


**LTPBR WORKSHOP**

# LOW-TECH APPROACHES

## Broad Umbrella of Low-Tech



  Stephen Bennett





# OUTLINE:



  Stephen Bennett

## I. Introduction to Low-Tech

## II. Low-Tech structures we will focus on

### I. PALS

### II. BDAs

From Shahverdian et al. (2019) – Chapter 1 & 4 of LTPBR Manual

DOI: [10.13140/RG.2.2.14138.03529](https://doi.org/10.13140/RG.2.2.14138.03529) DOI: [10.13140/RG.2.2.22526.64324](https://doi.org/10.13140/RG.2.2.22526.64324)

# Design Manual References – Chapters 1 & 4

## Chapter 1 – BACKGROUND & PURPOSE



Prepared by:

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**Recommended Citation:**  
Shahverdian, S., Wheaton, J.M., Bennett, S.N., Bouwes, N. and Maestas, J.D., 2019. Chapter 1 – Background & Purpose. In: J.M. Wheaton, S.N. Bennett, N. Bouwes, J.D. Maestas and S.M. Shahverdian (Editors), Low-Tech Process-Based Restoration of Riverscapes: Design Manual. Utah State University Wheaton Restoration Consortium, Logan, Utah, 29 pp.



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### IMPLICATIONS FOR PRACTICE

- Riverscapes are composed of connected floodplain and channel habitats that together make up the valley bottom.
- The scope of degradation of riverscapes is massive. Tens of thousands of miles of riverscapes are in poor or fair condition.
- Structural starvation is both a direct cause of degradation, as well as a consequence of land use changes and direct modification of stream and riparian areas.
- Engineering-based restoration tends to emphasize channel form and stability, rather than promoting the direct modification of stream and riparian areas.
- Process-based restoration focuses on restoring physical processes that lead to healthy riverscapes.
- Low-cost, simple, hand-built structures have been used for over a century. Restoration principles are needed to guide the use of low-tech structures in order to address the scope of degradation, which will require that practitioners "let the system do the work."
- The overarching goal of low-tech restoration is to improve the health of as many miles of riverscapes as possible and to promote and maintain the full range of self-sustaining riverscape processes.

RIVERSCAPE RESTORATION MANUAL

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CHAPTER 1: BACKGROUND & PURPOSE

## Chapter 4 – MIMICKING & PROMOTING WOOD ACCUMULATION & BEAVER DAM ACTIVITY WITH POST-ASSISTED LOG STRUCTURES & BEAVER DAM ANALOGUES



Prepared by:

Scott M. Shahverdian, Joseph M. Wheaton, Stephen N. Bennett, Nicolaas Bouwes, Reid Camp, Christopher E. Jordan, Elijah Portugal, and Nicholas Weber

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Shahverdian, S.M., Wheaton, J.M., Bennett, S.N., Bouwes, N., Camp, R., Jordan, C.E., Portugal, E. and Weber, N., 2019. Chapter 4 – Mimicking and Promoting Wood Accumulation and Beaver Dam Activity with Post-Assisted Log Structures and Beaver Dam Analogues. In: J.M. Wheaton, S.N. Bennett, N. Bouwes, J.D. Maestas and S.M. Shahverdian (Editors), Low-Tech Process-Based Restoration of Riverscapes: Design Manual. Utah State University Restoration Consortium, Logan, Utah, 68 pp.



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### IMPLICATIONS FOR PRACTICE

- Post-assisted log structures (PALS) and beaver dam analogues (BDAs) are hand-built structures. PALS mimic and promote the processes of wood accumulation, whereas BDAs mimic and promote beaver dam activity.
- PALS and BDAs are permeable, temporary structures, built using natural materials.
- BDAs differ from PALS in that BDAs create ponds using a variety of fill materials; PALS are built with only woody material, which tends to be larger diameter than the woody material used for BDAs.
- PALS and BDAs are both intended to address the broad impairment of structural starvation in wadeable streams, but can also be used to mitigate against a range of more specific impairments.
- PALS and BDAs can be built using a variety of natural materials, and built to a range of different shapes, sizes and orientations.
- PALS and BDAs are most likely to achieve restoration goals when built in high numbers.
- Some PALS and BDAs are likely to breach and/or lose some wood, but when many structures are installed, that material will accumulate on downstream structures or in natural accumulation areas leading to more complexity.

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CHAPTER 4: MIMICKING & PROMOTING WOOD ACCUMULATION & BEAVER DAM ACTIVITY WITH PALS & BDAs

Chap 1: Shahverdian et al. (2019a)

DOI: [10.13140/RG.2.2.11621.45286](https://doi.org/10.13140/RG.2.2.11621.45286)

Chap 4: Shahverdian et al. (2019a)

DOI: [10.13140/RG.2.2.22526.64324](https://doi.org/10.13140/RG.2.2.22526.64324)



# Low-tech restoration isn't new

France 1870's

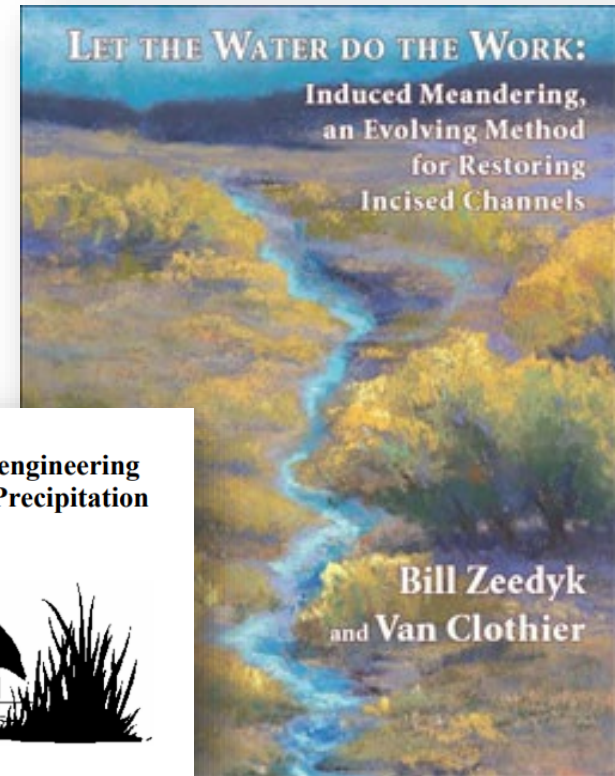


Frédéric Liébault (2003) PhD Thesis; Demontzey (1892 & 1894)

USA 1930's



Soil Conservation Service



## Streambank Soil Bioengineering Field Guide for Low Precipitation Areas



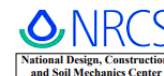
*Prepared by*

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Center, P.O. Box 296, Aberdeen ID 83210

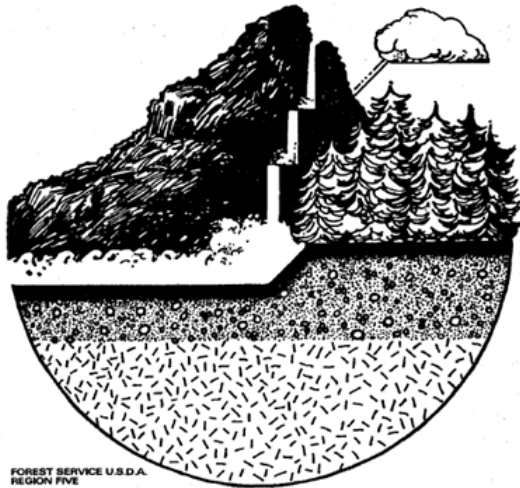
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December 2002



GUIDELINE FOR  
WATERSHED IMPROVEMENT MEASURES



U.S. Forest Service  
Pacific Southwest Library and Information Center  
1323 Club Drive  
Vallejo, CA 94592-1110

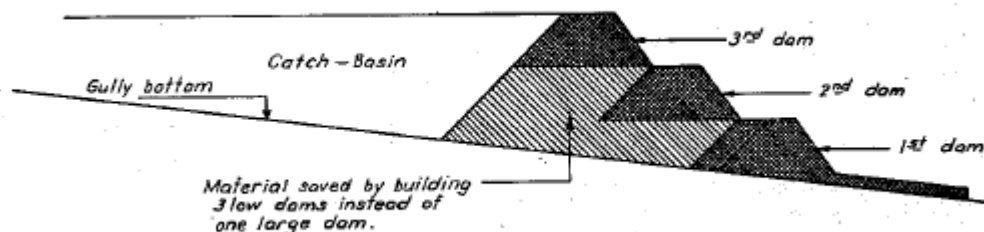
1. Numerous low dams along a gully are preferred to a few high dams. A "low" check dam is considered to be not over three or four feet

in height. There is less danger of such structures washing out in time of flood, and if they should wash out less damage will result. Further, low dams are more economical than high dams.

2. It is more economical to reclaim a gully by stages, than to try to do it at one time or with one set of dams. The best method is to construct a series of low dams along the gully. When the catch-basins behind these dams have filled, another series of dams can be built on top of or just upstream from the original dams as illustrated in figure 17. One to three years will ordinarily elapse before it is necessary to construct a new set of dams, although occasionally one big storm may be sufficient to fill the catch-basins.

3. Temporary rather than permanent check dams are usually preferred. Once a gully has been reclaimed, and the erosion properly controlled by vegetation, the check dams serve no further purpose. It has also been found that temporary semi-pervious dams, consisting in part of brush, forest litter and other such material, are more effective in reclaiming gullies than more impervious dams. While the dams should be of a semi-pervious and temporary nature, leaving permanent control of the reclaimed meadow to be obtained by proper vegetative methods, it should not be assumed that dams need not be carefully designed and built.

## Handbook of Erosion Control in Mountain Meadows. Published 1934







# Airborne Beavers Fight Floods



**O**UT in Idaho, the Department of Fish and Game is teaching eager beavers to yell "Geronimo!" These busy little creatures are being dropped by parachute to terrain where they can do their bit in the conservation battle.

Idaho state caretakers trap unwanted beavers which may be a nuisance in certain areas, round them up at central points and pack them in pairs in specially constructed wooden crates. After they are dropped, the boxes remain closed as long as there's some tension on the parachute shrouds but pull open as soon as the chute collapses on the ground. Then, out crawl Mama and Papa beaver, ready to start work.

After they're settled, the 40-pound, web-footed rodents multiply and become outpost agents of flood control and soil conservation. Fur supervisor John Smith reports that in carefully observed early operations, the beavers headed straight for water and started building a new dam within a couple of days.

However, one problem still remains to be solved—a question of ethics more than conservation. Are these eager beavers bona fide members of the Caterpillar Club? •



ked for travel, this beaver is placed crate designed by Scott Heter, left. ber bands pull the box apart when he hits the ground, freeing the animals. ading for water, the airborne beavers working like beavers on their new dam.



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## Parachuting Beavers Into Idaho's Wilderness? Yes, It Really Happened

By SAMANTHA WRIGHT • JAN 14, 2015

# Desired attributes of Low-Tech

- Simple, cost-effective, efficiently scaled up
- Structures (if needed) are hand-crafted using locally-sourced, natural materials
- Let the system do the work (process-based)
- Allows broad audiences to participate





# Grazing Management



# Brush Placement



# Tree Felling



# Beaver Management



# Riparian Plantings



# "Sticks and Stones"





Table 5 – A list of typical low-tech approaches to promoting specific process-based restoration outcomes.

Name	Helpful Reference(s)
<b>Promoting and/or Mimicking Wood Accumulation</b>	
<b>Seeding of Wood – Direct Recruitment of Unanchored Wood</b>	
Direct Felling	Carah et al. (2014)
Grip-Hoisting	Micelston (2014)
<b>Structural Placement of Wood Accumulations</b>	
Post-Assisted Log Structures	Chapter 4 (Shahverdian et al., 2019a)
<b>Improving Supply of Woody Material</b>	
Riparian Plantings	Hall et al. (2011)
Grazing Management	Swanson et al. (2015)
<b>Promoting and/or Mimicking Beaver Dam Activity</b>	
Beaver Translocation	Woodruff and Pollock (2015)
Beaver Dam Analogues	Chapter 4 (Shahverdian et al., 2019a)
Trapping Closures	Figure 9; (Valachovic)
<b>Erosion Control (often for intermittent &amp; ephemeral channels)</b>	
Baffles	Zeedyk and Clothier (2009)
One Rock Dams	Maestas et al. (2018); Zeedyk and Clothier (2009)
Post and Brush Plugs	Kraebel and Pillsbury (1934)
Tree Dam	Kraebel and Pillsbury (1934)
Tree Plug	Kraebel and Pillsbury (1934)
Vanes	Zeedyk and Clothier (2009)
Wicker Weirs	Kraebel and Pillsbury (1934)
Zuni Bowls	Maestas et al. (2018); Zeedyk and Clothier (2009)



# Our contribution to Low-Tech toolbox

Low-tech process-based restoration

*noun*

1. A practice of using simple, low unit-cost, structural additions (e.g., wood and beaver dams) to [riverscapes](#) to mimic functions and promote specific processes. Hallmarks of this approach include an explicit focus on the promoting geomorphic and [fluvial](#) processes, a conscious effort to use cost-effective, low-tech treatments (e.g., hand-built, natural materials, non-engineered, short-term design life-spans) because of the need to efficiently scale-up application, and 'Letting the [system](#) do the work', which defers critical decision making to riverscapes and beaver.



<http://lowtechpbr.restoration.usu.edu/>



# Where does Low-Tech PBR fit?



United States Department of Agriculture

643-CPS-1

## Natural Resources Conservation Service

### Conservation Practice Standard

## RESTORATION OF RARE OR DECLINING NATURAL COMMUNITIES

CODE 643

(Ac.)

### DEFINITION

Reestablishment of abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals.

### PURPOSE

To restore the physical conditions and/or unique plant community on sites that partially support, or once supported, a rare or declining natural community. Application of this practice addresses resource concerns of a degraded plant condition and/or inadequate wildlife habitat.



### USDA - Natural Resources Conservation Service

Practice: 643 - Restoration of Rare or Declining Natural Communities

Scenario: #50 - Beaver Dam Analogues or Post-Assisted Log Structures

### Scenario Description:

This scenario includes installation of low-tech woody structures (Beaver Dam Analogues (BDAs) or Post-Assisted Log Structures (PALS)) to facilitate process-based restoration in perennial, intermittent, or ephemeral streams and riparian areas. These simple structures are low, semi-permeable, and hand-built using native materials (wood, sod, etc.). Untreated wooden fence posts are added where necessary for extra stability. Structures are designed to be short-lived and used primarily as a temporary tool to promote natural process recovery. Structures mimic the function of natural beaver dams and wood accumulation in streams by reducing water velocities, raising water tables, enhancing floodplain connectivity, and inducing other dynamic ecological and hydrogeomorphic processes. Typically, complexes consisting of multiple structures within a reach are used to meet project objectives. Structures can be used on all land uses to address a variety of resource concerns and are strategically placed to meet specific purposes, such as, mesic and wetland vegetation expansion, floodplain development in incised channels, increased habitat complexity for fish and wildlife, and beaver re-establishment. Associated practices include: 528, 391, 644, 612, 382. Typical scenario includes 20 structures averaging 20 ft length each (total = 400 lin ft of structures). Crew of one biologist, one crew manager, and three laborers (one skilled).