Passive Restoration 101: Framework and Techniques Overview

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What Defines Passive Restoration?

- Process-based, nature-driven
- Minimal equipment and material inputs
- Support recovery of form and function, rather than designing a final desired state
- Low-cost techniques- restore a greater area for the same (or less) money
- Often takes more time, but adaptive and allows complete ecosystem recovery

Today's focus: Low-cost structural techniques that mimic beaver damming activity or perform similar functions ("beaver mimicry")

- Variations on post and brush construction
- Techniques complement each other and are often combined
- Brief review of slightly more intensive techniques

Goals of beaver mimicry restoration techniques:

- ❑ Raise water table to re-activate channels and floodplain
- ❑ Reduce stream erosive power
- ❑ Restore natural sediment trapping
- ❑ Sub-irrigate riparian vegetation
- ❑ Restore natural water storage in floodplain
  - Mitigate flood flows
  - Improve late-season flows
- ❑ Increase aquatic habitat complexity
- ❑ Re-establish riparian wetlands
- ❑ Improve watershed resiliency to changing climate

Or, something like this

Example Management Actions

- Exclude or reconfigure riparian grazing
- Prevent building in floodplains
- Spend more on forest restoration, including prescribed fire, and less on suppression of fire
- Policy- building in WUI and insurance requirements
- Limit or exclude beaver trapping; increase use of non-lethal mgt techniques
- Develop framework for policy-supported restoration of headwater wetlands – e.g. payment for ecosystem services and water banking

Passive restoration generally does not include:

- Earth moving, removal, or fill
- Channel relocation and re-contouring
- Active reconstruction of stream bank, channel or floodplain
- High-cost, short-duration projects
- Extensive planting with nursery stock
- Large rock or non-native materials
- Large equipment

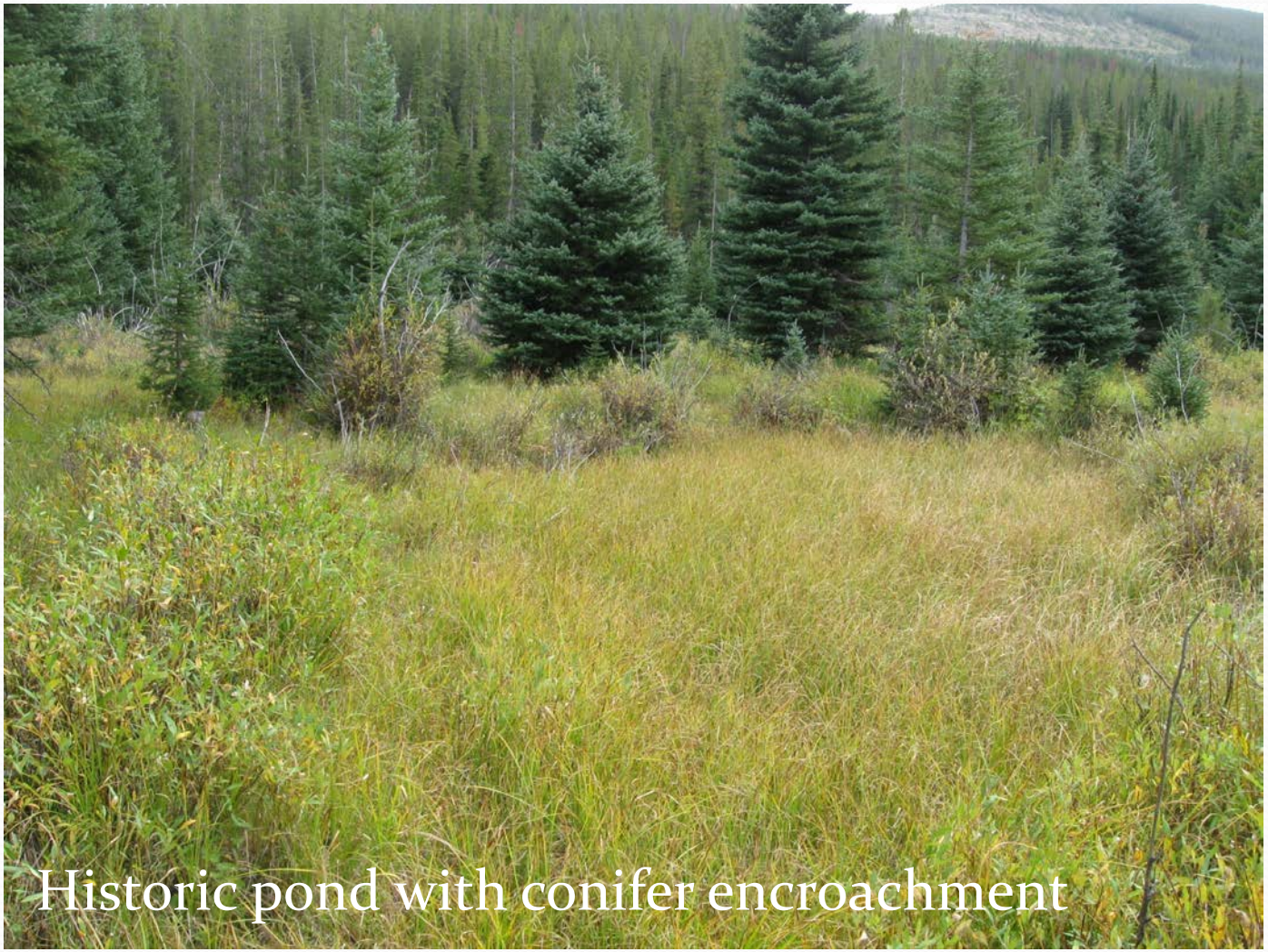
Passive restoration is not always the answer

- Large rivers or very flashy streams
- Severely polluted sites requiring remediation
- Large infrastructure protection
- Disaster recovery- but helpful for some disaster prevention
- Alien invasion or zombie apocalypse

Benefits of Working with Natural Processes

- Resilience under changing conditions
  - Changing climate and runoff patterns
  - More severe storms and fires
  - More development pressure
- Economic benefits
  - Lower long-term costs
  - Less loss of life and property
  - Fish and wildlife response, tourism economy
  - More water when we need it; cleaner water

Our Current Restoration Context
"The Big Picture"



Historical Influences on our Current Framework

- Beaver extirpation
- Fire suppression
- Channel simplification
- Stream dewatering
- Overgrazing
- Road-building in stream corridors
- Development in WUI and on Floodplain
- Placer and Hydraulic Mining

Fire Suppression- Creating its own need

- **98.5% of fire ignitions are controlled at Initial Attack**
- **1.5% of fires that escape Initial Attack are becoming increasingly large and increasingly destructive**
- **Fires are showing greater "resistance to control"**

Fire suppression → Conifer Encroachment

Browns Gulch 1947

Browns Gulch 2001

Loss of Habitat Diversity Due to Fire Suppression

"Fire On the Land"

Confederated Salish & Kootenai Tribes:
http://www.cskt.org/fire_history.swf

Historical and Projected Drought Severity

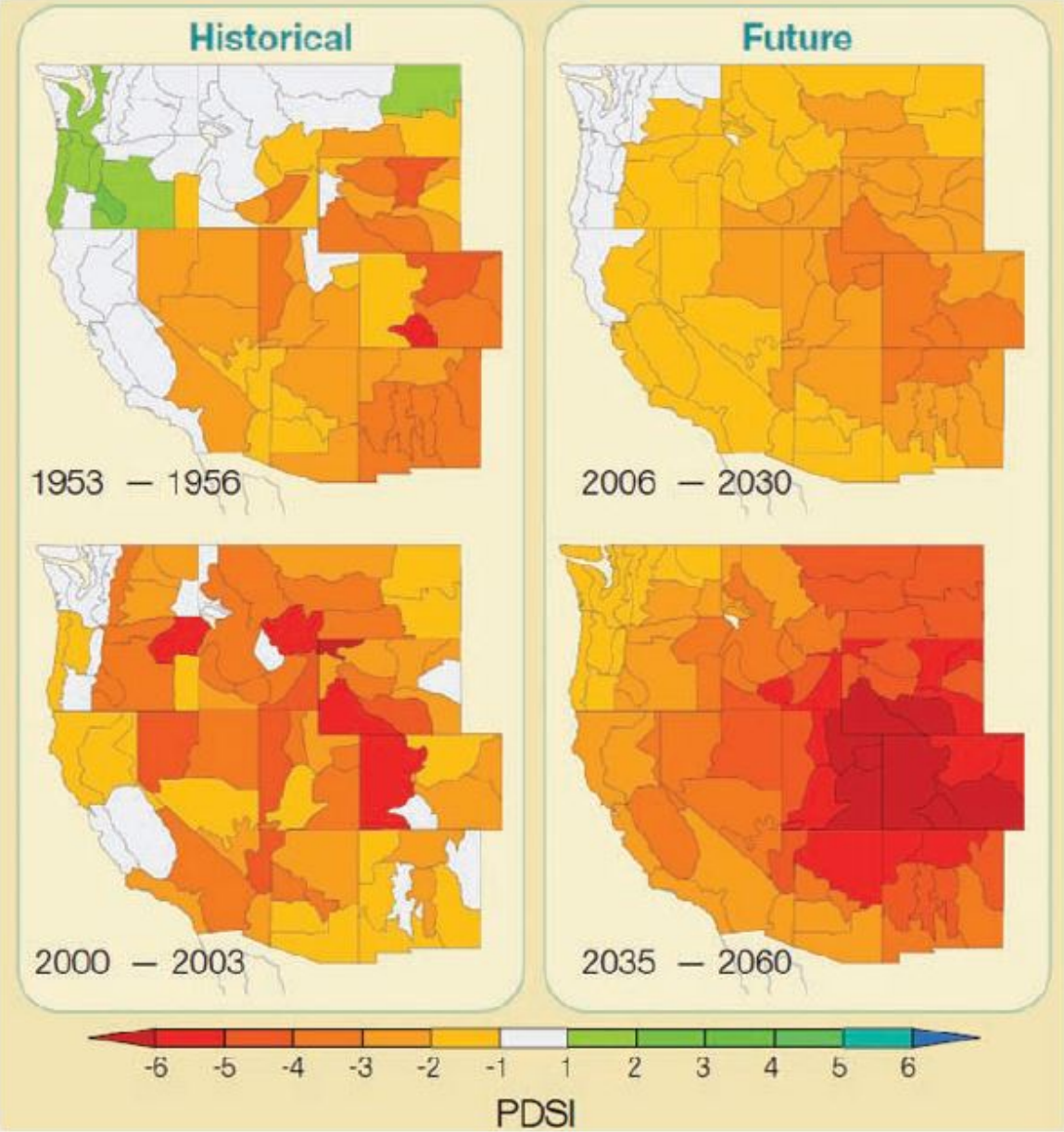


Figure 6. Distribution of Palmer Drought Severity Index scores based on historical conditions and future projections (from Hoerling and Eischeid 2007).

Source:
Rieman and Isaak, 2010. Climate change, aquatic ecosystems, and fishes in the Rocky Mountain West: implications and alternatives for management. Gen. Tech. Rep. RMRS-GTR-250.

Whether too little water or too much, do our rivers have enough resilience?

Missoula, MT

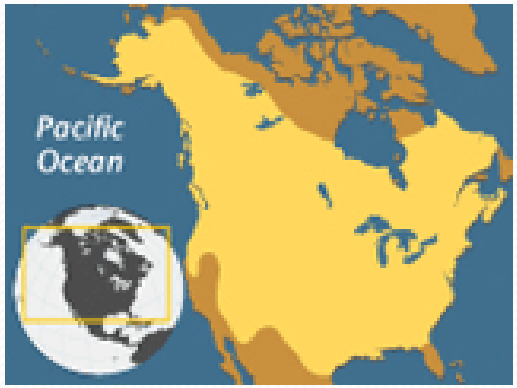
Grand Forks, ND

New Orleans, LA

How can we add resiliency under changing patterns?

- Where can we reduce energy of flood flows?
  - Restore channel length (reactivate side channels)
  - Re-introduce energy traps (wetlands, ponds, logs, access to floodplains, riparian shrubs)
- Where are our opportunities to store flood flows for more consistent late-season flows?
- Where can we add resiliency to flow surges after storms and fires?

History of Beaver Activity

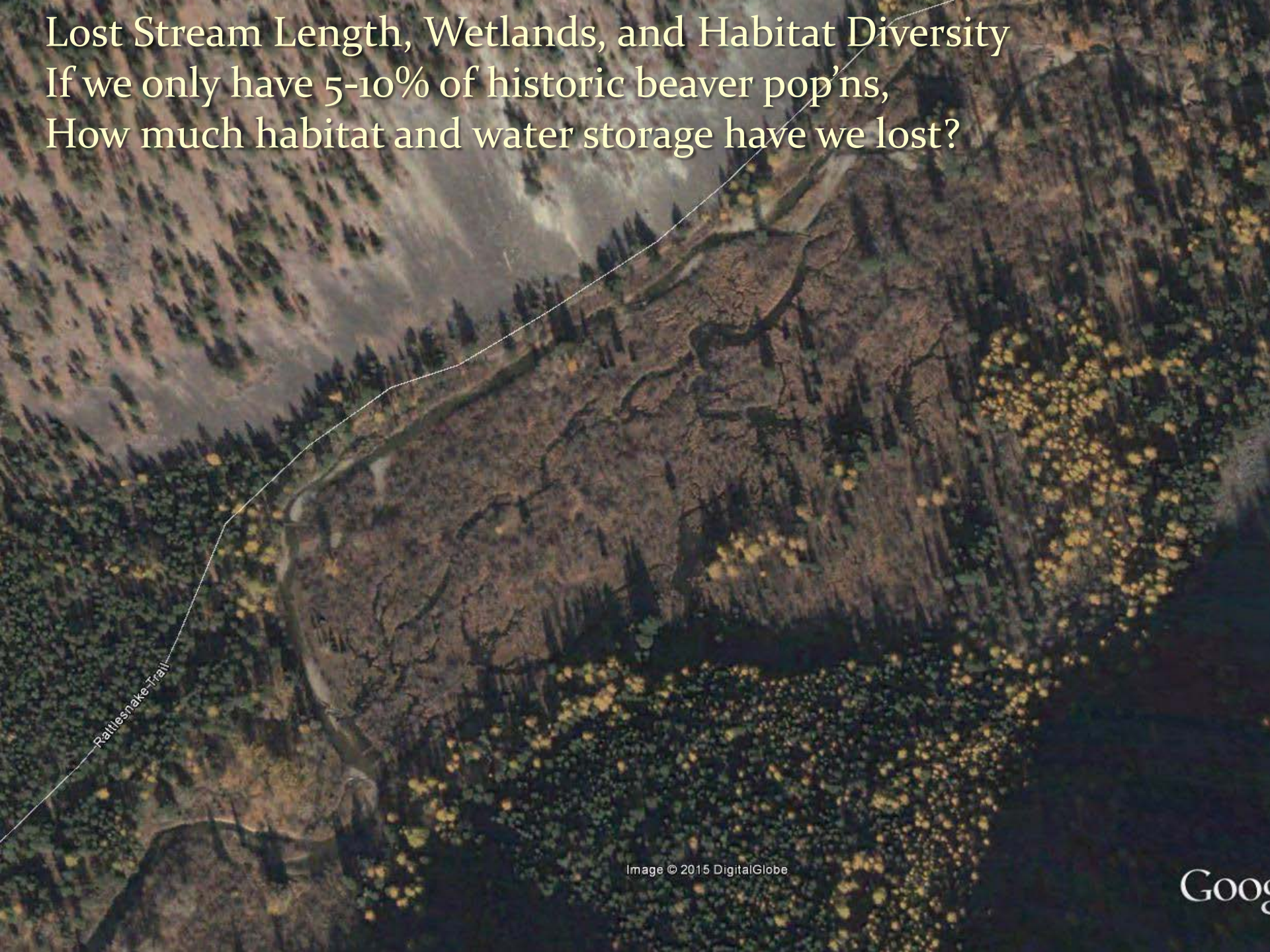


- Beavers were once common throughout most of North America
- Population greatly reduced by beaver trapping in the 1600s-1800s
- Beaver almost extinct by 1930s, but drought spurred legislation to protect beavers (weaker protection now)
- Recovering in recent decades due to better management and understanding of their value

Streams have changed dramatically

- Beaver damming helped form many valleys and meadows in the West
- Lewis and Clark documented “endless” series of beaver ponds on streams in southwest Montana
- Current population estimated at 5-10% of historic population, due to trapping and habitat loss
- Now many streams are single-channel and incised, and more flashy: the “flume effect”

Lost Stream Length, Wetlands, and Habitat Diversity
If we only have 5-10% of historic beaver pop'ns,
How much habitat and water storage have we lost?



Channel down-cutting dries up meadows and reduces water storage

Restore Stream Resiliency

Aim for habitat value at multiple spatial and temporal scales: Habitat connectivity, sediment and water storage, and flow moderation.

Beavers are a keystone species and create important habitat

Image: thecottagersguidetobeavers.blogspot.com

LOTS of natural water storage

Water Storage by an Over-Achiever Beaver

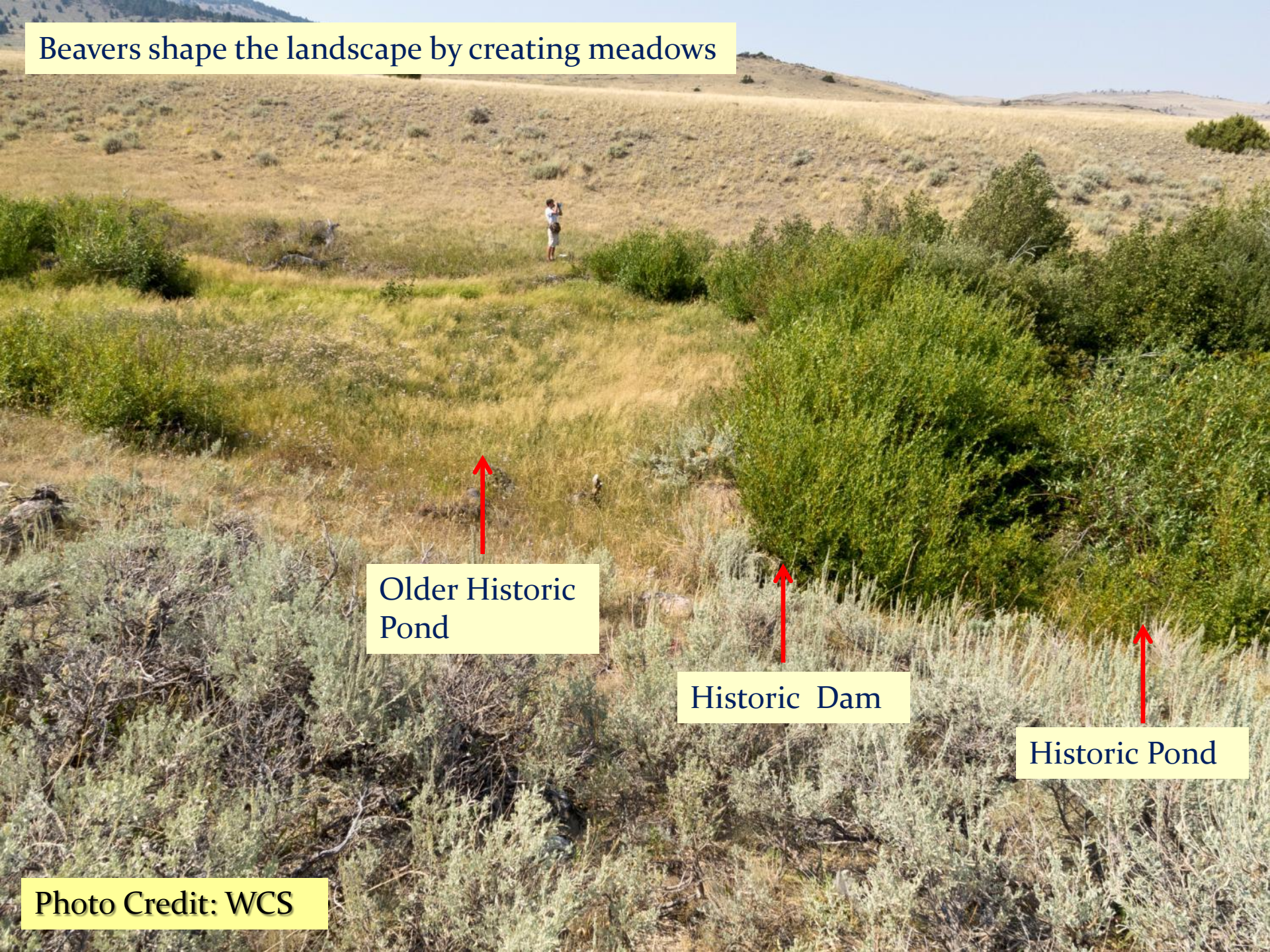
Beaver ponds and other wetlands filter water and reduce storm surges

On large rivers, this can happen on side channels and floodplains.

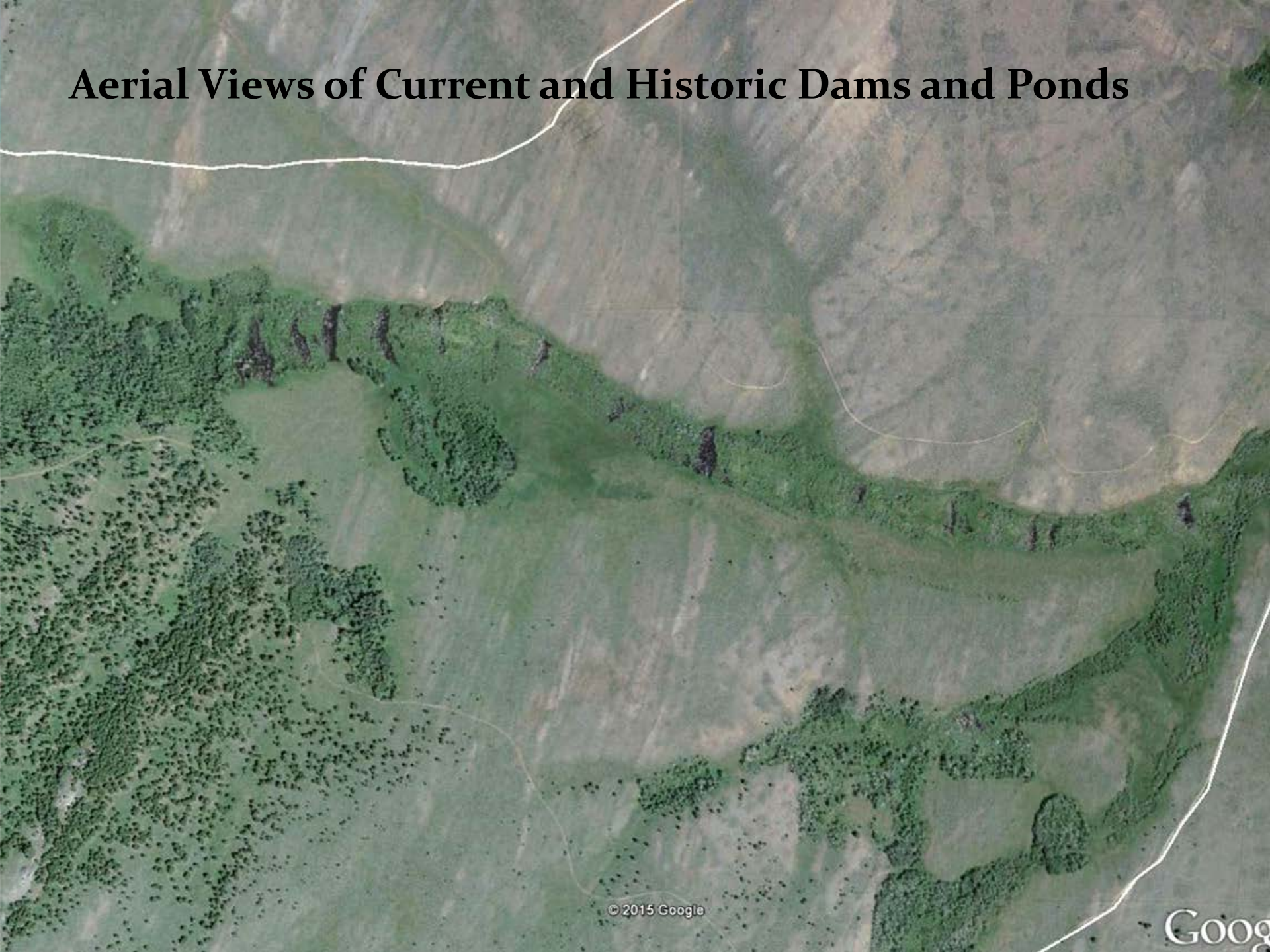
Trapped sediment forms meadows and stores water

The meadow-building cycle

(Sometimes)


Beavers shape the landscape by creating meadows
Older Historic Pond
Historic Dam
Historic Pond
Photo Credit: WCS

Aerial Views of Current and Historic Dams and Ponds



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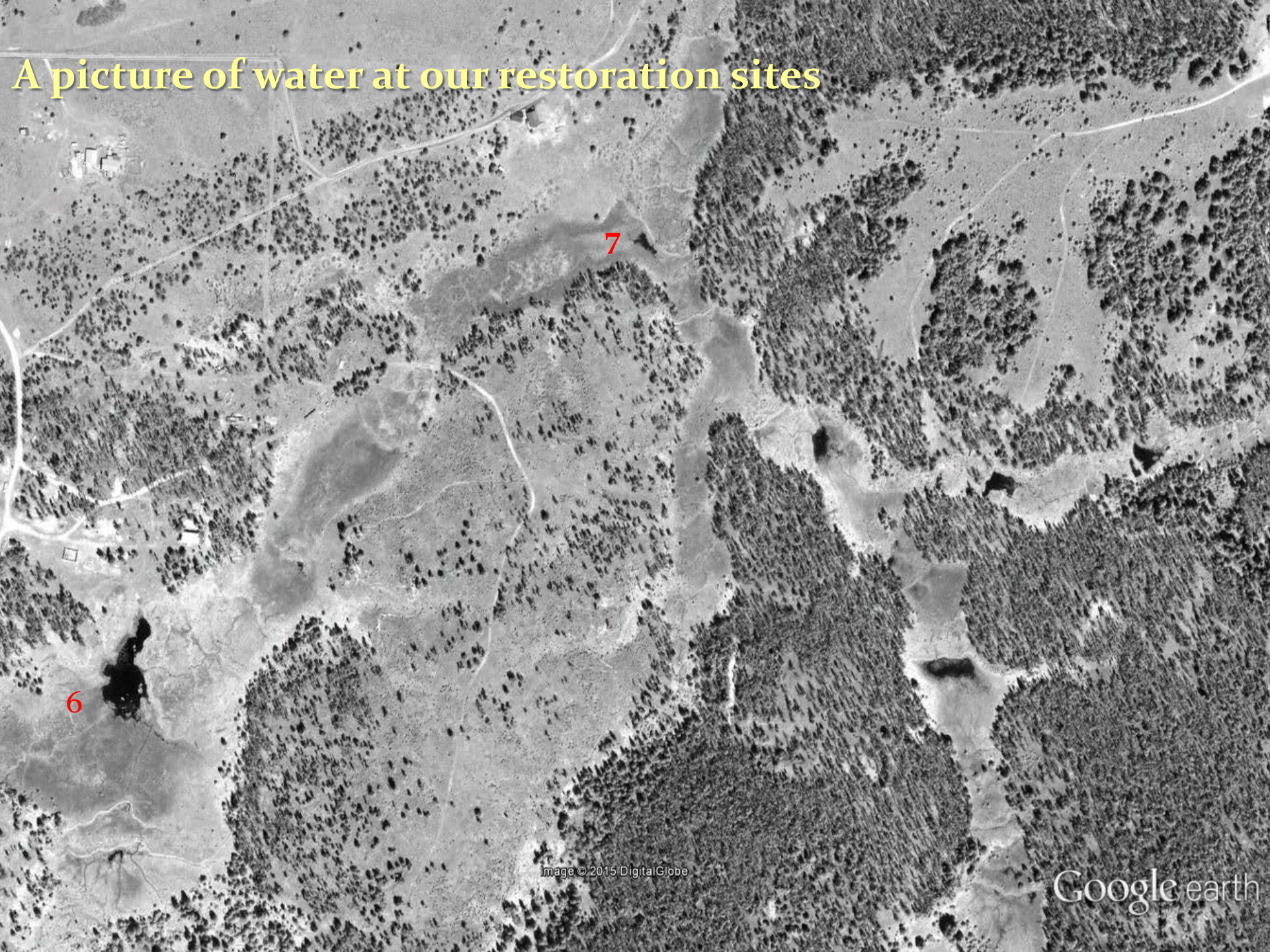
Historic Dams Contribute to Sinuosity

A picture of water at our restoration sites



How to think like a beaver

Photo credit: NOAA (Pollock et al.)
http://www.nwfsc.noaa.gov/research/divisions/fe/wpg/beaver-assist-stld.cfm

Habitat Restoration Considerations: What do beavers need?

- Food source (esp. winter)
- Low-energy stream to dam, or existing deep water
- Low gradient stream preferred (gen. <3%)
- Building materials
- Broad floodplain(gen. at least 4x stream width)
- Not to be shot or trapped

They can make the rest

What do beavers eat?

- Aspen and willows are primary winter food but aquatic plants and tubers comprise up to 80% of the summer diet

- Other foods: cottonwood, alder, red-osier dogwood, vine maple, grasses, sedges, rushes, fruit trees… other species in other areas

- In cold climates, beavers cut branches and store them in underwater caches for winter food

Sometimes less desirable species are used to sink the good stuff to below icing level

To Summarize: Benefits of Passive Restoration

- Provides more complete ecosystem recovery and restores balance

- Lower cost than most traditional restoration approaches

  -- allows for restoration over a greater area

- Provides additional ecosystem services

- In some cases sets the stage for beavers to take the project over and do maintenance for free

(also can happen in active restoration but people seem less enthused about it)

Some Good Tools for Initial Project Scoping

EPA stream layer for Google Earth
http://water.epa.gov/scitech/datait/tools/waters/tools/waters_kmz.cfm

Land Ownership: Montana Cadastral
http://svc.mt.gov/msl/mtcadastral/
or
Hunting GPS Maps for Google Earth (not free)
http://www.huntinggpsmaps.com

NRIS (now MT GIS clearinghouse)
http://geoinfo.msl.mt.gov/

Montana Natural Heritage Program
http://mtnhp.org/mapviewer/?t=8

NWI data available for GE as well
http://www.fws.gov/wetlands/data/google-earth.html