

Role of Beaver in Stream Ecosystems: Overview of beaver life history and habitat requirements

Chris Jordan, Michael Pollock - NOAA
Northwest Fisheries Science Center

Joe Wheaton, Nick Bouwes – Utah State
University

John Stella - SUNY College of Environmental Science
and Forestry, Syracuse



Overview

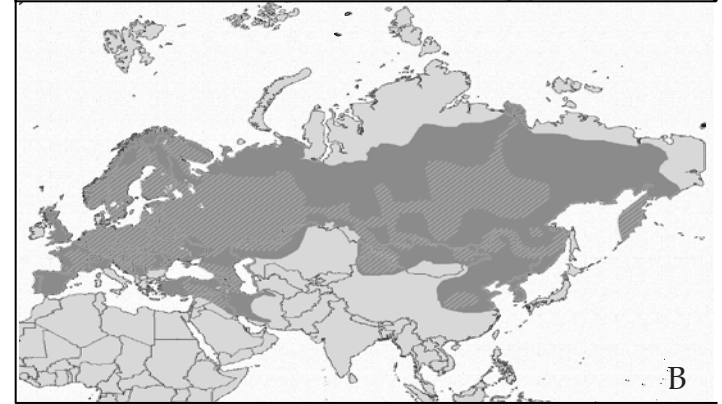
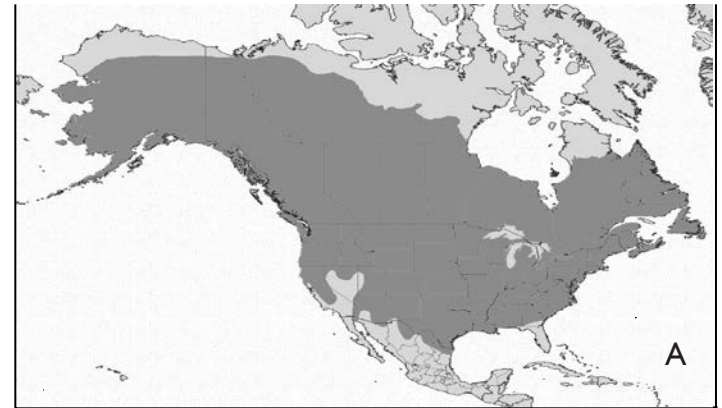
- Life history niche
- Beaver diet and food preference
- The colony, the lodge, and the cache
- Dams
- Geomorphological feedbacks
- Ecological feedbacks

Life History Niche

- Largest rodent in North America (up to 90 lbs!)
- Ubiquitous within N. hemisphere temperate ecosystems
- Range from boreal to aridlands
- Habitat generalist; highly adaptable
- Common habitat ingredients: water + wood
 - Northern tundra and treeline range boundary: wood limitation
 - Southern range desert boundary: perennial streamflow and/or wood limitation

Worldwide distribution of beaver

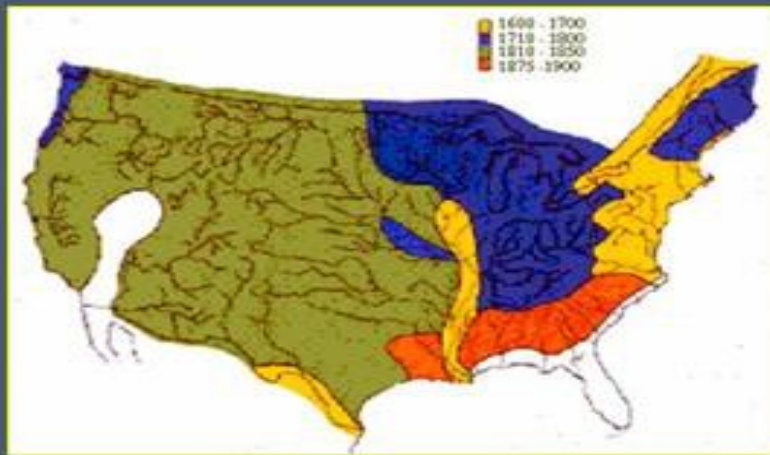
- *Castor canadensis* (N. America)
- Historically, 60–400 million pre--European settlement (Seton 1929)
- Currently, 6--12 million (Naiman et al. 1988), but estimates are crude
- Spatial distribution approaches its historical range
- *C. fiber* (Eurasian beaver)
- More limited current distribution, but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



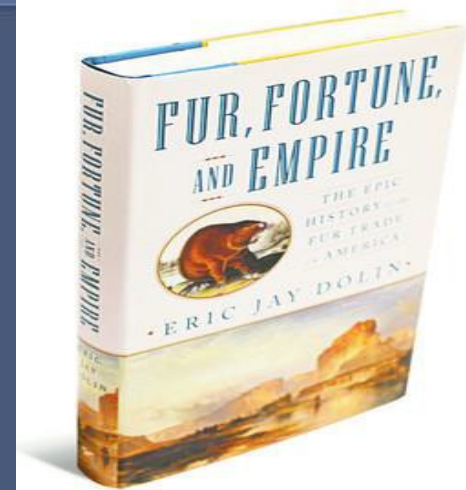
Pollock MM, Heim M and Werner D. 2003. *Hydrologic and geomorphic effects of beaver dams and their influence on fishes.*

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)

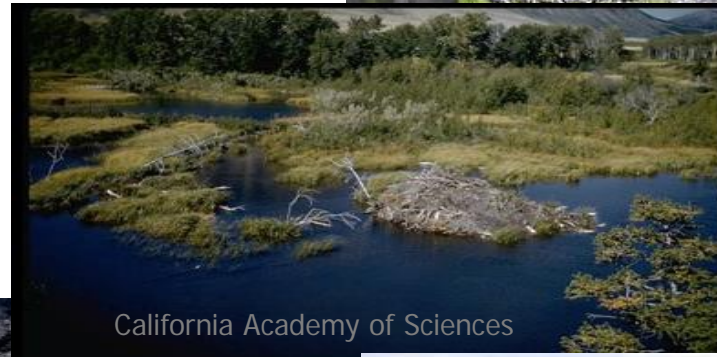


A HABITAT GENERALIST - AND HIGHLY ADAPTABLE

- Lakes
- Rivers and streams
- Abandoned channels on floodplains
- Wetlands



Pierre Cotacute



California Academy of Sciences



John Stella



John Stella

FROM BOREAL FORESTS....



Fred Hirschmann—Science Faction/Getty Images



<http://www.for.gov.bc.ca/dfn>

...TO DESERTS



Joe Wheaton



<http://www.rv-boondocking-the-good-life.com/>



Joe Wheaton

EVEN SOME UNLIKELY PLACES...

- Estuaries
- Glacier outwash streams



Beaver Dam Creek,
Long Island, NY

Mendenhall Glacier, AK (*Photo Bob Armstrong*)



Beaver Diet: A choosy generalist



- Spring/Summer: herbaceous plants, including aquatic and riparian forbs, grasses, grains and row crops
- Fall/Winter: tubers, bark and cambium of cached woody plants
- Woody plants comprise 86% of winter diet; 16% of summer diet (Roberts and Arner 1984)
- Number of woody species consumed range from 3 at northern range limit to >30 in southern region (Aleksiuk 1970, Hill 1982, Novak 1987)

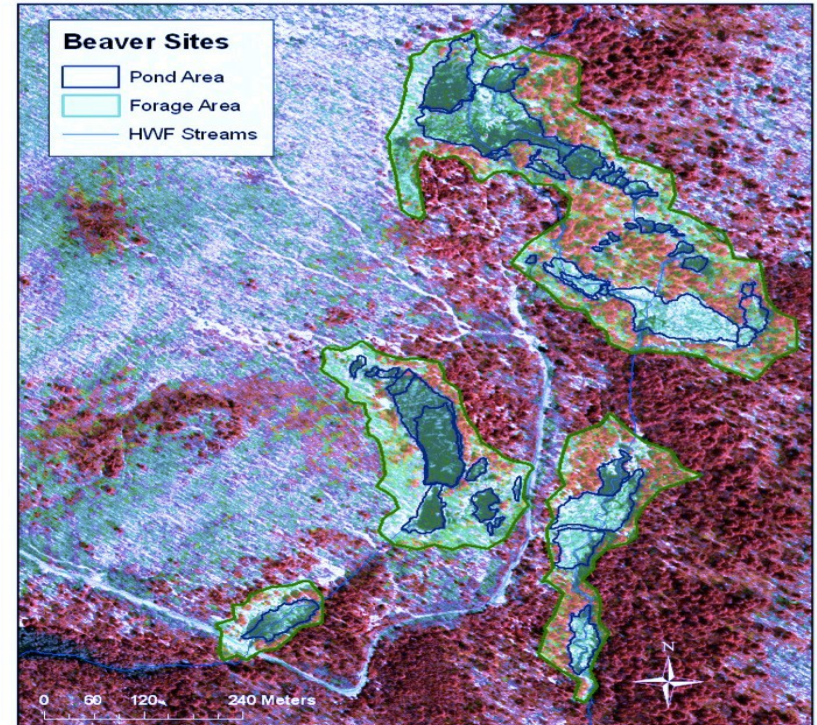


Chris Jordan

- Colony unit = 6–8 related individuals
- Avg. litters = 2–5 kits
- Young stay with parents at least 2 years
- Adults (>2 yrs) disperse to establish new lodge, 1 – 25k away from natal site
- 73% females dispersed in spring, 60% males dispersed in fall (Windels 2014)
- Territories marked with scent mounds
- Home ranges tend to follow shorelines in lakes, ~1km in streams
- Colony saturation densities vary with landscape and region
- Max. density ranges 0.5–5 colonies/km²

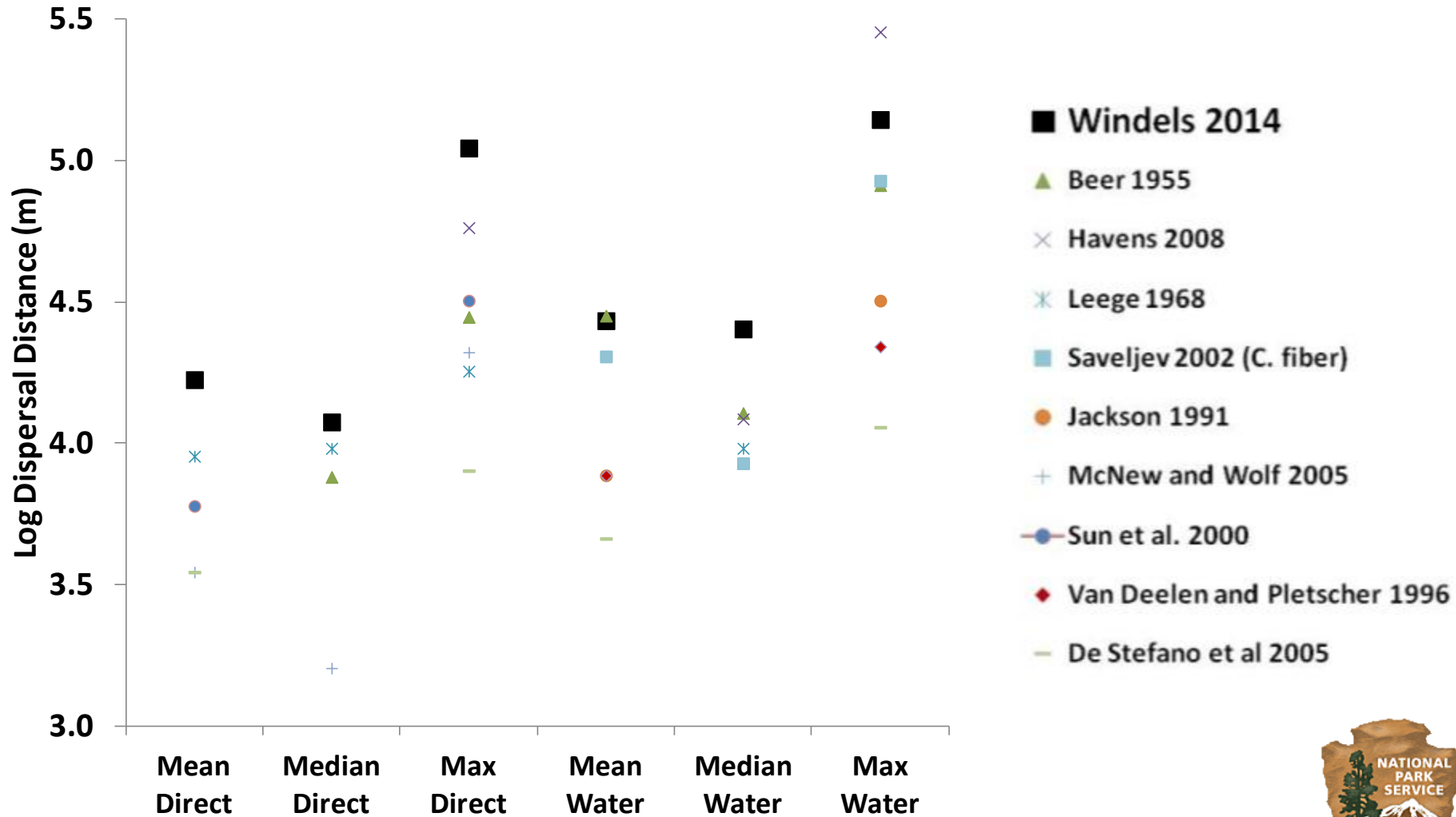
(Hill 1976, Novak 1987, Baker and Hill 2003)

The Colony



John Stella

Dispersal Distances



Data compiled by Steve Windels, NPS



Aquatic Habitat is Critical to their Success



- Beaver more agile in water than on land; maximize time in the water
- Ponds provide cover from predators and foraging pathways
- Lodge includes underwater entrance, nest area above water

Location, location,

- Bank dens vs aquatic lodges
- Caches are submerged or exposed

location...!



Bank den (Colorado Natural Heritage Program)

© CNHP



John Stella



© ET AL USU / <http://et.al.joewheaton.org>



Joe Wheaton

Yes, that's all well and good, but what we're really here to learn about is...

BEAVER DAMS



- Created to impound water around lodge
- Dam location / repair cued by running water
- Dams constructed of wood and available debris (e.g., plastic, metal)
- Where palatable species are rare, conifers are used more in dams, with hardwoods saved for the food cache (Barnes and Mallik 1996)

World's largest beaver dam



Images courtesy of EcoinformaOcs, Inc.

- Found in Alberta, Canada (2007) using Google Earth
- 850 m; longer than Hoover Dam



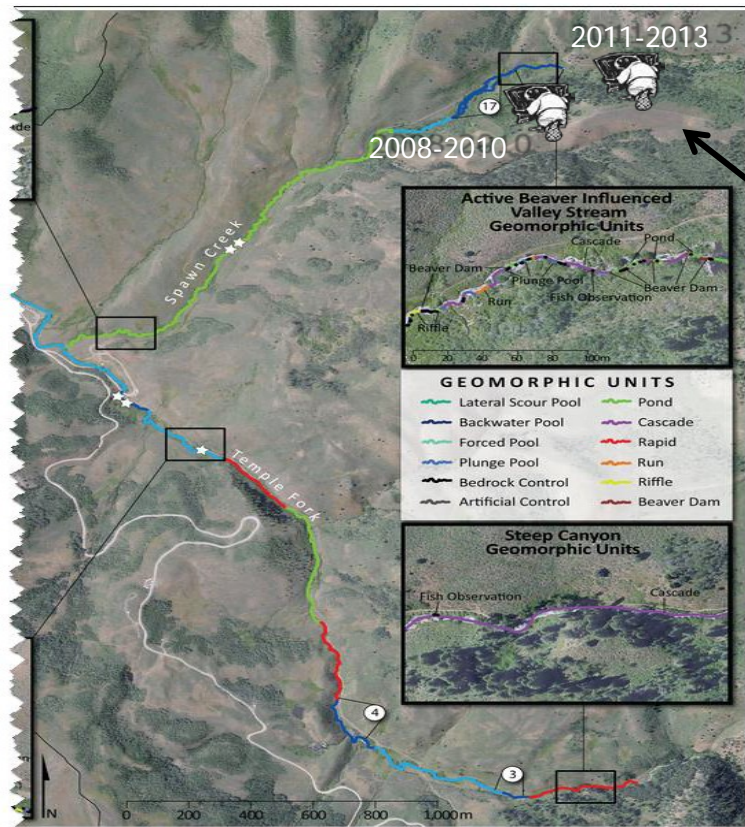
Dam/Pond

- Multiple dams create safe transportation corridors to connect large ponds
- Dams complexes grow over time, allowing beaver access to more food sources



BEAVER ARE LIKE ROTATIONAL CROP FARMERS

- They will selectively work an area hard for 2-3 years
- Then let it lie fallow and move upstream or downstream



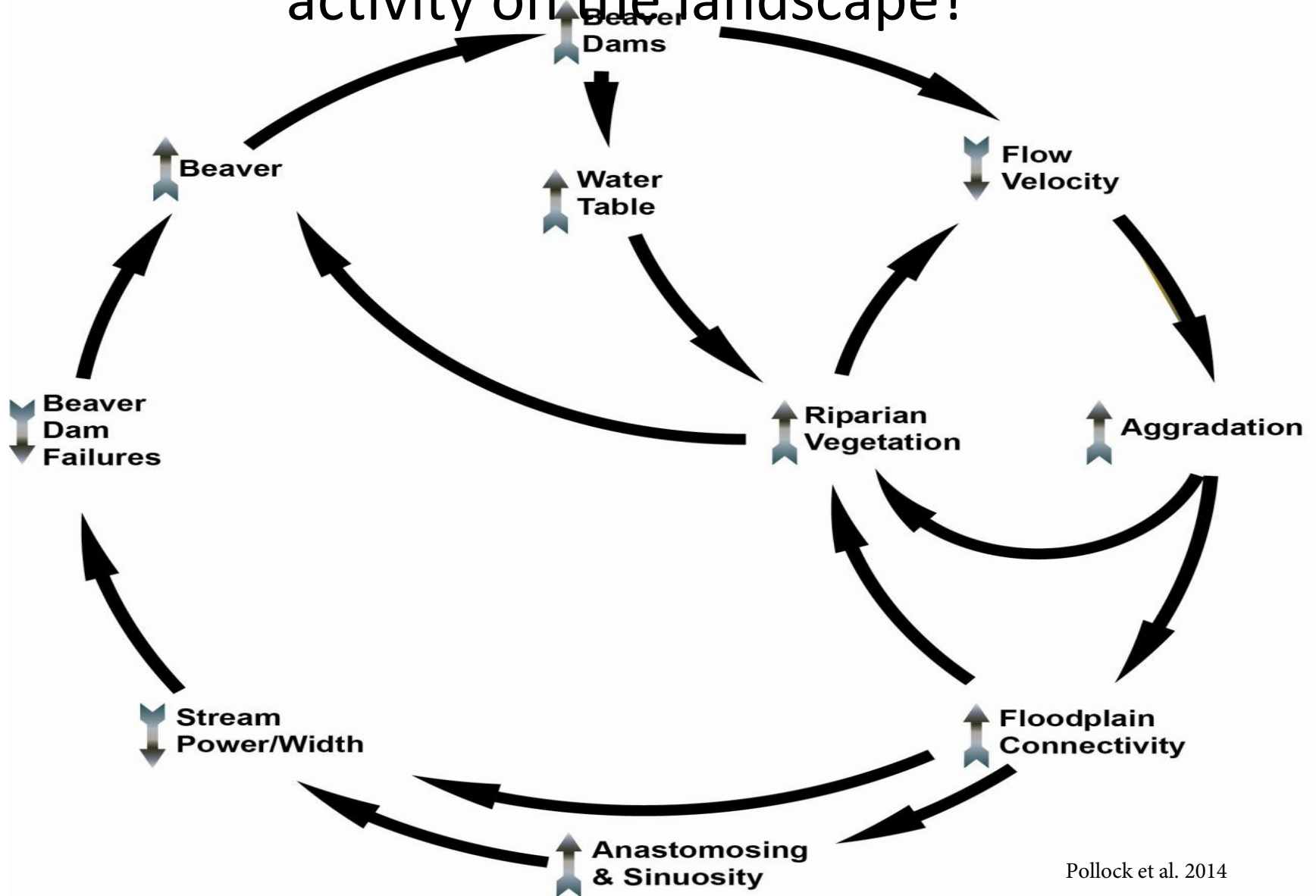
Joe Wheaton





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



DAMS ARE POROUS... & TRANSIENT



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DAMS CHANGE NATURE'S CLOCK



Residence time of:

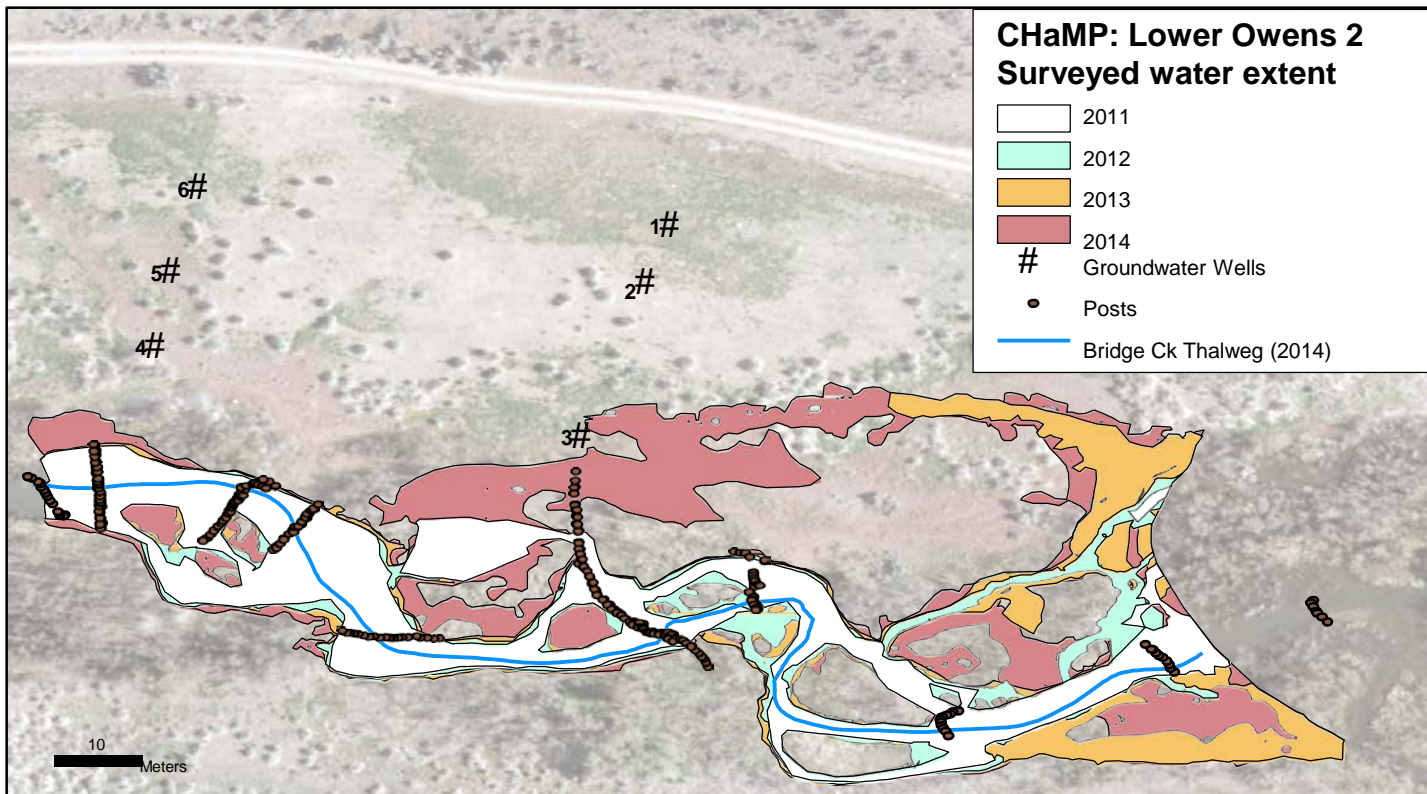
- Water
- Sediment
- Nutrients

What would time distributions look like when -

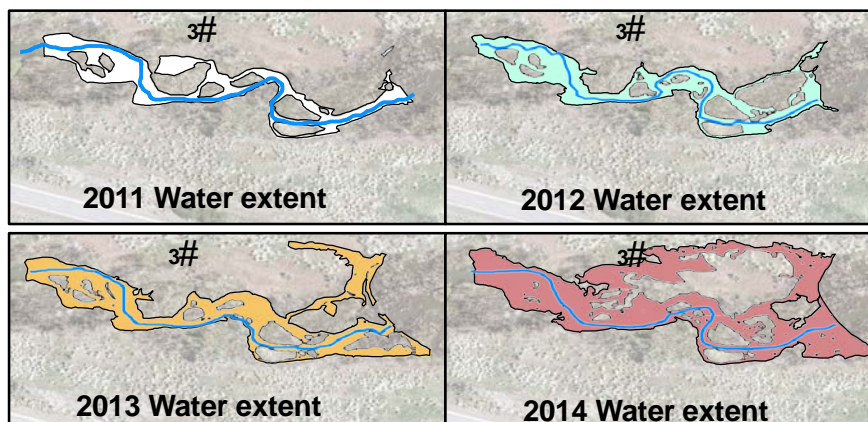
- Stream Undammed
- Dam present, Dam breached / failed?

DAMS CREATE A DIVERSITY OF HYDRAULIC HABITATS...





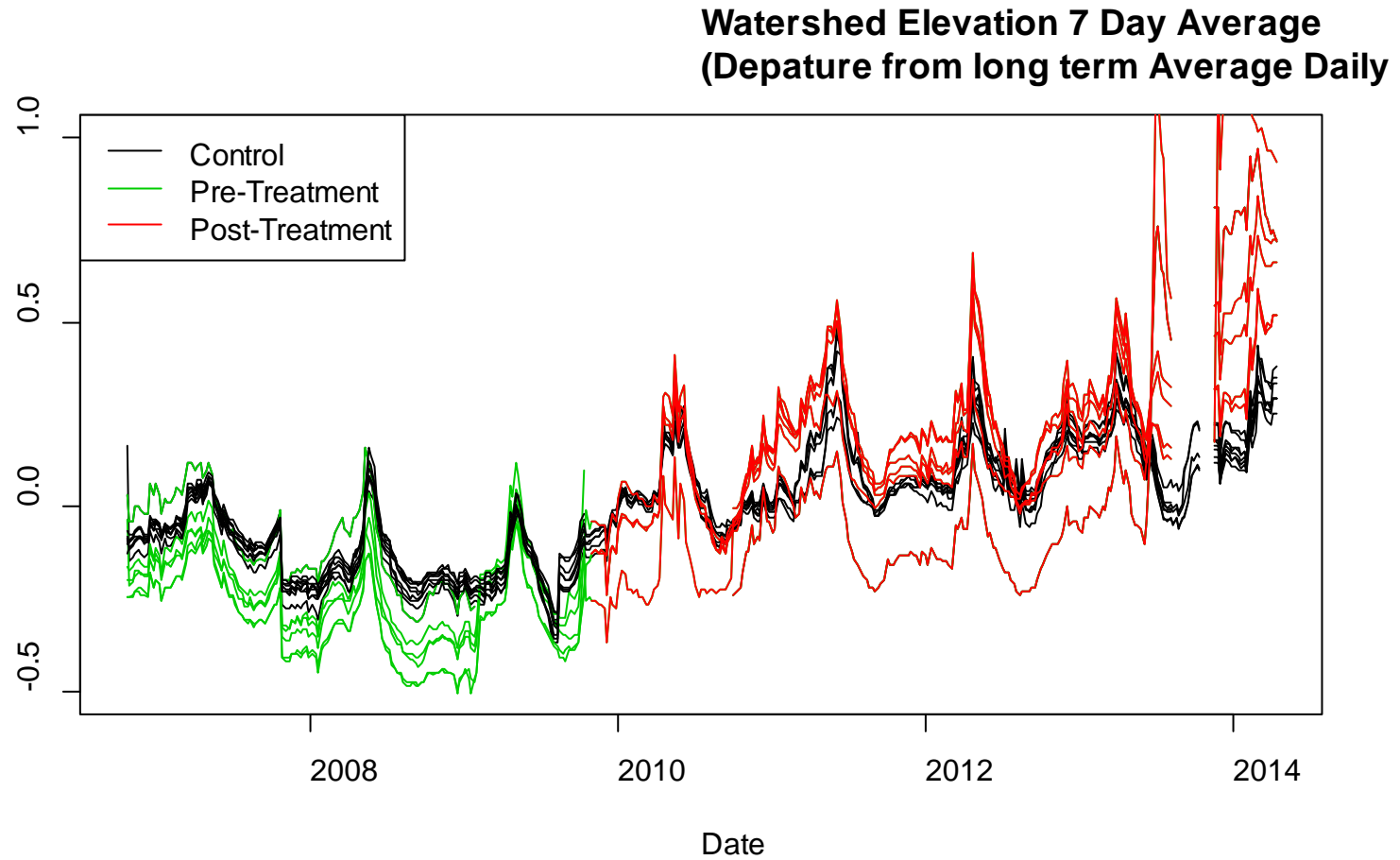
Carol Volk



Dams spread water out...

Dams back water up (and down)...

7 Day Ave Water Elevation Depar



Dam building activity drives the ecological feedbacks that beaver are known for



- Shallower water table
- Increased groundwater moisture
- Forest species composition and size distribution
- Multi-stemmed growth
- Woody species regeneration

Beaver impacts: increase wetland area

- Beaver change landscape from terrestrial to aquatic
- Most landscape change occurs in first 20 years
- Increased landscape diversity (Wright et al. 2002)
- Waterfowl habitat
- Increased amphibian habitat (Karraker and Gibbs 2009)



Beaver impacts: forest structure

- Removal of understory and canopy trees
- Open up canopy to understory/unpalatable species





Chris Jordan



Chris Jordan

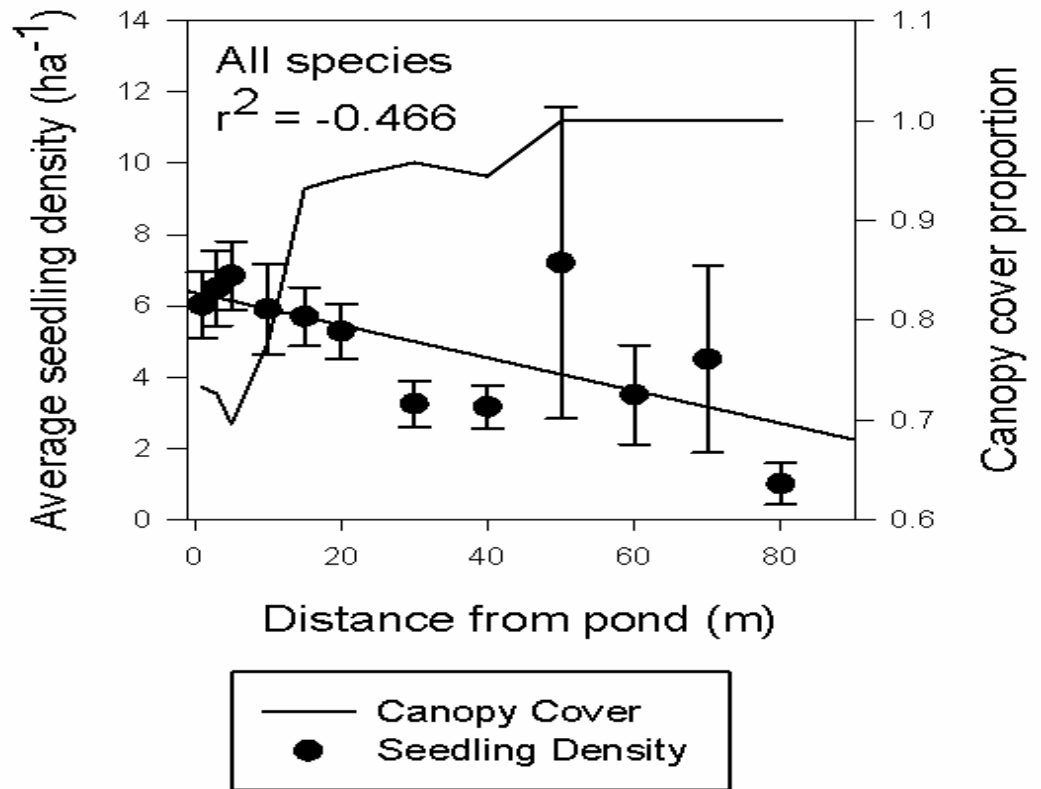
Multi - stemmed growth habit



Photos: Anna M. Harrison

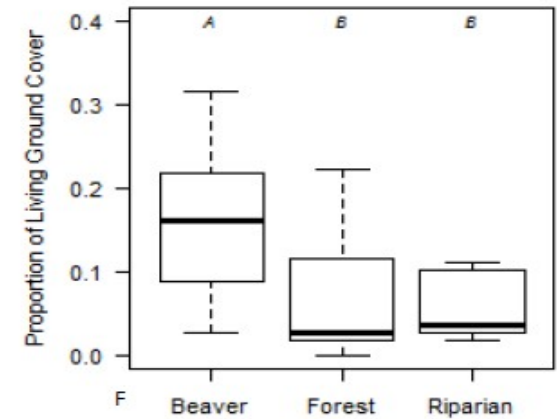
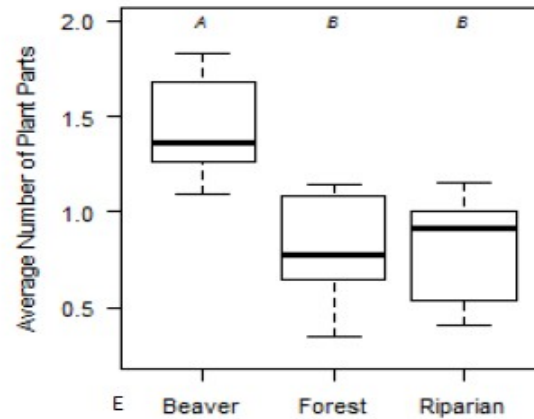
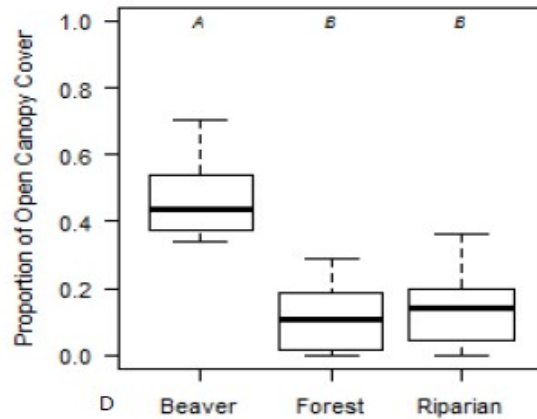
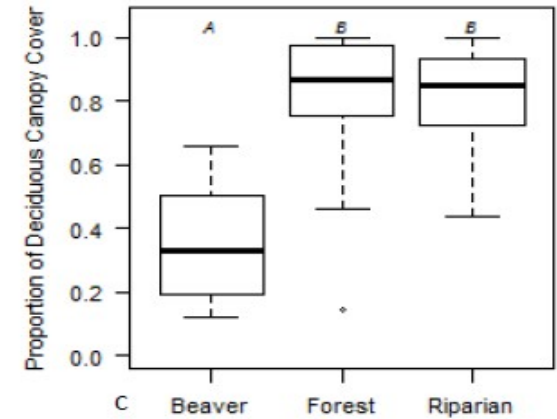
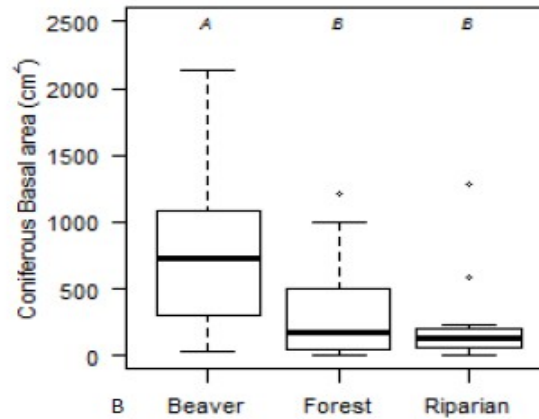
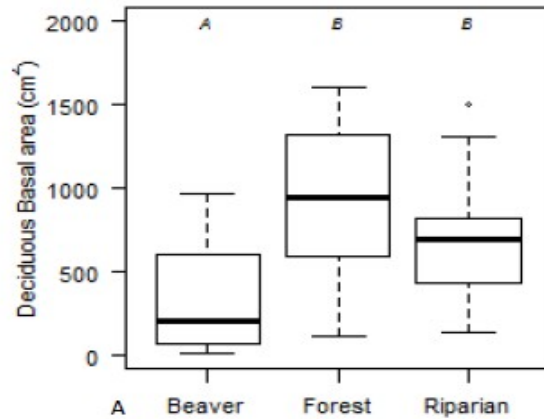
*Not for distribution
(Please contact J. Stella, stella@esf.edu)*

Woody Species Regeneration

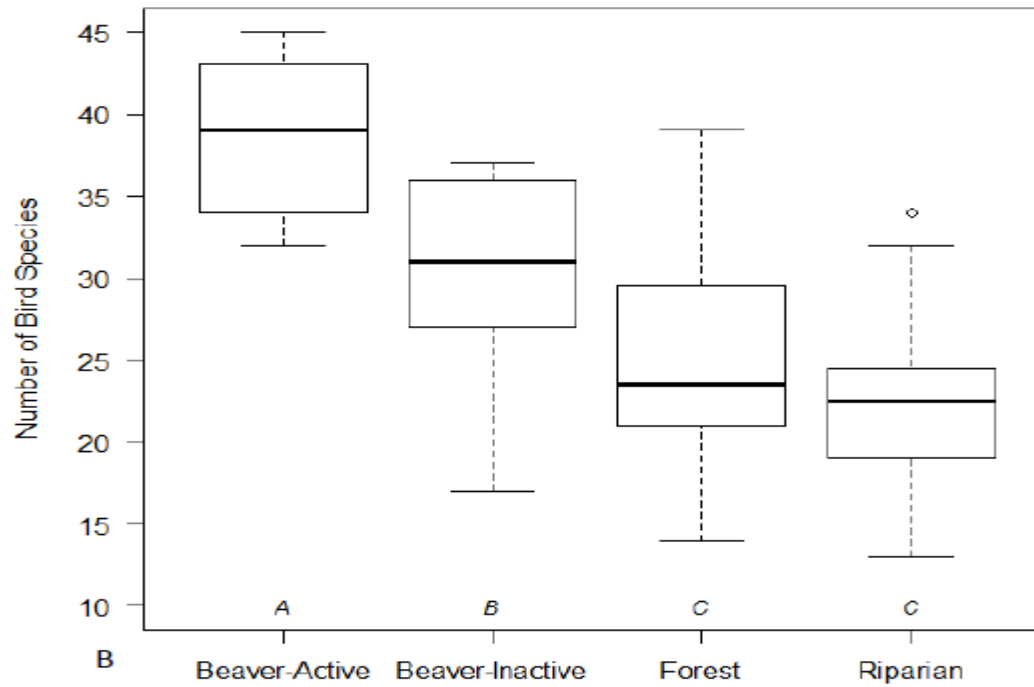


Harrison & Stella 2010;
Not for distribution
(Contact J. Stella, stella@esf.edu)

Ecological Consequences of Beaver Activity


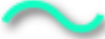




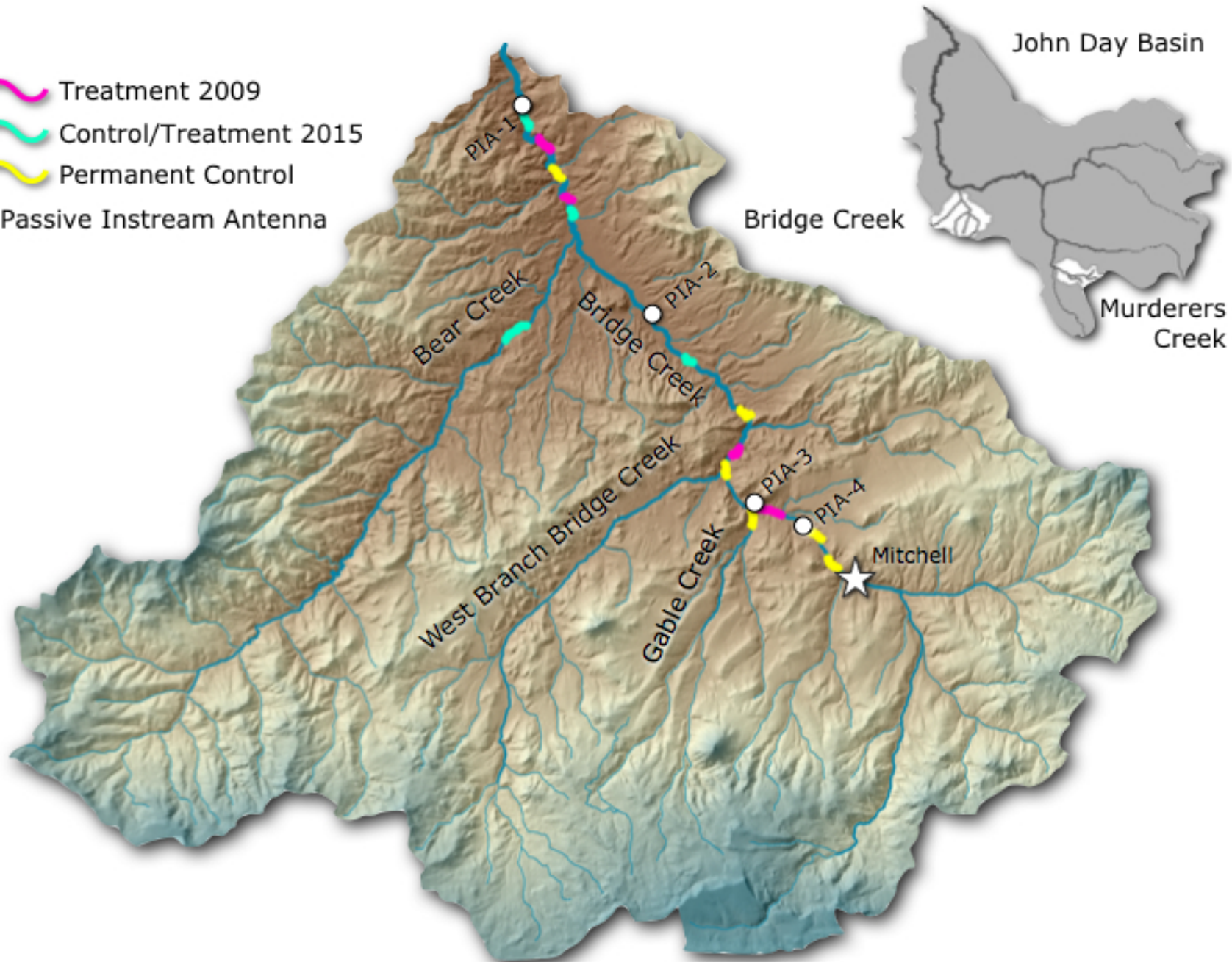
Another Ecological Consequence of Beaver Activity



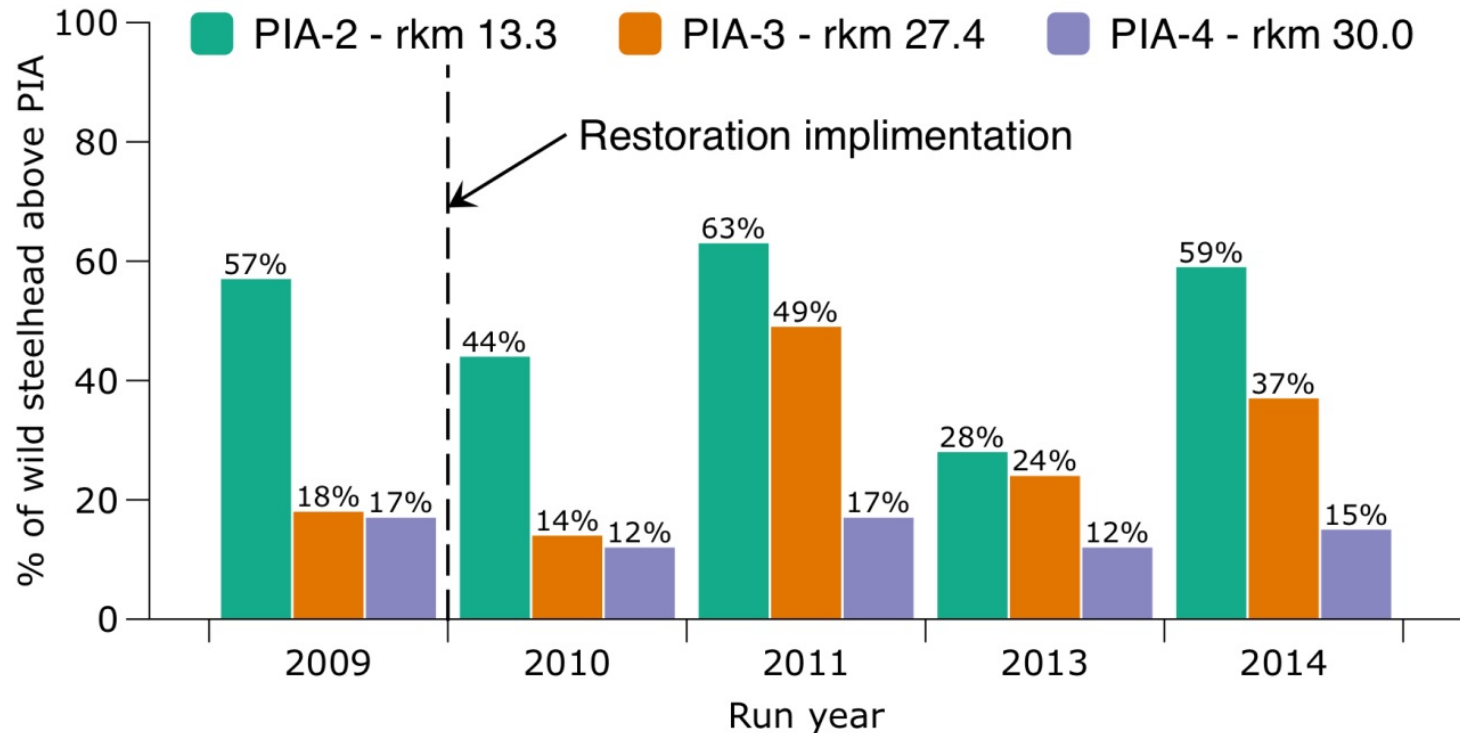
Alza, C.M. 2014

But what about the down-sides?

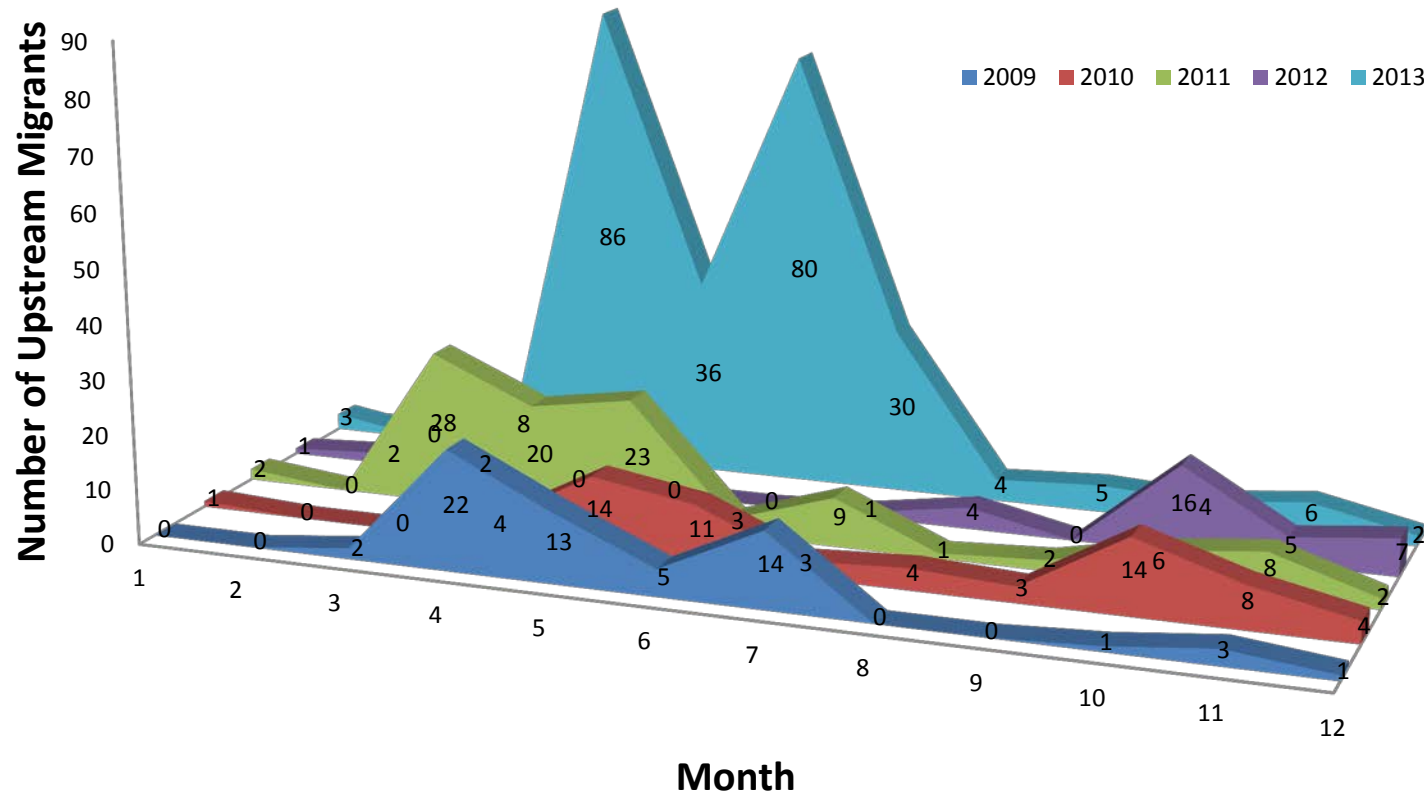
-  Treatment 2009
-  Control/Treatment 2015
-  Permanent Control
-  Passive Instream Antenna



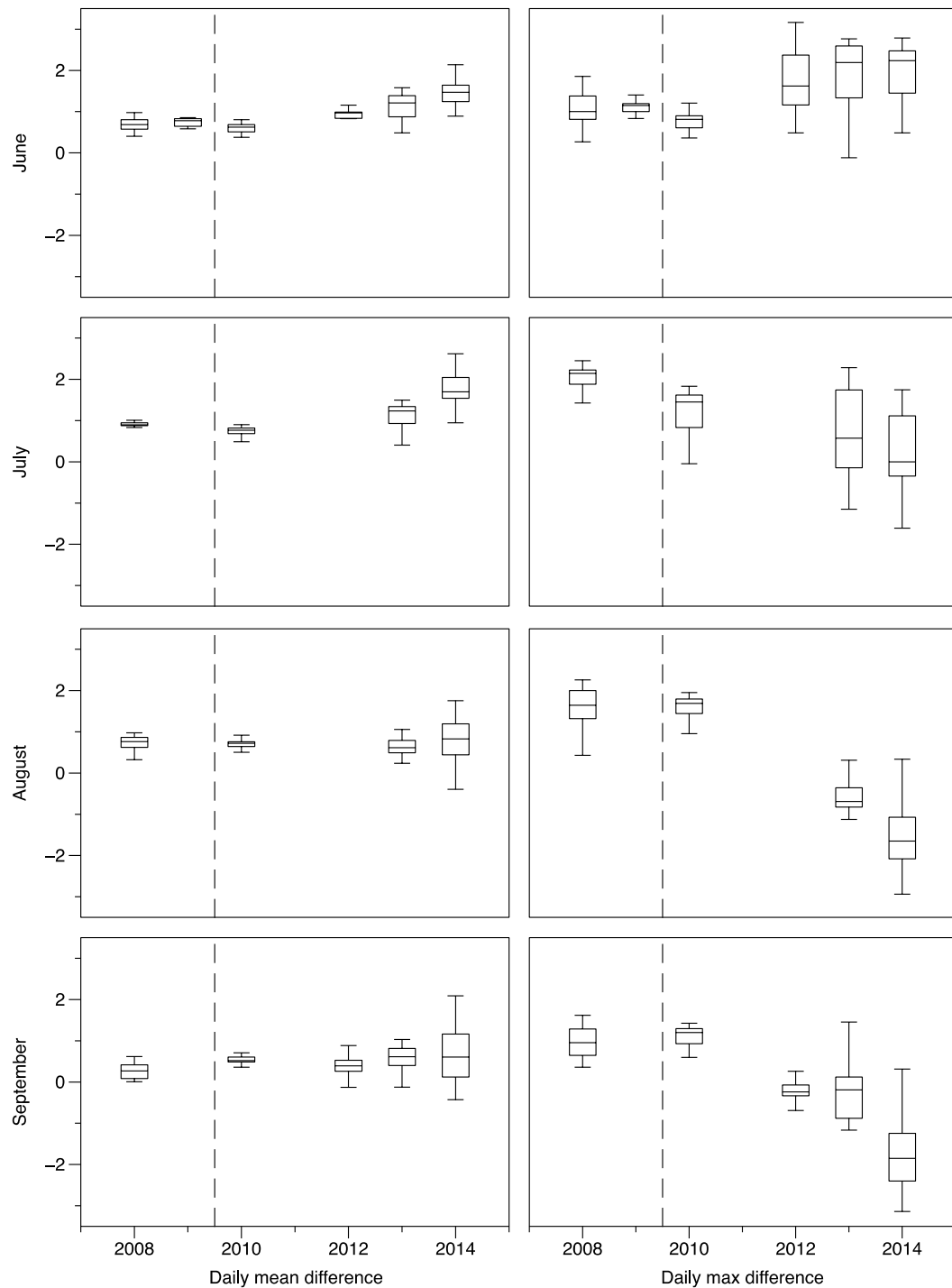
Upstream passage of beaver dams (natural and analogs) by adult steelhead trout



Upstream passage of beaver dams (natural and analogs) by juvenile steelhead trout



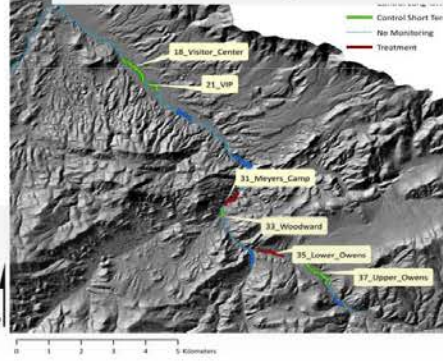
Temperature difference between treatment and control reaches



But What Happens When Beaver Dams “Fail”?



Figure 10: Progression of reach at upper Owens through a period without a dam (A; 2005), with an active, partially breached dam (B; Nov 2009), to an abandon, partially breached dam (C; April 2010).



Joe Wheaton

The Dynamics of Beaver Dam Complexes Form Landscapes

