East River Watershed Assessment

Eric Berntsen
Kalispel Tribe Natural Resources Department



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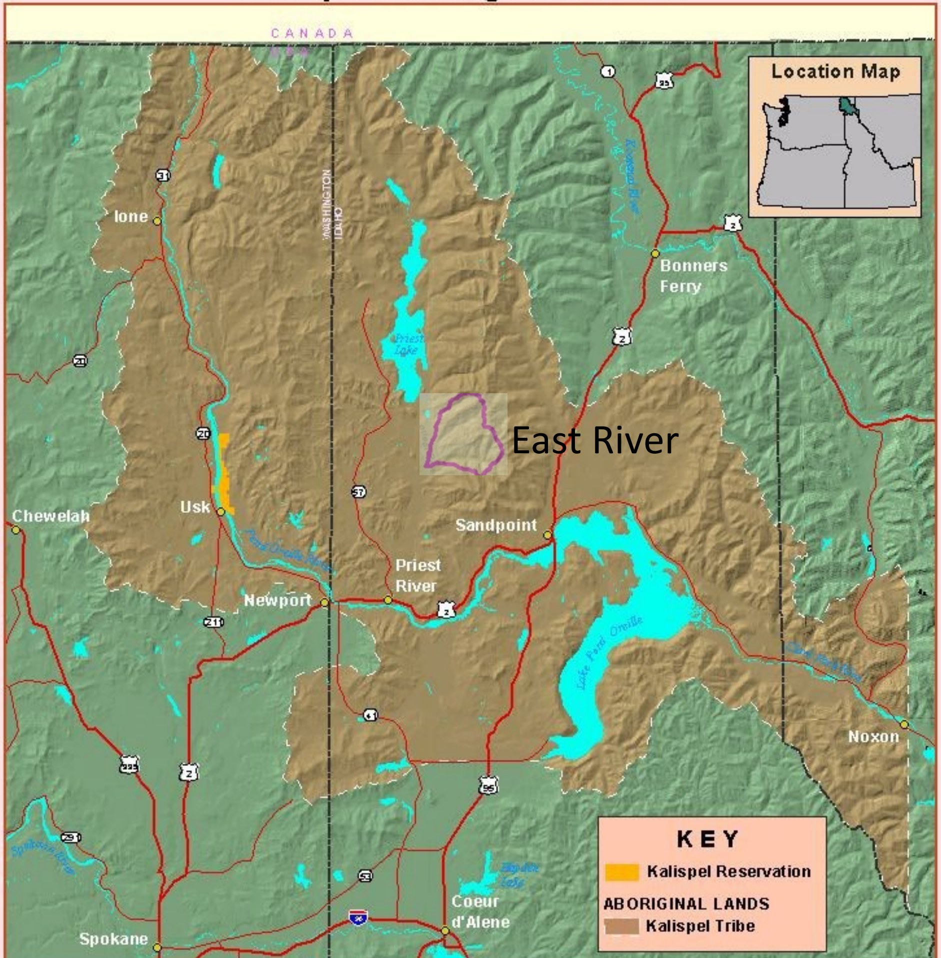
Kalispel Aboriginal Lands



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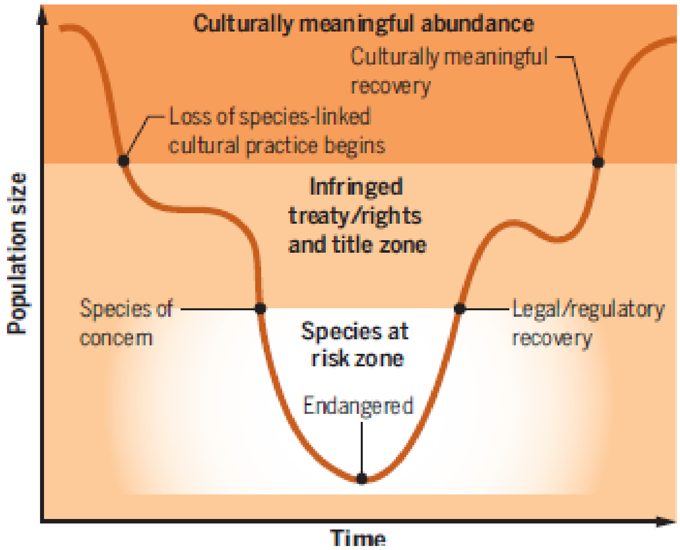
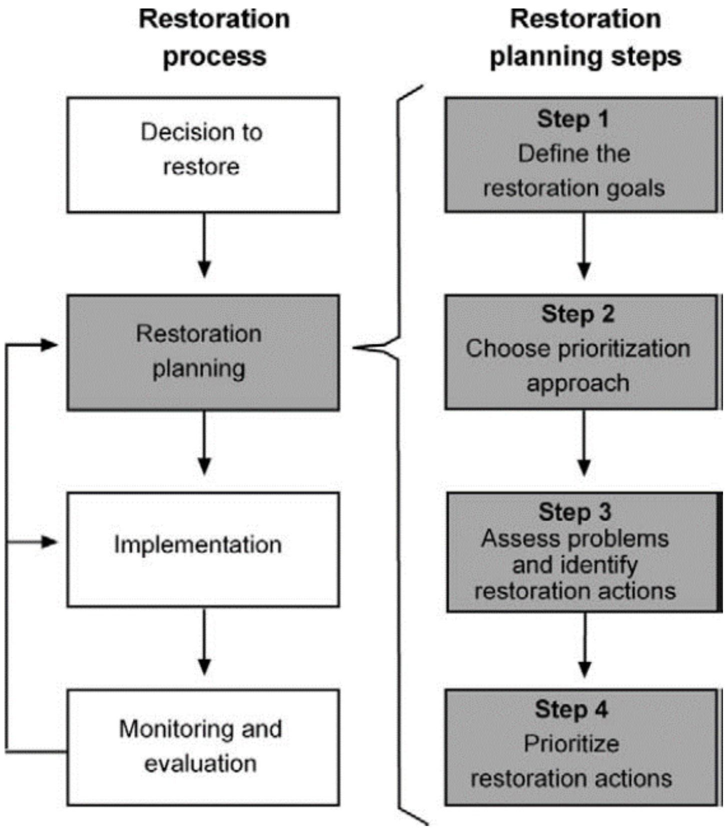
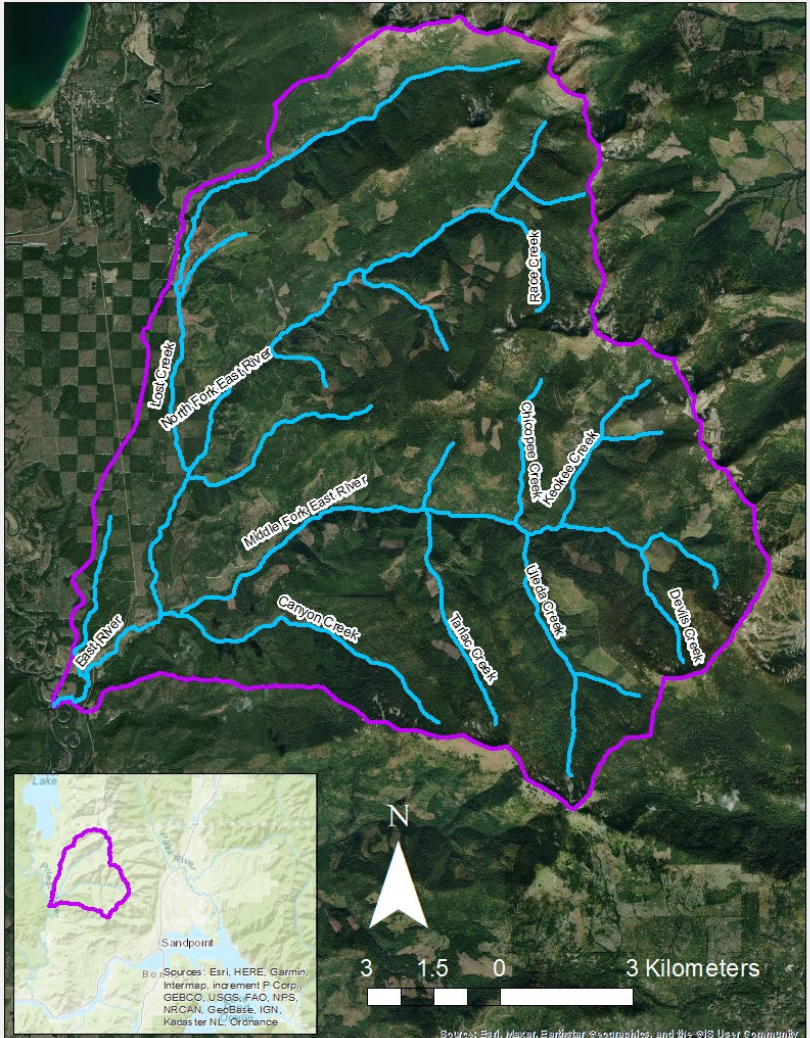
We’re trying to restore “culturally meaningful abundance”



(Lamb et. al. 2023)



(Firehammer et al. 2011)


Race Creek
Lost Creek
North Fork East River
Chicopee Creek
Keokee Creek
Middle Fork East River
East River
Canyon Creek
Tarlac Creek
Uleda Creek
Devils Creek
Lake
Pack River
Sandpoint
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance
N
3 1.5 0 3 Kilometers
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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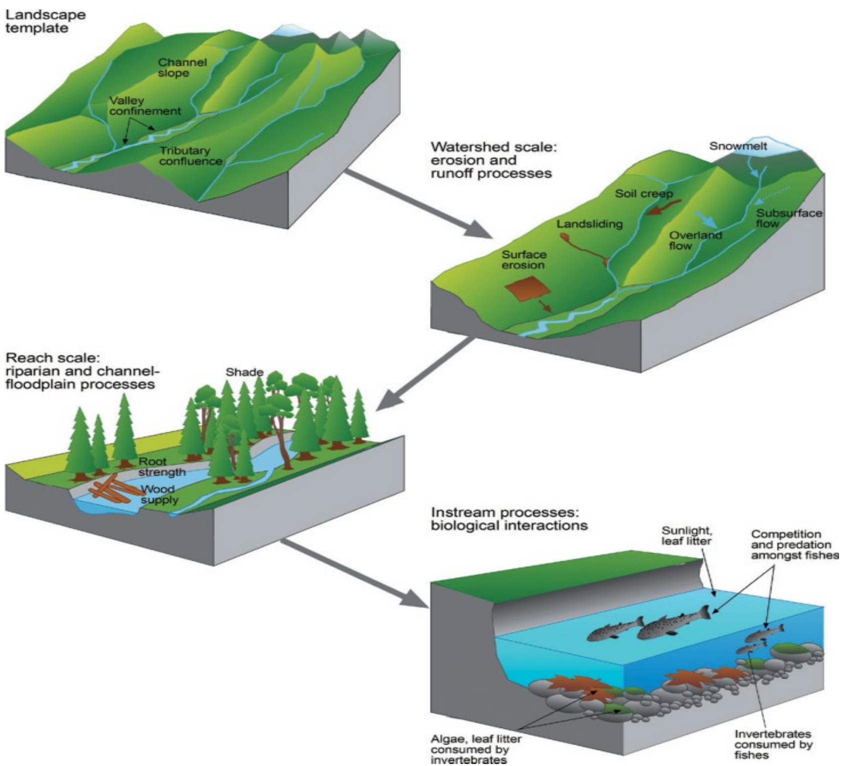
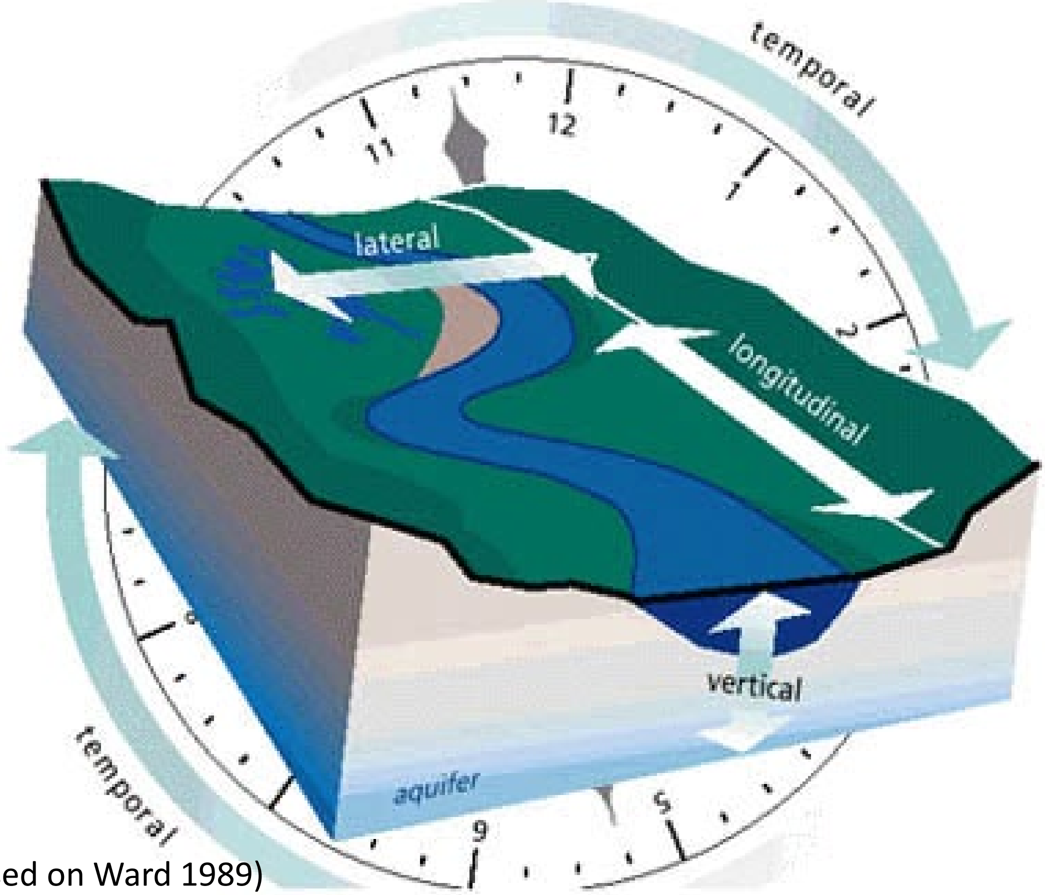
Hierarchical nature of watersheds and related watershed processes

(Roni and Beechie 2013)



The four dimensions of rivers



(EPA based on Ward 1989)

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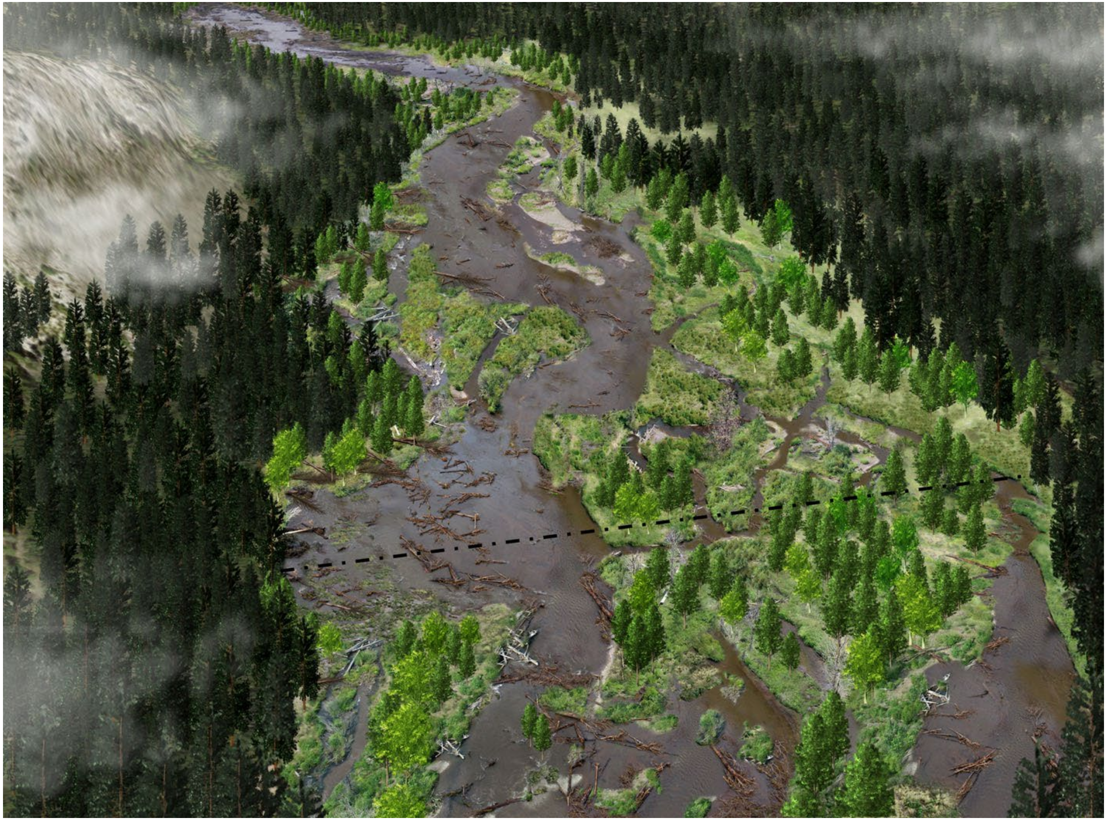
River-Wetland Corridors

(Powers et al. 2022)



Kalispel natural resources

Methods

- **Valley confinement, floodplains, and channel segment types**
  - Channel response
  - Incision
- **Sediment supply**
  - Priest River Sediment TMDL
- **Runoff**
  - USFS 2040 and 2080 streamflow predictions

Methods (cont'd)

- **Instream wood**

  - Kalispel 2005/2006 data (pieces ≥10 cm diameter, ≥ 1m in length)

- **Barriers**

  - IDFG Fish Barrier dataset

SEDIMENT

FS _ Fine Sediment Deposition
CS - Coarse Sediment Deposition

DISCHARGE

SC - Scour Depth
SF - Scour Frequency
BE - Bank Erosion

WOOD

WL - Wood Loss
WA - Wood Accumulation

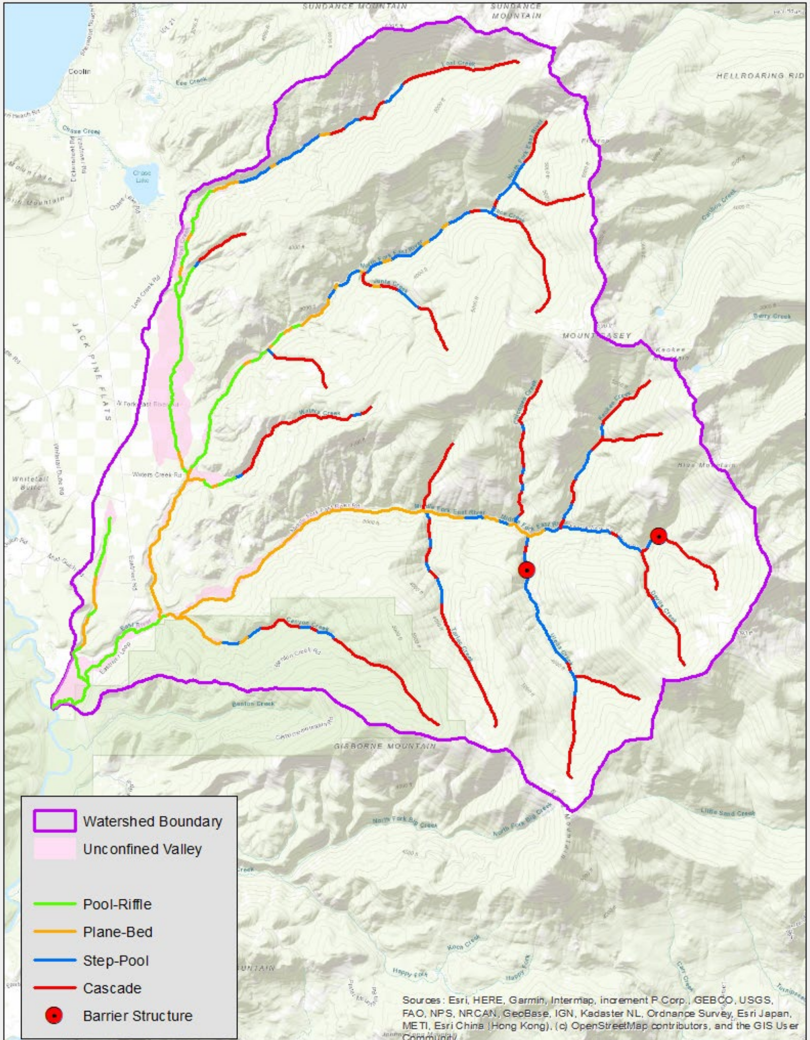
CATASTROPHIC EVENTS

DFS - Debris Flow Scour
DFD - Debris Flow Deposition
DB - Dam Break Flood

	<1.0 Pool-Riffle	1.0 - 2.0 Pool-Riffle, Plane-Bed	2.0 - 4.0 Plane-Bed, Forced Pool-Riffle	4.0 - 8.0 Step-Pool	8.0 - 20.0 Cascade	> 20.0 Colluvial
VW > 4CW UNCONFINED	FS BE WA	WL SF FS BE	DB DFD BE CS SF WL	DFS/DFD DB WL	DFS	....
2CW < VW < 4CW MODERATELY CONFINED	FS BE WA	CS BE SD WL FS	CS BE DB SD DFD WL SF	DFS/DFD DB SF WL	DFS	DFS
VW < 2CW CONFINED	....	CS WL	CS SD WL DFD DB	DFS/DFD DB SF WL	DFS	DFS

VALLEY GRADIENT AND TYPICAL CHANNEL BED MORPHOLOGY

(WDNR 2011)



SUNDANCE MOUNTAIN
SUNDANCE MOUNTAIN
Coolin
HELLROARING RID
JACK PINE FLATS
GISBORNE MOUNTAIN
Watershed Boundary
Unconfined Valley
Pool-Riffle
Plane-Bed
Step-Pool
Cascade
Barrier Structure
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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Results

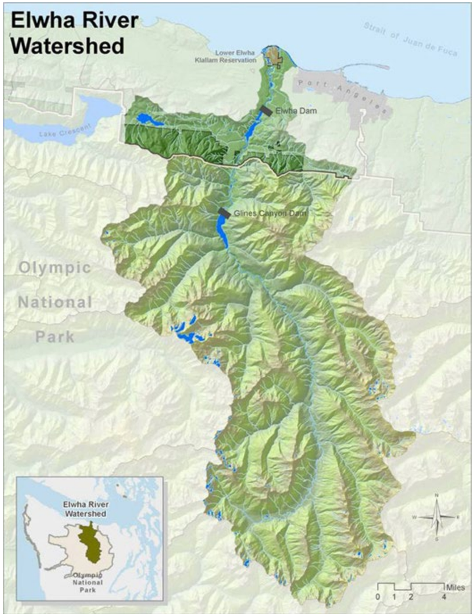
Process	Rating	Reason
Incision	Fair	Vegetation clearing/grazing
Sediment	Poor	Roads/channel erosion
Runoff	Poor	Low summer flows
Instream Wood	Good to Poor	Vegetation clearing/grazing
Barriers	Good	No barriers

Table 3. Definitions of selected classes of restoration actions used in river management.

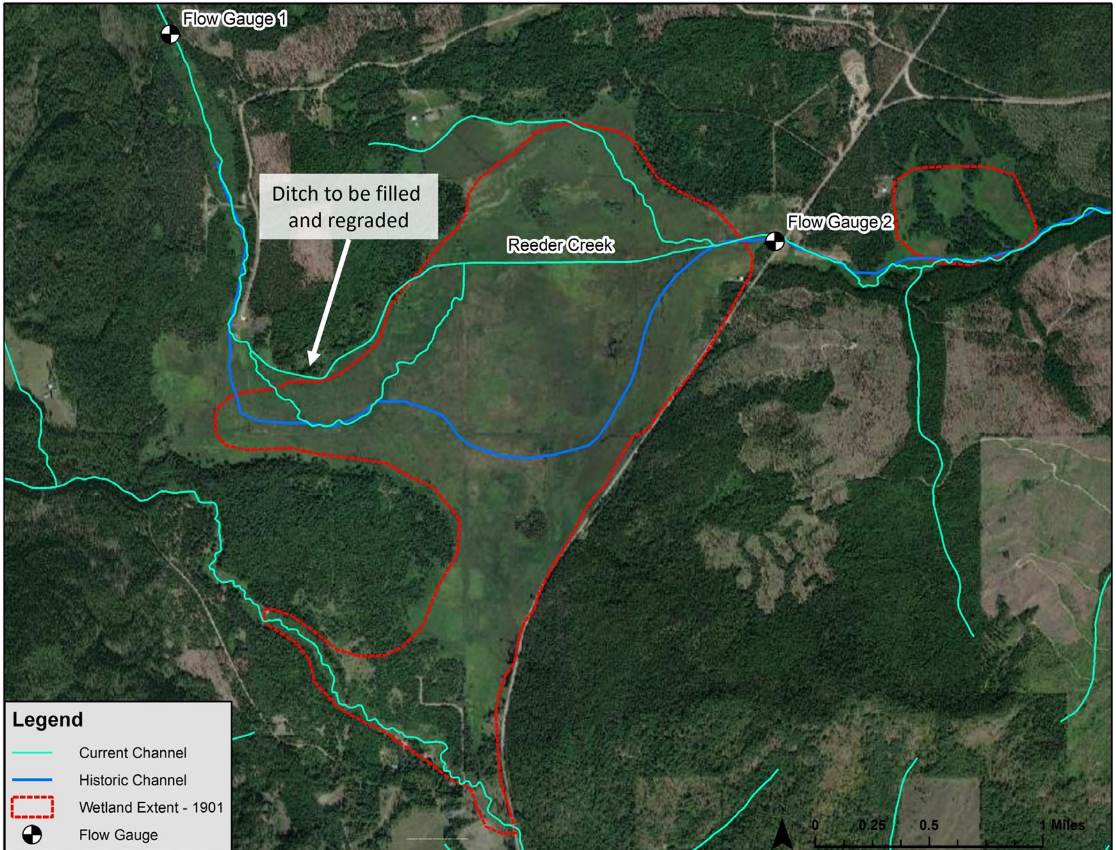
Action class	Definition
Full restoration	Restore processes that create and maintain habitats and biota, thereby returning a river ecosystem to its normative state.
Partial restoration	Restore or improve selected ecosystem processes, thereby partially restoring a riverine ecosystem.
Habitat creation	Improve quality of habitat by treating specific symptoms through creation of locally appropriate habitat types; used where causes of degradation cannot be addressed.

(from Beechie et al 2010)

Example of full restoration –Dam removal, longitudinal reconnection



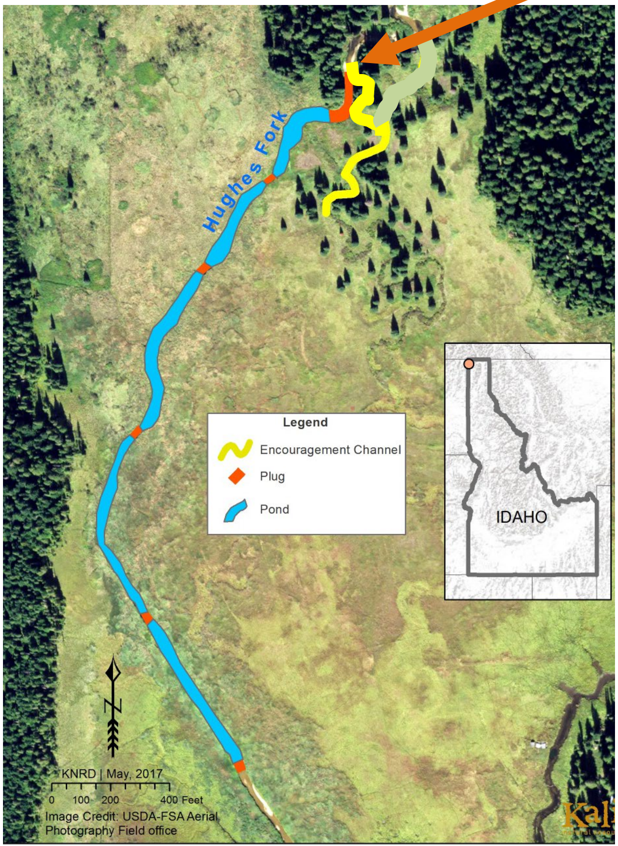
Example of partial restoration – Valley regrade



Example of partial restoration – ”Pond & Plug”

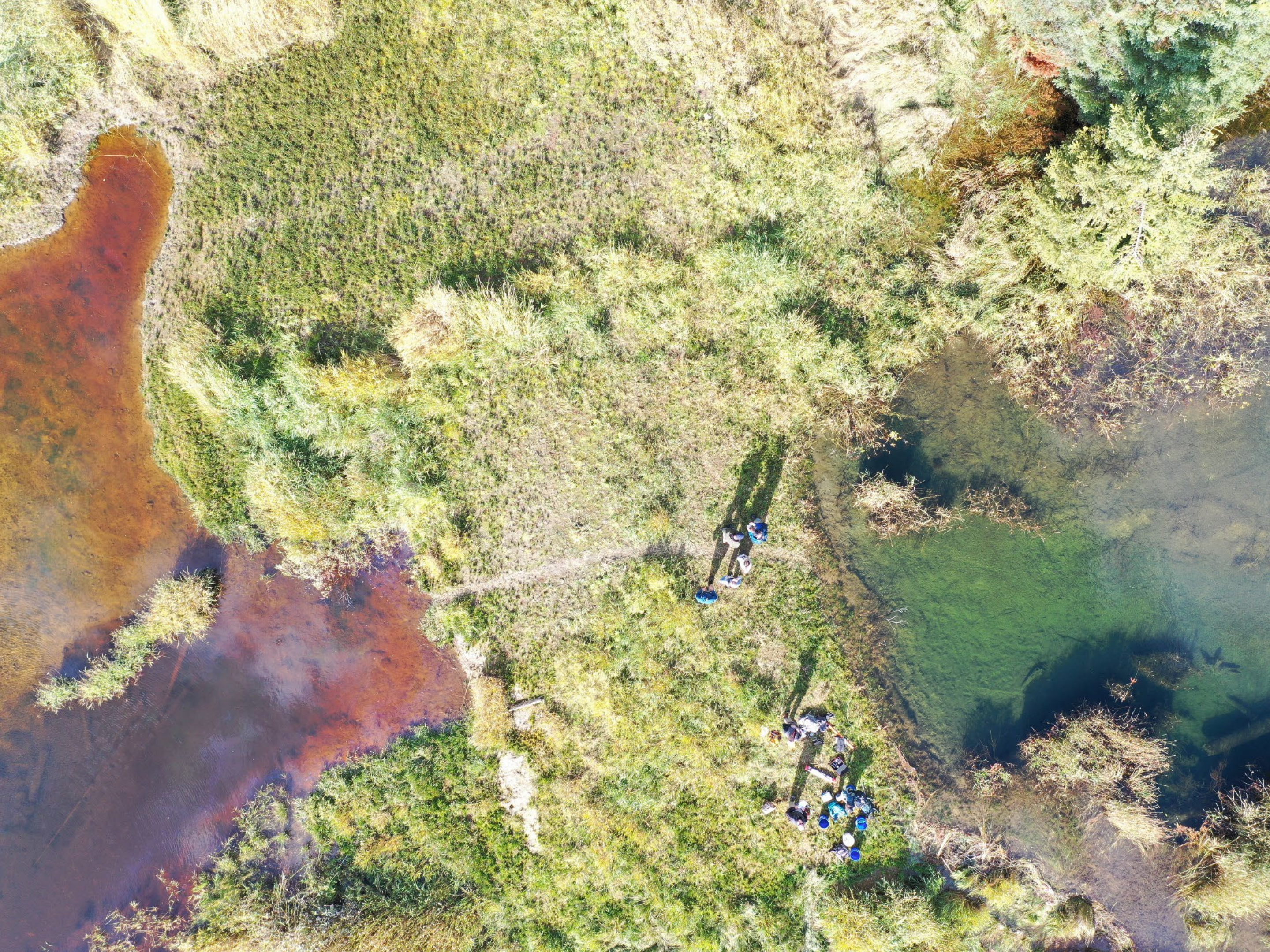

CAT


KOBELCO



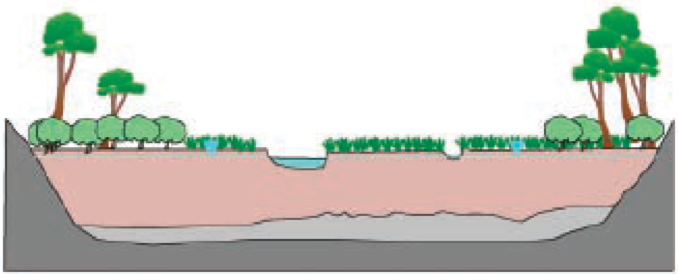
Example of partial restoration – "Pond & Plug"


Re-routed
Hughes Fork

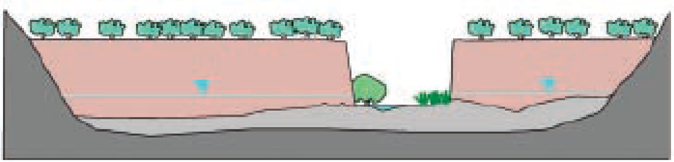


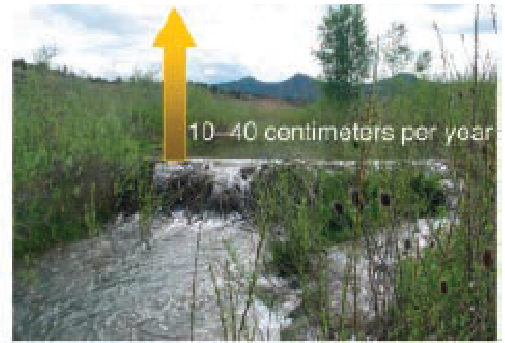
Example of partial restoration –beaver dam analogs

Wet floodplain system:
- sedge meadows
- deep accumulation of sediments
- elevated water table



Incised channel:
- conversion to xeric vegetation
- lowered water table
- intermittent streamflow





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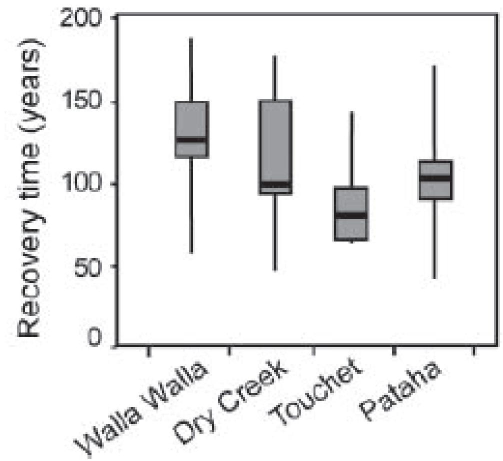

Beaver dam analog in Goose Creek, Idaho

Example of habitat restoration
Temperature Augmentation

Potential Actions

Process	Action(s)
Incision	Floodplain reconnection (BDAs, regrade, pond and plug)
Sediment	Fix roads/reduce channel erosion/exclusion fencing/ stock watering
Runoff	Floodplain reconnection/ increase water storage
Instream Wood	Add wood

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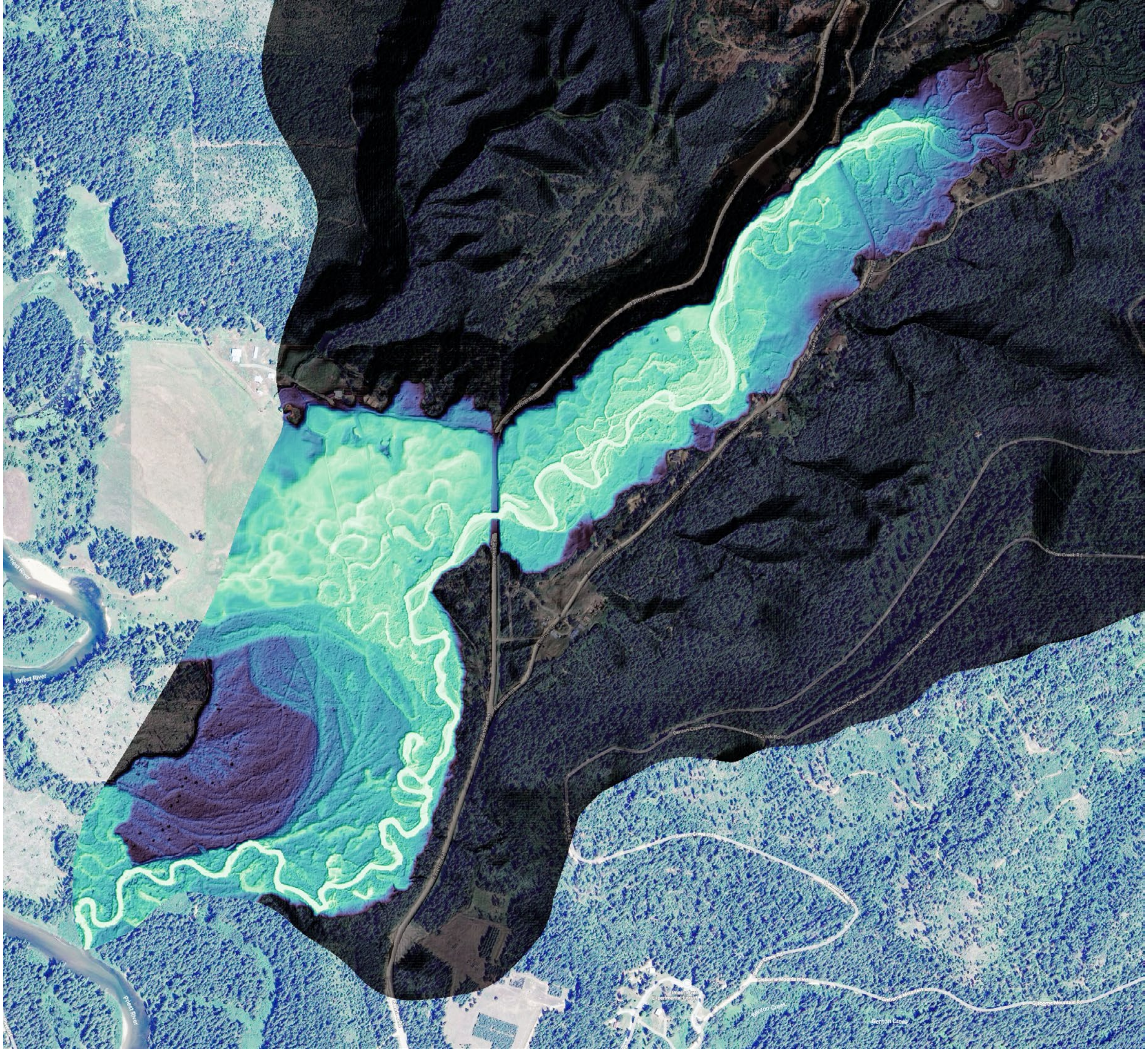
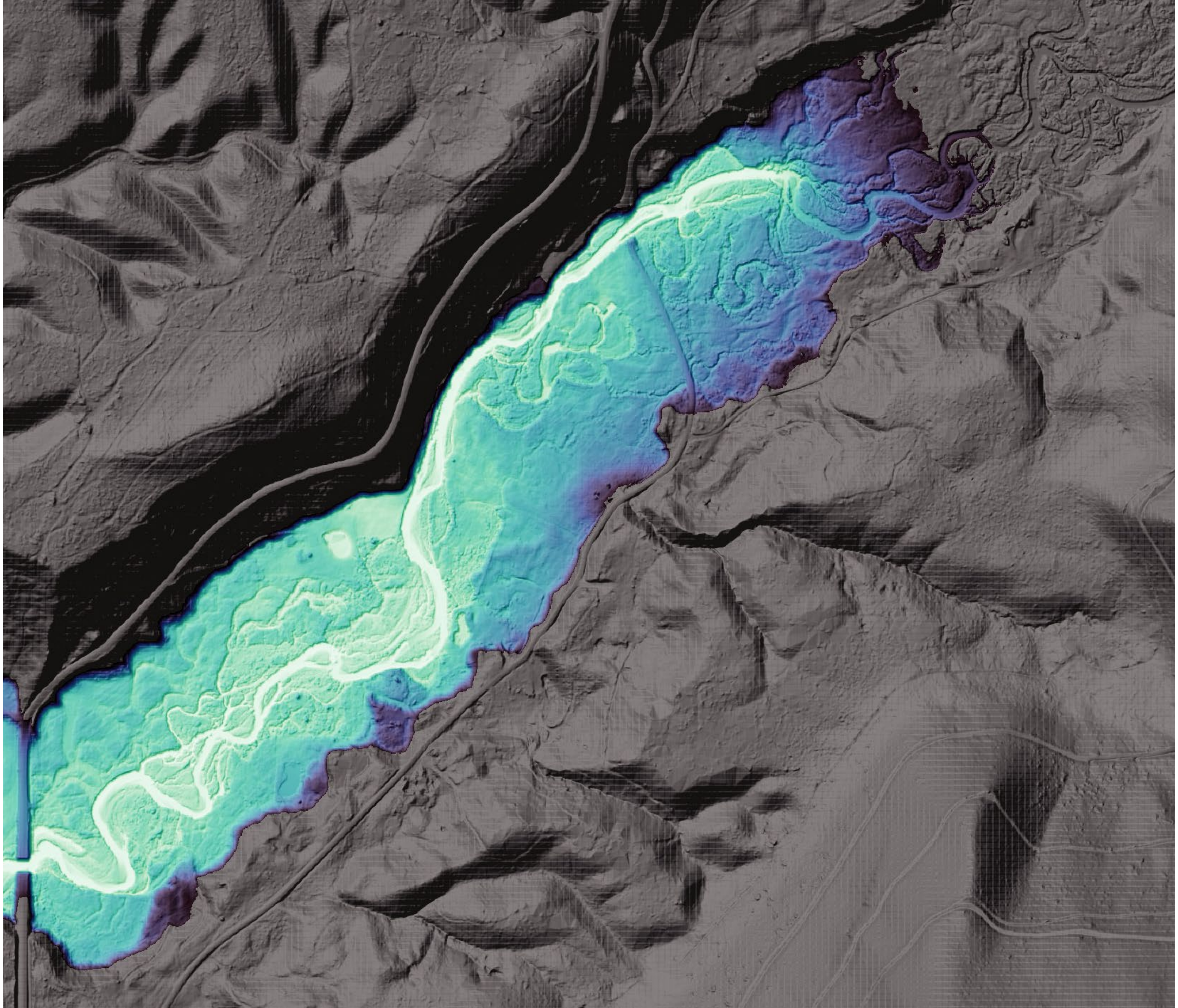

Priest River



Planning for Restoration: A Decision Analysis Approach to Prioritization

Kendra A. Cipollini,[1,2,3] Aimee L. Maruyama,[1,4] and Christopher L. Zimmerman[1,5]

Abstract

Ecological restoration often relies on the use of expert opinion to make management decisions in the face of uncertainty. The quantification of expert opinion can be difficult, especially when more than one expert is consulted and experts are not in agreement. Decision analysis can provide a framework to systematically deconstruct a complex problem and provide greater objectivity to restoration decisions. We utilized decision analysis techniques to identify restoration objectives and to quantify expert opinions to prioritize restoration activities at 112 prairie openings in the Edge of Appalachia Preserve in southern Ohio, U.S.A. We first created an objectives hierarchy to model how decision-makers decide which prairies to manage. We then determined how to measure each component of the hierarchy and sampled all prairies for percent woody cover, geology, indicator species index (an index of plant species richness), slope, aspect, and distance to nearest prairie. We modeled seven different experts' preferences for managing prairies with varying values for each of these ecological measures. We then interviewed the same decision-makers to determine relative weights for each component of the objectives hierarchy using trade-off analysis. By combining the weights, preference relationships, and sampling data, we were able to rank each prairie and management unit based on its management priority. Experts had similar preferences except for the measure of distance to nearest prairie. We found that decision-makers gave different weights to each of the different components of the hierarchy. Generally, experts weighted percent woody cover, indicator species index, and geology more highly than slope, aspect, and distance to nearest prairie. Despite these differences, priorities for management, once all factors were weighted and combined, were similar.

Key words: burning, conservation planning, Edge of Appalachia, limestone prairies, multiattribute analysis, Ohio.

Introduction

A primary goal of ecological restoration is to restore ecosystems to a target level of ecological integrity (Wyant et al. 1995; Parrish et al. 2003) or, in other words, to reestablish "pre-disturbance functions and related physical, chemical and biological characteristics" (NRC 1992). Meeting this goal requires analysis of ecological and physical factors that determine limits to the ecological composition, structure, and function of an ecosystem (Wyant et al. 1995). Unfortunately, reference ecosystem conditions and ecological integrity are frequently unknown for restoration projects. Adaptive management provides a way to incorporate information gathered as management proceeds into future management actions, yet can be a lengthy process (Walters & Holling 1990; Haney & Power 1996). To make rapid decisions on restoration management, management experts rely on experiential knowledge of ecological integrity. Often there is some knowledge of how different components (i.e., ecological and physical processes) of ecological integrity interconnect, but the expert opinion used to assess the importance of different ecological integrity components is neither quantifiable nor consistent among different experts.

Management of prairie openings at the Edge of Appalachia Preserve (EOA) in southern Ohio, U.S.A., provides a case study of these complexities in making restoration prioritization decisions. The ecological integrity of prairie openings at EOA is threatened by shrub and woody plant succession. Studies of aerial photographs taken in 1938, 1950, 1965, and 1971 found that EOA prairies are succeeding to forest (Annala & Kapustka 1983; Annala et al. 1983). To control the encroachment of shrubs and woody plants and to reintroduce a necessary disturbance regime, preserve managers have selectively managed these prairies by prescribed burns, hand cutting, or a combination thereof. This management, however, has been complicated by a number of obstacles. There is some lack of consensus in the scientific literature as to the ori-

Prioritization criteria

Prioritization Criteria	**Description**	**Weight**	**1 (Low)**	**2 (Moderate)**	**3 (High)**	**Rationale**
PC-1	Reach Prioritization Score	3	low	moderate	high	Reaches were prioritized based on habitat use, habitat function, geomorphic function, riparian function, and hillslope function. Weight is based on best professional judgement. Restoration actions located in reaches most in need of restoration receive the highest scores.
PC-2	Number of Process Impairments Addressed	3	1	2-3	>3	Erosion and runoff are the major watershed scale habitat forming processes. Riparian and channel-floodplain interactions form habitat at the reach scale. Weight is based on best professional judgement. Restoration actions that address multiple process impairments receive the highest scores.

Prioritization criteria (cont'd)

Prioritization Criteria	Description	Weight	1 (Low)	2 (Moderate)	3 (High)	Rationale
PC-3	Species to Benefit	3	No adfluvial or native fish present	Native fish present, no adfluvial fish	Adfluvial fish present	Different categories of fish species will likely benefit from restoration actions. Weight is based on best professional judgement. Restoration actions that will likely benefit adfluvial and native fish receive the highest scores.
PC-4	Proximity to High Priority Reach	2	far	moderate	near	Restoration actions that are spatially link stand the greatest chance of success. Weight is based on best professional judgement. Restoration actions located near high priority reaches receive the highest scores.

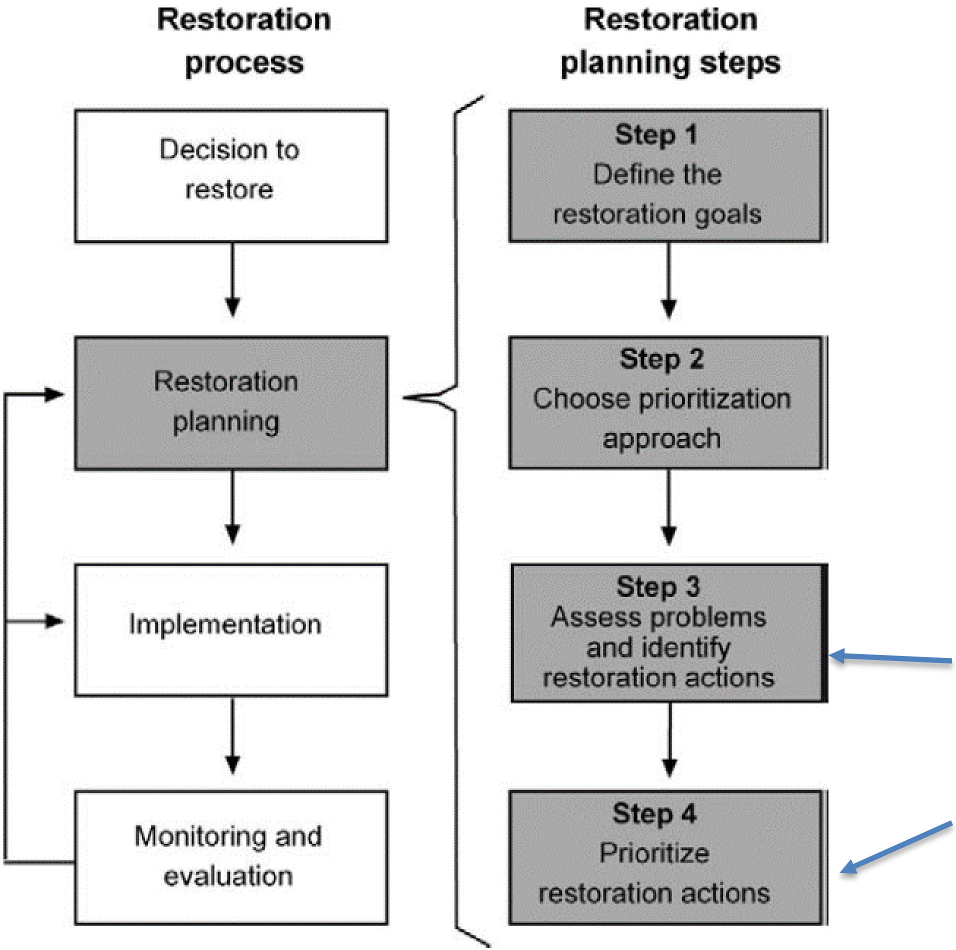
Prioritization criteria (cont'd)

Prioritization Criteria	Description	Weight	1 (Low)	2 (Moderate)	3 (High)	Rationale
PC-5	Constructability	2	Strong landowner resistance or poor access	Moderate landowner support, limited financial support, or moderate access	Strong landowner support, ample financial support, or good access	The success of restoration actions is dependent on landowner and financial support and suitable access for construction, maintenance, and monitoring. Weight is based on best professional judgement. Restoration actions that have strong landowner support, ample financial support, and good access receive the highest scores.
PC-6	Number of included habitat actions from Beechie et al. (2013)	2	1	2-3	>3	Habitat actions that are most effective at addressing stream temperature increases, reduced stream flows, and increasing fish population resilience include 1) Longitudinal connectivity through removal of barriers to fish migration and streamflow, 2) Floodplain reconnection laterally and vertically, 3) Improved vertical connectivity of hydrology within geomorphic units and 4) Improved native riparian plant community (Beechie et al. 2013). Weight is based on best professional judgement. Restoration actions that include more than three habitat actions that are most effective at addressing stream temperature increases, reduced stream flows, and increasing fish population resilience receive the highest scores.

Prioritization criteria (cont'd)

Prioritization Criteria	Description	Weight	1 (Low)	2 (Moderate)	3 (High)	Rationale
PC-7	Certainty of Success	1	Experimental technique, high degree of uncertainty	Moderate level of uncertainty	Proven technique that rarely fails	Some restoration actions (e.g., reducing sediment delivery to stream channels and increasing the availability of large wood for recruitment) address root causes of impairment to habitat forming processes and have a high certainty of success, if implemented at an appropriate size and scale. Weight is based on best professional judgement. Proven techniques that rarely fail receive the highest scores.
PC-8	Educational and cultural value	1	Low visibility, little educational and indigenous cultural value	Moderate visibility, moderate educational and indigenous cultural value	High visibility, identifiable educational and indigenous cultural value	Successful restoration actions that are highly visible can often serve as catalysts for future restoration, serving as a model for similar projects and as a means of educating the public. Indigenous cultures (e.g. the Kalispels) often have place names associated with areas where resources were consumed and various ceremonies were conducted Weight is based on best professional judgement. Restoration actions that are highly visible and have identifiable educational and indigenous cultural value receive the highest scores.

		Stream						
		Ruby	Ruby	Ruby	Ruby	Ruby	NF Ruby	NF Ruby
River Kilometer (Approx.)		10.2	8.8	6.8	3.2	19	2.6, 3.4	1.2
Project Type		LWD Addition	LWD Addition	LWD Addition	LWD Addition	Stage-0	Culvert Replacement	LWD Addition
Prioritization Criteria and Weight								
Reach Prioritization	3	2	2	2	2	3	3	3
Proximity to High Priority Reach	2	3	3	3	3	1	3	3
Functional Impairments Addressed	3	1	1	1	1	3	2	2
Constructability	2	2	2	2	2	2	2	2
Actions included from Beechie et al. (2013)	2	2	2	2	2	3	2	2
Certainty of Success	1	2	2	2	2	2	3	2
Species to Benefit	3	2	2	2	2	2	2	2
Education Value	1	1	1	1	1	2	2	2
Weighted Score		32	32	32	32	40	40	39


Restoration process
Decision to restore
Restoration planning
Implementation
Monitoring and evaluation
Restoration planning steps
Step 1
Define the restoration goals
Step 2
Choose prioritization approach
Step 3
Assess problems and identify restoration actions
Step 4
Prioritize restoration actions


#SchittsCreek
I'M HAPPY TO HELP

Kalispel