



The North American Beaver and Stream Restoration – Don't Believe Everything You Think

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“I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer.”

Thinking Like a Mountain
Aldo Leopold













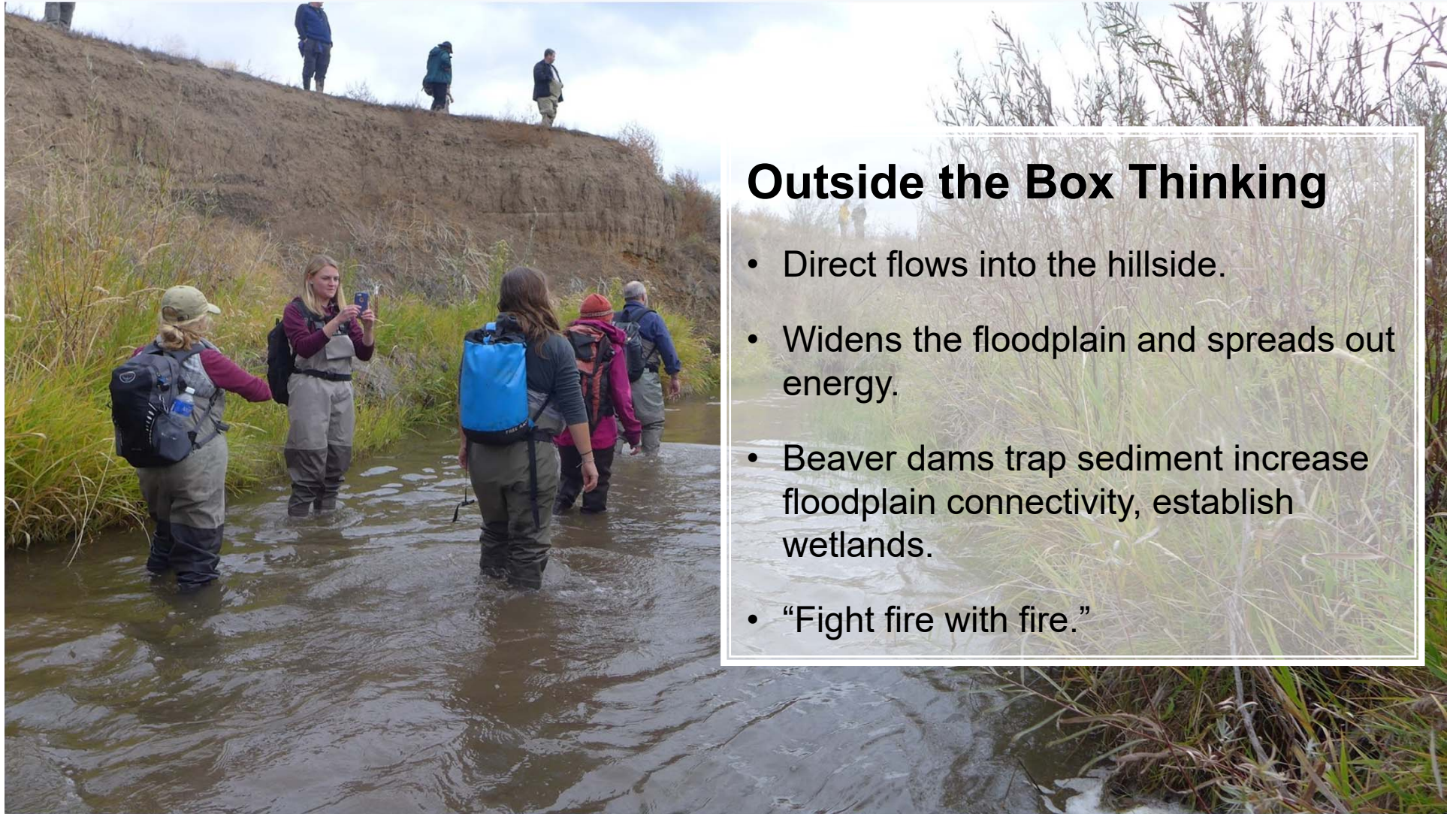




Bridge Creek, Oregon

- 10 year study
- Beaver dam analogs
- NOAA funding
- Objective is to improve salmonid habitat
- Several meters of aggradation in 5 years



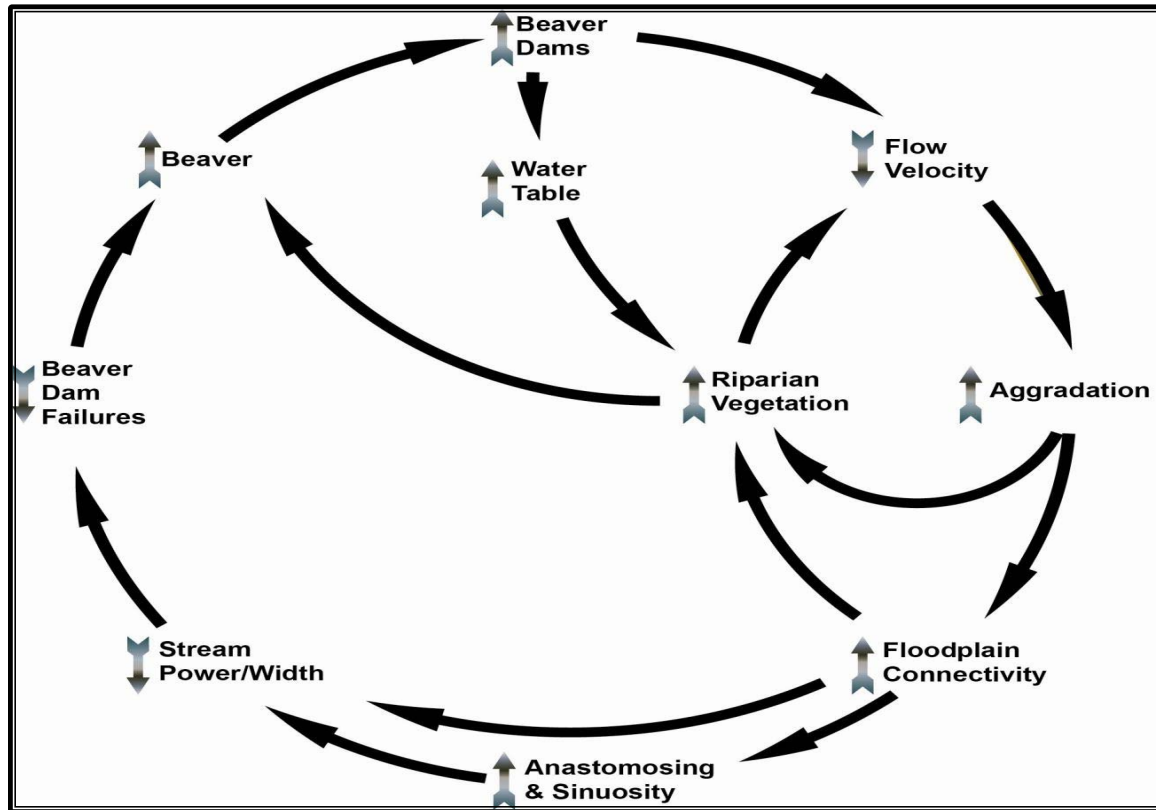


Outside the Box Thinking

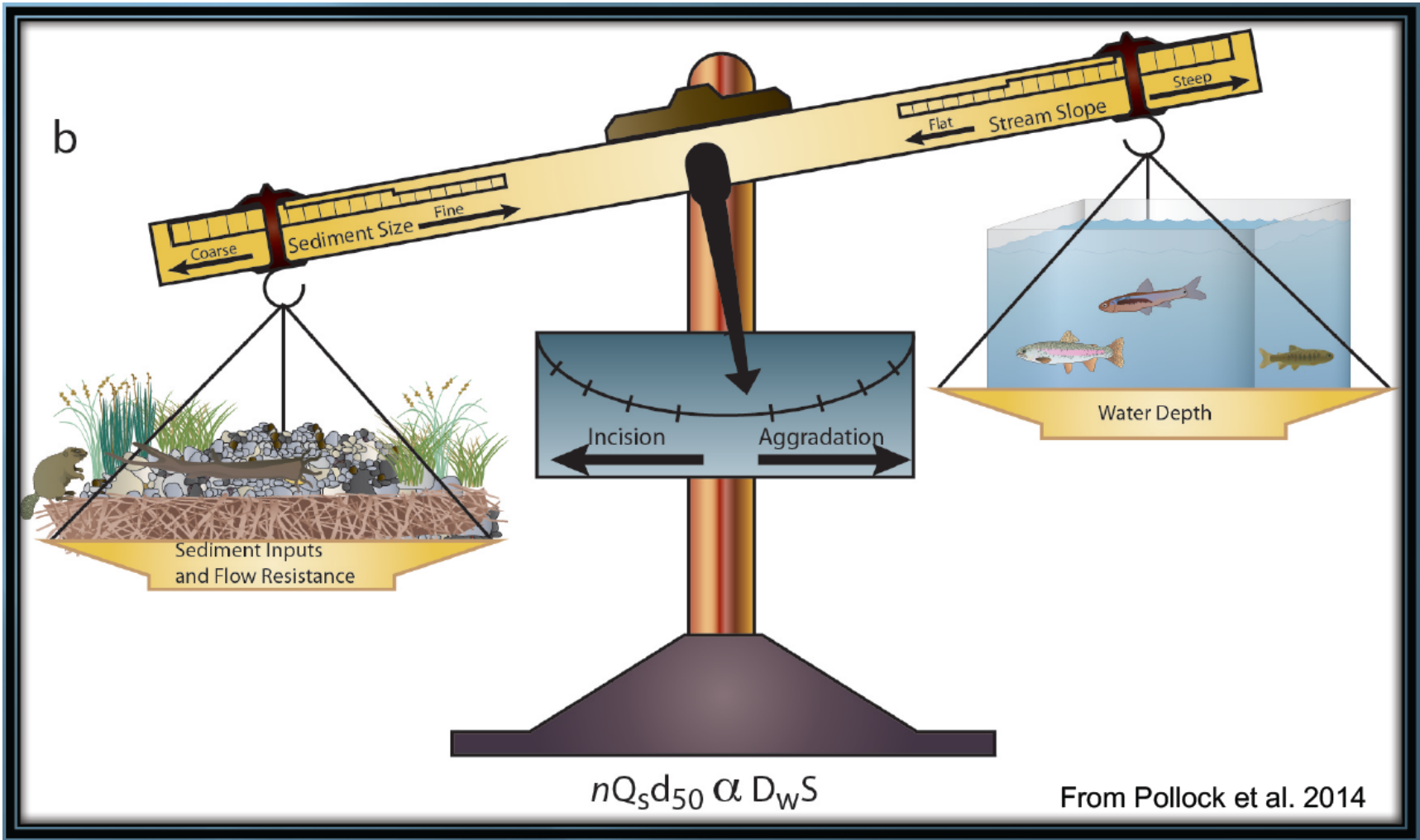
- Direct flows into the hillside.
- Widens the floodplain and spreads out energy.
- Beaver dams trap sediment increase floodplain connectivity, establish wetlands.
- “Fight fire with fire.”



What are the effects of beaver dam building activity on the landscape?

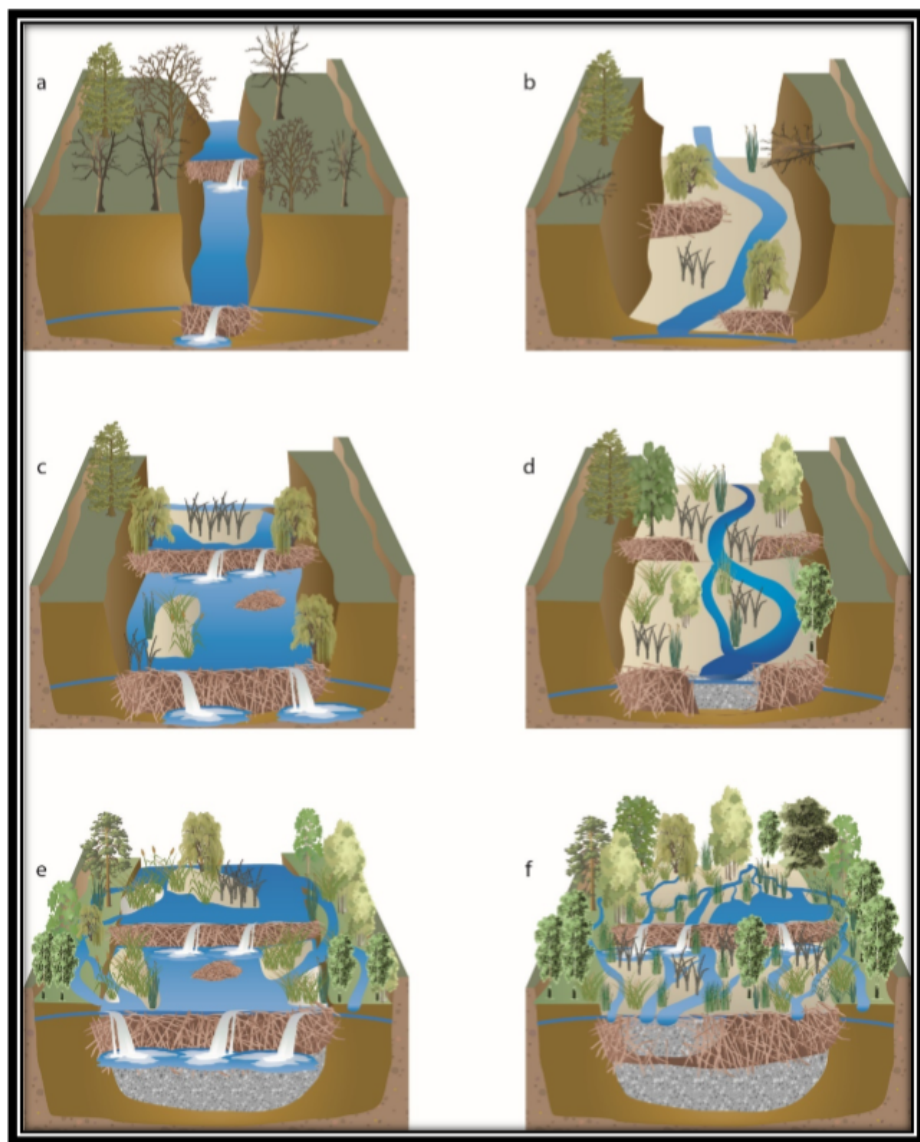


Pollock et al. 2014



Beaver in incised streams

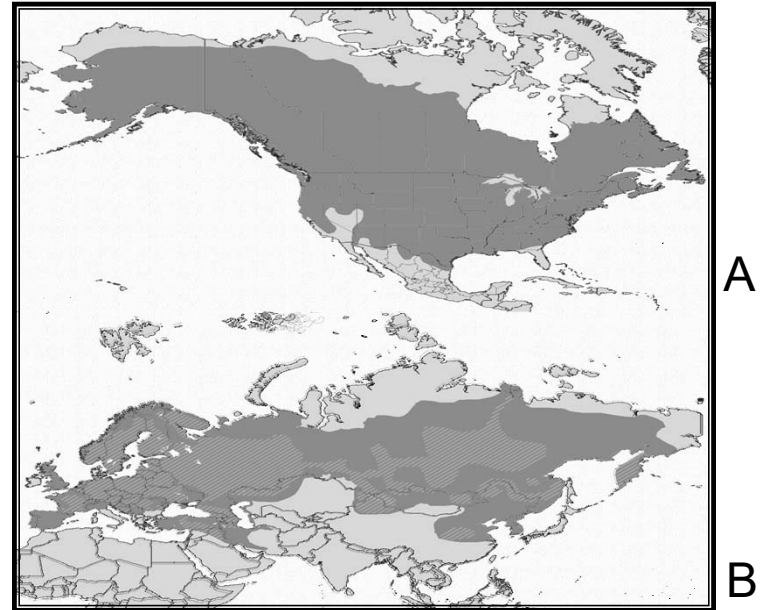
“Recovery possible in years to decades instead of decades to centuries”



Pollock et al., 2014. using beaver dams to restore incised stream ecosystems. *Bioscience*, 64(4).

Worldwide distribution of beaver

- *Castor canadensis* (N. America)
- Historically, 60–400 million pre-European settlement (Seton 1929)
- Currently, 6–12 million (Naiman et al. 1988), but estimates are crude
- Spatial distribution approaches its historical range
- *C. fiber* (Eurasian beaver)
- More limited current distribution, but expanding back to parts of its historical range



Pollock MM, Heim M and Werner D. 2003. *Hydrologic and geomorphic effects of beaver dams and their influence on fishes.*

"Claiborne's elaborate preparations and largescale operation brought in 7488 pounds of beaver pelts (worth £4493 at 12 s./lb.)...in the six years before Kent Island's takeover by Maryland in 1638" – Fredrick J. Fausz, "Present at the Creation"

"Claiborne's timing was perfect, for in 1629 the English had captured Quebec in a war with France, and beaver fever spread throughout the London merchant community after the Canada Company brought home some three hundred thousand pounds of pelts in 1630." Fredrick J. Fausz, "Present at the Creation"

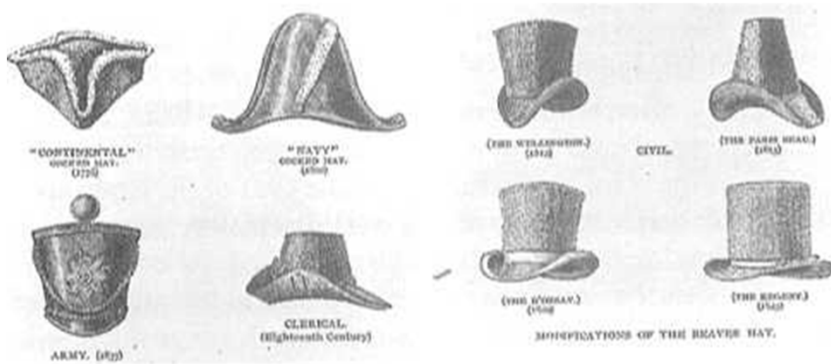


Photo Credit: Portland State University



Photo Credits: Canadian Museum of History



"In 1643-44 also, over 5700 pounds of beaver pelts were mentioned in debt cases, at a time when one pound was worth between 12s. and 24s., or from 36 to 144 pounds of tobacco." – Fredrick J. Fausz, "Present at the Creation"

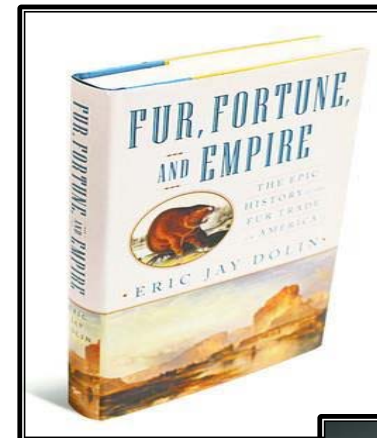
"On more than one occasion, colonists found themselves so deeply in debt for beaver pelts that they mortgaged, or had to put up as security, a large portion of their property" – Fredrick J. Fausz, "Present at the Creation"

300 year history of beaver extirpation in US - economic, not necessarily biological extirpation

Timing of Beaver Trapping
in the Lower 48 States



Map courtesy of Jim Sedell, USDA Forest Service (2001)





Rudolf Ruedemann

*Beaver Dams as Geologic
Agents. Science.
02 Dec 1938*



STATE OF THE BEAVER CONFERENCE

FEB 22-24,
2017

BRINGING
BACK BEAVERS
TO BRING BACK
LIFE.



AGENTS OF REGENERATION



Beavers in Devon

Enclosed Beaver Project

In 2011 a male and female beaver were introduced into a three hectare fenced enclosure in the Tamar headwaters, where their impacts are being studied in detail. Most of the results presented in this document are from this research site.



The 900 m perimeter fence has electric strands to prevent beavers climbing and a weldmesh apron on the inside to prevent them burrowing underneath. This fencing cost approximately £35/m to construct.



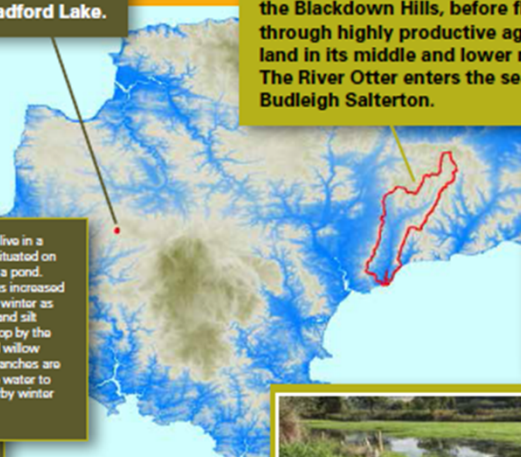
The beavers live in a large lodge situated on the banks of a pond. The lodge has increased in size every winter as more sticks and silt are built on top by the beavers, and willow sticks and branches are placed in the water to create a nearby winter food cache.



Since 2011, 13 ponds of varying sizes have been constructed by the beavers. The dramatic engineering of the watercourse in this site has provided a perfect opportunity to study the impacts of beaver dams on a wide range of different subjects.

The Enclosed Beaver Project is situated on private land in the headwaters of the River Tamar and upstream of Roadford Lake.

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River Otter Beaver Trial

In March 2015 two families of wild-living beavers of unknown origin were captured from the River Otter and proven to be healthy before being released back into the river as part of a five year licensed trial.

The River Otter Beaver Trial area covers the entire 250 km² of the Otter catchment containing 594 km of watercourse. The river rises in the predominately pastoral landscape of the Blackdown Hills, before flowing through highly productive agricultural land in its middle and lower reaches. The River Otter enters the sea at Budleigh Salterton.



In February 2015 five beavers were captured by the Animal and Plant Health Agency (APHA). They were given detailed health examinations by beaver experts from the Royal Zoological Society of Scotland (RZSS), who confirmed they were healthy Eurasian beavers and fit for re-release.

Photo:
Nick Upton / Naturepl.com



The beavers were released back into their territories in March 2015. At the start of the trial approximately nine beavers were identified, living in two family groups.

Photo:
Nick Upton / Naturepl.com



In the early stages, beaver activity was concentrated in the lower reaches of the river where there is sufficient deep water, and so they have not needed to build dams. As their numbers have increased and they have moved into sub-optimal areas, they are beginning to build dams in the ditches and headwater streams. These are now the subject of detailed research work.

Partners and funders



The Enclosed Beaver Project site is owned by John and Elaine Morgan who have kindly allowed this wetland area within their farm to be managed by the beavers. Additional funding has come from Natural England through Higher Level Stewardship (HLS).



The beavers are owned and managed by the Derek Gow Consultancy. The initial fencing and other infrastructure was funded by Viridor Credits Environmental Company and the Truell Charitable Foundation.

In 2012, Westland Countryside Stewards began funding the project allowing the University of Exeter to carry out detailed research work on the hydrological and water quality implications of the beaver dams.

Funding is currently being sought to continue this project.

Partners and funders

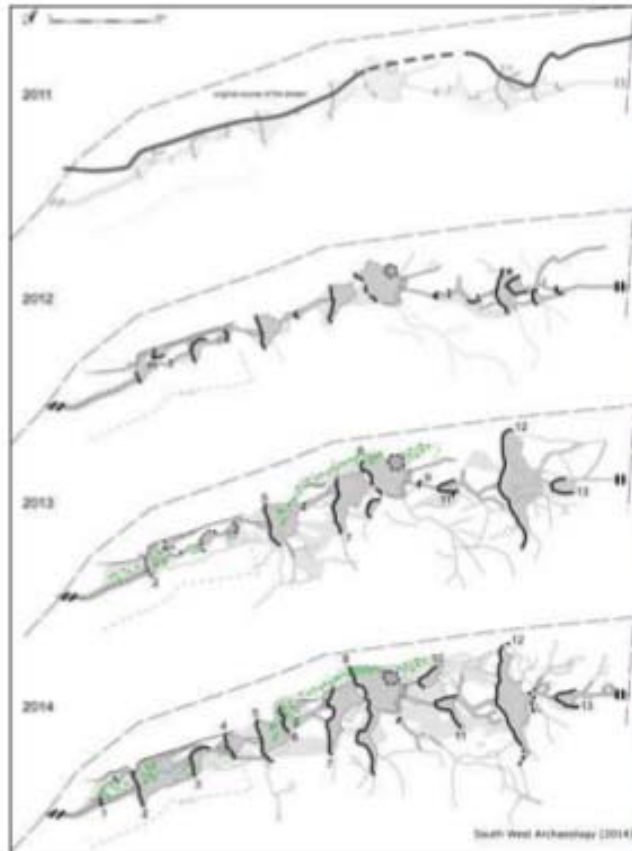
The River Otter Beaver Trial is led by Devon Wildlife Trust working in partnership with The University of Exeter, the Derek Gow Consultancy, and Clinton Devon Estates. Expert independent advice is also provided by the Royal Zoological Society of Scotland, Roisin Campbell-Palmer, Professor Alastair Driver, Professor John Gurnell, and Gerhard Schwab, an international beaver expert based in Bavaria.

Funding for the ROBT comes from Devon Wildlife Trust (DWT), the Royal Society for Wildlife Trusts (RSWT), Peter de Haan Charitable Trust, Garfield Weston Foundation, University of Exeter and from the generous donations from the public.

In 2016, Devon Wildlife Trust launched a crowdfunding campaign to encourage the public to donate to the project in return for a series of unusual things such as beaver chips, guided walks or the appearance of Nora the beaver mascot at your event. www.supportdevonbeavers.org/



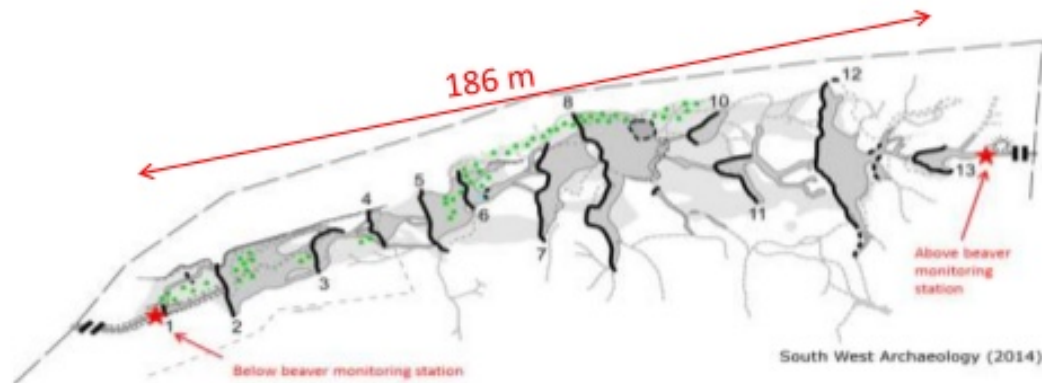
Devon Beaver Project: Overview



- Fenced 1.8 ha site in North Devon, UK
- 1st order tributary draining from IMG
- A pair of beavers introduced in 2011
- Dramatically changed site from small first order tributary running through wet woodland, to a diverse mosaicked wetland environment.



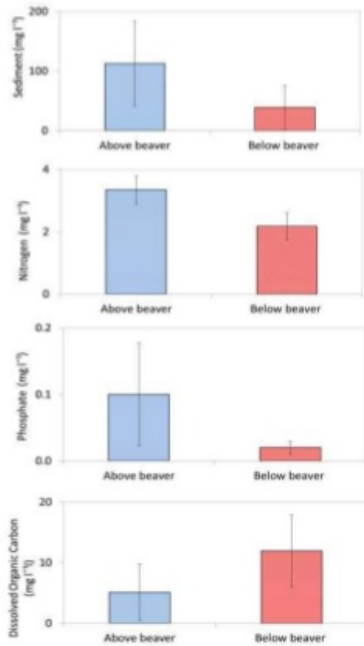
Devon Beaver Project: Experimental Design



Quantifying Water Quality and Quantity entering, leaving and stored in the site:

1. Flow in and out (continuous monitoring) and pond storage.
2. Rainfall in (continuous monitoring).
3. pH, suspended sediment, dissolved organic carbon, nitrogen, phosphate, colour (flow based monitoring).

Devon Beaver Project Results – water quality

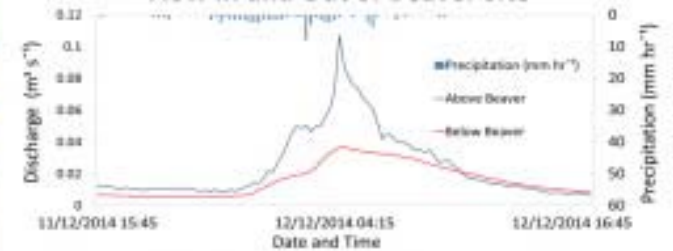


Storm monitoring (17 events, 178 samples above, 119 below), suggests site may act as a sink or filter for diffuse water pollutants from agriculture (suspended sediment, nitrogen and phosphate).

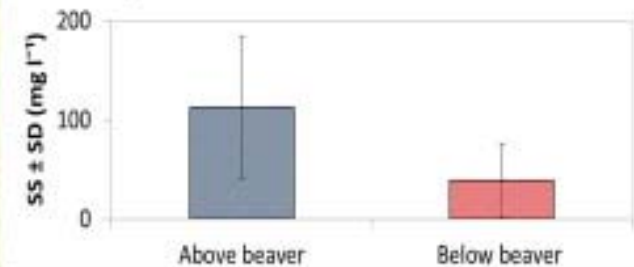
However, more organic matter in the site, so potentially results in a greater loss of dissolved organic carbon than comparative agricultural land.



Flow In and Out of Beaver Site



Suspended Sediment Above and Below Beaver Site





1994



2008





2018





MOULTRIE

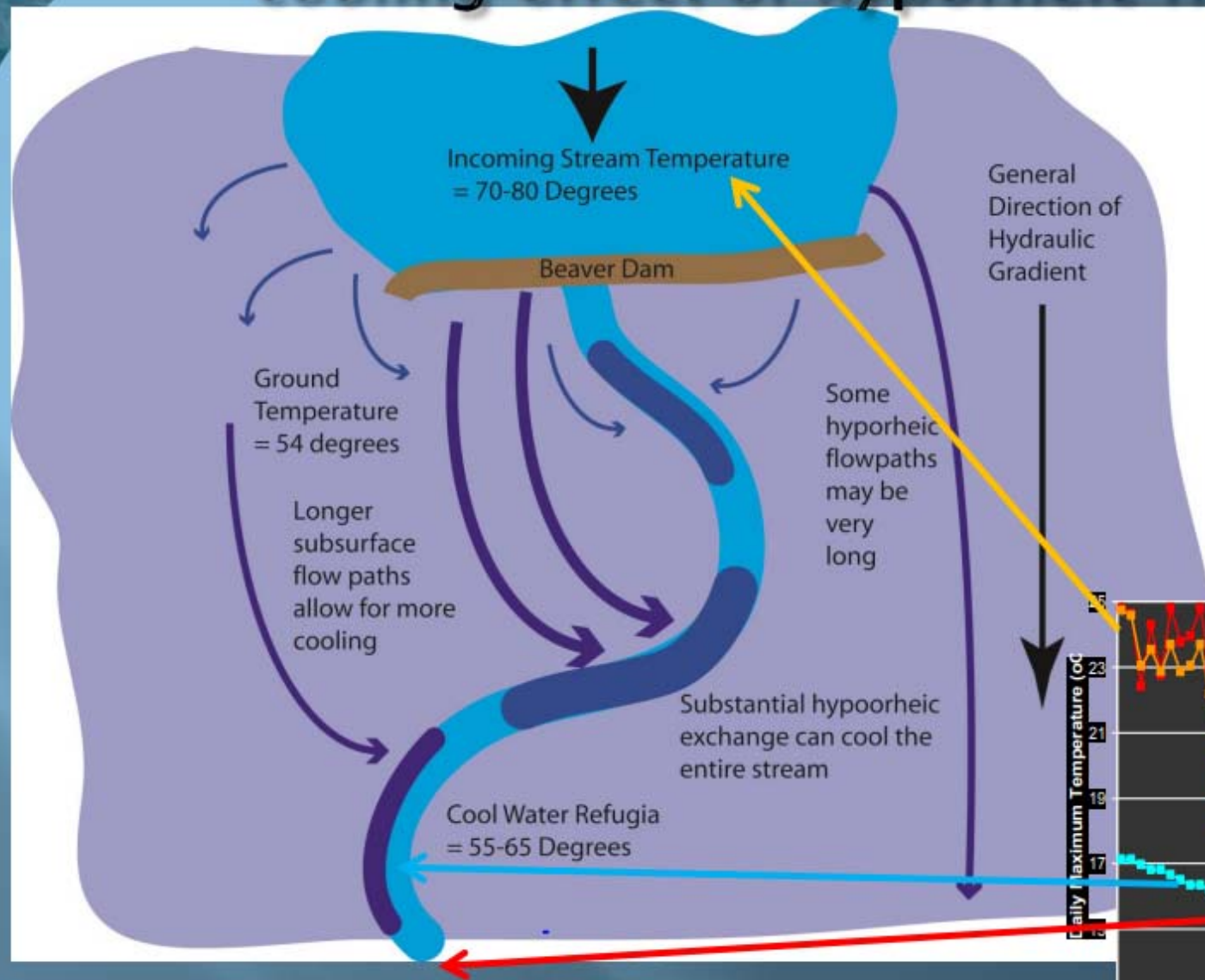


CAMERA 1

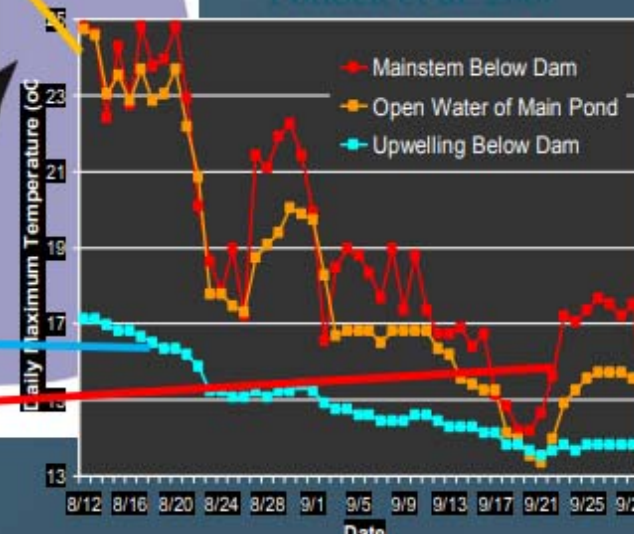
16 MAR 2018 05:33 am



Plan view of a beaver dam showing cooling effect of hyporheic flow paths



Pollock et al 2007





5

BIOLOGY »

FUNCTION: *Primary Production, Food Web, Life History, Population Dynamics*
PARAMETERS: *Primary Production, Macroinvertebrate Community, Riverian Communities*

4

PHYSIOCHEMICAL »

FUNCTION: *Temperature and oxygen regulation; processing of organic matter and nutrients*
PARAMETERS: *Dissolved Oxygen, Temperature Regulation, pH, Conductivity, Nutrient Processing, Organic Processing, Turbidity*

3

GEOMORPHOLOGY »

FUNCTION: *Transport of wood and sediment to create diverse bed forms and dynamic equilibrium*
PARAMETERS: *Sediment Transport Capacity and Competency, Channel Evolution, Streambank Erosion Rates, Point Bar, Riffle and Pool, Depth Variability, Substrate Distributions, Large Woody Debris Transport and Storage, Riparian Vegetation density and composition*

HYDRAULIC »

FUNCTION: *Transport of water in the channel, on the floodplain, and through sediments*
PARAMETERS: *Velocity, Shear Stress, Stream Power, Bank Height Ratio, Entrenchment Ratio, Rating Curves (discharge vs. stage), Groundwater/Surface Water Exchange*

1

HYDROLOGY »

FUNCTION: *Transport of water from the watershed to the channel*
PARAMETERS: *Precipitation/runoff relationship, Channel Forming Discharge, Flood Frequency, Flow Duration*



Stream restoration design to encourage beaver colonization

- Disperse energy across the ENTIRE floodplain.
- Leave oxbows, wet meadows
- Regenerative species - willow, alder, dogwood
- Wide easement
- Landowner education
- Stage 0 restoration





Challenges

- Stringent success criteria
- Devotion to existing approaches
- Trapping as a management tool
- Event based restoration vs. process based



Excerpted from a recent mitigation bank proposal in Virginia:

*18. I support the plan to propose dam removal and stream restoration on the upper limits of S21. However, beaver activity was noted on the site. **Therefore a beaver eradication plan will need to be include in the bank proposal.***



7. Gilbert's Addition - Surveyed 8 Mar. 1716 for Jervis Gilbert, and
 from "T.W." No. 306a granted to for
 50 acres. Beginning at three... N.D. at the
 head of a little swamp on the N. side of
 the N.W. branch of Swan Creek "and might halfe a mile to
 1/2 Eastward of the said Jervis's plantation"; and -

9. Swallow, 90 " to the end of a small
 Island in a marsh,

1. E. S. E., 150 paces to a R.O. by a small
 procession,

the Cattail Marsh, swamp near Runny Green,

22. West, 2 1/2 " to a R.O. by a swamp side

said Creek, near a small meadow,

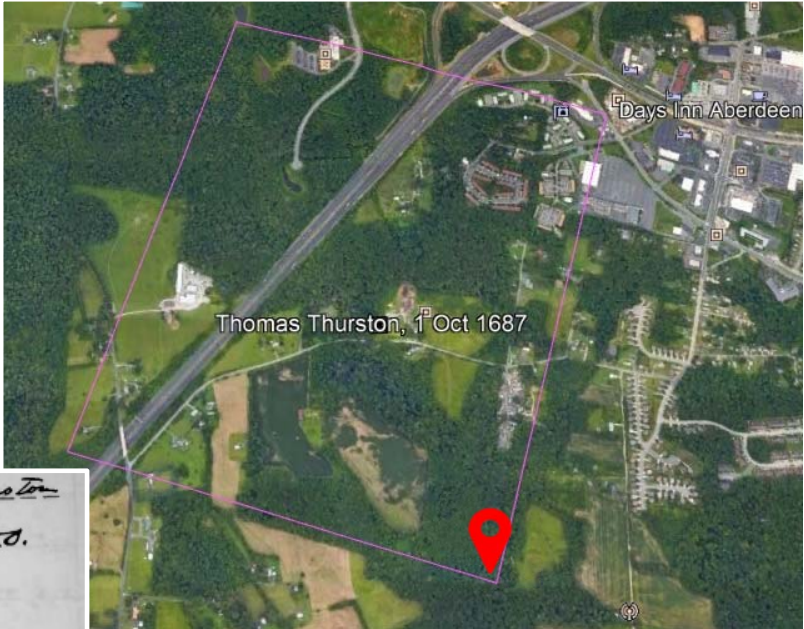
making part of other surveys or lying under water,

West, 128 paces to a R.O. by a swamp
 side the Reg. Turnoff,

Beginning at a Sweet Gum... by a great swamp or poconon...



26. Timber Swamp - Sur. 15 Dec. 1738 for John Taylor



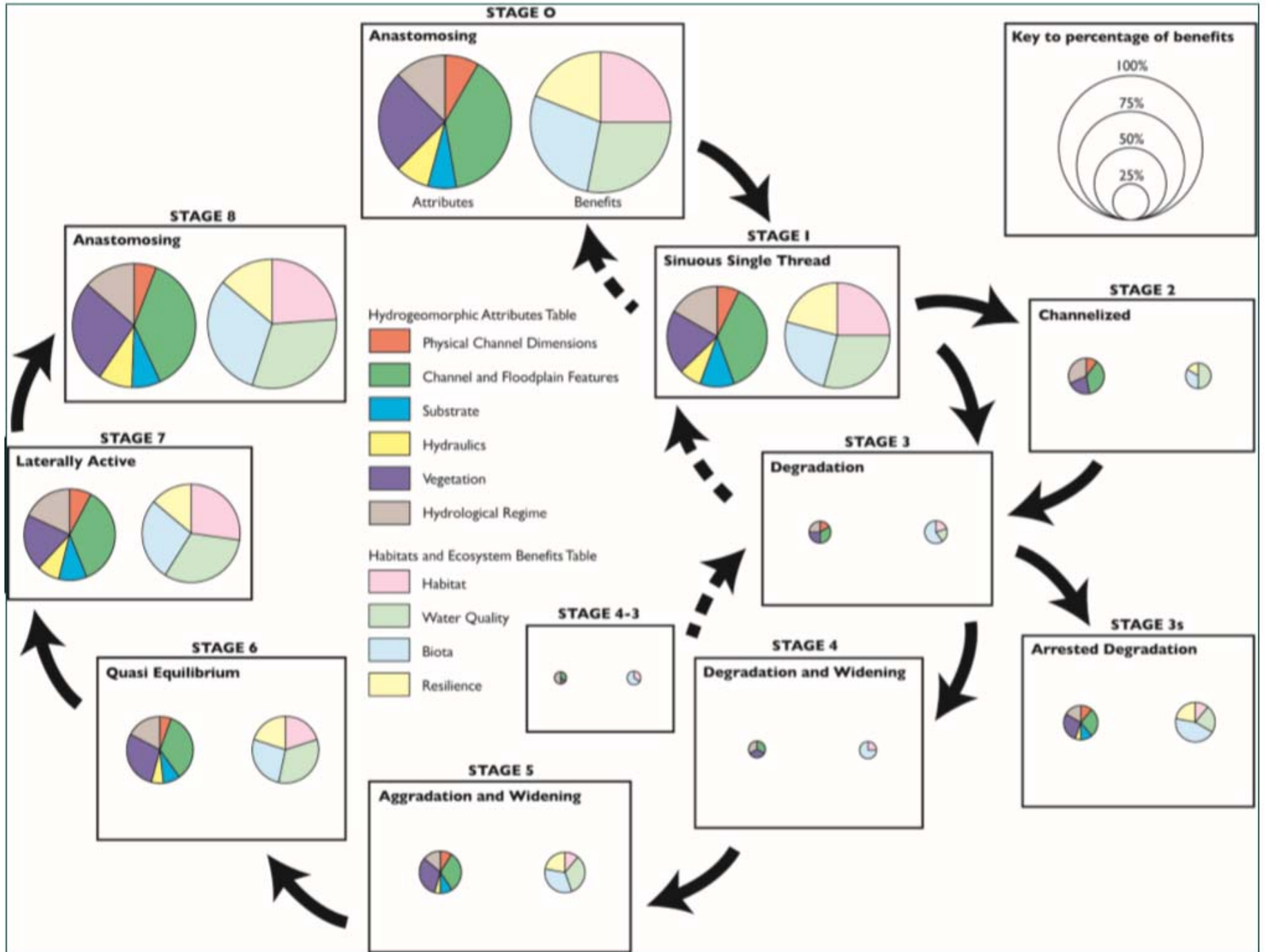
1. The Agreement - Sur. gr. 10 Oct. 1687 to Thomas Thurston
 Field Book II "Four or five" "to the end of 500 acres"
 "from 1st N.S., No. 2, page 471" for 500 acres Beginning at a bounded N.D.
 to the end of .. by a Poconon and running thence
 John Kitch, Lessee } July 22
 John Osborn } 1722



Photo Credit: Johan Hogervorst



Photo Credit: Johan Hogervorst











“Move Forward Dam It”

Good Reads:

Once They Were Hats by Frances Backhouse

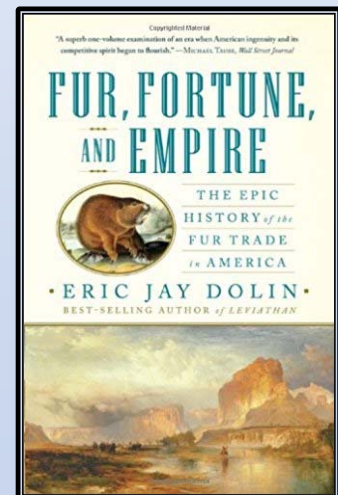
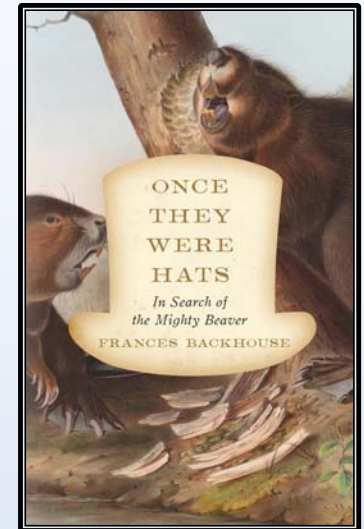
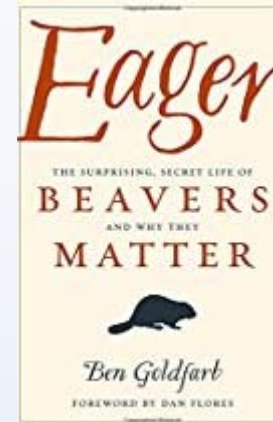
The American Beaver and His Works by Lewis Henry Morgan

Fur, Fortune, and Empire, The History of the Fur Trade in America by Eric Jay Dolin

Eager: The Surprising Secret Life of Beavers and Why They Matter by Ben Goldfarb

Upcoming Conferences/Workshops:

The State of the Beaver 2019 – Agents of Regeneration, Seven Feathers Convention Center, Canyonville, Oregon.



Questions?



ecotone
ecological restoration

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