The importance of beavers in stream and riparian processes – opportunities for restoring watershed functions

FRANKLY MY DEAR, YOU SHOULD GIVE A DAM
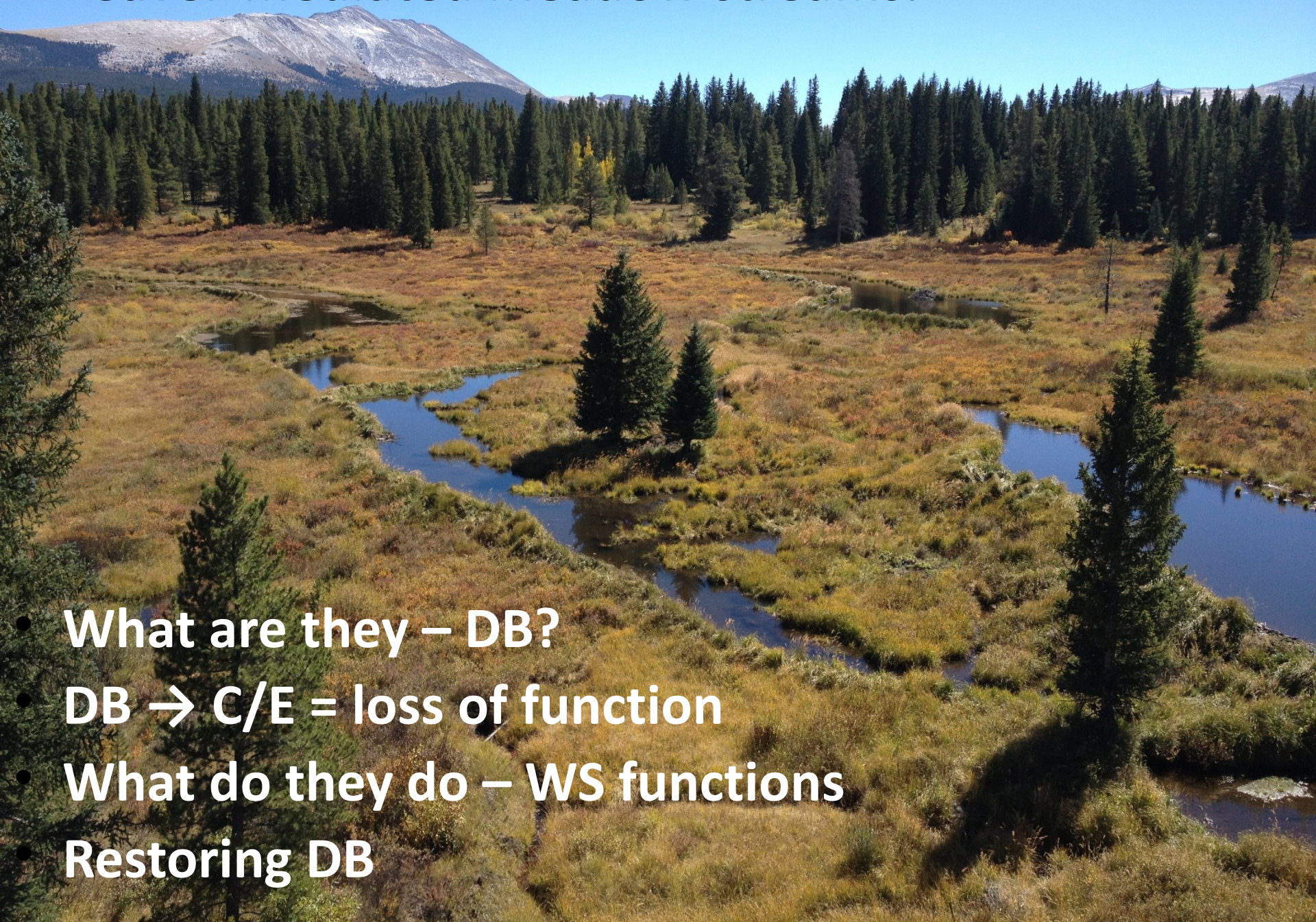
Mark Beardsley
&
Jessica Doran

EcoMetrics

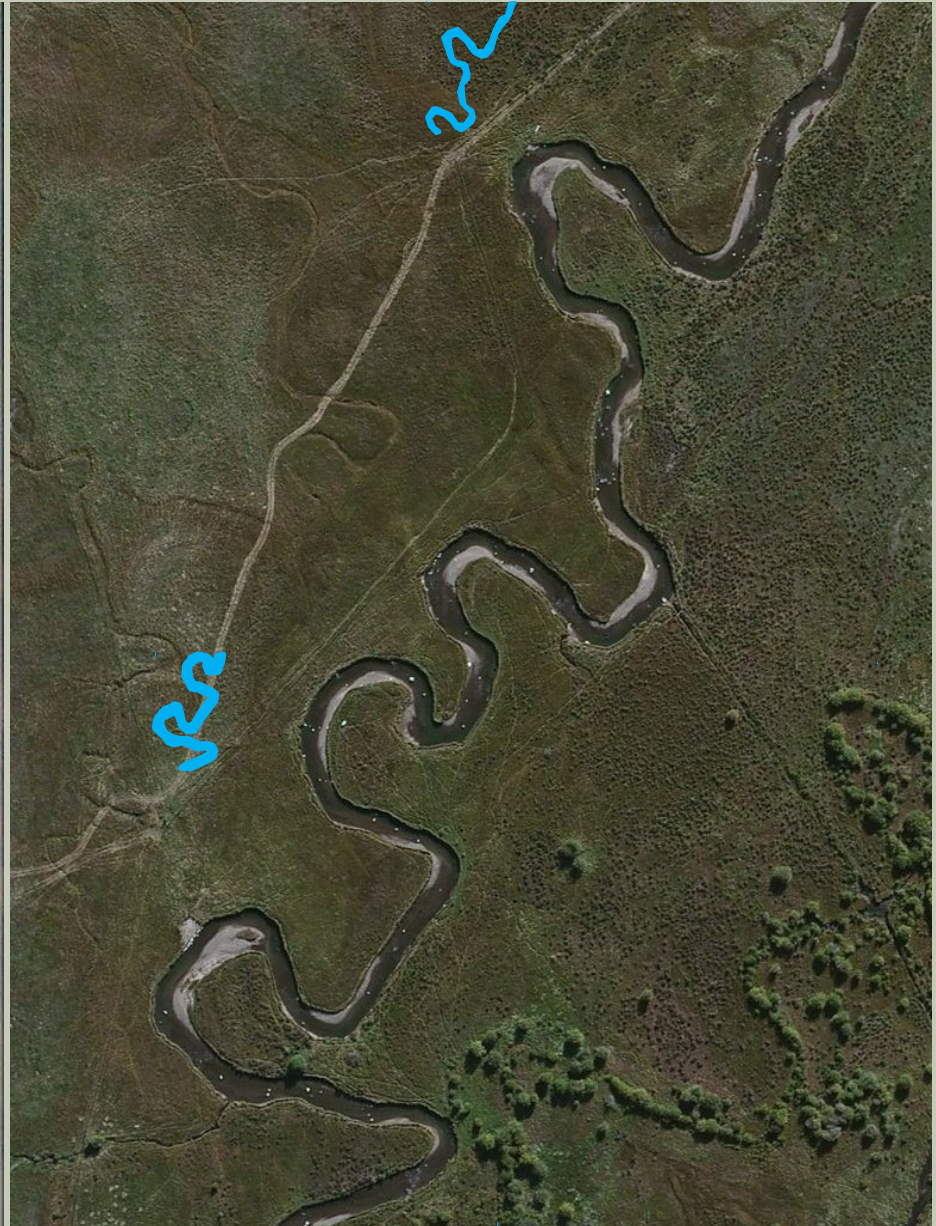Stream & Riparian Monitoring, Assessment & Restoration

Beaver-mediated meadow streams.

- **What are they – DB?**
- **DB → C/E = loss of function**
- **What do they do – WS functions**
- **Restoring DB**

Beaver-mediated meadow stream   Meandering meadow stream

Beaver-mediated meadow streams - What are they?

Characteristics

- Anastomosed
- Beaver dams and channels
- Floodplain connectivity
- Frequently inundated
- Wetland
- Hyporheic connectivity
- Ponds and deep pools
- Sed. transport episodic
- Aggradation/meadow-building?
- Dynamic: scour and deposition
- Diverse vegetation structure
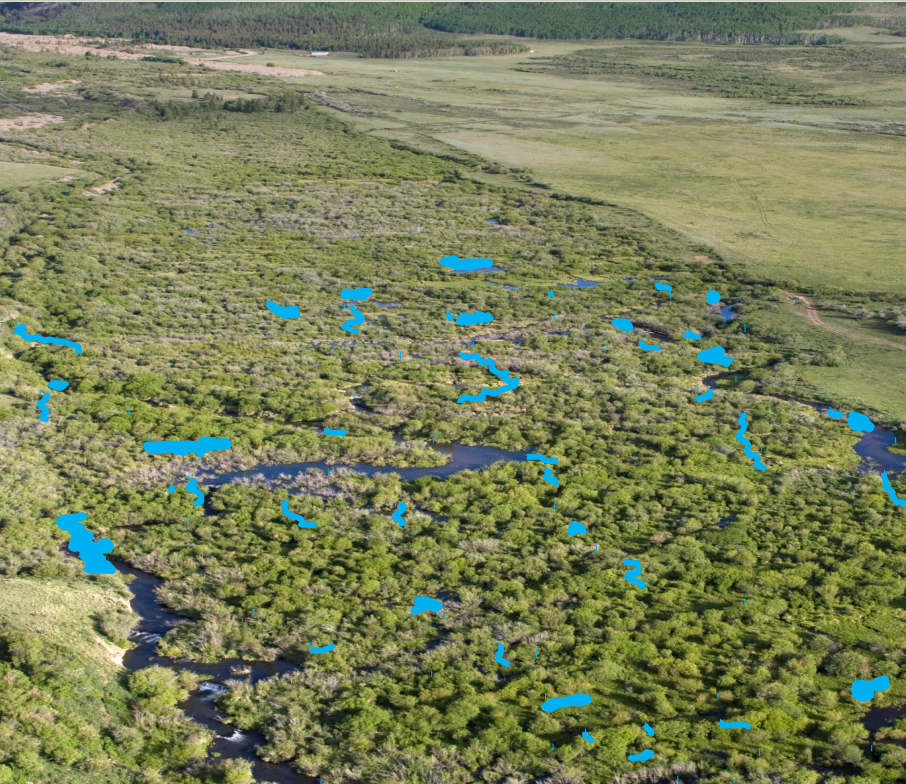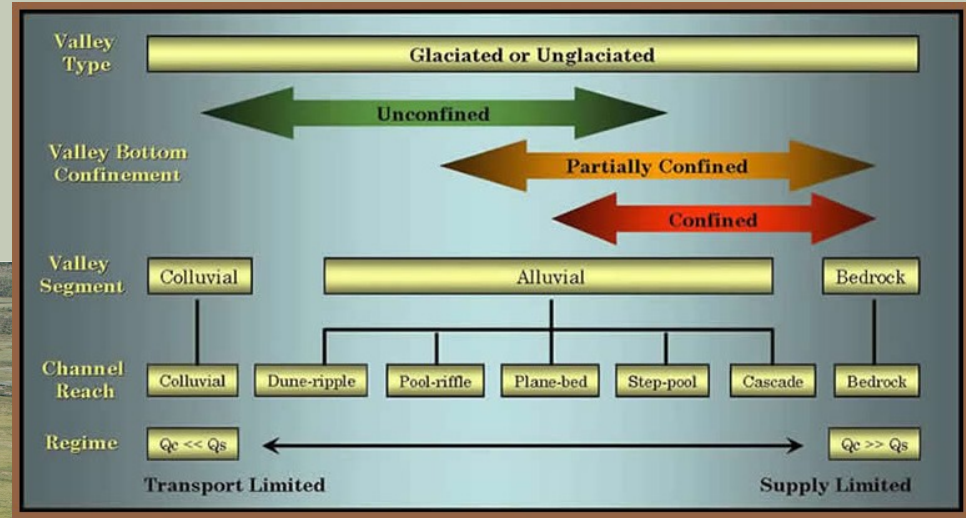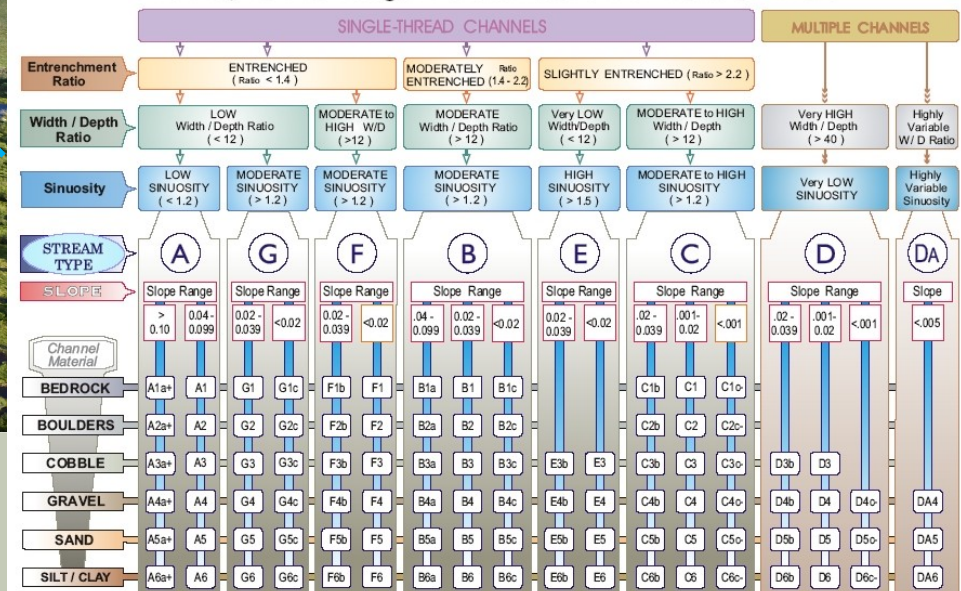- Woody vegetation (trees/shrubs)

2008/09/19

Classification

existing systems are inadequate

The Key to the Rosgen Classification of Natural Rivers

SINGLE-THREAD CHANNELS

MULTIPLE CHANNELS

Entrenchment Ratio	ENTRENCHED (Ratio < 1.4)		MODERATELY ENTRENCHED (1.4 - 2.2)	SLIGHTLY ENTRENCHED (Ratio > 2.2)				
Width / Depth Ratio	LOW Width / Depth Ratio (< 12)	MODERATE to HIGH W/D (>12)	MODERATE Width / Depth Ratio (> 12)	Very LOW Width/Depth (< 12)	MODERATE to HIGH Width / Depth (> 12)	Very HIGH Width / Depth (> 40)	Highly Variable W/D Ratio
Sinuosity	LOW SINUOSITY (< 1.2)	MODERATE SINUOSITY (> 1.2)	MODERATE SINUOSITY (> 1.2)	MODERATE SINUOSITY (> 1.2)	HIGH SINUOSITY (> 1.5)	MODERATE to HIGH SINUOSITY (> 1.2)	Very LOW SINUOSITY	Highly Variable Sinuosity
STREAM TYPE	A	G	F	B	E	C	D	DA

SLOPE — Slope Range

Stream Type	Slope Range			
A	> 0.10	0.04 - 0.099		
G	0.02 - 0.039	<0.02		
F	0.02 - 0.039	<0.02		
B	0.02 - 0.039	<0.02		
E	.04 - 0.099	0.02 - 0.039	<0.02	
C	0.02 - 0.039	.001 - 0.02	<.001	
D	0.02 - 0.039	.001 - 0.02	<.001	
DA	<.005			

Channel Material

|	A	G	F	B	E	C	D	DA
BEDROCK	A1a+ A1	G1 G1c	F1b F1	B1a B1 B1c		C1b C1 C1o		
BOULDERS	A2a+ A2	G2 G2c	F2b F2	B2a B2 B2c		C2b C2 C2o		
COBBLE	A3a+ A3	G3 G3c	F3b F3	B3a B3 B3c	E3b E3	C3b C3 C3o	D3b D3	
GRAVEL	A4a+ A4	G4 G4c	F4b F4	B4a B4 B4c	E4b E4	C4b C4 C4o	D4b D4 D4o	DA4
SAND	A5a+ A5	G5 G5c	F5b F5	B5a B5 B5c	E5b E5	C5b C5 C5o	D5b D5 D5o	DA5
SILT / CLAY	A6a+ A6	G6 G6c	F6b F6	B6a B6 B6c	E6b E6	C6b C6 C6o	D6b D6 D6o	DA6

KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the "continuum of physical variables" within stream reaches, values of **Entrenchment** and **Sinuosity** ratios can vary by +/- 0.2 units; while values for **Width / Depth** ratios can vary by +/- 2.0 units.
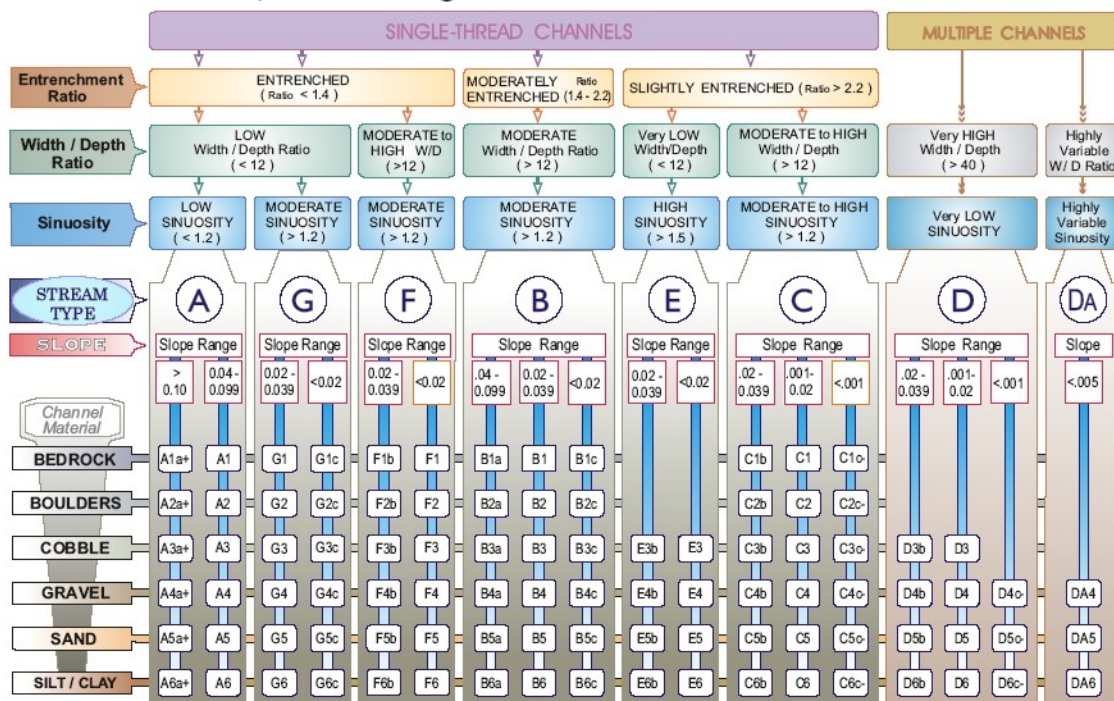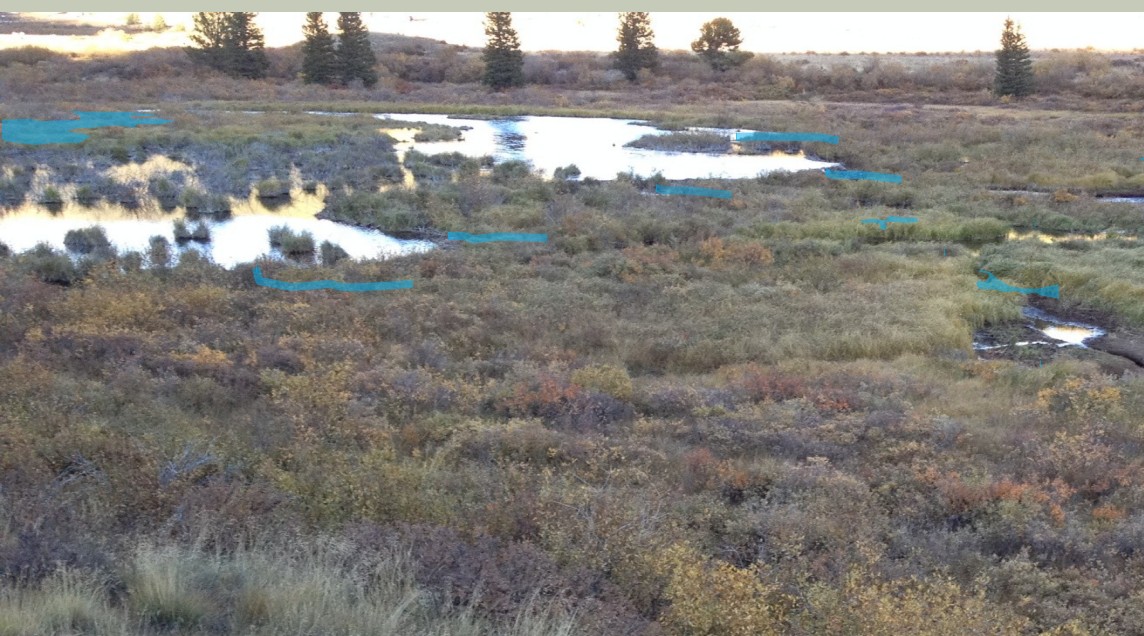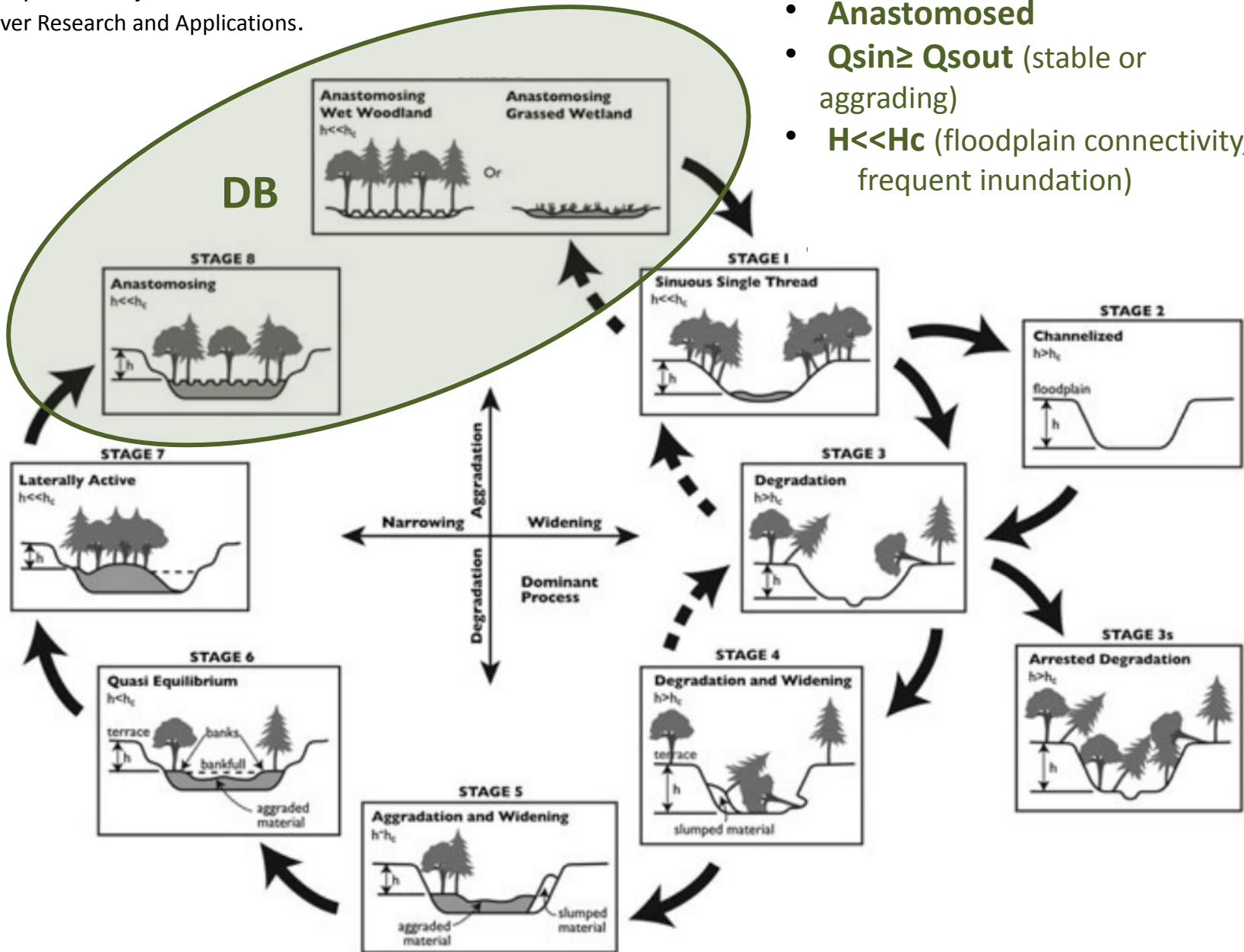
DB

DOWN WITH THE SYSTEM

SEM (Stream Evolution Model)

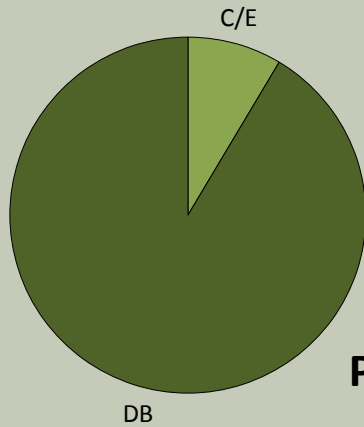Cluer and Thorne (2013) *A Stream Evolution Model Integrating Habitat and Ecosystem Benefits.*

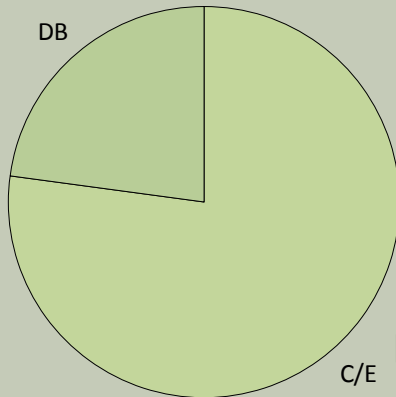River Research and Applications.

DB Stream Type

- **Stage 0 or 8**
- **Anastomosed**
- **Qsin≥ Qsout** (stable or aggrading)
- **H<<Hc** (floodplain connectivity, frequent inundation)

Watershed perspective

Pre-settlement

Present-day

Conversion of 0 (DB) → 1-7 (C/E)
 = loss of functions

Beaver-mediated meadow streams.
Functions and services

Hydrology
Floodplain connectivity
Water storage/retention
Base flow maintenance
Flood attenuation
Groundwater exchange

Habitat/wetlands
Vegetation structure and diversity
Aquatic habitat diversity
Fisheries support
Wildlife support

Water quality
Temperature regulation
Filtration
Nutrient cycling
Sediment storage/retention

Beaver-mediated meadow streams. Functions and services

Floodplain connectivity

Beaver-mediated meadow streams.
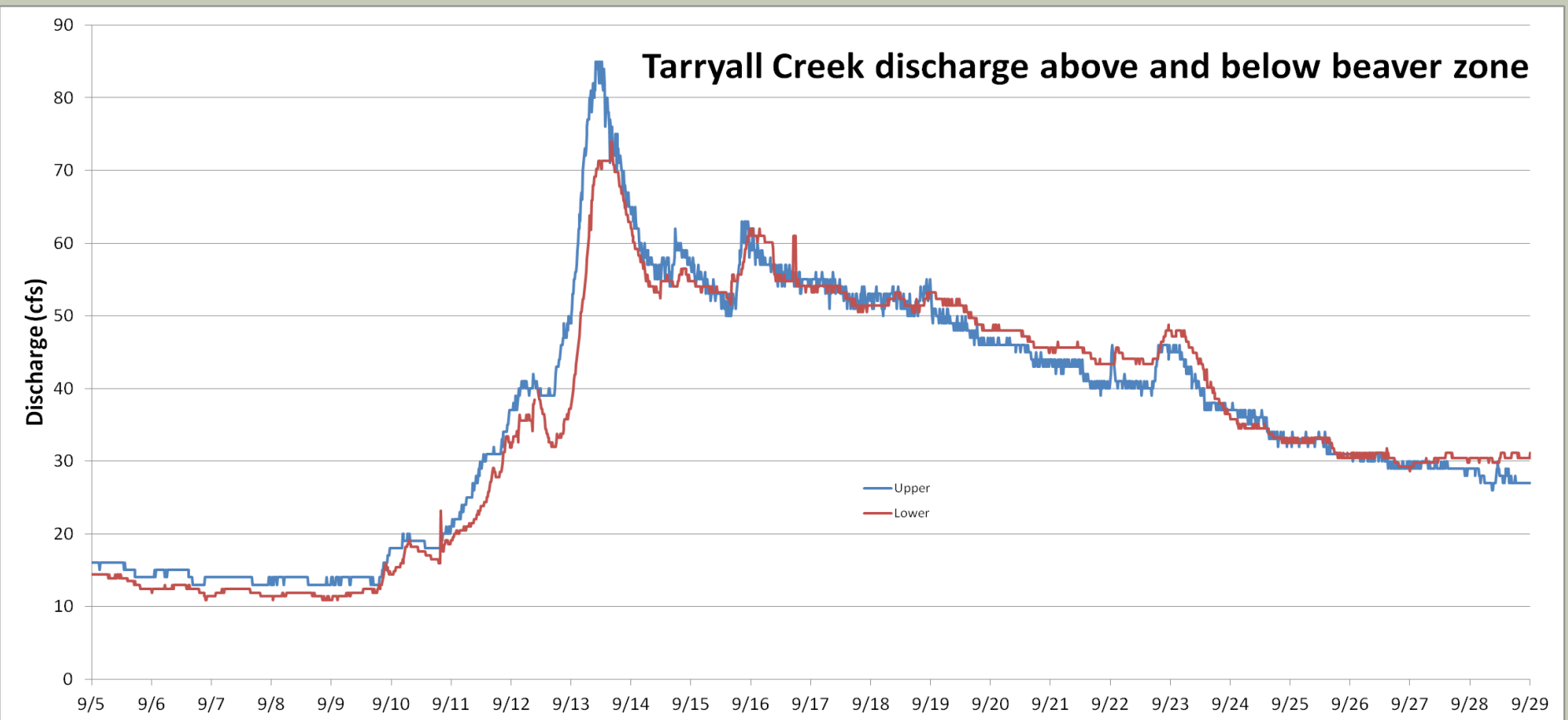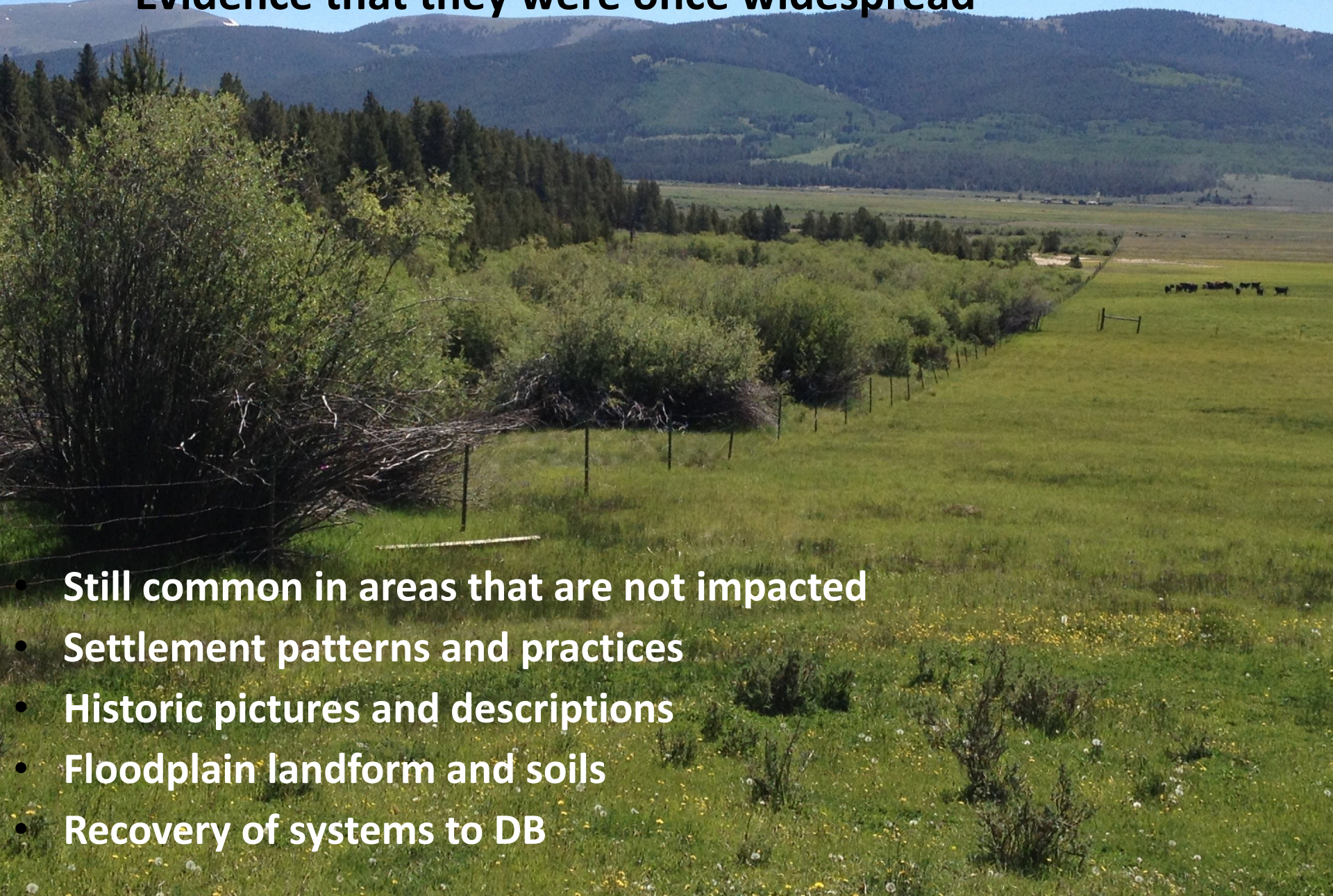## Functions and services

Water storage/

retention

Base flow maintenance
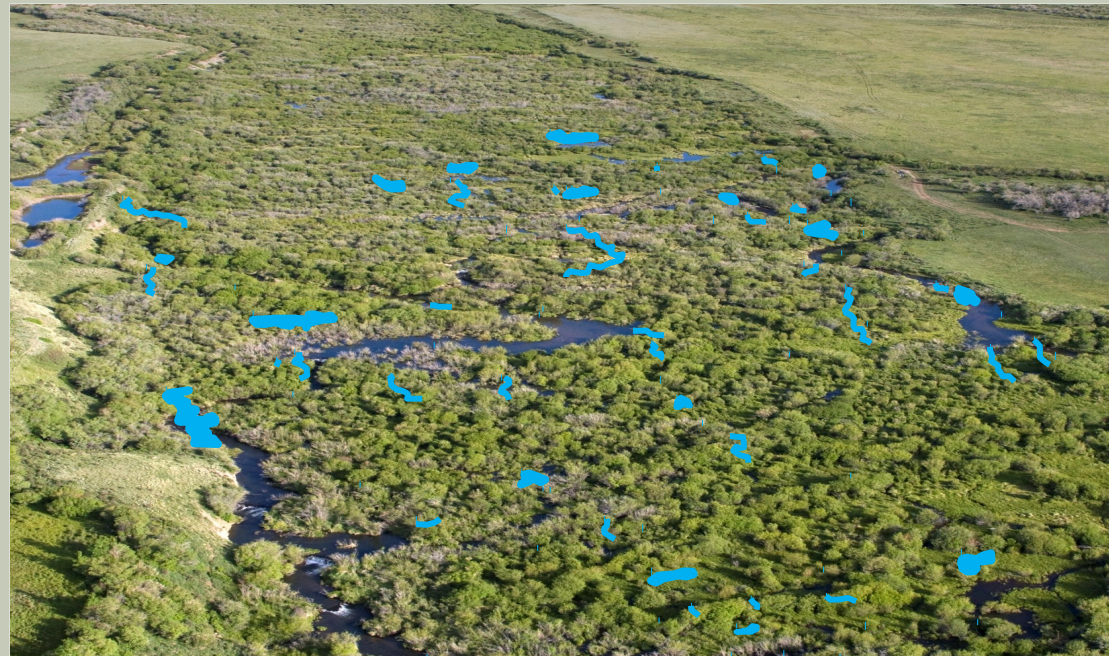
Tarryall Creek discharge above and below beaver zone

Beaver-mediated meadow streams.
Evidence that they were once widespread

- Still common in areas that are not impacted
- Settlement patterns and practices
- Historic pictures and descriptions
- Floodplain landform and soils
- Recovery of systems to DB

Still common in un-impacted areas

Settlement patterns/practices

- Bottomlands/riparian
- Vegetation/shrub clearing
- Floodplain leveling
- Channelization
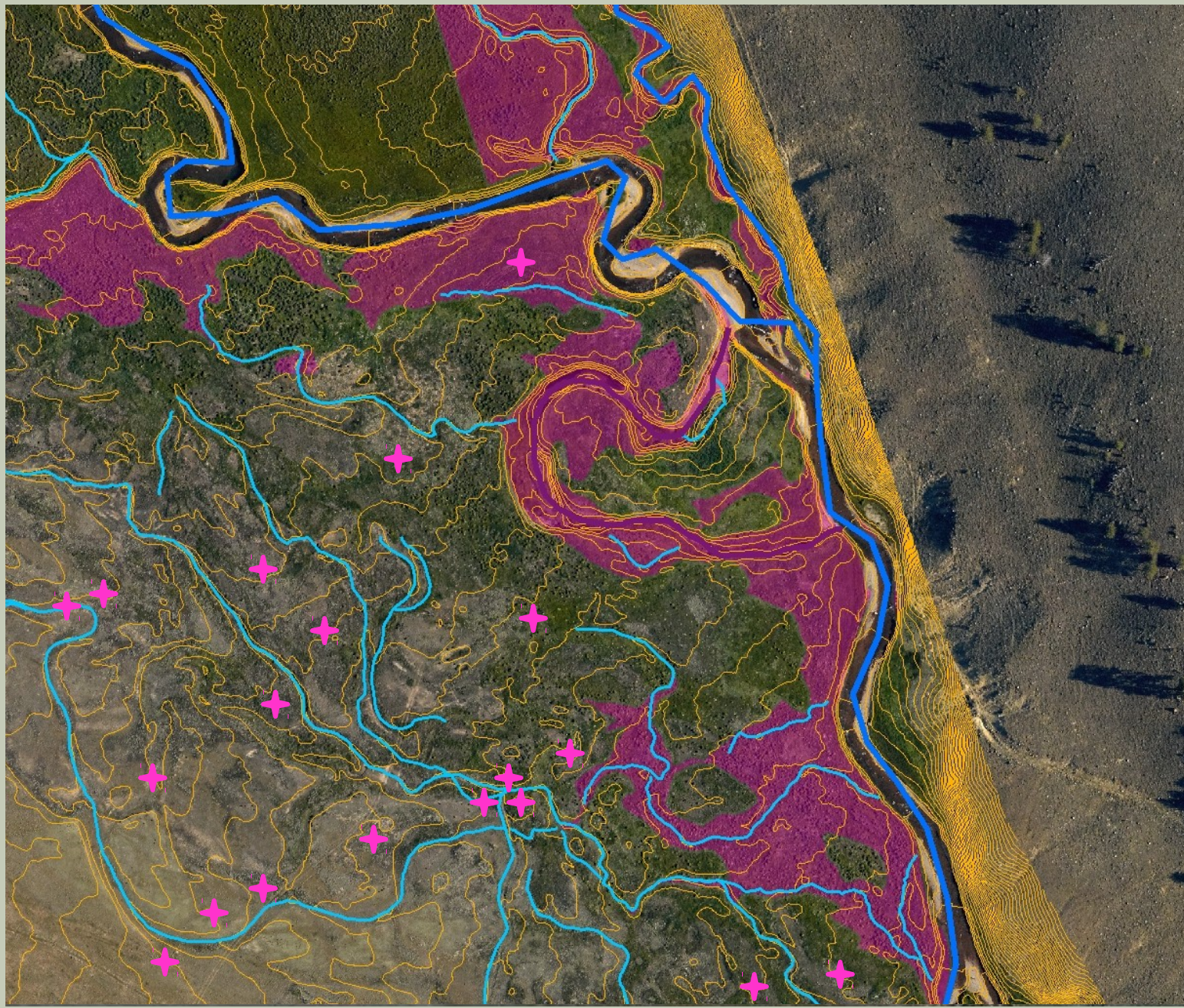- Draining
- Irrigation

Late 1800s

2012

Historic photos/descriptions

Floodplain landform & soils

Recovery of systems back to DB

(the beav comes back)

Restoring beaver-mediated meadow streams

Land – protected riparian buffer

1. Land use/conservation

- *wide riparian buffer*

2. Restore riparian vegetation

- *reestablish woody species*

3. Restore hydrology/geomorph

- *floodplain reconnection*
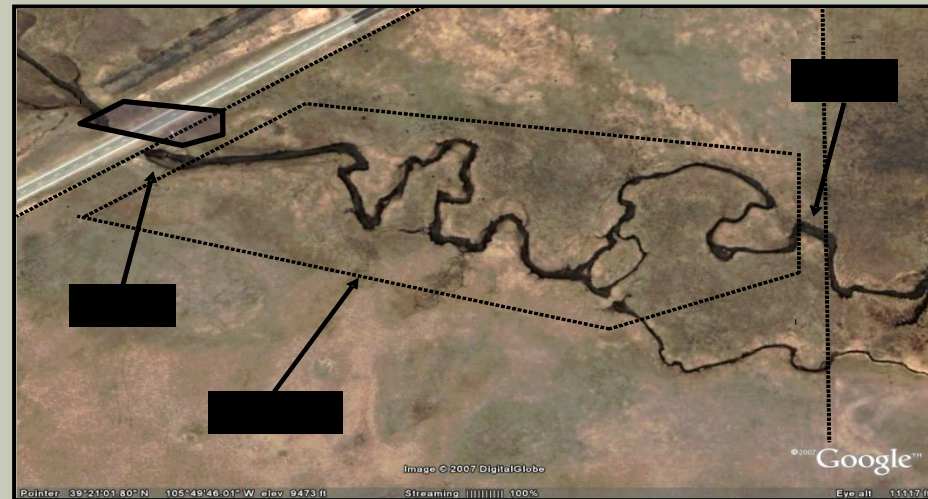
- *side channel and swale flooding*

4. Restore beavers

- *immigration and/or active transplanting*

Restoring beaver-mediated meadow streams

Land – protected riparian buffer

Restoring beaver-mediated meadow streams

Land – protected riparian buffer

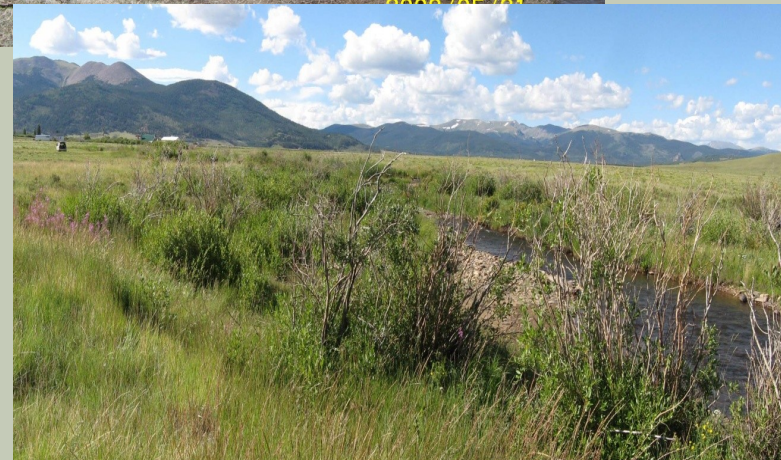# Restoring beaver-mediated meadow streams

Land – protected riparian buffer

Restoring beaver-mediated meadow streams

Land – protected riparian buffer

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Land – protected riparian buffer

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