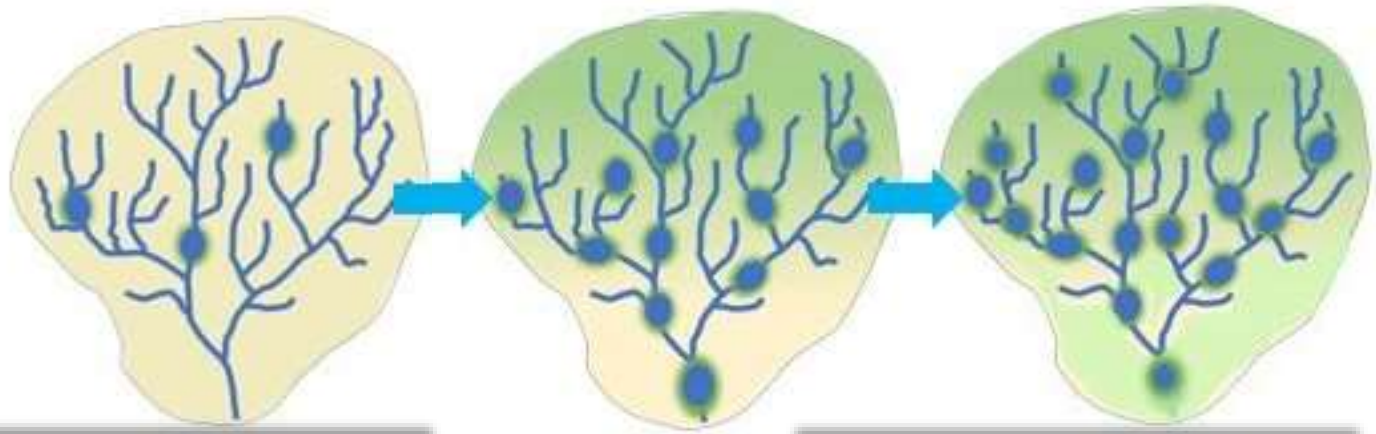
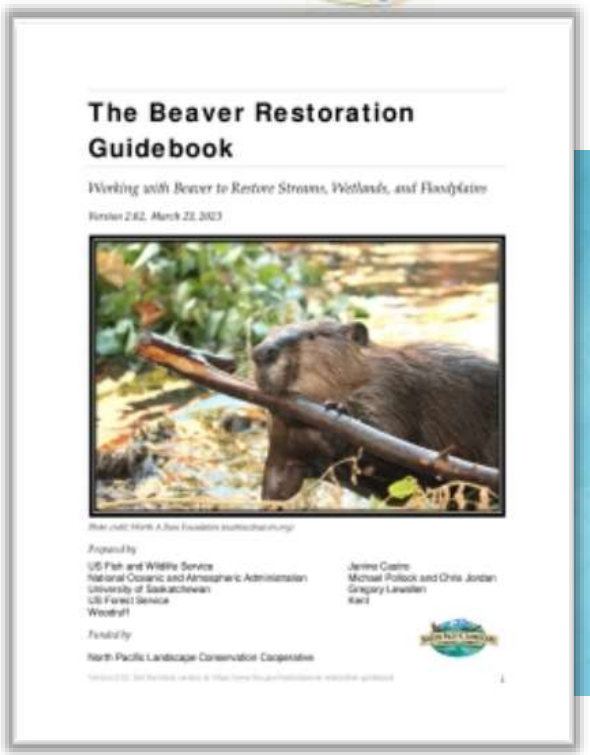
Beaver Managed Floodplains (BMFPs) and the “Beaver Part“

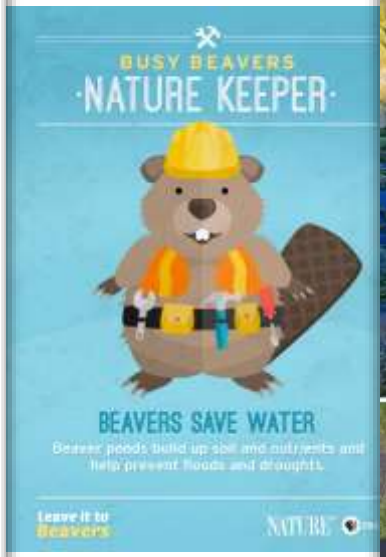
What’s Missing?

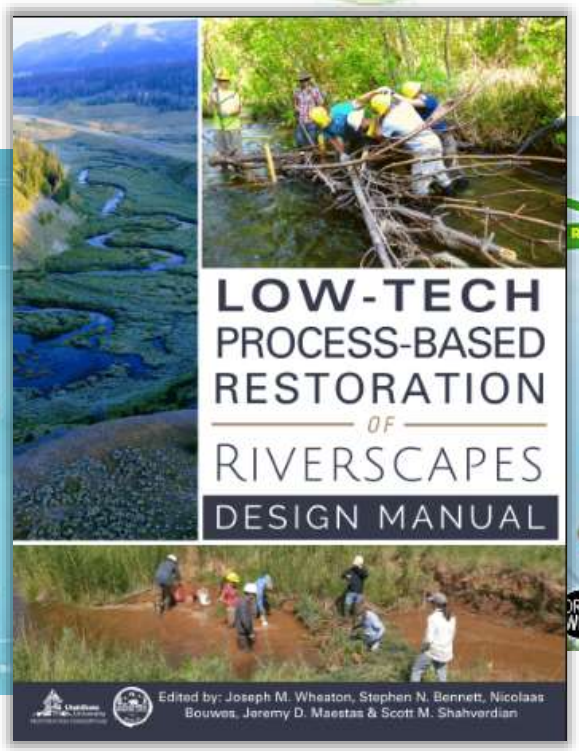
Reese Mercer
Western Beavers Cooperative

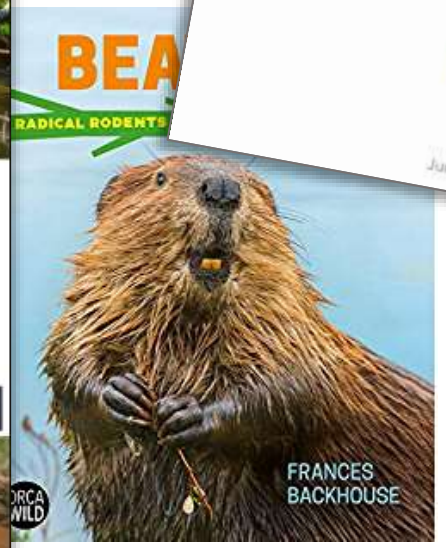
BEAVERS BACK ON THE LAND











TODAY'S TALK

- What's missing
- Why it matters
- Considering the beaver
- Beaver recovery at watershed scale
- Tools

BEAVER BACKGROUND

- Learning mode since 2016, and
  - Western Beavers Cooperative (2023)
  - Beaver Institute (2020) and Coexistence Working Group
  - Beaver Works Oregon (2019)

- Advocate and support for beavers and natural beaver recovery

- Mostly private lands focus

- Past 5 years monitoring 42 miles of beaver occupied streams:
  - Occupancy and forage monitoring
  - Beaver inventories
  - Tools: trail cameras, drones, hiking boots
  - Landowner conversations

- Beaver based restoration planning and support past 3 years:
  - Vegetation design and implementation
  - BDA design and consulting: design and implementation
  - Beaver conflict devices

- Launched Cooperative 2023 for shared learnings around BBR

- ***Grateful*** for the stream restoration work of WCs, SWCDs, NRCS, more…

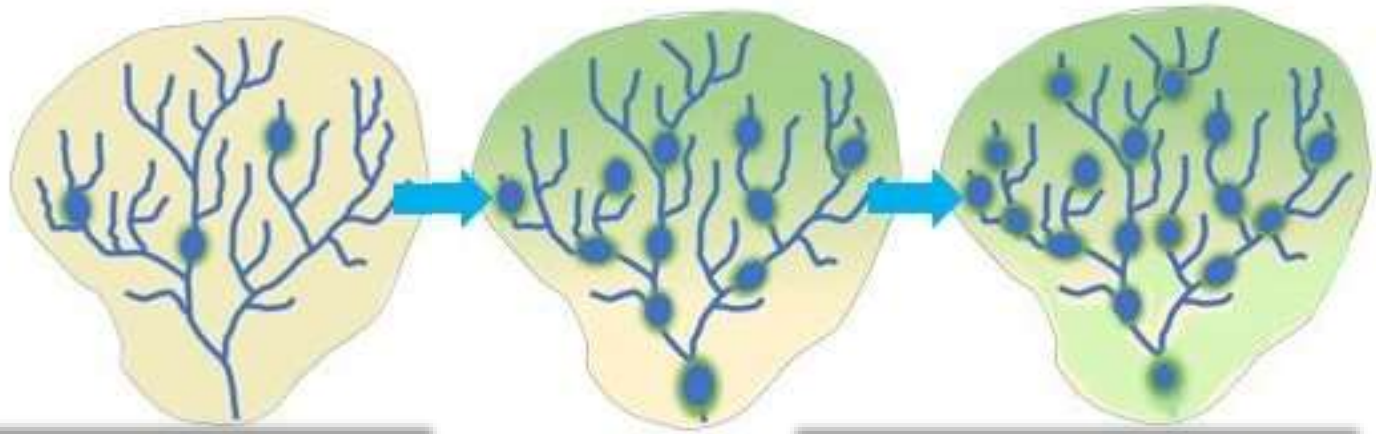
REESE MERCER

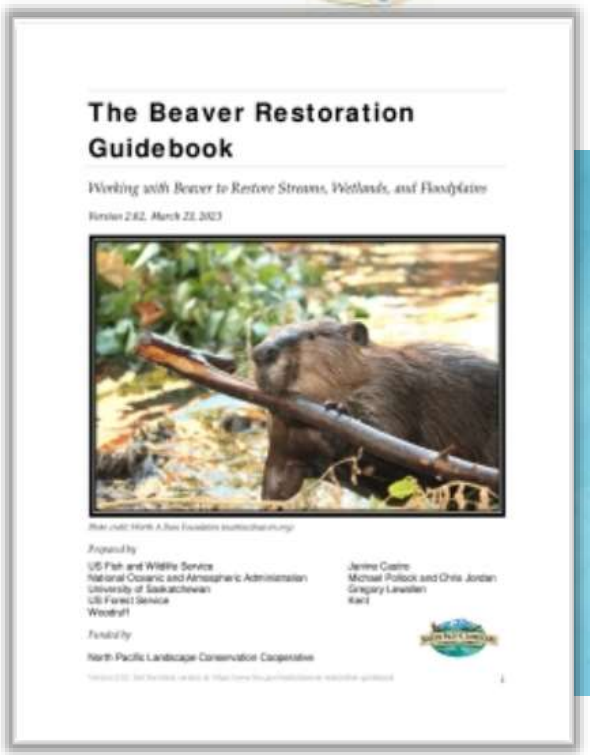
WESTERN BEAVERS COOPERATIVE

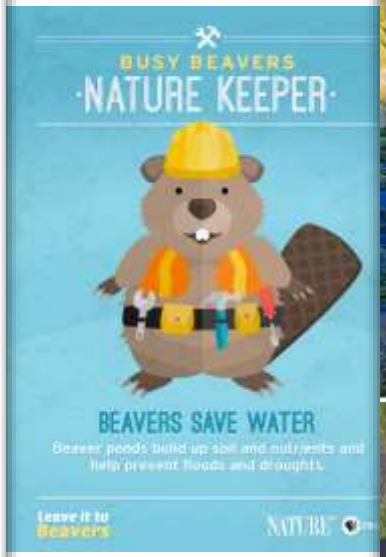
BEAVER SITE MONITORING

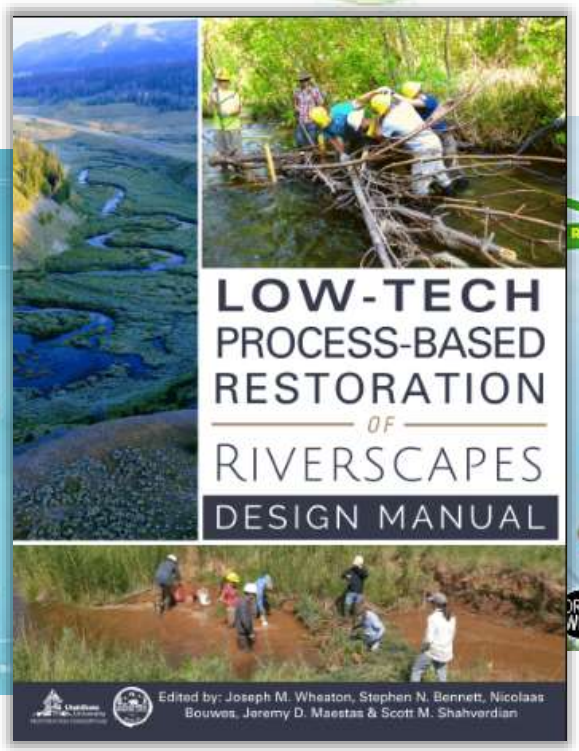
Since 2019
42 Stream Miles

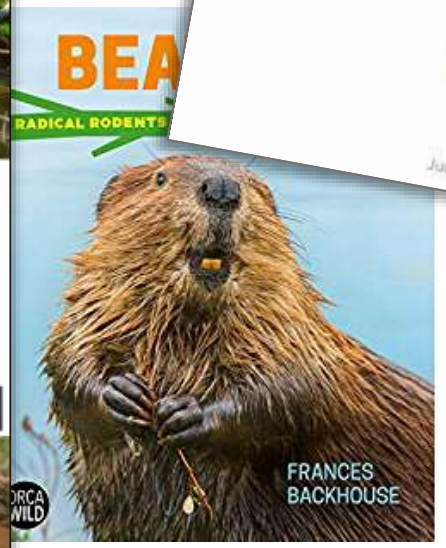
BEAVERS BACK ON THE LAND











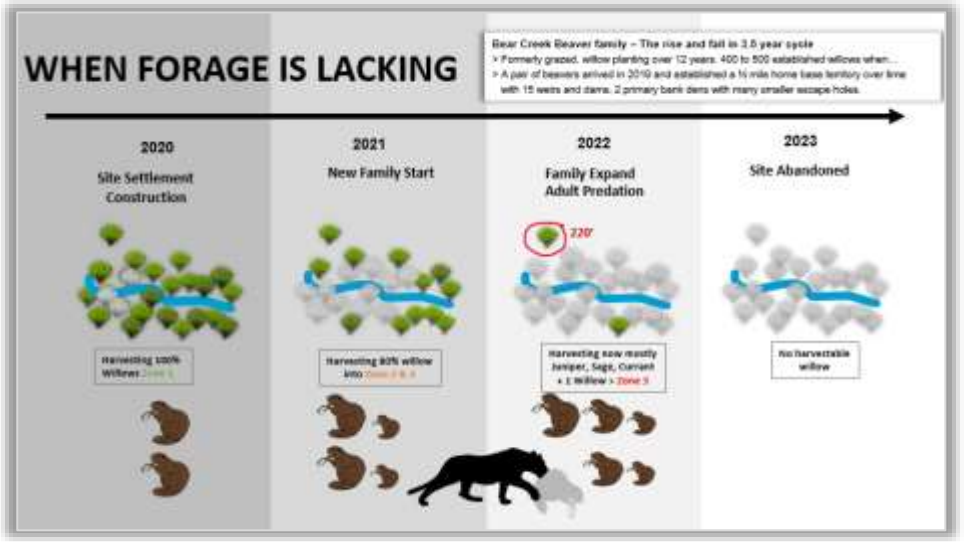
WHAT'S MISSING?

WHAT'S MISSING?

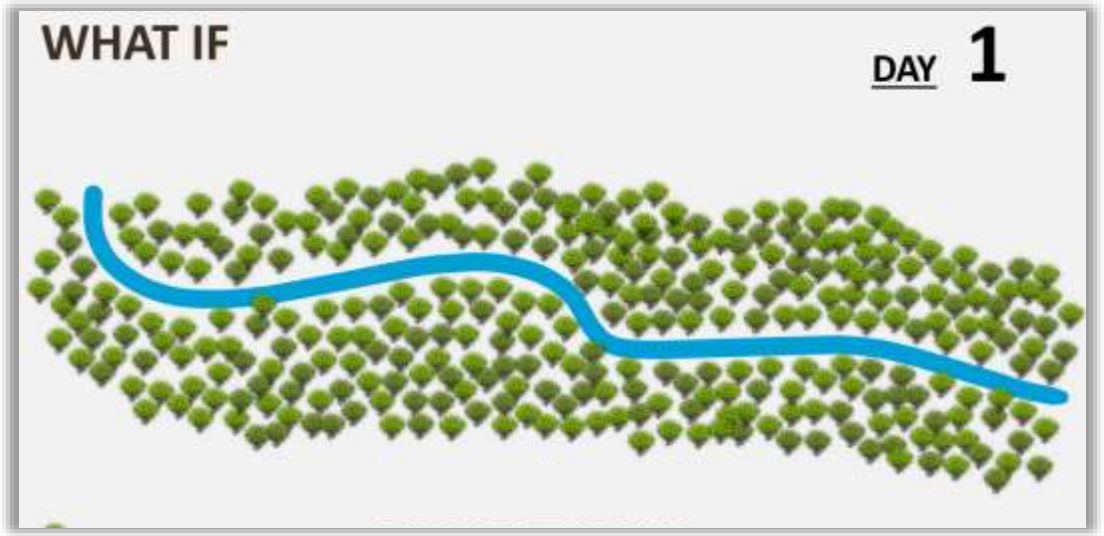
- **A WELL-DEFINED GOAL FOR SITE SUCCESS**

VERY DIFFERENT DESTINATIONS

EPHEMERAL



PERSISTENT



WHAT'S MISSING?

- **BEAVERS GOTTA EAT**

WHAT'S MISSING?

- ***BIOLOGY* AS FOUNDATION**

Abstract 2019

The foundations of river restoration science rest comfortably in the fields of geology, hydrology, and engineering, and yet, the impetus for many, if not most, stream restoration projects is biological recovery. Although Lane's stream balance equation from the mid-1950s captured the dynamic equilibrium between the amount of stream flow, the slope of the channel, and the amount and calibre of sediment, it completely ignored biology. Similarly, most of the stream classification systems used in river restoration design today do not explicitly include biology as a primary driver of stream form and process. To address this omission, we cast biology as an equal partner with geology and hydrology, forming a triumvirate that governs stream morphology and evolution. To

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RESEARCH ARTICLE

WILEY

The stream evolution triangle: Integrating geology, hydrology, and biology

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NG7 2RD, UK,
Sciences Research
and Number: EP/

Abstract

The foundations of river restoration science rest comfortably in the fields of geology, hydrology, and engineering, and yet, the impetus for many, if not most, stream restoration projects is biological recovery. Although Lane's stream balance equation from the mid-1950s captured the dynamic equilibrium between the amount of stream flow, the slope of the channel, and the amount and calibre of sediment, it completely ignored biology. Similarly, most of the stream classification systems used in river restoration design today do not explicitly include biology as a primary driver of stream form and process. To address this omission, we cast biology as an equal partner with geology and hydrology, forming a triumvirate that governs stream morphology and evolution. To represent this, we have created the stream evolution triangle, a conceptual model that explicitly accounts for the influences of geology, hydrology, and biology. Recognition of biology as a driver leads to improved understanding of reach-scale morphology and the dynamic response mechanisms responsible for stream evolution and adjustment following natural or anthropogenic disturbance, including stream restoration. Our aim in creating the stream evolution triangle is not to exclude or supersede existing stream classifications and evolutionary models but to provide a broader "thinking space" within which they can be framed and reconsidered, thus facilitating thought outside of the alluvial box.

KEYWORDS

channel evolution model (CEM), conceptual model, fluvial geomorphology, river restoration, stream evolution model (SEM), stream classification

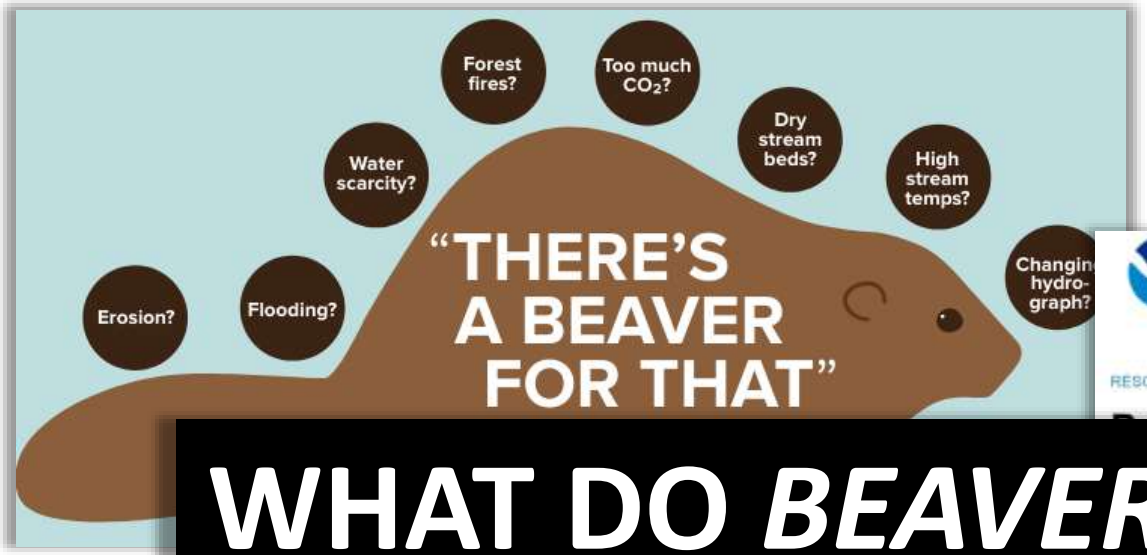
1 | INTRODUCTION

The stream evolution triangle (SET) is a conceptual model that blends long-established principles of fluvial geomorphology with results emerging from recent research revealing the high degree to which biological agents affect stream processes and systems (Atkinson, Allen, Davis, & Nickerson, 2016; McCluney et al., 2014). Conceptual models are useful when attempting to integrate information from natural science disciplines in order to understand complex systems (Fortuin, van Koppen, & Leemans, 2011) and are consequently well-suited to fluvial systems. With the SET, we attempt to create a conceptual space inclusive enough to represent wide ranges of process drivers, stream forms, and evolutionary pathways but simple enough to allow for creative thinking and rapid evaluation of both established and new ideas (Jackson, Trebitz, & Cottingham, 2000).

In common with existing stream classifications (e.g., Leopold & Wolman, 1957; Montgomery & Buffington, 1993; Rosgen, 1996; Schumm, 1985 [Figure 1]) and evolution models (e.g., Cluer & Thorne,

WHAT'S MISSING?

- TALK OF THE CRITTER'S NEEDS



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Partnering with Beavers to Adapt to Climate Change

YouTube · Miistakis Institute

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Putting Beavers to Work Project

NOAA FISHERIES

Menu

RESOURCES

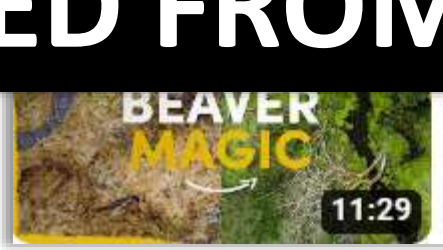
Are Beavers Nature's "Little Firefighters"?

WHAT DO *BEAVERS* NEED FROM US?

https://www.cbsnews.com › ... › Local News

California aims to tap beavers, once viewed as a nuisance ...

Jul 24, 2023 — The state is also running pilot projects to **relocate beavers** to places where they can be more beneficial. The aim is to preserve more ...



ully revitalise

Mossy Earth

290K views · 1 month ago

Montana FWP (.gov)

https://fwp.mt.gov › fwp › conservation › beaver PDF

BEAVERS AND THEIR ROLE IN RIPARIAN ...

Jan 2, 2023 — Essentially, **partnering with beavers** for stream restoration involves assuming that the effort will be successful and therefore trying to ...

upr

Donate

USU Researchers Are Using Beavers As Tools In Stream Restoration

Utah Public Radio | By Niall Clancy

Published April 9, 2019 at 10:31 AM MDT

WHAT'S MISSING?

- **RELOCATION STATS (p.s. IT DOESN'T WORK)**

Deaths reported **from capture** in

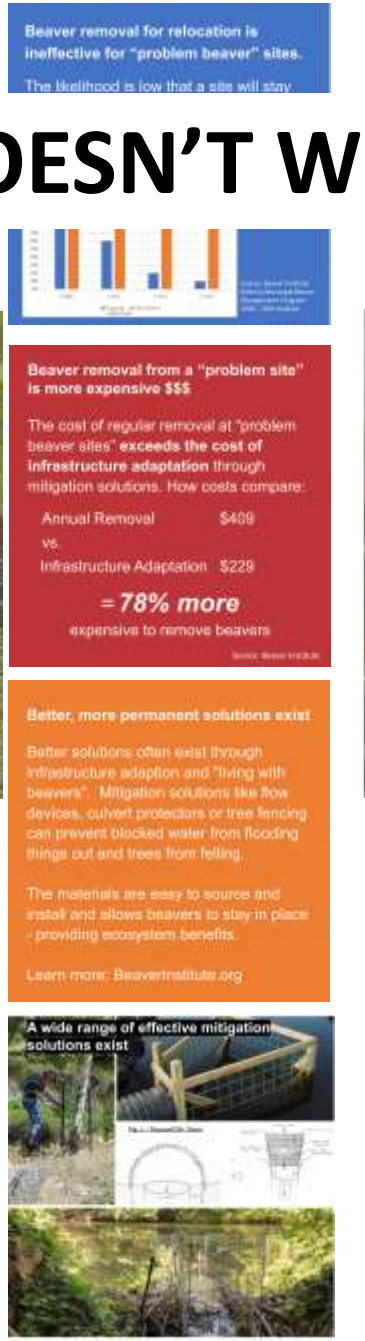
60%

of studies

Deaths reported **during captivity** in

42%

of studies



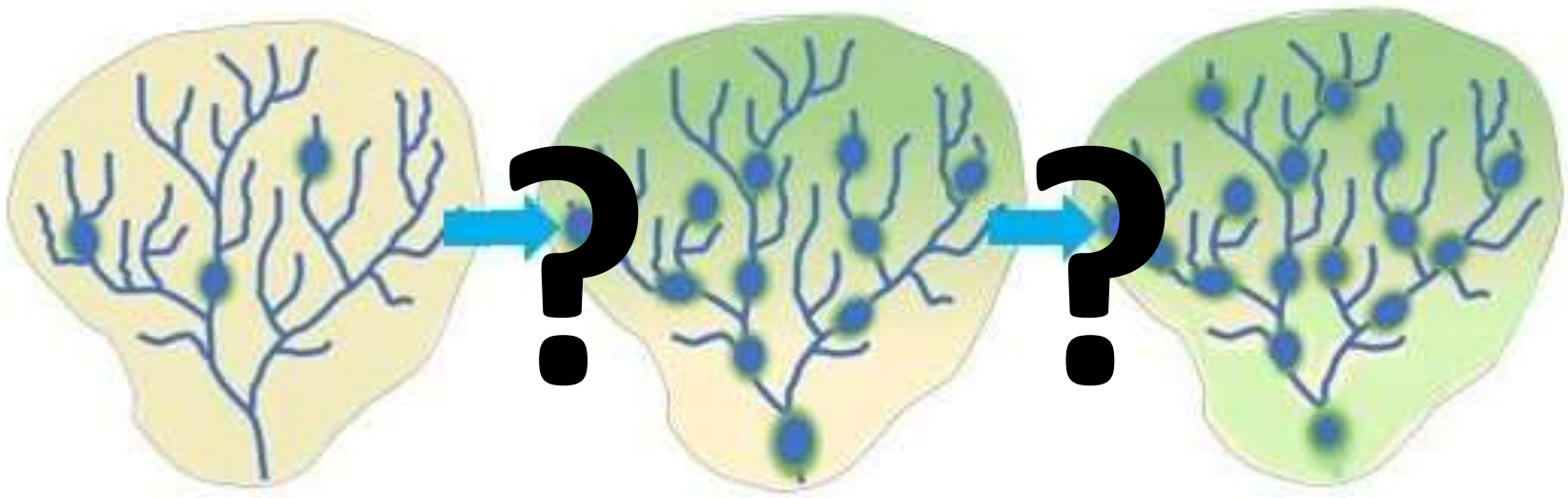
Beavers **stay at release site** in only

33%

of studies

What happens to the other 67%?

WHAT'S MISSING?
A SOUND VISION FOR SCALING BEAVER RECOVERY



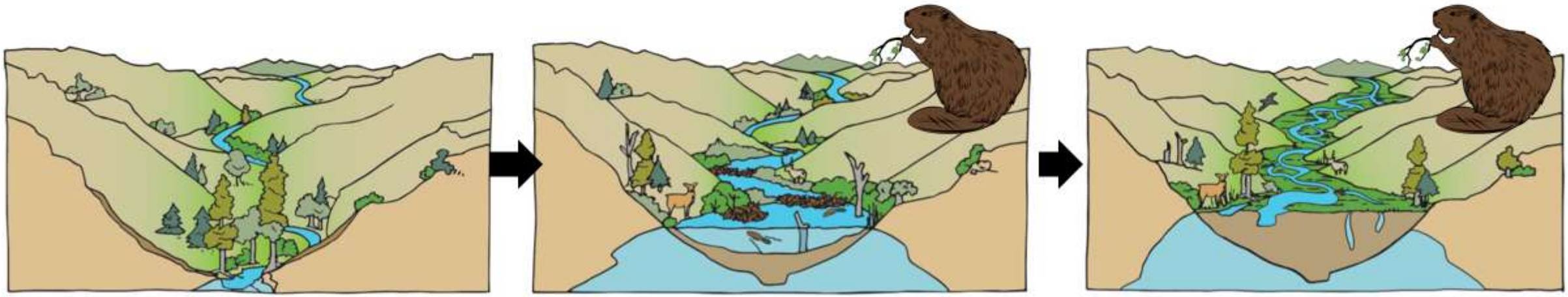
WHY IT MATTERS

WHY IT MATTERS

Archaeologist finds ancient beaver teeth in eastern Oregon -- earliest record of the animal in North America - Pacific Northwest News, 2011

7 Million Years

The March of Time in a Beaver-occupied Stream Valley



1 Steep, narrow, absent sediment accumulation

2 Beaver dams slow water, hold in sediment and organic matter

3 Shallow gradient, wide valley floors with rich soil and charging groundwater

WHY IT MATTERS

- Because within this process based restoration space we're actively developing, there's a paradigm that's reductive.
- Without a more holistic and relational approach, without considering the beaver and biology, we'll lose integrity over the long term of the function in ecosystems that we're all working toward.
- What's missing – is we talk about "partnering with the beaver", **without much consideration for what the beaver actually needs to be a successful, thriving participant in all of this.**

CONSIDERING THE BEAVER

THE MOST BASIC NEEDS

1. **Fitness** - The ability to stay alive
2. **Forage** – Sufficient food source for survival and family rearing

THE GOAL / DESTINATION

‘Individual Fitness’ of the individual, with capacity to reproduce and successfully pass on their genes.

~

Persistent occupancy of thriving beaver with multigenerational residency managing riverscapes for the long term.

FORAGE

1 FORAGE NEEDS AND PREFERENCES

- Will harvest for both eating and for building Often – but not always - these are same things
- Will risk predation to harvest their favorites

Preferred

Aspen
Willow
Cottonwood
Maple

Aquatic veg:
Speedwell,
Cattails, Lilies,
Sedge

Seasonal, adaptive

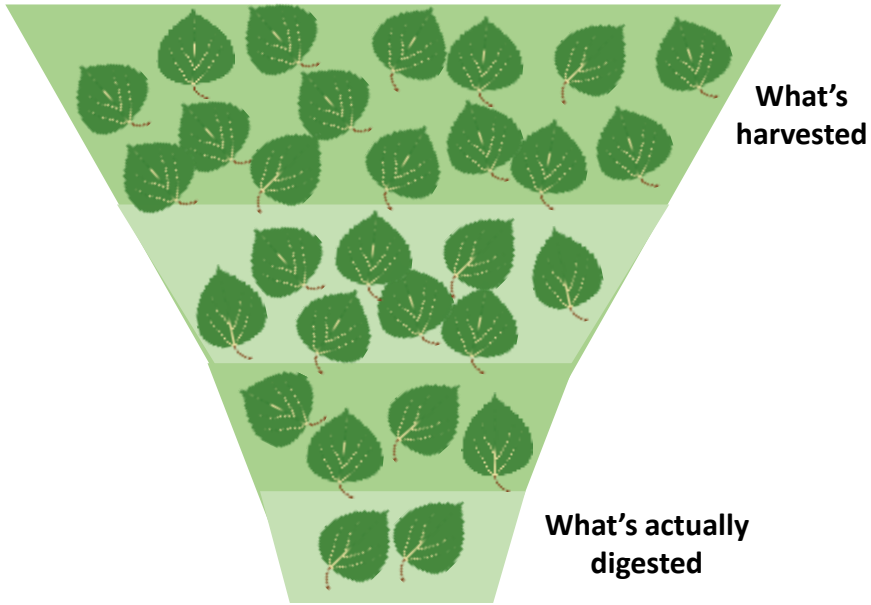
Juniper, Conifer
Sage, Currant

For building only:
Alder
Sage

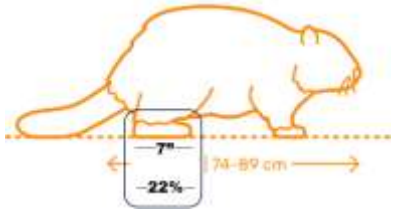
2 FROM HARVEST TO DIGESTION

- Only digest 33% of what's ingested. * Currier etal, 1960
- Considered "wasteful harvesters". Often cut trees and branches tangle in canopy, unable to access.

Progression from Harvest to Digestion



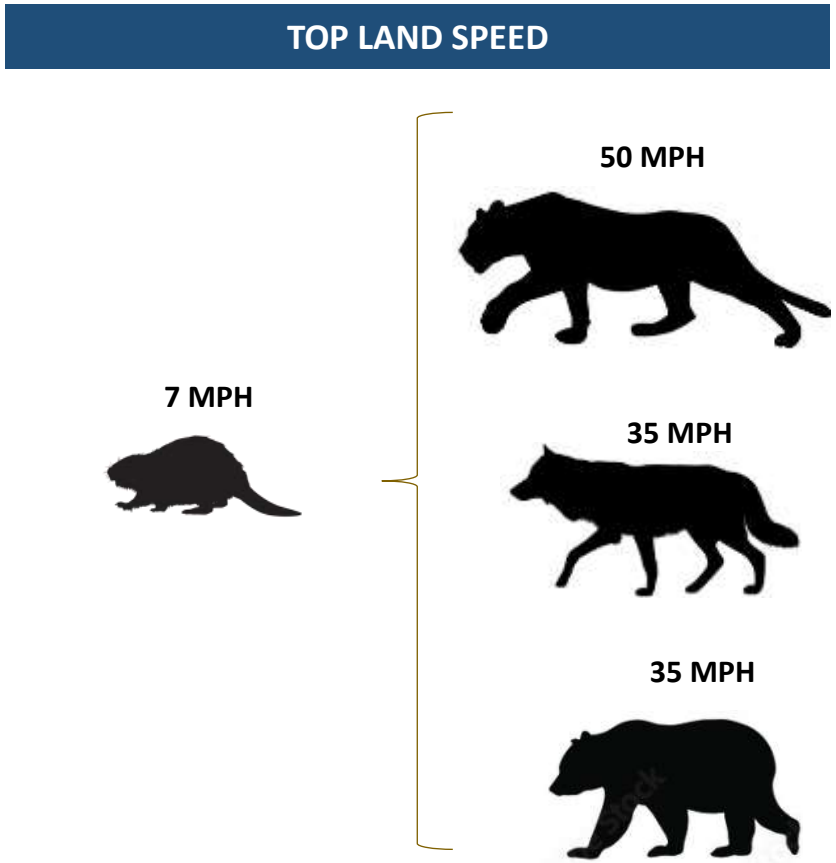
FITNESS AND PREDATION RISK



When is this guy most likely to be predated?

➡ **In travel, and out of water:**

- **dispersing juveniles leaving home**
- **displaced by water extremes: high flows or drought**
- **harvesting too far from pond safety in search of preferred food**
- **displaced by relocation**



HARVEST ZONES AND PREDATION RISK

“Harvest Benefit"
vs.
“Predation Risk”

HARVEST ZONES FOR PREFERRED FOOD

LOW
Within **30’** return to escape cover

SOME RISK
Within **50’** return to escape cover

HIGH RISK
Within **75’** return to escape cover

ASPEN v. COTTONWOOD and WILLOW

WHEN FORAGE IS LACKING

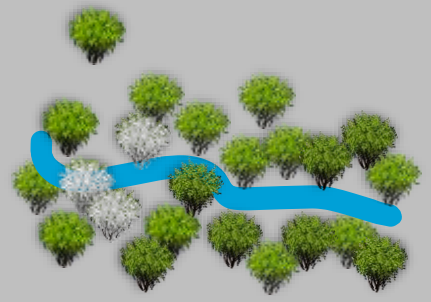
Bear Creek Beaver family – The rise and fall in 3.5 year cycle

> Formerly grazed, willow planting over 12 years. 300 to 400 established willows when…

> Beaver arrived 2019 and established a ½ mile home base territory over time with 15 weirs and dams, 2 primary bank dens with many smaller escape holes.

2020

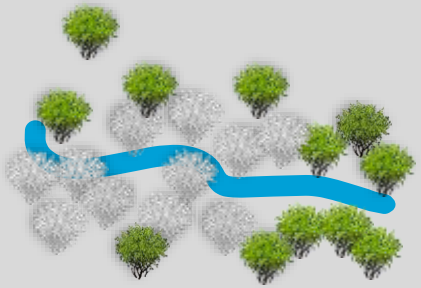
Site Settlement Construction



Harvesting 100% Willows Zone 1

2021

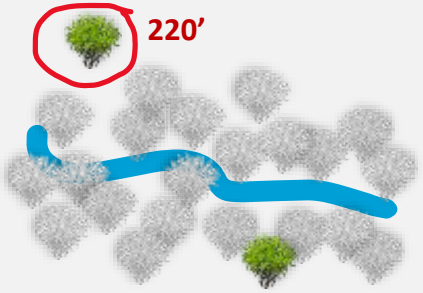
New Family Start



Harvesting 80% willow into Zone 2 & 3

2022

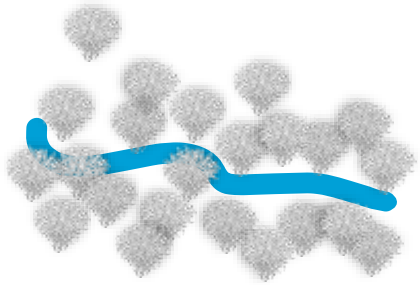
Family Expand Adult Predation



Harvesting now mostly Juniper, Sage, Currant + 1 Willow > Zone 3

2023

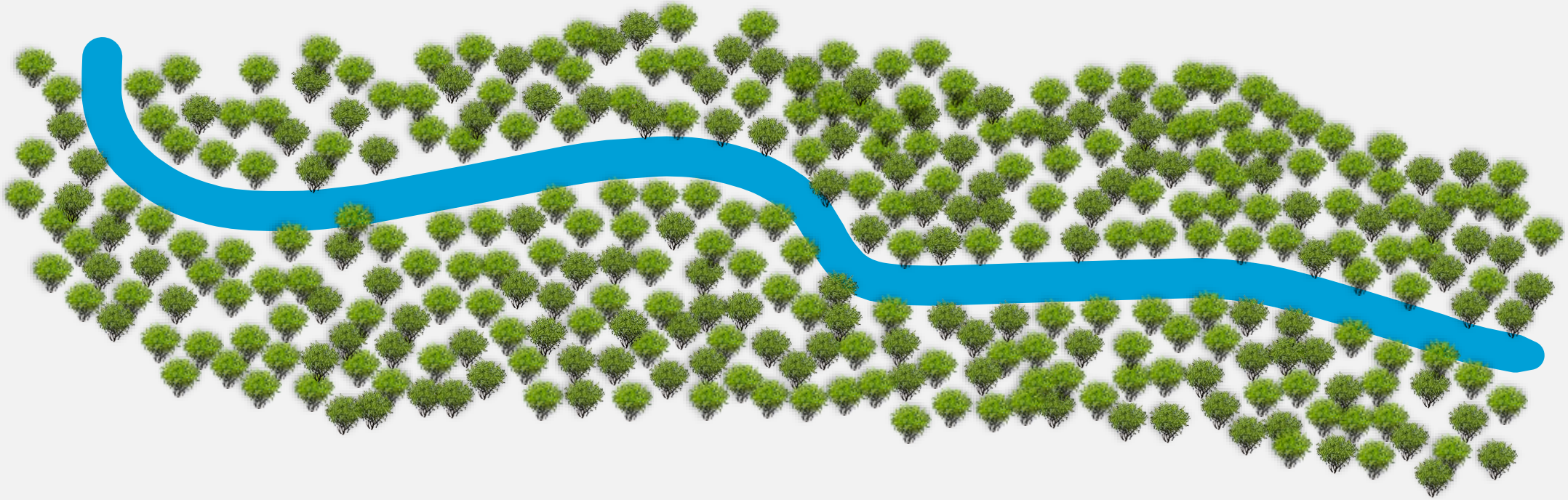
Site Abandoned



No harvestable willow

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

DAY 1



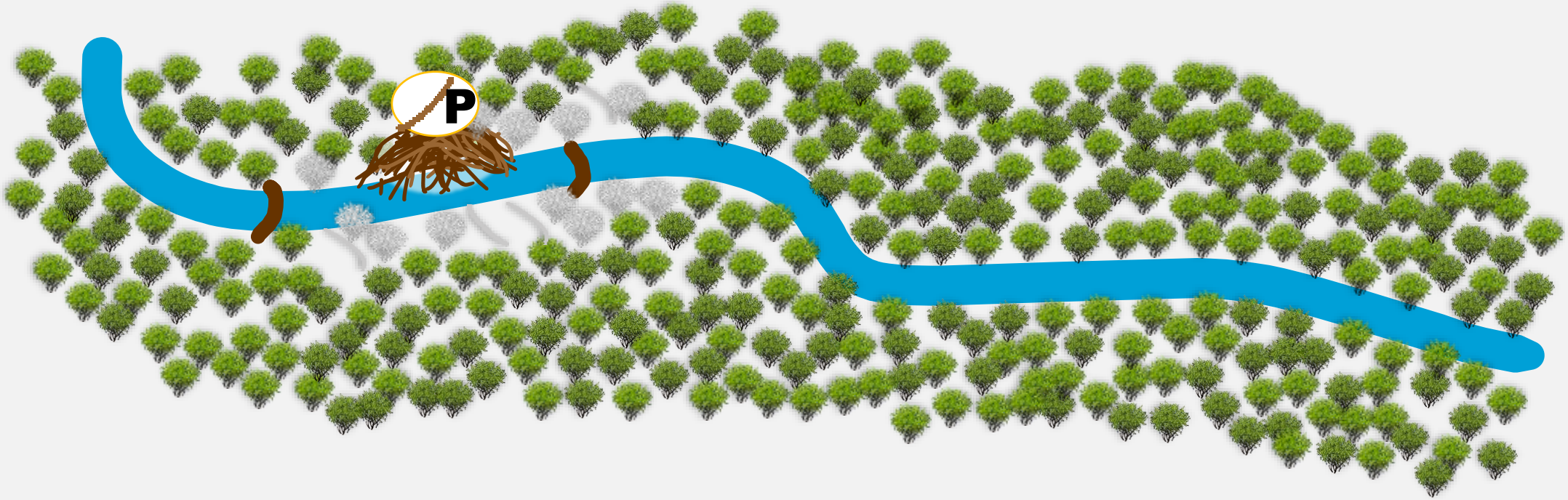
= 30 willows

Beaver“Could”

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 1



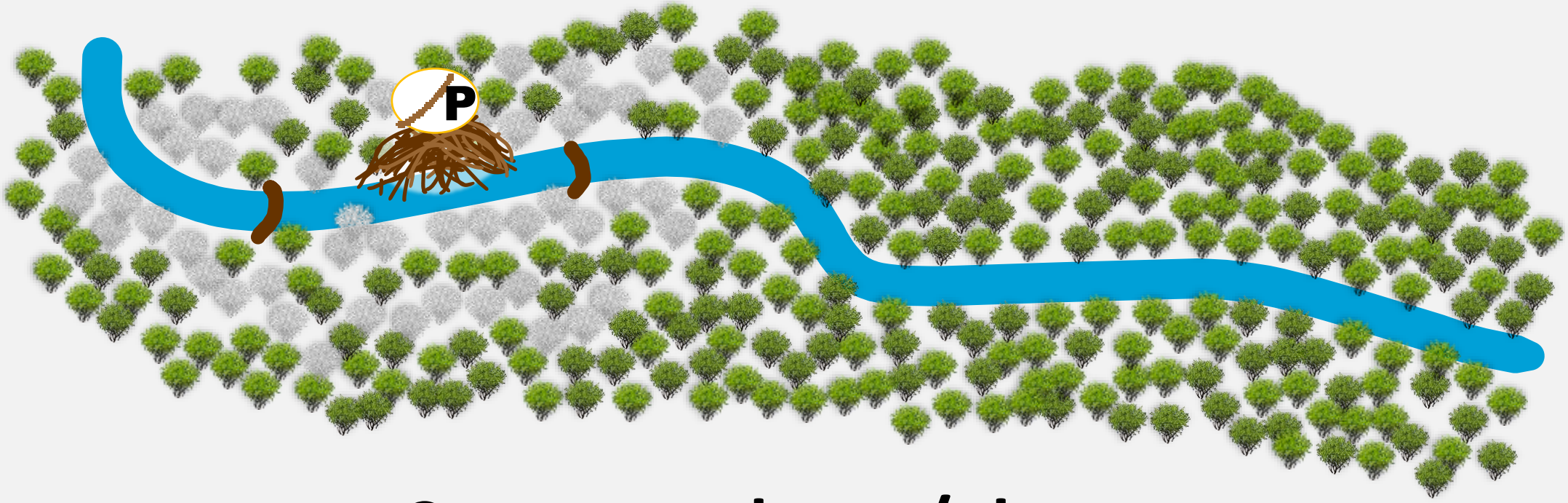
= 30 willows

Beavers settle

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 2



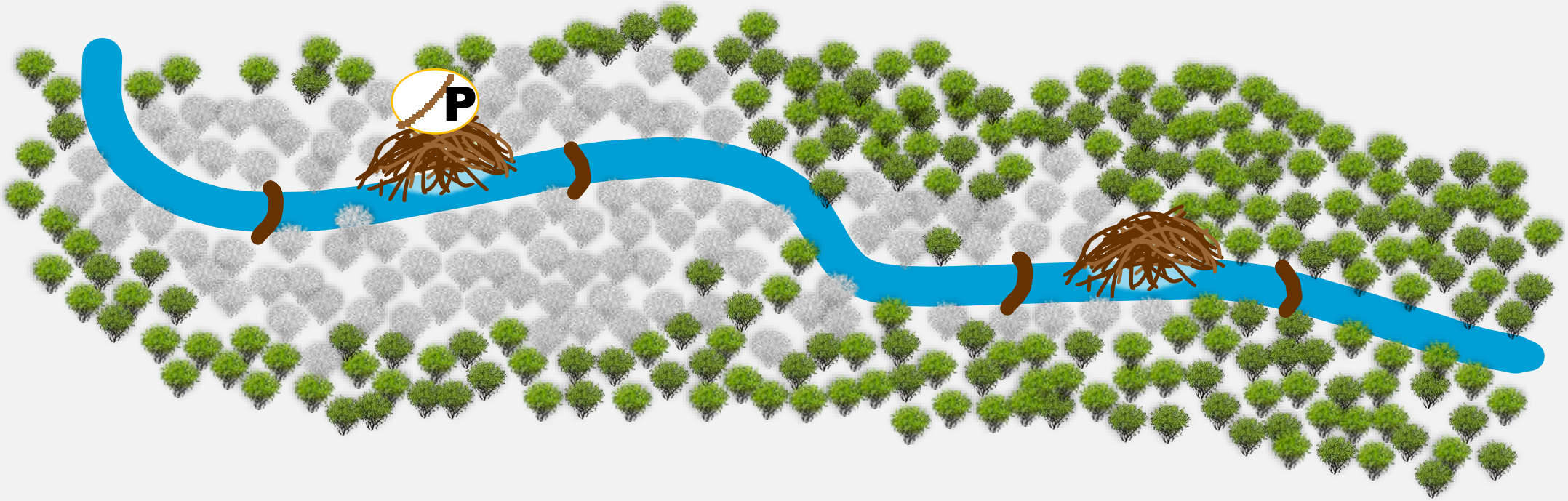
Construct dams / den

= 30 willows

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 3



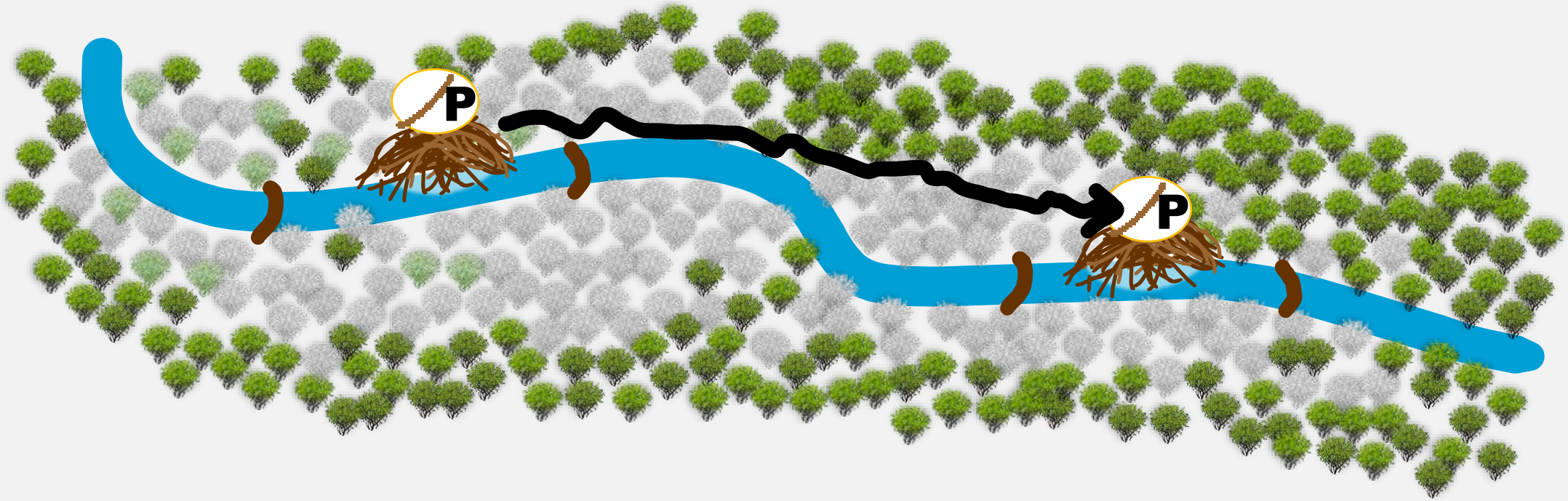
= 30 willows

Upstream forage depleted

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 4



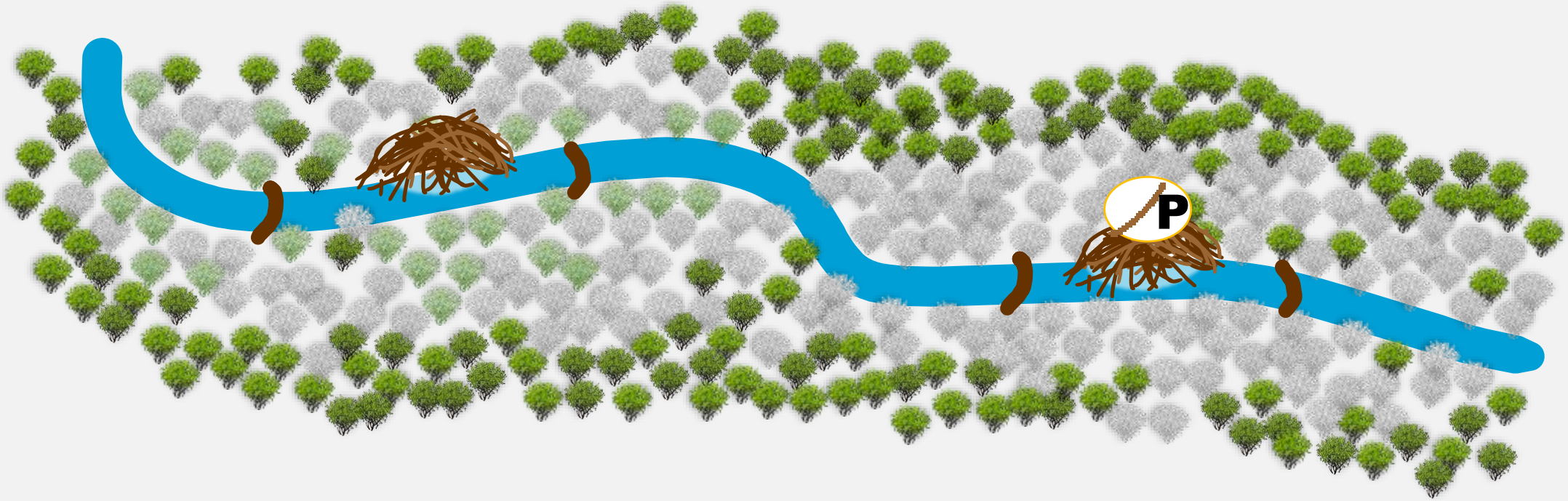
= 30 willows

Relocate downstream

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 5



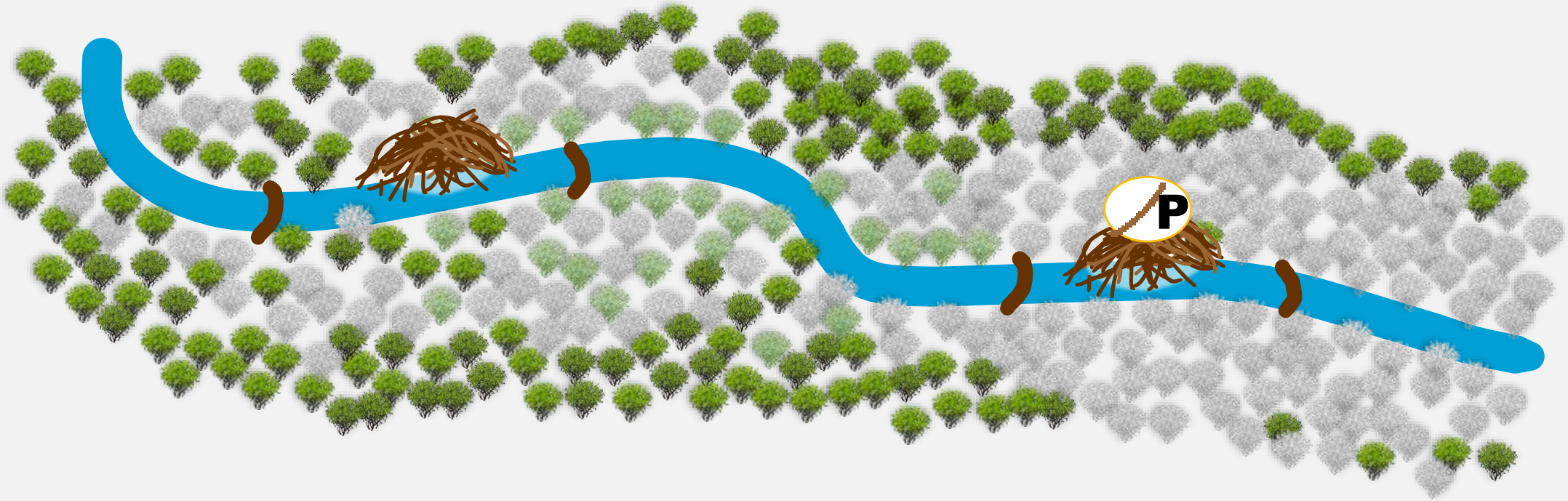
= 30 willows

Upstream veg starts regrowth

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 6



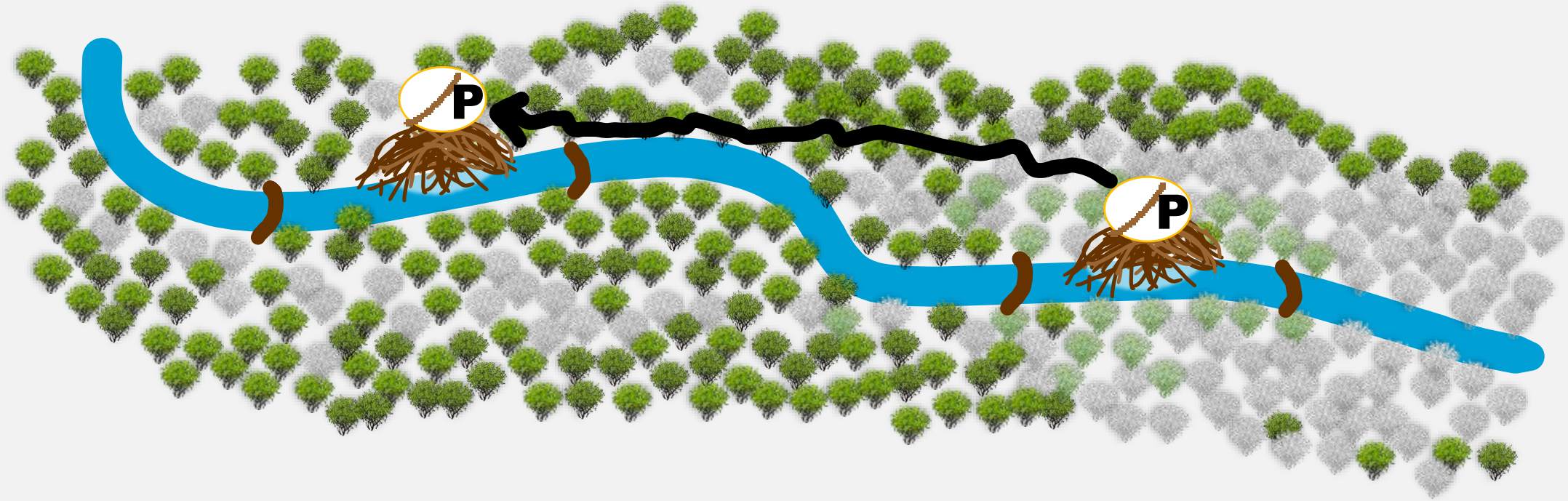
= 30 willows

More regrowth upstream

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 7



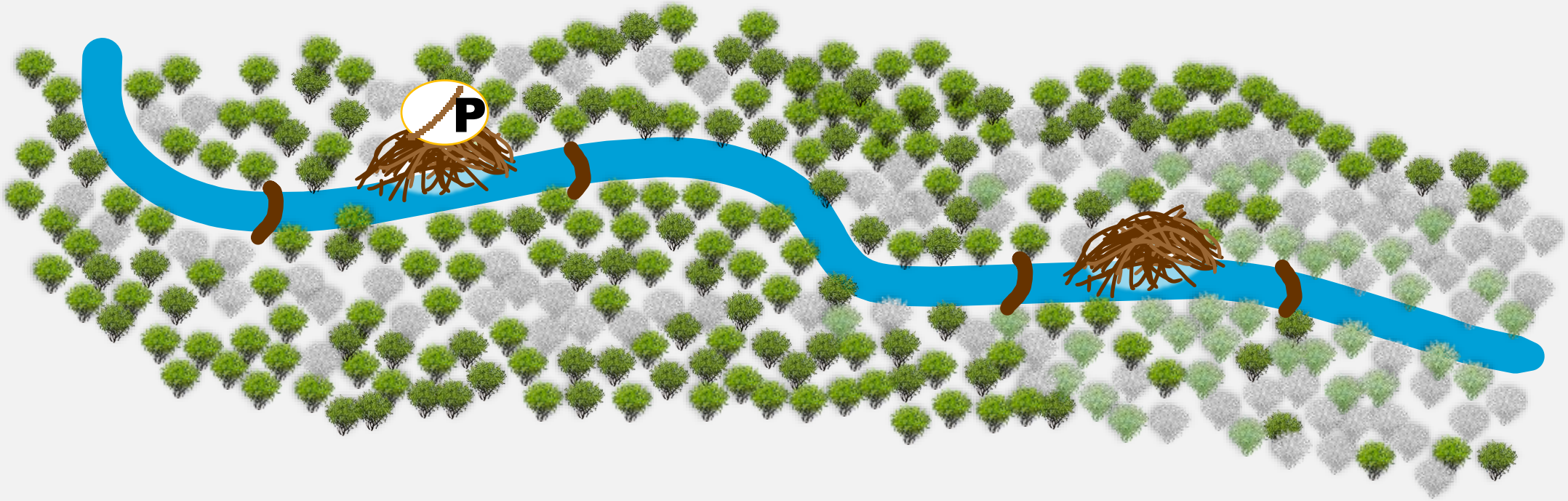
= 30 willows

Relocate back upstream

< ½ Mile >

SITE PERSISTENCE – HARVESTING PATTERN WITH WILLOW REGROWTH

Year 8

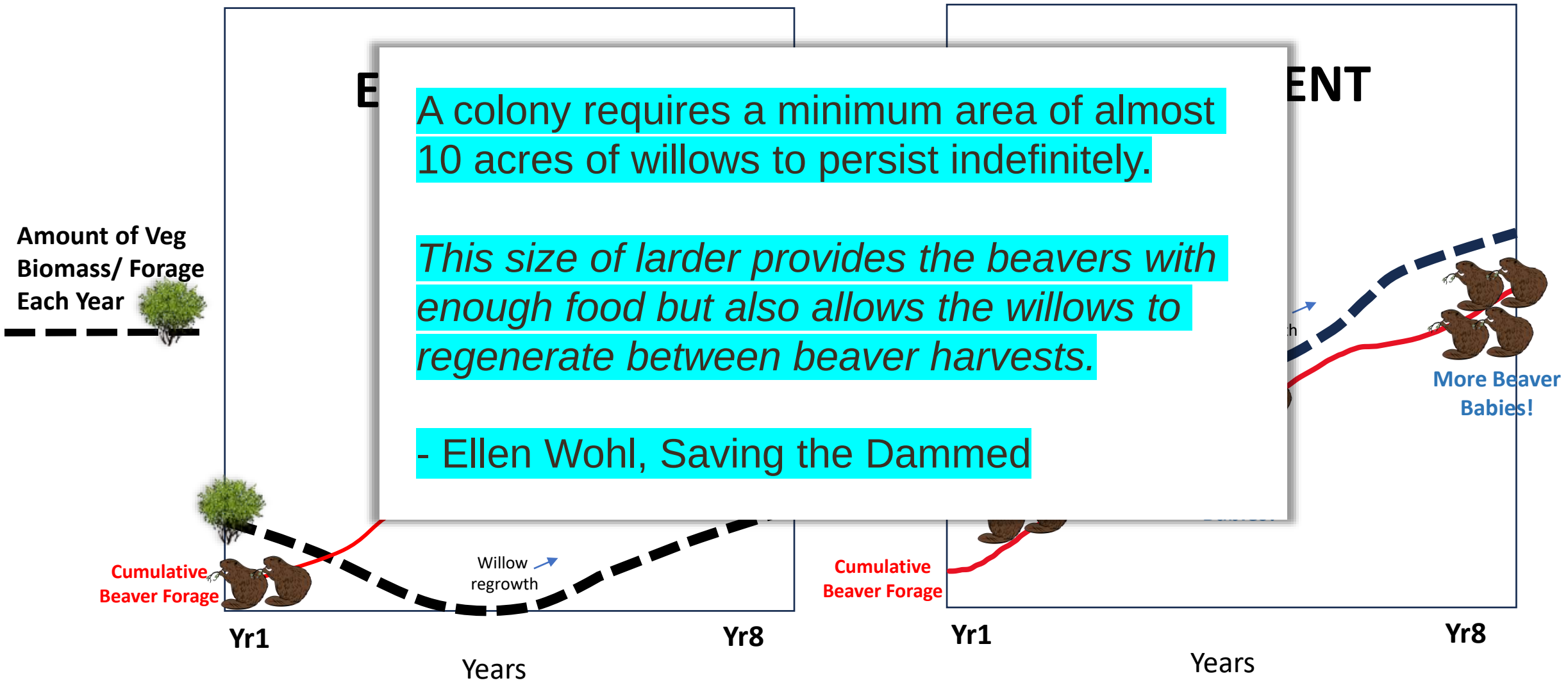


= 30 willows

Rinse and repeat

< ½ Mile >

SITE PERSISTENCE



A colony requires a minimum area of almost 10 acres of willows to persist indefinitely.

This size of larder provides the beavers with enough food but also allows the willows to regenerate between beaver harvests.

- Ellen Wohl, Saving the Dammed

PLANNING BEAVER VEG

HOW MUCH FORAGE?

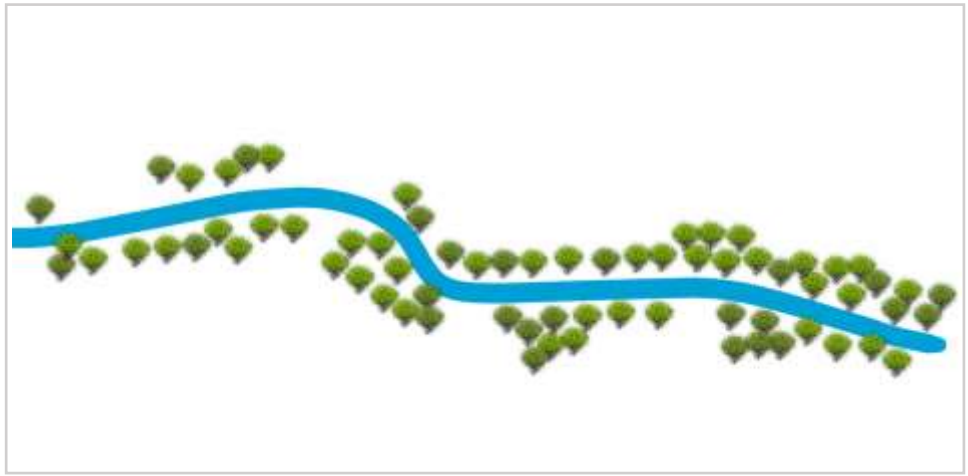
Day 1 of occupancy for an average family to sustain <u>long term site persistence</u>?

<u>One</u> adult beaver harvests annually *:
- 1,000 lbs of forage
- 216 trees

* Read: A study of beaver colonies in Michigan. Journal of Mammalogy, Glenn Bradt, 1938

216 trees
X
5 beavers

Not enough



½ Mile Territorial Home Base/Reach

8,000 to 12,000+

Within 75' stream safety ideal

½ Mile Territorial Home Base/Reach

Enough forage Day 1 so that over time *the rate of beaver forage and the rate of willow regeneration are equal* – ie. a "steady state" of willow and beaver occupancy.

Read: "Simulation modeling to understand how selective foraging by beaver can drive the structure and function of a willow community." Ecological Modeling, Raúl Peinetti, et al., 2009

ASSESS EXISTING SITE FORAGE

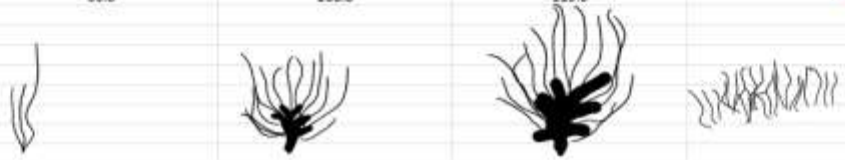
For preferred species

- ✓ Willow, Cottonwood, Aspen (Eastern O.)
- × Not Alder, Not Dogwood, e

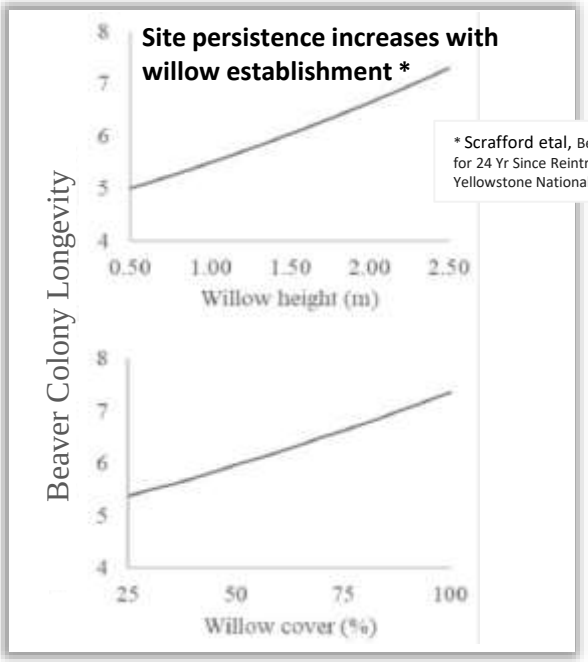
- ❑ Size and Age (r
- ❑ Location
- ❑ Quantity

VEGETATION ASSESSMENT

Section	On Map	feet	Early new growth, 3 to 20ish young branches and no obvious trunk or base yet established. Small	Estimate 4-5 yrs old with the form of a 1/2" to 2" tall trunk (or base) and thickness at stem base of 1/2" to 2" wide. May have some past beaver chew. A lot in some cases. Medium	Estimate 5+ yrs old with large trunk form 1" to 2"+ tall cut over many years. Largest thickness at stem base of 3" to 4"+, different ages of beaver chew. May include recent new growth of 10-30 young stems. Large	Area of Small/new to medium willows closely located. Mostly coyote willow, young stems <1/2" wide. Clump areas (Sq Ft)	Generally Medium to Large sized trunks but entirely dead, mostly fully beaver chewed appear beyond the ability to regenerate. Dead Stumps
Culvert to fence	A	72	2	5	1		
Barbed fence to old dam	B	143	45	11	1		
Old dam to nickpoint	C	71	5	15	6	120	
nickpoint to dam above den	D	233	36	21	9		
Dam above den to primary dam site 8	E	283	0	0	0		mostly 20-30 stumps of very dead, heavily chewed beaver veg in here
		802	88	52	17	120	
	If average weight range per willow assuming 1 yr of growth			Total Count S/M/L	157		
	low		0.25	5	10	0.25	per square ft
	high		1	10	20	1	
	% of stem edible providing nutritional		75%	50%	35%		
	Weight Range low		16.5	130.0	59.5		RANGE OF TOTAL LBS/ BIOMASS PROVIDING CALORIC VALUE
	Weight Range high		66.0	260.0	119.0		206.0
							445.0



‘COVERAGE’ AND SCOPING YOUR TREE ORDER



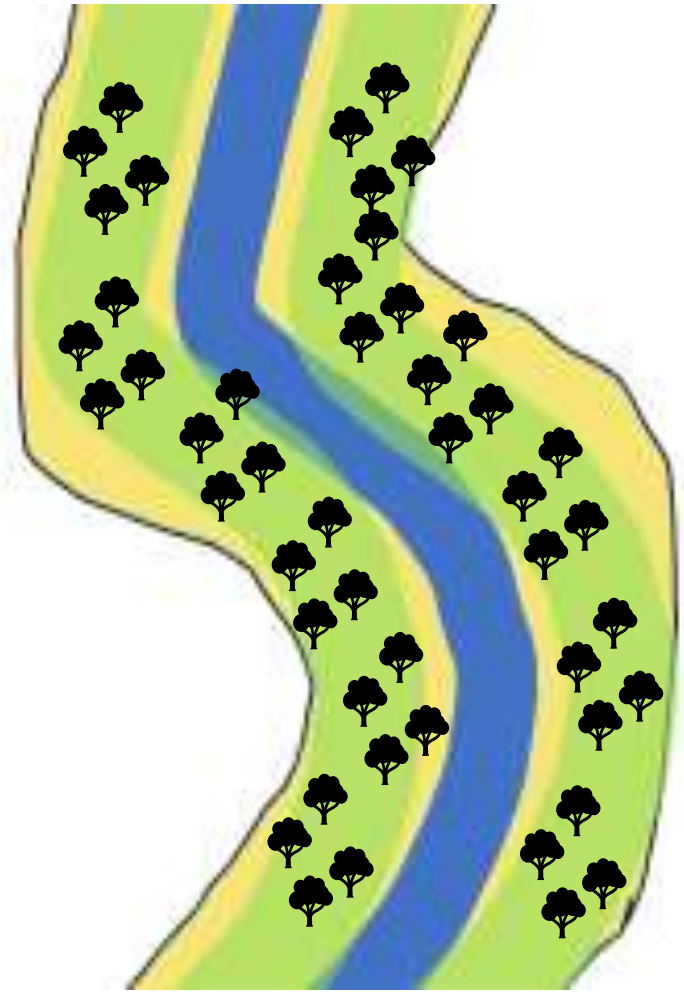
* Scrafford etal, Beaver Habitat Selection for 24 Yr Since Reintroduction North of Yellowstone National Park

<u>Preferred Forage (eastern O.)</u>:

- Aspen
- Cottonwood
- Willows (Pacific, Peachleaf, Booth, MacKenzie, Drummond)
- NOTE: Coyote willow seems least preferred willow (stem size too small)

Will also eat:

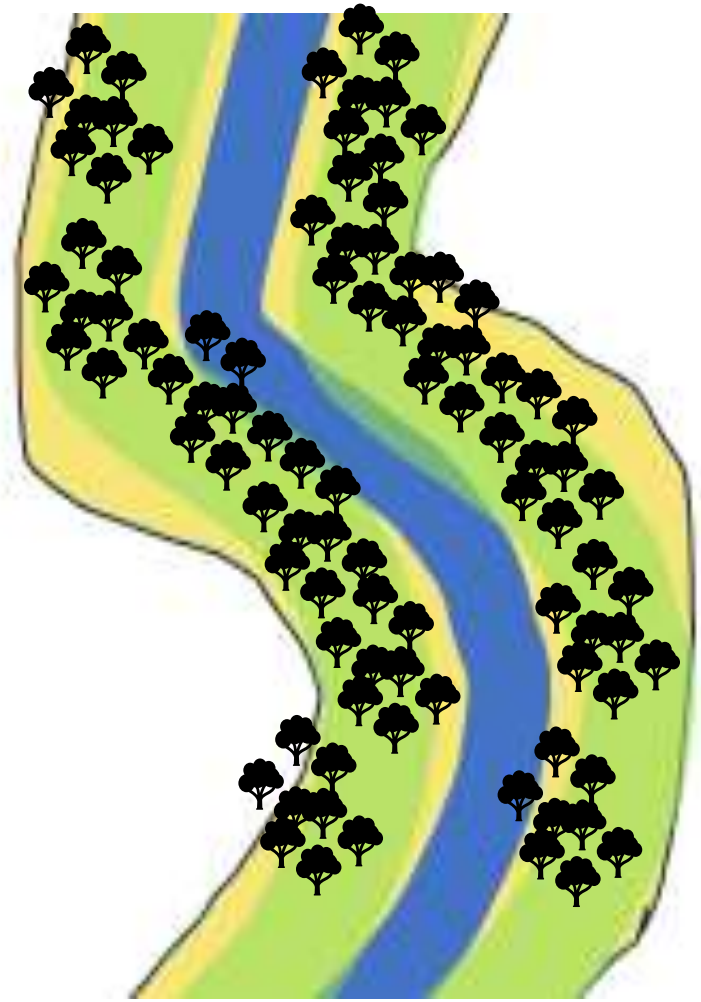
- Aquatic veg: sedge, cattail, speedwell, etc.
- Conifers, juniper seasonally



Number of trees <u>if spaced 20’</u>

7,890 At 100% coverage

5,918 At 75% coverage

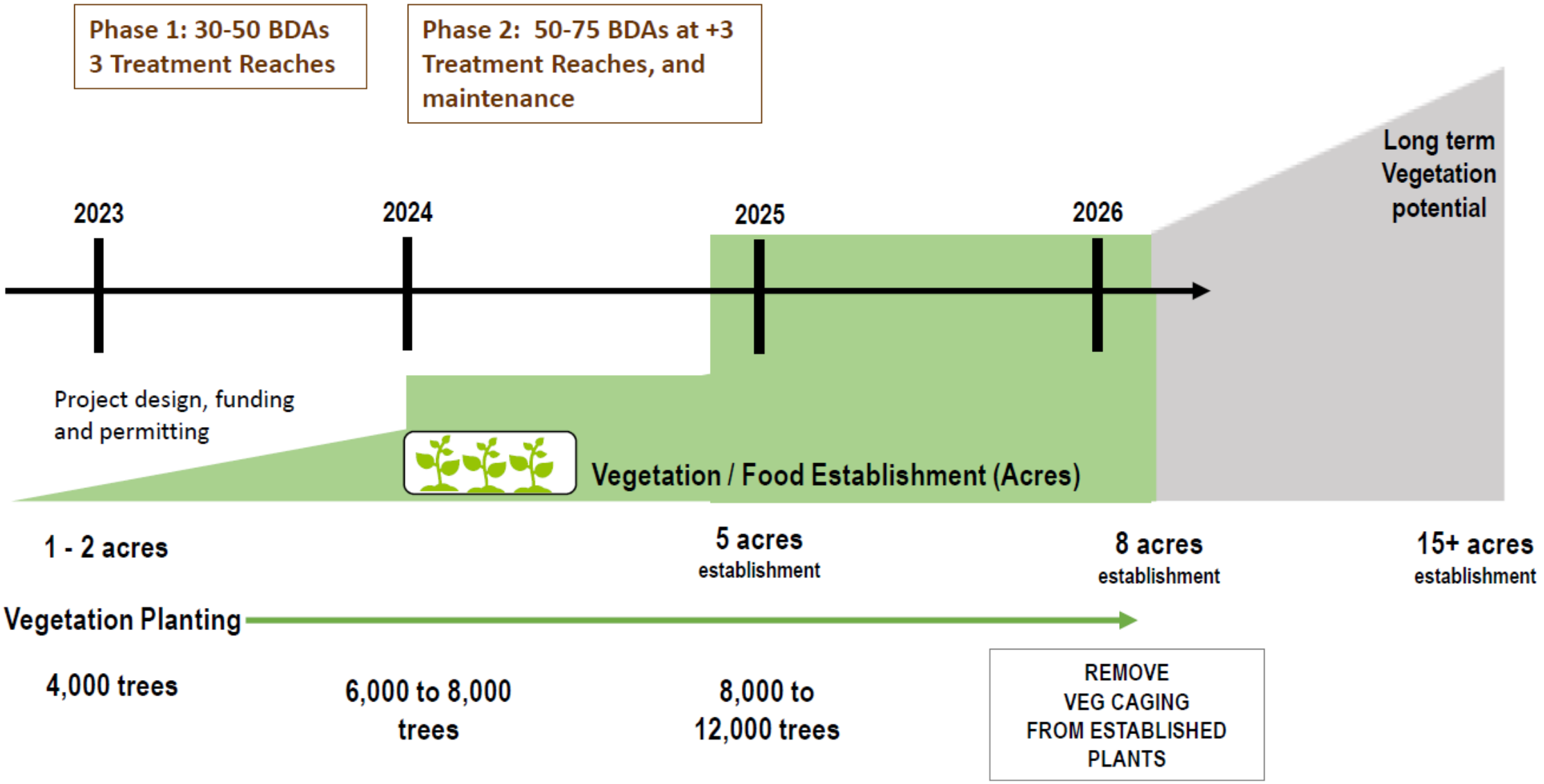


Number of trees <u>if spaced 15’</u>

10,520 At 100% coverage

7,890 At 75% coverage

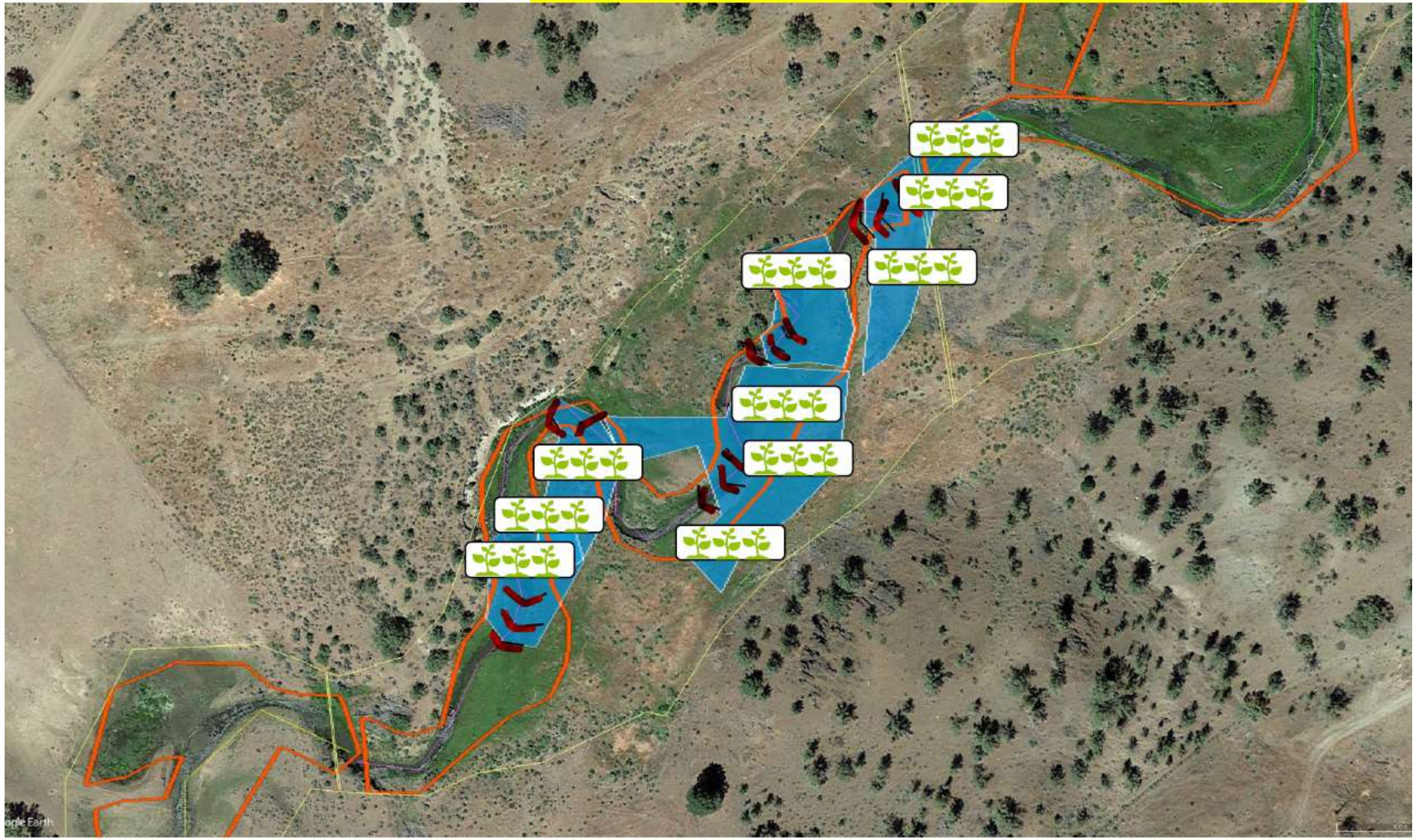
POST, OREGON – LEADING WITH BIOLOGY



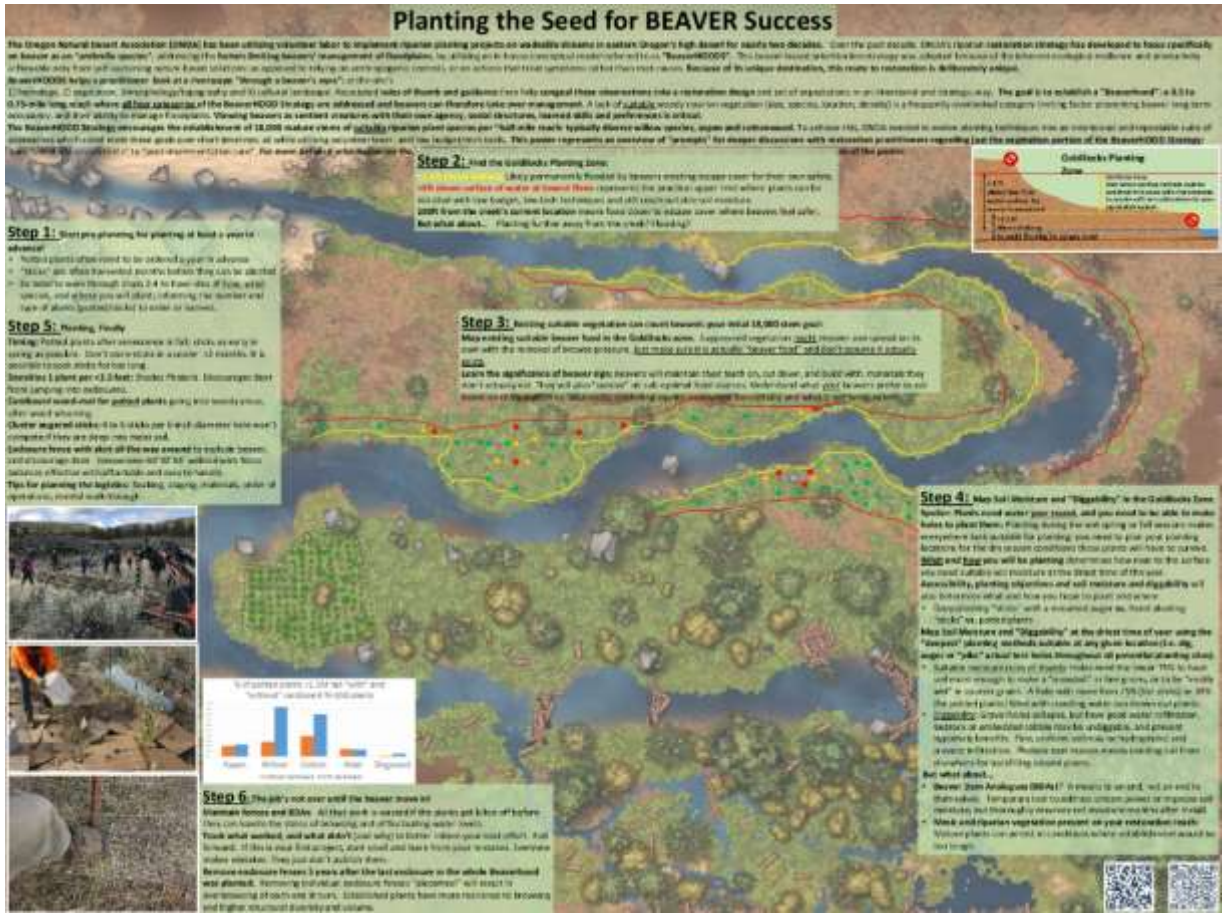
POST, OREGON – LEADING WITH BIOLOGY

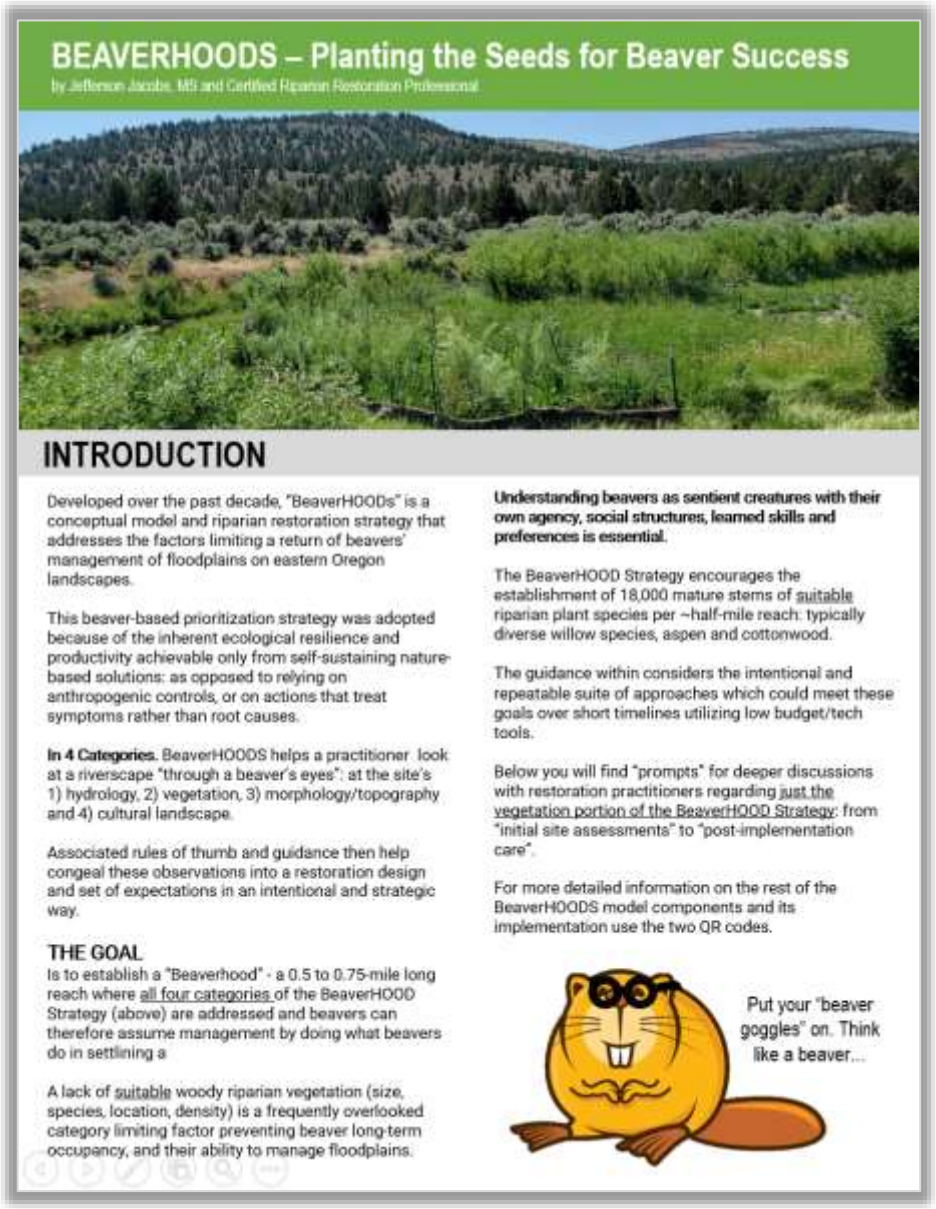
Phase 1

BDA'S REACH 8 WITH ZOIs – WORKSTAGE 2 ADD RIPARIAN VEGETATION



NEW: PLANTING GUIDANCE FOR SURVIVAL

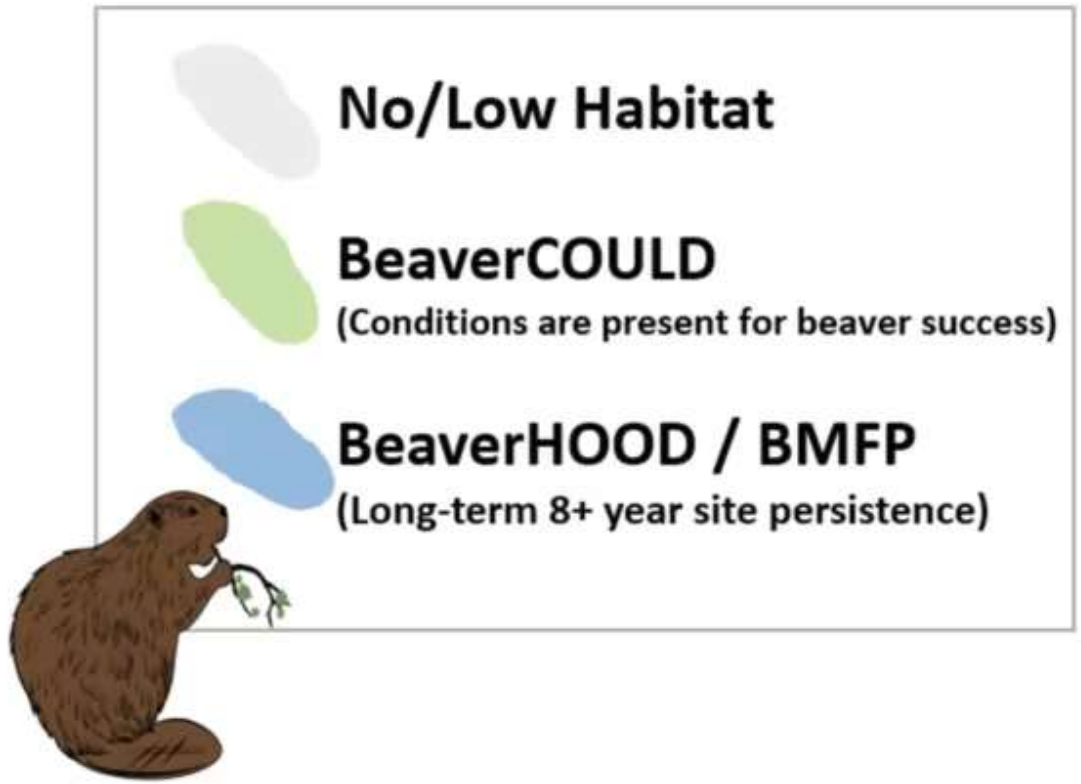




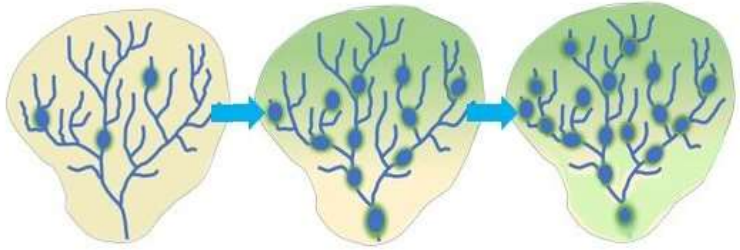
p.s. SCALING BMFP’s

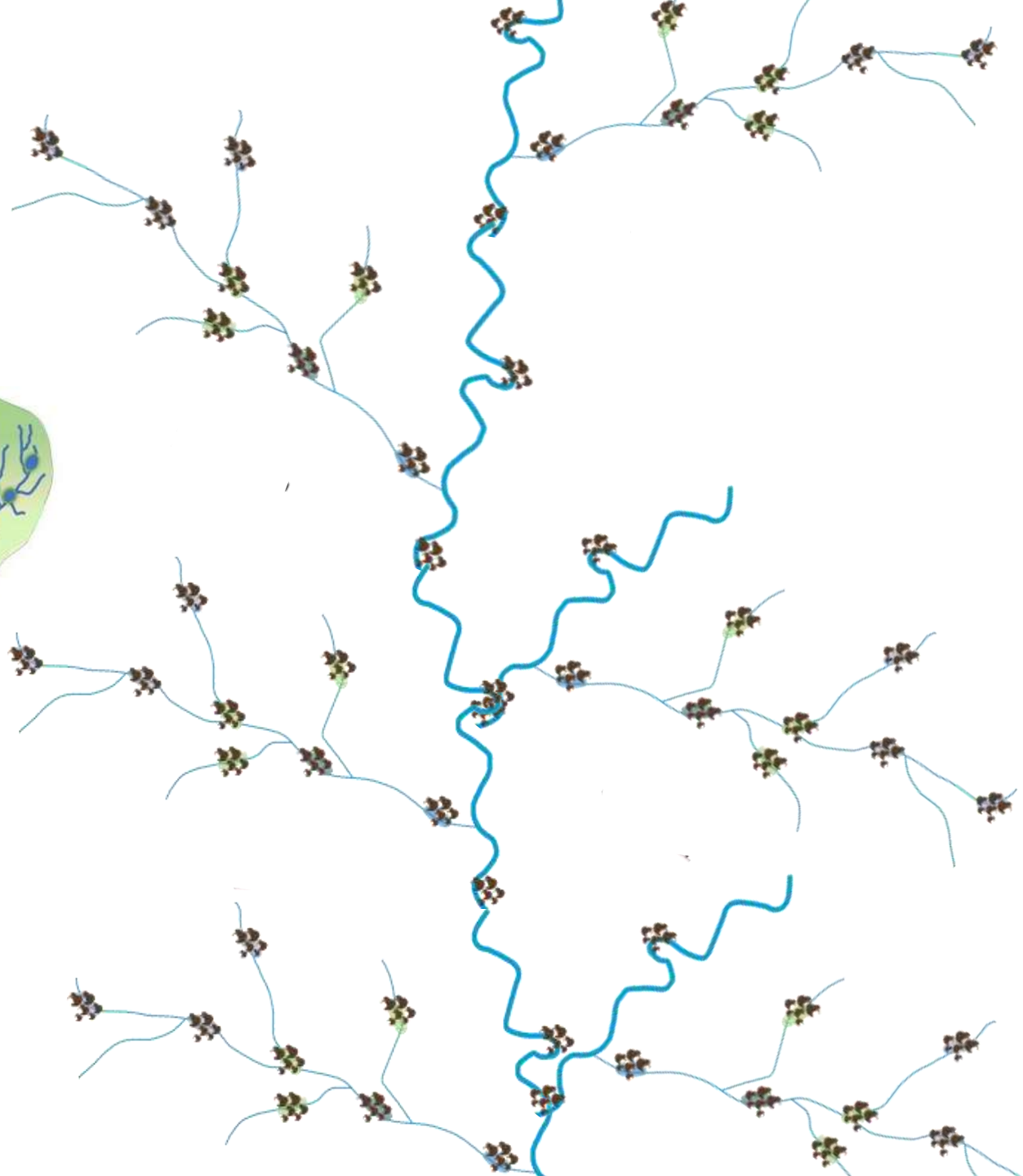
CHARTING A PATH

TO BEAVERHOODS



CONNECTING SUBBASINS TO SCALE

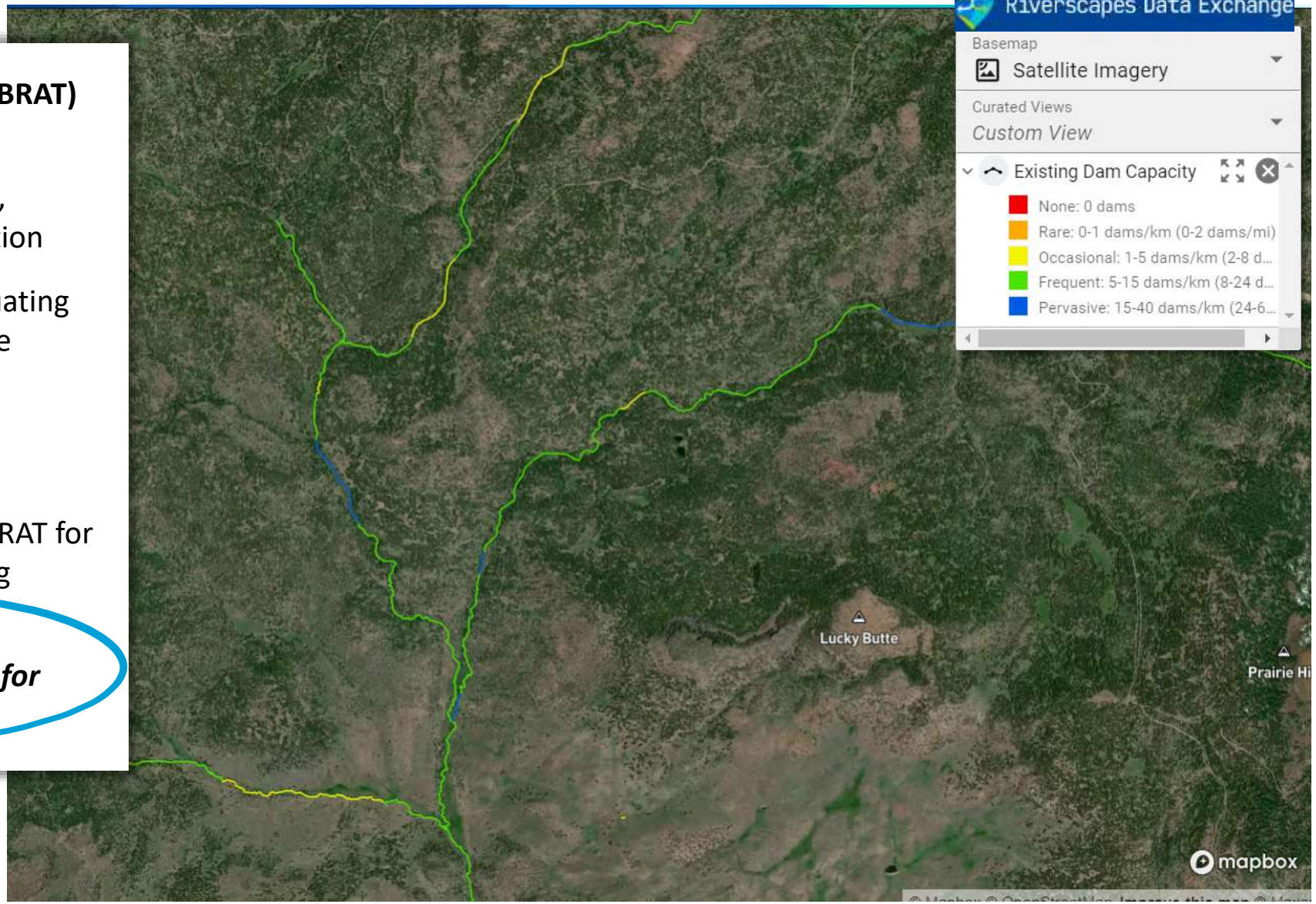




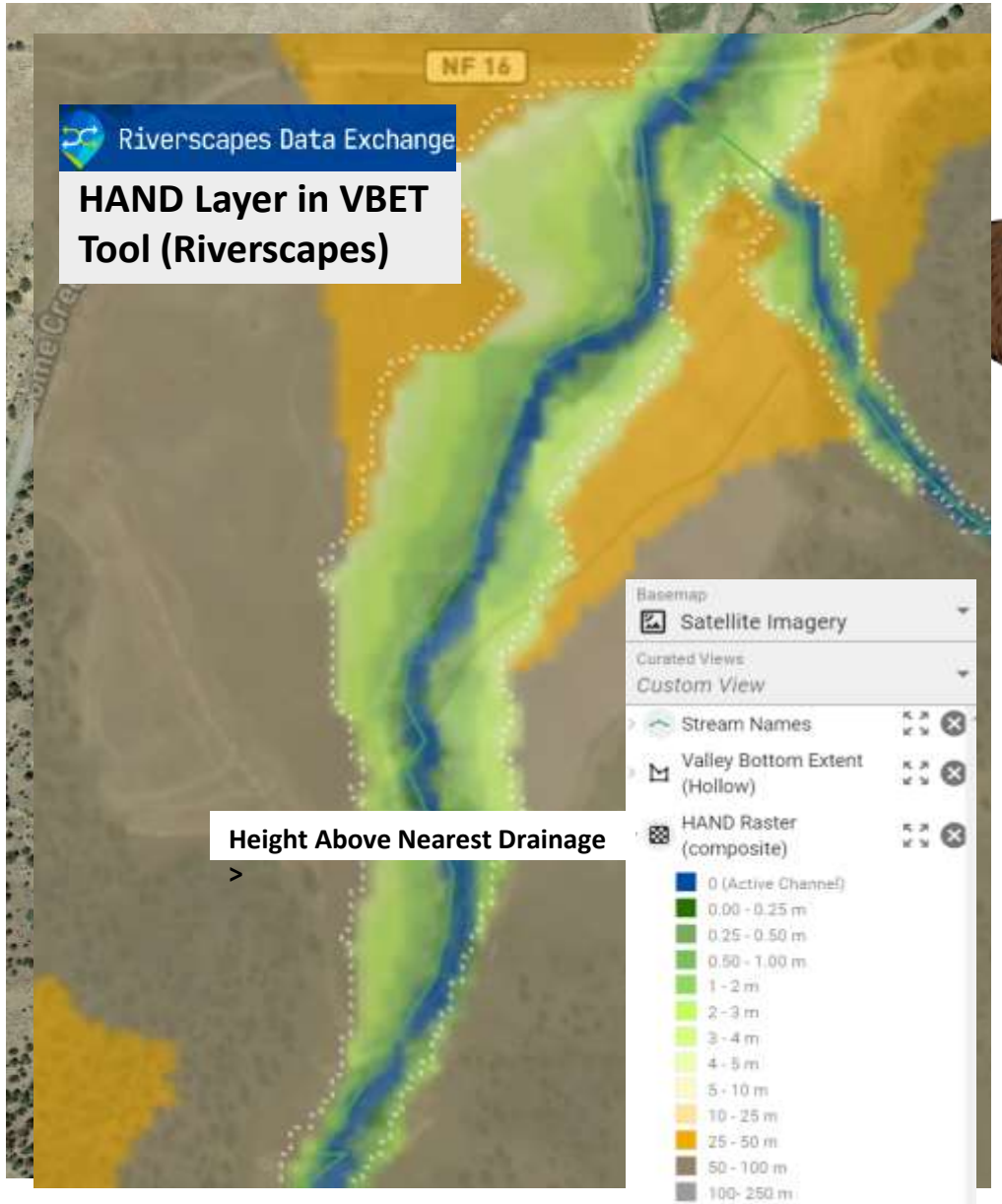
EVALUATING BMFP POTENTIAL AT SCALE

Beaver Restoration Assessment Tool (BRAT) now Oregon wide (but 'uncalibrated')

- Considers geomorphology, hydrology, infrastructure and (attempts) vegetation
- Imperfect, but best promise for evaluating at scale some of the conditions where beavers MIGHT succeed
- Free, easy to access, easy to use https://data.riverscapes.net/
- Ground truthing needed to localize BRAT for refined results and fine scale planning
- Calibration and localization effort is underway through BEF. ***Get involved for your region!***



EVALUATING POTENTIAL FOR INUNDATION CONFLICT



TOOLS

TOOLS

PROJECT TYPE

Beaver Restoration Assessment Tool (BRAT)

The Beaver Restoration Assessment Tool (sqlBRAT)

Basic Properties

FULL NAME	The Beaver Restoration Assessment Tool (sqlBRAT)
SHORT NAME	Beaver Restoration Assessment Tool (BRAT)
MACHINE NAME	BRAT
WEBSITE	https://tools.riverscapes.net/brat
CREATED	03/10/2023 12:59 PM (-07:00 America/Los_Angeles)

Description

The Beaver Restoration Assessment Tool combines a model estimating the capacity of a riverscape to support dam building activity with analysis of potential anthropogenic conflicts to create a tool that can be used to inform where LTPBR restoration using beaver can be targeted.

VBET

Valley Bottom Extraction Tool

Basic Properties

FULL NAME	Valley Bottom Extraction Tool
SHORT NAME	VBET
MACHINE NAME	VBET
WEBSITE	https://tools.riverscapes.net/vbet
CREATED	03/10/2023 12:59 PM (-07:00 America/Los_Angeles)

Description

The Valley Bottom Extraction Tool uses a DEM and a channel area network to estimate the valley bottom extents (area that could plausibly flood in contemporary natural flow regime) thereby defining the riverscape network.

BEAVER HABITAT ASSESSMENT CHECKLIST (Underway)

Existing Vegetation Inventory

- ❑ Available established (but not decadent) willow streamside
- ❑ Coyote willow streamside
- ❑ Proximity to stream

Structure

- ❑ Muddy sediment for dam/den building
- ❑ Availability of larger stemmed vegetation for dam strength
- ❑ Vegetation streamside for supportive, strong denning

Human

- ❑ Possible infrastructure conflict areas
- ❑ Length of time/exposure livestock activity near denning sites

DISCUSSION TEMPLATE: BEAVER MANAGEMENT PLAN FOR _____ RANCH

The purpose of a Beaver Management Plan for Acme Ranch (Acme) will serve as: 1) a management resource for ranch operators/land stewards to understand the capacity of the landscape to hold beavers and the potential benefits that their activities can bring to land health, 2) a decision tool for evaluating where beaver activities may conflict with operations and infrastructure, along with a range of barnyard based tools for effective response, and 3) a planning tool for land stewardship decisions and opportunities to support beaver re-establishment.

The written plan will include these areas:

Evaluation

1) Of existing beaver occupancy within 'home base territories' that are already established and by whom (family unit numbers, ages, and primary activities)
2) Beaver carrying capacity of the system – historical and potential for future
3) Identify and prioritize places to support long-term beaver occupancy through 'process-based' restoration approaches like vegetation and/or BDA establishment

Decision Making: Challenges and Opportunities

4) Define different 'tolerance' levels of beaver occupancy at different locations along stream sections
5) Establish a Decision Framework so that where potential conflicts or opportunities exist, the ranch can evaluate and decide on:
   a) Challenges: different options for "beaver cheater" type solutions where the potential for infrastructure conflicts exist
   b) Opportunities: the potential for encouraging new beaver wetlands (Ref #3 above), and possible conservation easements or incentives that may provide financial offset when production conflicts (like hay production, foraging) exist.

Monitoring

6) Establish a Year 1 baseline for hydrology (water retention seasonally, flow levels), geomorphology (sediment aggradation and erosion) and vegetation volume (biomass, health, and expansion of preferred beaver forage)
7) Establish a monitoring protocol for measuring #6 above (over 5 to 10 year horizon)
8) Identify opportunities for deeper research/study to advance a body of knowledge around beaver/hydrology, vegetation, sediment aggradation in Crooked River watershed and eastern Oregon basins at large.
9) Through this process, gain a better understanding of the riverscape's natural 'dynamism', its potential for floodplain connectivity and 'spread' (ie, where and how much can the 'streams be a stream' within the confines of productive livestock operations.)

BEAVERHOODS – Planting the Seeds for Beaver Success

by Jefferson Jacobs, MS and Certified Riparian Restoration Professional

INTRODUCTION

Developed over the past decade, "BeaverHOODs" is a conceptual model and riparian restoration strategy that addresses the factors limiting a return of beavers' management of floodplains on eastern Oregon landscapes.

This beaver-based prioritization strategy was adopted because of the inherent ecological resilience and productivity achievable only from self-sustaining nature-based solutions: as opposed to relying on anthropogenic controls, or on actions that treat symptoms rather than root causes.

In 4 Categories. BeaverHOODS helps a practitioner look at a riverscape "through a beaver's eyes": at the site's 1) hydrology, 2) vegetation, 3) morphology/topography and 4) cultural landscape.

Associated rules of thumb and guidance then help congeal these observations into a restoration design and set of expectations in an intentional and strategic way.

THE GOAL

Is to establish a "Beaverhood" - a 0.5 to 0.75-mile long reach where all four categories of the BeaverHOOD Strategy (above) are addressed and beavers can therefore assume management by doing what beavers do in settlining a

A lack of suitable woody riparian vegetation (size, species, location, density) is a frequently overlooked category limiting factor preventing beaver long-term occupancy, and their ability to manage floodplains.

Understanding beavers as sentient creatures with their own agency, social structures, learned skills and preferences is essential.

The BeaverHOOD Strategy encourages the establishment of 18,000 mature stems of suitable riparian plant species per ~half-mile reach: typically diverse willow species, aspen and cottonwood.

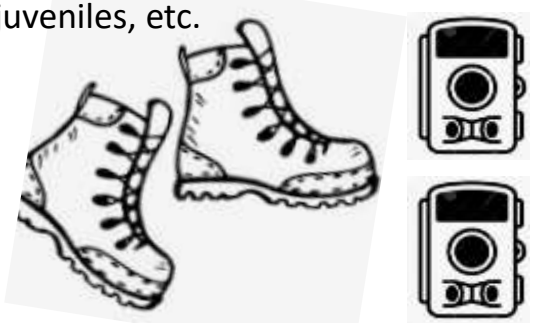
The guidance within considers the intentional and repeatable suite of approaches which could meet these goals over short timelines utilizing low budget/tech tools.

Below you will find "prompts" for deeper discussions with restoration practitioners regarding just the vegetation portion of the BeaverHOOD Strategy: from "initial site assessments" to "post-implementation care".

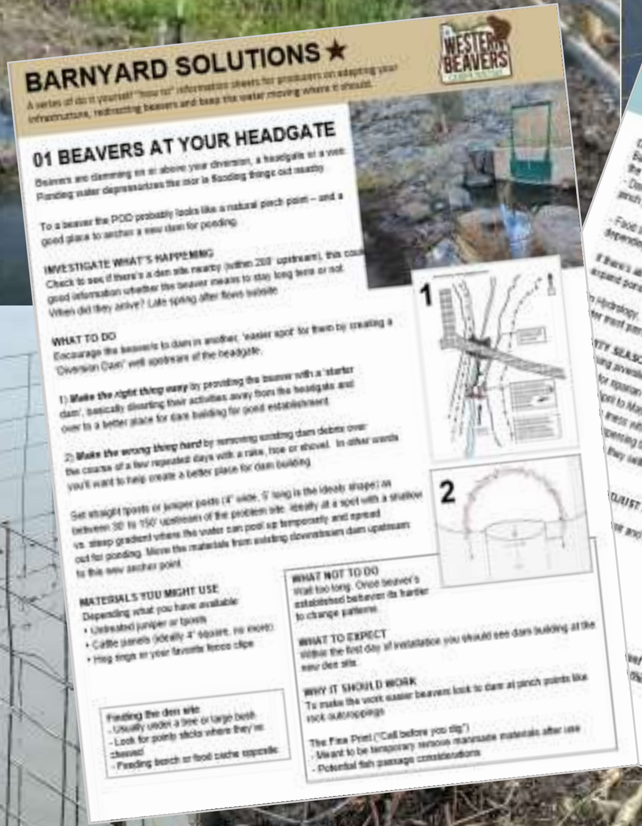
For more detailed information on the rest of the BeaverHOODS model components and its implementation use the two QR codes.

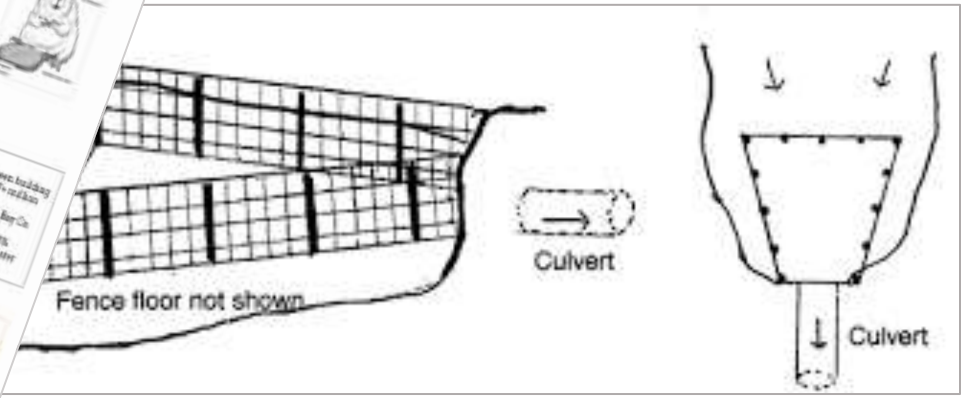
Put your "beaver goggles" on. Think like a beaver...

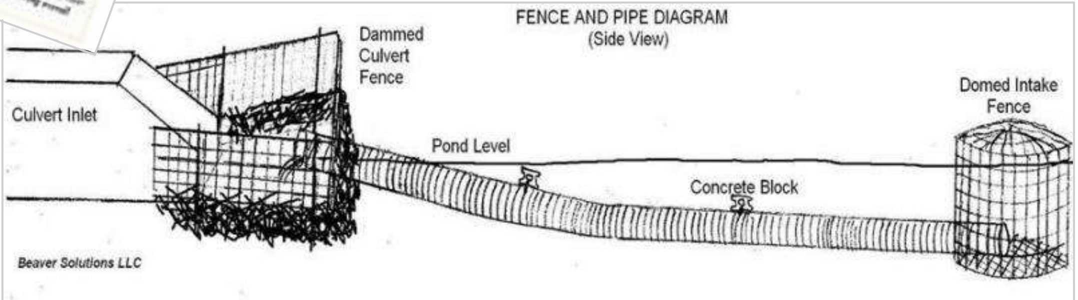
Get to know local families: size, habits, food source, kits/ juveniles, etc.



BEAVER CHEATERS







TAKEAWAYS, FOR BMFP SUCCESS . . .

- Set restoration goal for “long term site persistence” and “beaver success”
- *Lead* with biology
- Consider the beaver’s needs
- Learn where beavers are thriving, this should inform your planning

QUESTIONS?

Eastern Oregon?
From Western Beavers consider:

- **Monthly BBR practitioner check-in**
- **Borrowing our “Beaver Booth” kit for community outreach**
- **Interest in upcoming:**
  1) willow workshop
  2) ‘beaver goggles’ field trip
- **BRAT calibration – contact JP**

Contact: reese@westernbeavers.org

More at:
www.westernbeavers.org/connect2024