.18
Caribou Fen (Benedict and Maher, unpublished data)	3,400	**10,500 ± 70**	1.32	0.26
Zapf's Fen (Benedict and Maher, unpublished data)	2,725	**5,000 ± 140**	N/A	N/A
La Poudre Pass (Madole 1980)	3,103	**9,800 ± 400**		
San Juan Mountains, CO				
Eureka Gulch Bog (Carrara *et al.* 1991)	3,665	**6,180 ± 160**	2.40	0.29
California Gulch Bog (Carrara *et al.* 1991)	3,165	**7,860 ± 40**	1.55	0.20
Placer Gulch Bog (Carrara *et al.* 1991)	3,600	**8,790 ± 260**	0.85	0.10
Picayne Gulch Bog (Carrara *et al.* 1991)	3,750	**8,350 ± 250**	1.30	0.16
Hurricane Basin Bog (Carrara *et al.* 1991)	3,660	**8,420 ± 750**	2.05	0.24
Cottongrass Fen (Cooper – Telluride)	3600	**10,300**	3.2	
Gunnison County, CO				
Red Lady Fen (Fall 1997)	3,350	**4,675 ± 155**	0.95	0.20
Red Well (Fall 1997)	3,290	**2,805 ± 160**	1.00	0.36
Iron Bog (Fall 1997)	2,290	**8,260 ± 220**	2.20	0.27
Splains Gulch Meadow (Fall 1997)	3,150	**8,560 ± 600**	2.00	0.23
Average	**3,146**	**8,190**	**1.99**	**0.25**

GMUG Fens: Past Work Forest-wide

Inventory of Fens in a Large Landscape of West-Central Colorado

Grand Mesa, Uncompahgre, and Gunnison National Forests

April 6, 2012

Beaver Skull Fen in the West Elk Mountains – a moat surrounding the floating mat

Barry C. Johnston[a], Benjamin T. Stratton[b], Warren R. Young[c], Liane L. Mattson[d], John M. Almy[e], Gay T. Austin[f]

Mapped potential fen sites using NWI layer/ photointerpretation (2008-2009);

Stratified into 12 landscape areas using geology, climate, glaciation (2009);

Sampled randomly selected sites for soils (peat), vegetation, H_2O (pH. EC); 147 fens in 12 landscape areas (incl. Sawatch Mtns) (2009-2010).

B. Johnston, B. Stratton, W. Young, S. Jay, J. Simonsen, J. Almy. Fen WFT874, Taylor Park, June 10, 2010.

Findings: 81% of sampled fens in good condition; 18% in moderate condition; 1% in poor condition. Estimated 1,738 (± 827; 95% confidence) fens on GMUG

GMUG Fens: Past Work on Grand Mesa

Wetlands Ecol Manage
DOI 10.1007/s11273-015-9458-7

CrossMark

ORIGINAL PAPER

Persistence of high elevation fens in the Southern Rocky Mountains, on Grand Mesa, Colorado, U.S.A.

Gay Austin · David J. Cooper

Received: 1 May 2015 / Accepted: 3 September 2015

46 fens (52%) had little-to-no disturbance;
14 fens (16%): severe hydrological alteration; disturbance to peat body

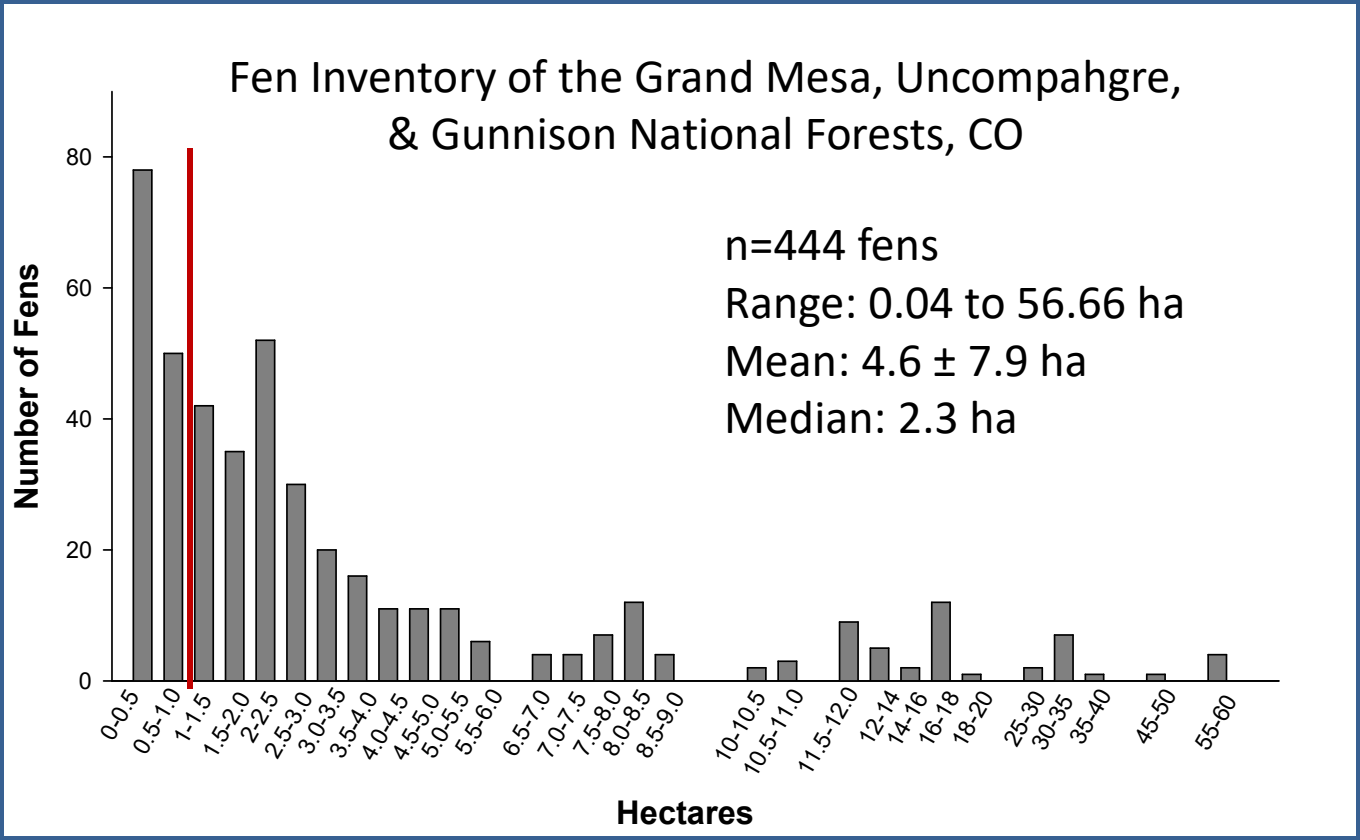
Visited 111 candidate sites:
- 88 Fens
- 15 wet meadows
- 2 marshes

Characterized vegetation, hydrology, H_2O chemistry, soils, management & land use impacts.

Peat Depth Inventory Results: National Forests

	Medicine Bow NF, WY	Bighorn NF, WY	GMUG NFs, CO	Manti LaSal NF, UT
No. Wetlands Visited	104	332	308	353
Peat 0-20 cm (not fens)	23	244	144	269
Peat 20 - 40 cm	11	40	11	29
Peat ≥ 40 cm	70	48	153	55

Mountain Fens: Small and Numerous



Sierra Nevada, CA
n=79 fens
Range: 0.0045-20 ha
Median: 0.17 ha
(Wolf & Cooper. 2014. *Mires and Peat* 15:1-15)

San Juan Mtns., CO
n=624 fens
Range: 0.2 to 20.5 ha
Mean: 1.2 ha
Median: 0.8 ha
(Chimner et al. 2010. *Wetlands* 30: 763-771.)

29% of the sampled fens were < 1 ha.

Johnston et al. 2012. Inventory of fens in a large landscape of west-central Colorado; Grand Mesa, Uncompahgre, and Gunnison National Forests. 198 pages.

Conservation of Wetlands on USFS Lands

- USDA Forest Service 2012 Planning Rule: Riparian is defined as " the transition between aquatic and upland…." (lake, pond, stream, river, *wetland*);
- Buffers set to protect water quality, riparian-stream or wetland habitat;
- Buffers = delineated area

  Streams: **100 ft** on each side of channel

  Fens: **100 ft** perimeter

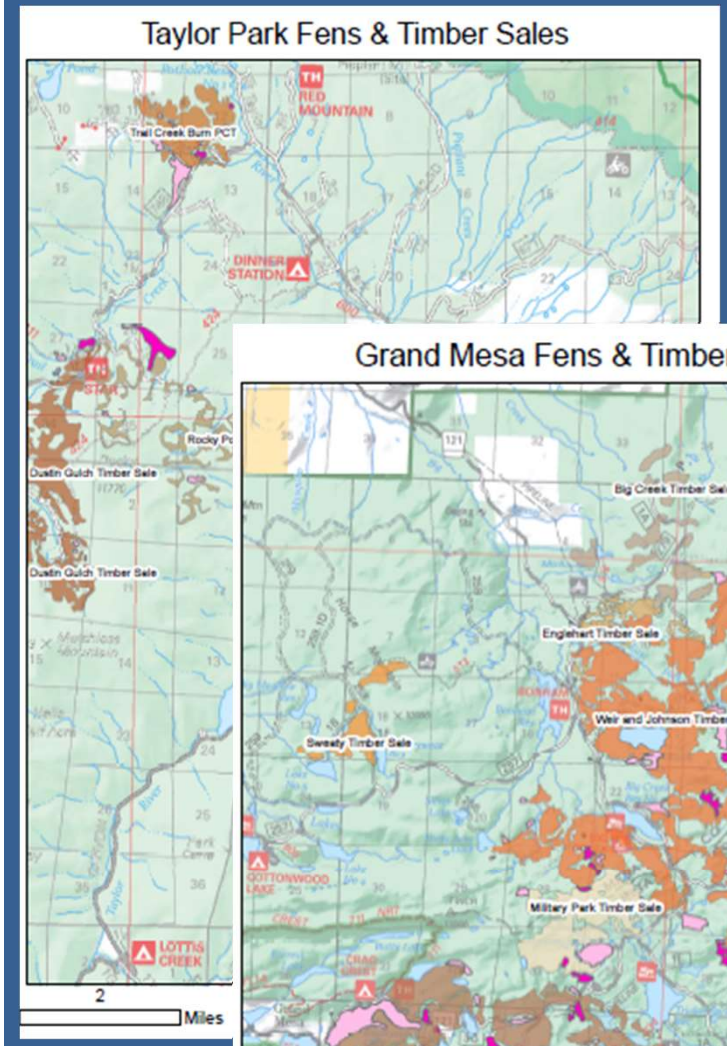
  Non-fen wetlands: **50 ft** perimeter

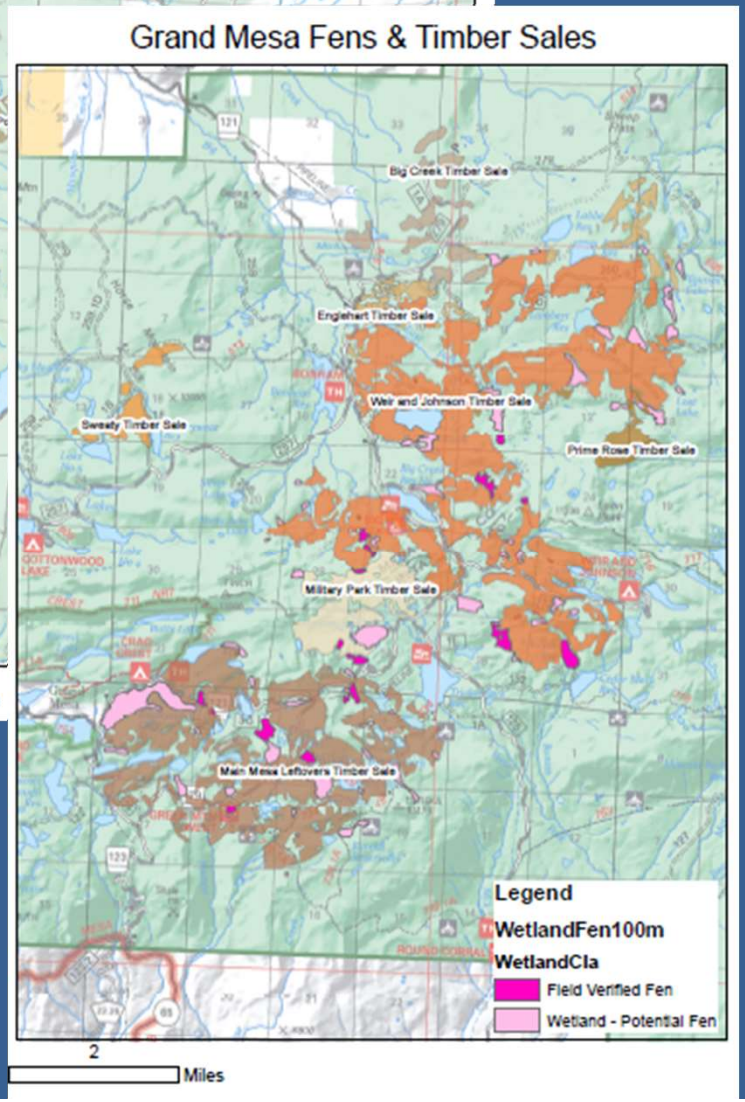
  Springs: **25 ft** on each side of run-out channel

Challenges of Managing Fens:

- Locating wetlands within SBEADMR/ Taylor Park treatment areas;
- Determining which wetlands are fens;
- Correctly buffering fens, non-fen wetlands, and springs;
- Determining & mitigating impacts of fuel reduction activities:

  Understanding groundwater dynamics.





Taylor Park 2021/2022

- Characterized 14 wetlands (12 fens) in proposed treatment units;
- Surveyed for sensitive plant species;
- Sampled supporting springs within & surrounding fens.

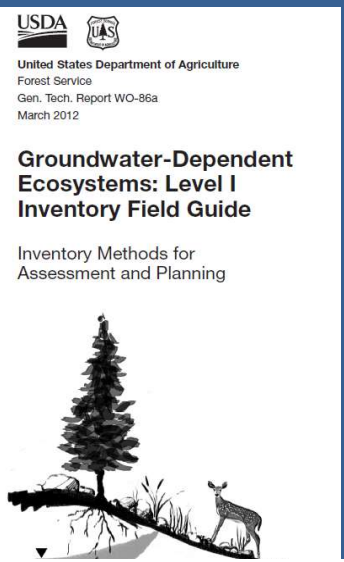
Grand Mesa 2021/2022

- Characterized 27 wetlands (24 fens) in proposed treatment units;
- Surveyed for sensitive plant species;
- Sampled supporting springs within & surrounding fens;
- Instrumented study fen (Grey Jay Fen).

Minerals & Geology Management |USFS Enterprise Program

FY22 GDE Survey Assistance

Field Crew (4)
Characterize new or unverified GDEs within planned projects on the Grand Mesa;
Crew used GDE Level 1 Protocol;
Visited 24 sites; collected data on 18 wetlands.
Late August 2022.



Impacts of Large-scale Fuel Reduction Treatments

Major Unknowns:

- Impacts of logging equipment & operations (& tree removal) on subsurface hydrology and groundwater sources?
- Effectiveness of 25', 50' and 100' buffers in protecting springs, wetlands, and fens from logging equipment & operations (& other upland management treatments)?
- Impacts of different treatments on nutrient and sediment inputs to fens?
- Impacts of different treatments on fen microclimates?

Monitoring to Assess Impacts of Treatments

At selected fen sites in Taylor Park and on the Grand Mesa:

Hydrologic monitoring:

- Install & monitor wells & piezometers to track water table elevation seasonally pre-and-post treatment;
- Collect meteorlogical information;
- Model & characterize groundwater dynamics pre-and-post treatment. (in collaboration with USFS Groundwater Program).

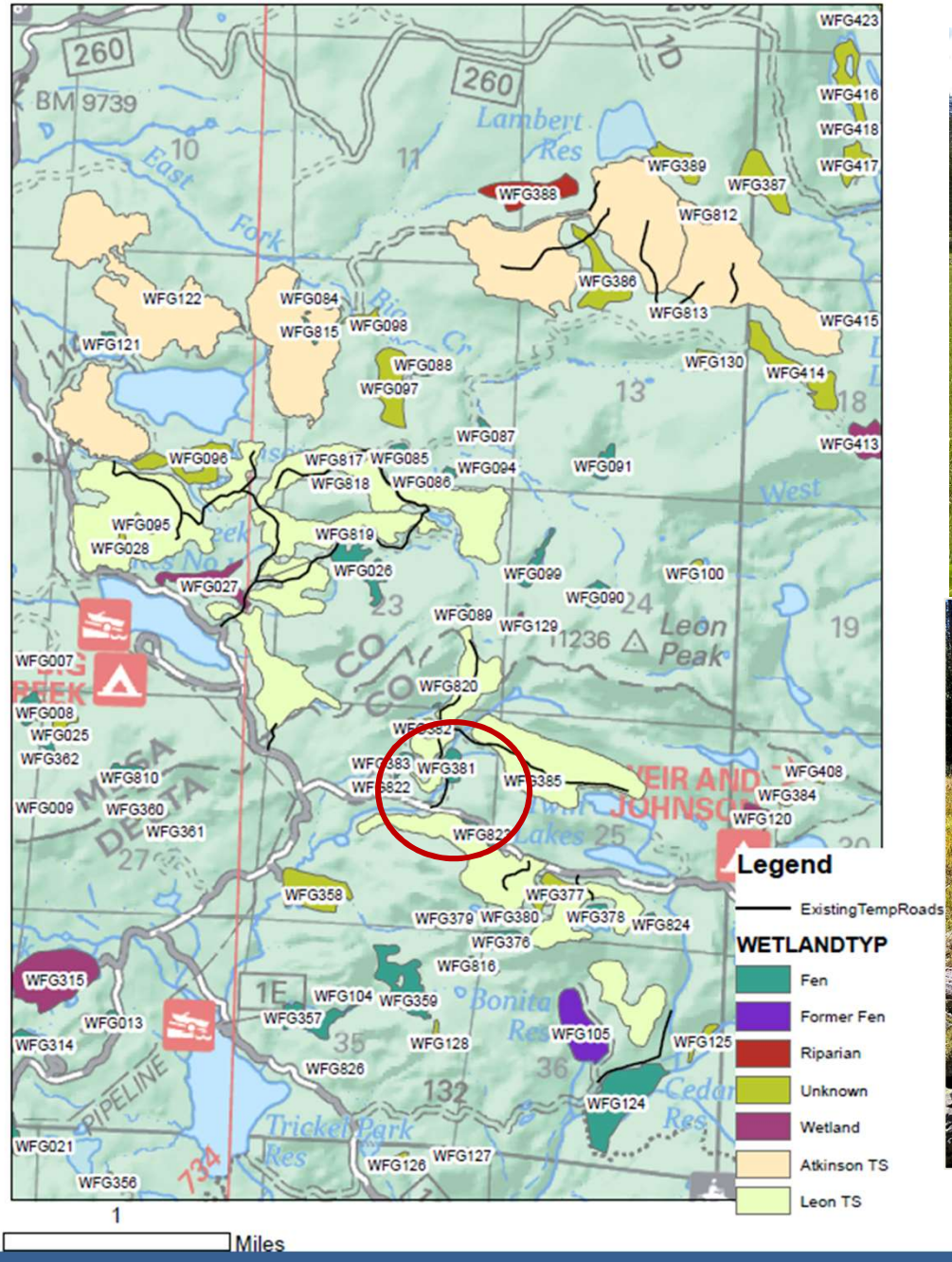
Vegetation monitoring:

- Establish permanent transects through different fen plant communities and monitor cover & frequency;
- Survey for sensitive plant species throughout potentially impacted fens;

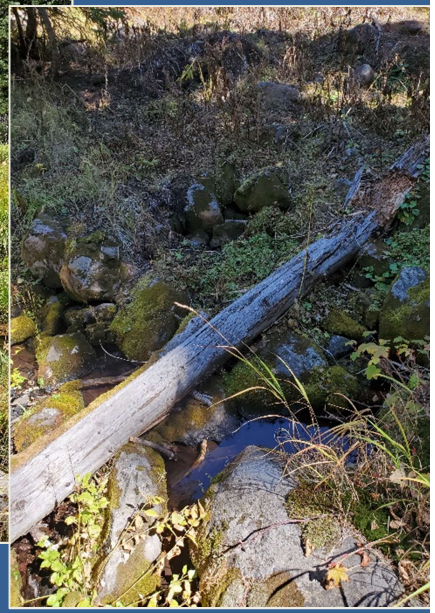
Monitoring of sediment and nutrient inputs:

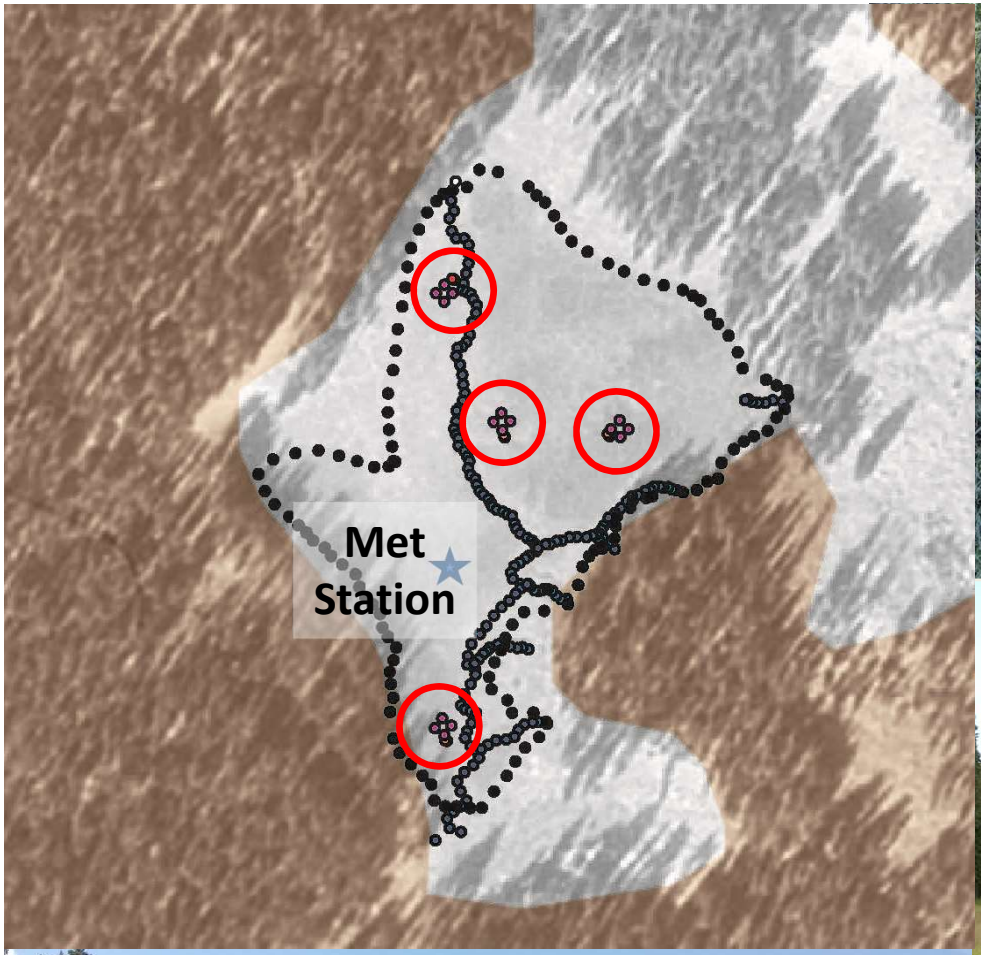
- Install sediment discs and measure inputs;
- Collect & analyze water samples seasonally.

Atkinson and Leon TS and Wetland/Fen Inventory June 2022



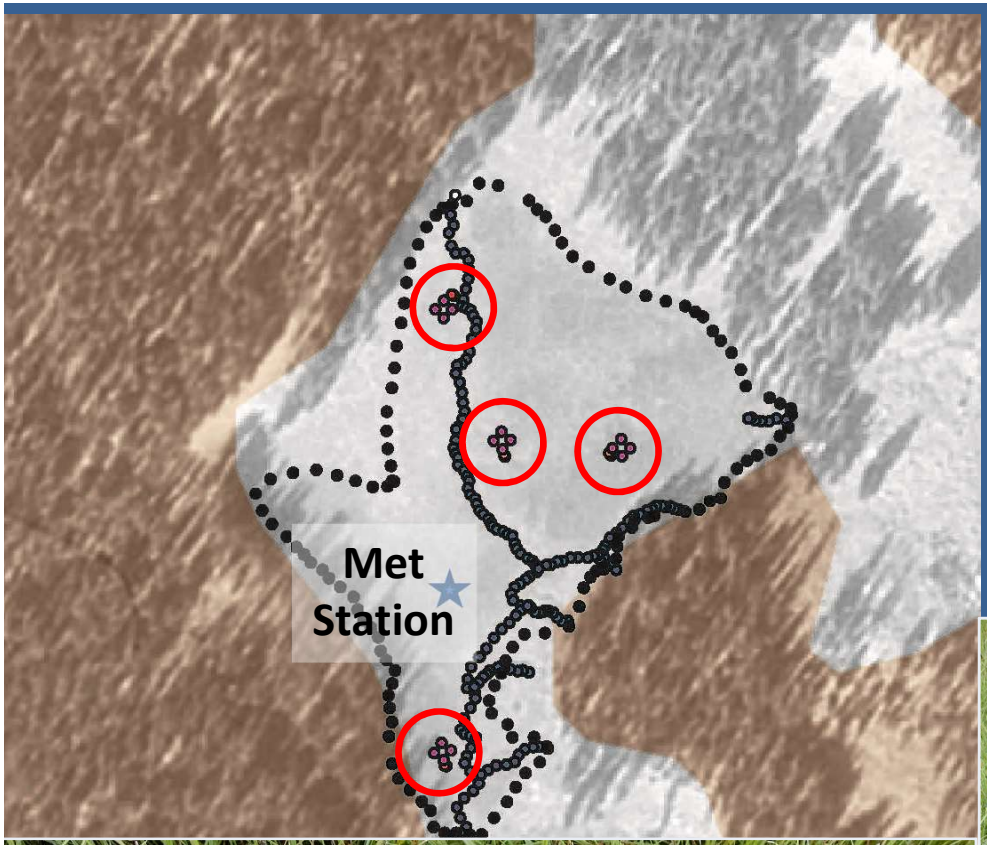
Grey Jay Fen (WFG381)



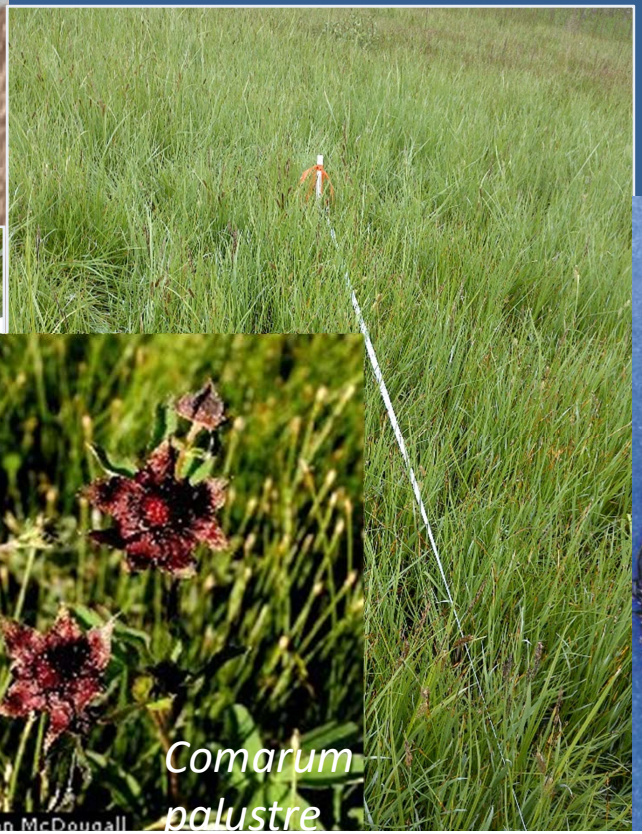

Met
Station

Vegetation Transects

- Permanent transect within each of 4 plant communities: ELQU2-PEGR; CAAQ-CACA4; DECE-CAAQ-CALE4; CACA11-DECE-CACA
- 52 vascular plant species,
- 4 bryophyte species

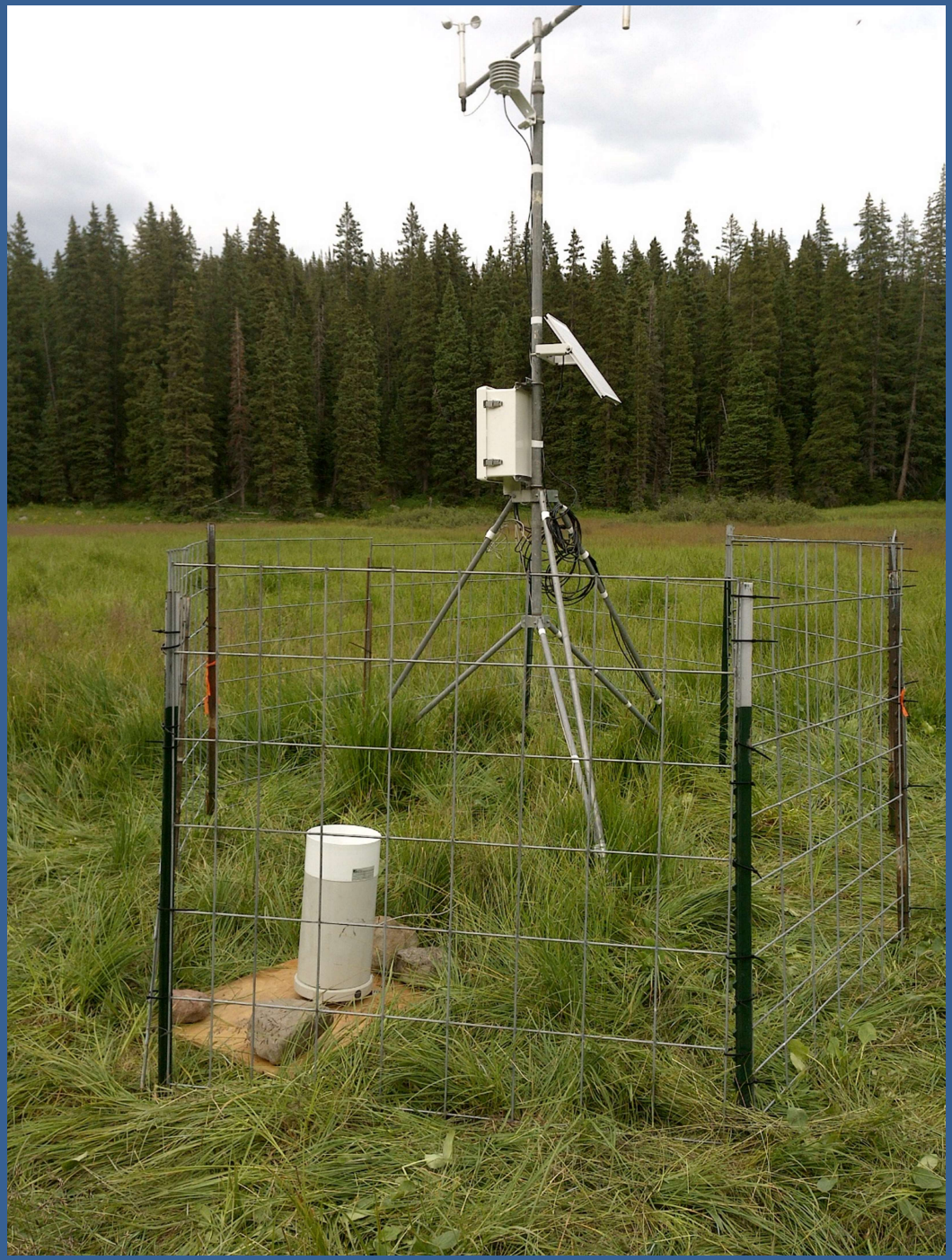



Carex simulata



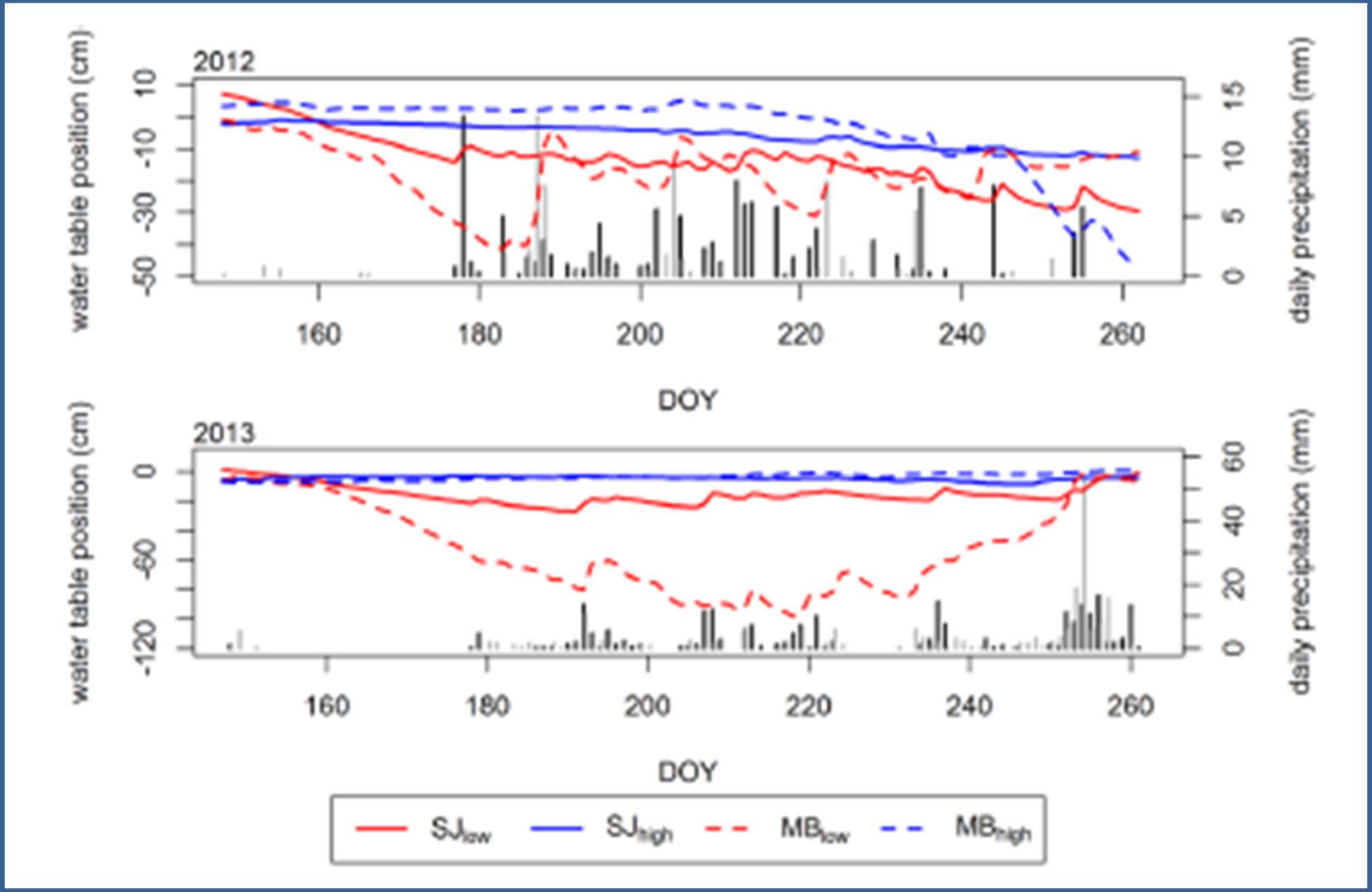
Comarum palustre


Carex saxatilis



Many thanks to:
Gay Austin (retired BLM/USFS)
Bob Mosher &
Monica Klinger
GMUG Range Staff
Grand Valley RD

Hydrologic Monitoring in Fens:



Millar et al. 2016. Mountain peatlands range from CO_2 sinks at high elevations to sources at low elevations: Implications for a changing climate. *Ecosystems.*

Mapping Fen Wetlands on National Forests through Aerial Photo Interpretation

Gabrielle Smith, Joanna Lemly, & Karin Decker (retired)
Colorado Natural Heritage Program (CNHP)
Warner College of Natural Resources
Colorado State University

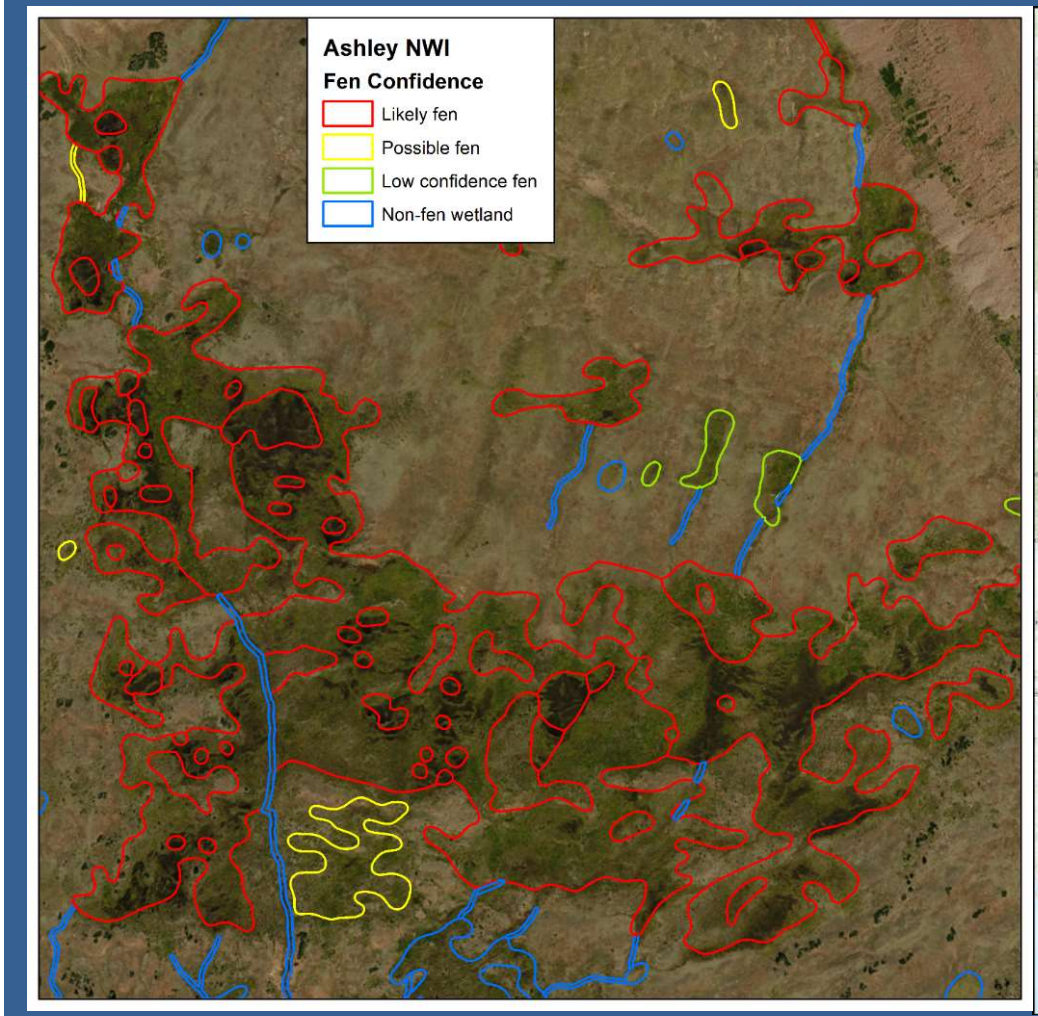
WARNER COLLEGE OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY

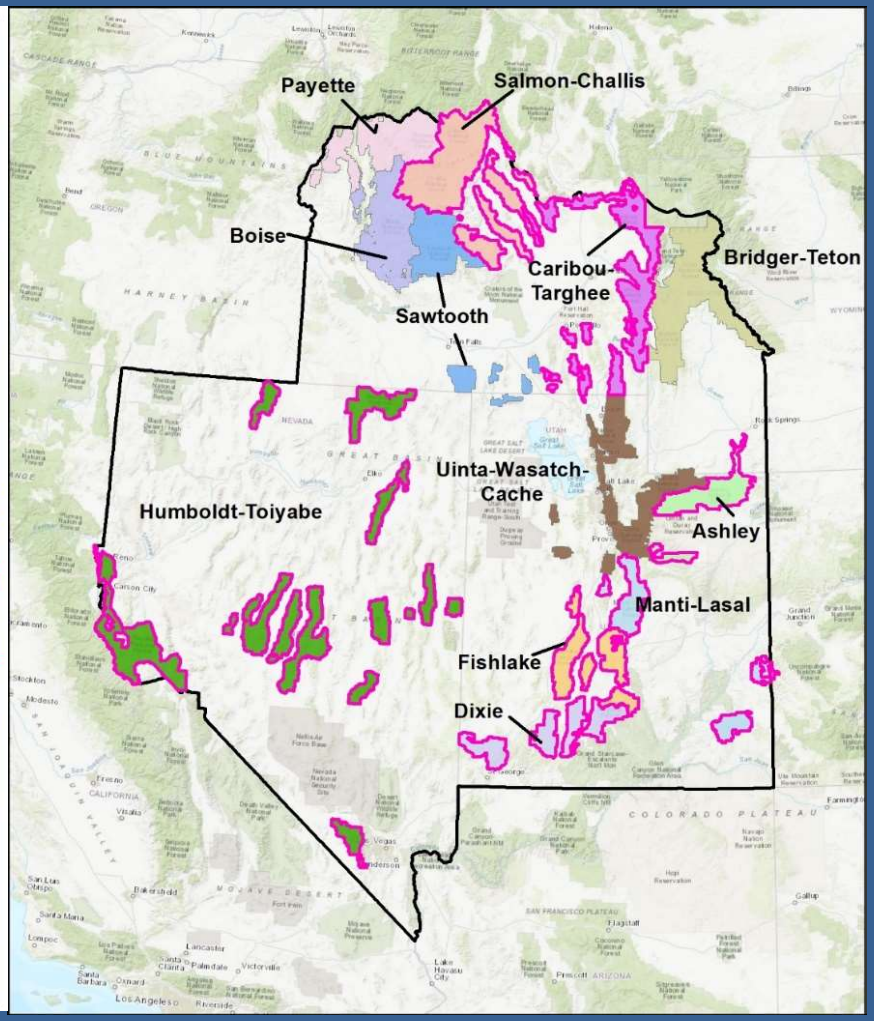
USDA FOREST SERVICE

CNHP Fen mapping:

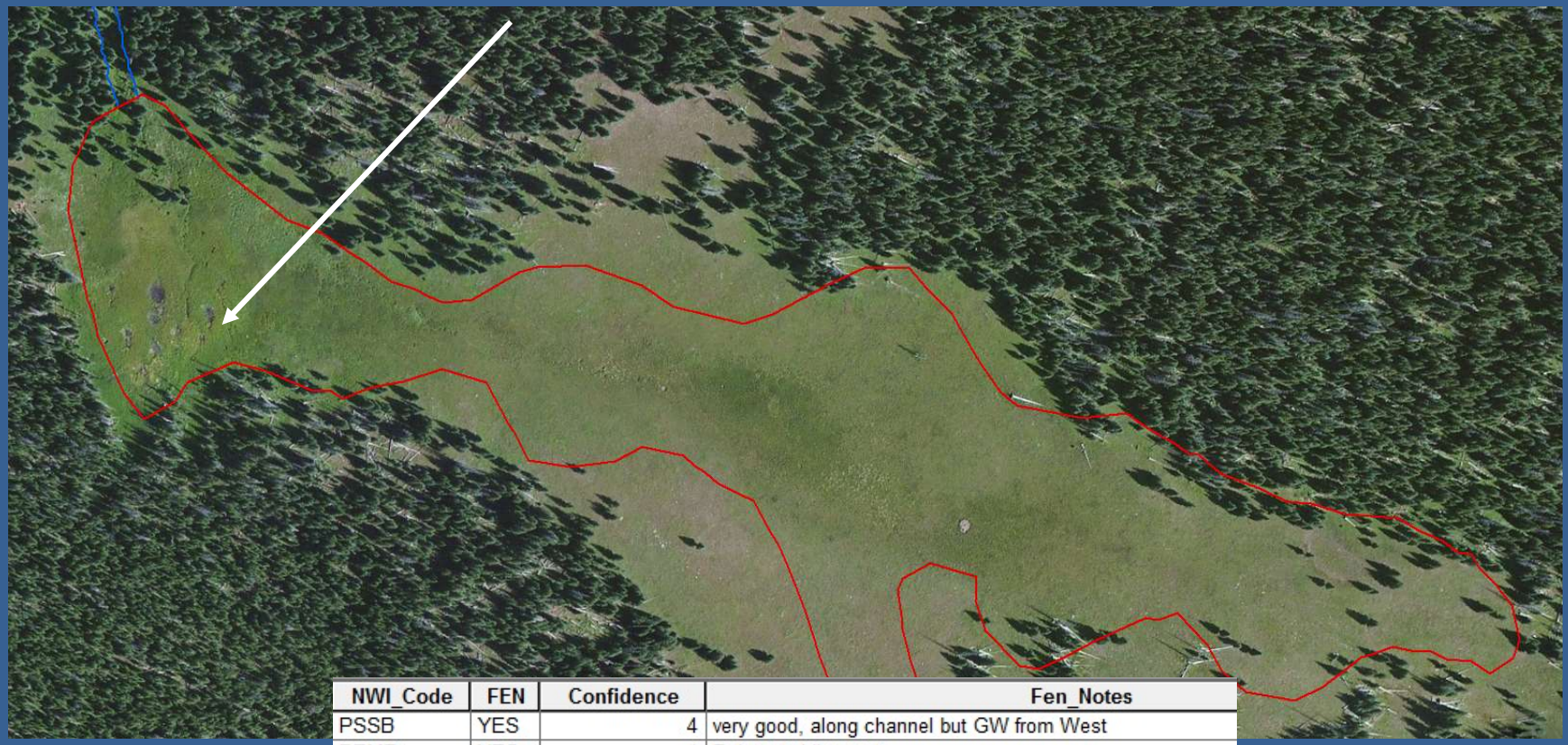
Completed for 12 National Forests in USFS Intermountain Region

Partial mapping for 2 National Forests in USFS Rocky Mtn Region.





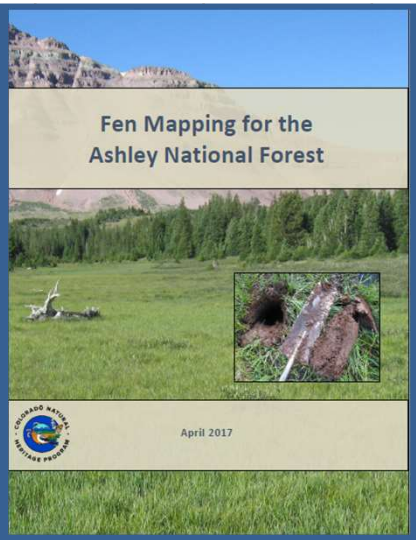
Criteria: categorizing mapped wetlands

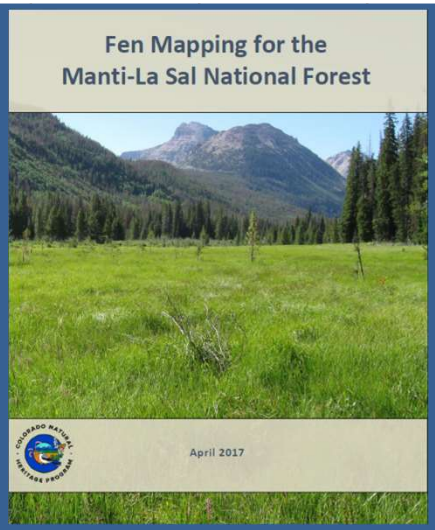


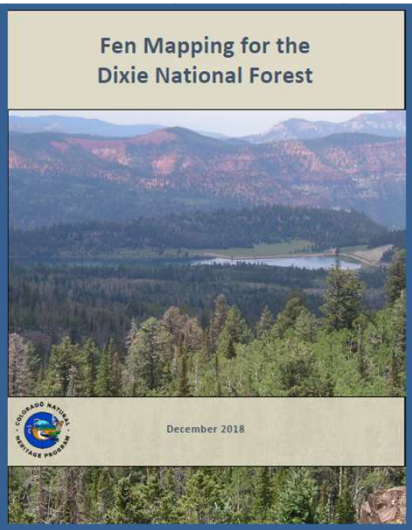
NWI_Code	FEN	Confidence	Fen_Notes
PSSB	YES	4	very good, along channel but GW from West
PEMB	YES	4	Below saddle, east,
PEMB	YES	5	excellent position and color and texture, poly too big
PEMB	YES	5	POOLS, striations, color, bigger than poly
PEMB	YES	5	STRIATIONS, COLOR GOOD, SMALL pcoket
PEMB	YES	5	excellent in parts
PEMB	YES	5	EXCELLENT VERY LARGE, INTERESTING
PEMB	YES	5	EXCELLENT IN PARTS

Mapping Results: Utah National Forests

Confidence	Ashley NF			Manti-La Sal NF			Dixie NF		
	Count	Acres	Average size (acres)	Count	Acres	Average size (acres)	Count	Acres	Average size (acres)
5 – Likely Fen	4,019	9,007	2.24	30	158	5.26	62	193	3.23
3 – Possible Fen	2,765	2,929	1.06	336	800	2.38	237	538	2.27
1 – Low Confidence	1,830	1,932	1.06	752	586	0.78	585	1,549	2.65
Total	**8,614**	**13,869**	**1.61**	**1,118**	**1,544**	**1.38**	**884**	**2,281**	**2.58**







Management of GDEs on National Forests

1) **GDE resource management**
   - Water and water uses
   - Project planning
   - Conservation of threatened, endangered, & sensitive species

2) **Planning and environmental compliance**
   - Policy & procedures for land management planning & environmental compliance activities
   - **2012 Planning Rule**: Assessment of riparian areas and GDEs; at-risk species; carbon stocks; watershed & water resources; areas of tribal importance; cultural & historic resources & uses; designated areas (RNAs, ASBIs)

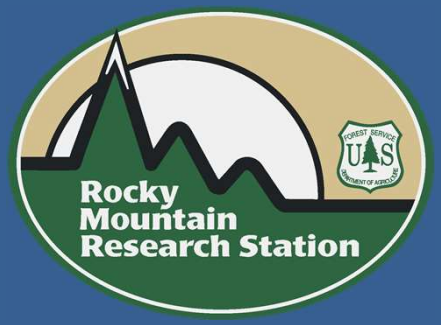
3) **Resource information management**

Ongoing Work (2023)

- Locating wetlands within SBEADMR/ Taylor Park treatment areas;
- Determining which wetlands are fens;
- Correctly buffering fens, non-fen wetlands, and springs;
- Instrumenting 2-3 additional sites for long-term monitoring.

Thanks to Collaborators:

Gay Austin (retired), BLM & GMUG USDA Forest Service
Carlyn Perovich, GMUG USDA Forest Service
John Korfmacher, RMRS USDA Forest Service
Gina Rone, GMUG USDA Forest Service
Susie Parker, GMUG USDA Forest Service
Jonathan Coop + students, Western Colorado University
Barry Johnston, USDA Forest Service (retired), CO
Joe Gurrieri, Tim Stroope, USFS Groundwater Program
Joanna Lemly, Colorado Natural Heritage Program, CO
Rod Chimner, Michigan Tech University
…. And many others



THANK YOU!

Wikipedia:

The word "fen" is derived from Old Greek *bogg* Old Norse *fen* (quagmire), Gothic *fani* (mud), Dutch *ven*, German *Fenn* (fen, bog), from Proto-Germanic **fanja*. Cognates include Gothic (*fani*), Old Frisian (*fenne*), Dutch (*veen*, *ven*) and German (*Fenn(e)*, *Venn*, *Vehn*, *Feen*, *Fehn*).[11]