

# A general protocol for identifying and prioritizing restoration actions

Tim Beechie  
George Pess  
Phil Roni  
NOAA Fisheries

Guillermo Giannico  
Oregon State University



## The basic steps

- Establish a restoration goal
- Choose prioritization approach
- Identify necessary restoration actions
- Set priorities

## Establish a restoration goal

- What are we restoring?
  - A listed species?
  - An ecosystem?
- What are the constraints?
  - Local economy?
- Specifies value system for setting priorities



## An example

- A goal for sustained ecosystem function:

Support salmon recovery by restoring landscape processes that sustain aquatic habitats, while minimizing impacts on local economies

## Six prioritization approaches

- Project type
- Refugia
- Decision support systems
- Single species
- Multi-species
- Cost effectiveness

## Six prioritization approaches

- Project type
- Refugia
- Decision support systems
- Single species
- Multi-species
- Cost effectiveness

Logic frameworks

## Six prioritization approaches

- Project type
- Refugia
- Decision support systems
- Single species
- Multi-species
- Cost effectiveness

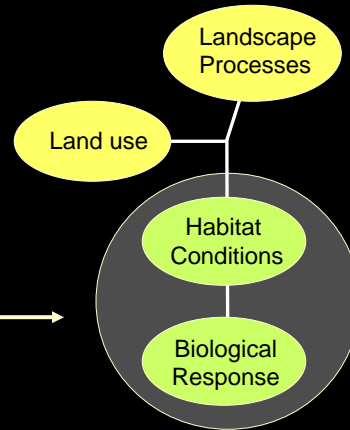
Analytical frameworks

## Information needs

Prioritization approach	Information needs			
	Causes of impairment	List of actions	Biological benefit	Cost
Project type	O	X		
Refugia	O	X		
Decision support system	O	X	O	O
Single species	X	X	X	
Multiple species/ecosystem	X	X	X	
Cost-effectiveness	X	X	X	X

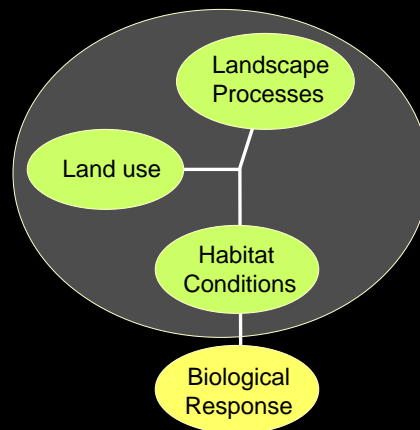
## Conduct watershed assessments

- Which habitat changes are most important? →



## Conduct watershed assessments

- What are the causes of habitat change? →
- Which habitat changes are most important?



## Scales and types of processes

- Basin scale
    - Non-point processes
  - Reach scale
    - Localized effects
  - Connectivity
    - Migration pathways
- 
- Sediment supply
  - Hydrologic processes
    - Urban
    - Rain-on-snow
  - Water quality
  - Riparian functions
    - Leveed floodplains and deltas
  - Inaccessible habitat
    - Stream blockages

## Scales and types of processes

- Basin scale
    - Non-point processes
  - Reach scale
    - Localized effects
  - Connectivity
    - Migration pathways
- 
- Sediment supply
  - Hydrologic processes
    - Urban
    - Rain-on-snow
  - Water quality
  - Riparian functions
    - Leveed floodplains and deltas
  - Inaccessible habitat
    - Stream blockages

## Scales and types of processes

- Basin scale
  - Non-point processes
- Reach scale
  - Localized effects
- Connectivity
  - Migration pathways
- Sediment supply
- Hydrologic processes
  - Urban
  - Rain-on-snow
- Water quality
- Riparian functions
  - Leveed floodplains and deltas
- Inaccessible habitat
  - Stream blockages

## List process restoration needs

- Summarize process impairment by location

Process	Sub-Process	Reach			
		1	2	3	4
Hydrology	Water quantity	M	M	L	L
	Tidal exchange	H	M		
Sediment	Sediment delivery	L	M	M	H
Riparian	LWD Delivery	M	M	H	H
	Stream shading	H	H	M	M
Channel	Channel migration	H	H	H	L
	Hydraulics	H	H	H	L
	Fish migration	M	L	M	M
Floodplain	Sediment routing	H	H	M	L
	Channel migration	H	H	H	L

## List necessary restoration actions

- Create the project list
- List all action types
  - Specify project type
  - Specify location

Process	Action	Reach			
		1	2	3	4
Hydrology	Culvert redesign	M	M	L	L
	Replace tide-gate	H	M		
Sediment	Road repair	L	L	M	H
Riparian	Riparian thinning	L	L	M	M
	Replant riparian	H	H	L	L
Connectivity	Fish passage	M	L	M	M
Floodplain	Levee setback	H	M	L	L
	Levee removal	H	H	L	L

## Prioritize actions

- Scoring system can consider
  - Species benefit
  - Cost
  - Certainty
  - Economic constraints
  - Education value

Project number <i>06-033</i>			
Project title <i>Clear Creek blocking culvert removal</i>			
Description <i>Remove culvert blocking fish passage at RM 3.5, and replace with new low-cost bridge</i>			
Evaluation Criteria	Weight	Score	Total
How many focal species does the project benefit? Range 0-5	3	<u>3</u>	<u>9</u>
Does the project directly address a cause of habitat impairment identified in the watershed assessment? Directly address causal process - 5 Does not address any process - 1	3	<u>5</u>	<u>15</u>
What is the certainty of project success? Proven technique that rarely fails - 5 Untried technique with high risk of failure - 1	3	<u>5</u>	<u>15</u>
What is the economic impact of the project? Low impact on local economy - 5 High impact on local economy - 1	3	<u>4</u>	<u>12</u>
Does the project have local landowner support? Strong support - 5 Strong resistance - 1	2	<u>3</u>	<u>6</u>
What is the project cost? Low - 5 High - 1	2	<u>3</u>	<u>6</u>
What is the difficulty of project design and permitting? Completed designs and permits - 5 Technically challenging and difficult to permit - 1	2	<u>4</u>	<u>8</u>
What is the education value of the project? High visibility and education value - 5 Low visibility and education value - 1	1	<u>3</u>	<u>3</u>
What is the likelihood of obtaining funding? Funded - 5 Likely difficult to fund - 1	1	<u>4</u>	<u>4</u>
Total Project Score			<u>78</u>



## Scoring system example

Project	Sub-basin	Priority score
Replace impassible culvert, Jones Road, MP3.6	3	79
Replace impassible culvert, Road 1341, MP 1.2	4	78
Riparian planting, Mainstem, Rkm 1.2-1.6	1	68
Levee setback, Mainstem Rkm 0.0-1.1	1	65
Riparian planting/fencing, Trib A, Rkm 0.2-1.1	2	58
Replace impassible culvert, Smith Road, MP 1.3	2	53
Road erosion reduction, Jones Road, MP 1.1-2.5	3	37
Road erosion reduction, Road 1341, MP 0.2-1.5	4	35
Wood placement, Mainstem, Rkm 6.4-7.2	3	35
Road erosion reduction, Road 1341, MP 1.6-2.3	4	34

## Scoring system example

Project	Sub-basin	Priority score
Replace impassible culvert, Jones Road, MP3.6	3	79
Replace impassible culvert, Road 1341, MP 1.2	4	78
Riparian planting, Mainstem, Rkm 1.2-1.6	1	68
Levee setback, Mainstem Rkm 0.0-1.1	1	65
Riparian planting/fencing, Trib A, Rkm 0.2-1.1	2	58
Replace impassible culvert, Smith Road, MP 1.3	2	53
Road erosion reduction, Jones Road, MP 1.1-2.5	3	37
Road erosion reduction, Road 1341, MP 0.2-1.5	4	35
Wood placement, Mainstem, Rkm 6.4-7.2	3	35
Road erosion reduction, Road 1341, MP 1.6-2.3	4	34

## Scoring system example

Project	Sub-basin	Priority score
Replace impassible culvert, Jones Road, MP3.6	3	79
Replace impassible culvert, Road 1341, MP 1.2	4	78
Riparian planting, Mainstem, Rkm 1.2-1.6	1	68
Levee setback, Mainstem Rkm 0.0-1.1	1	65
Riparian planting/fencing, Trib A, Rkm 0.2-1.1	2	58
Replace impassible culvert, Smith Road, MP 1.3	2	53
Road erosion reduction, Jones Road, MP 1.1-2.5	3	37
Road erosion reduction, Road 1341, MP 0.2-1.5	4	35
Wood placement, Mainstem, Rkm 6.4-7.2	3	35
Road erosion reduction, Road 1341, MP 1.6-2.3	4	34

## Cost-effectiveness example

Site	Project Type	Cost	Estimated smolts	Cost/smolt
Little Park Creek	Culvert (fish passage)	\$130,000	271,050	\$0.48
Boundary Creek	Culvert (fish passage)	\$81,000	129,375	\$0.61
Deepwater Slough	Reconnect side channel	\$242,000	205,875	\$1.18
Barnaby Slough	Reconnect side channel	\$80,000	363,600	\$0.22
Skinny Sauk Pond	Off-channel pond	\$37,700	45,300	\$0.83
Zander Pond	Off-channel pond	\$23,750	8,665	\$2.75
Finney Pond	Off-channel pond	\$25,000	7,690	\$3.25
Falls Creek	Wood placement	\$12,400	1,525	\$8.13
Circle Creek	Wood placement	\$4,700	340	\$13.82
Clear Beaver Cr.	Wood placement	\$18,000	815	\$22.08

## Cost-effectiveness example

Site	Project Type	Cost	Estimated smolts	Cost/smolt
Little Park Creek	Culvert (fish passage)	\$130,000	271,050	\$0.48
Boundary Creek	Culvert (fish passage)	\$81,000	129,375	\$0.61
Deepwater Slough	Reconnect side channel	\$242,000	205,875	\$1.18
Barnaby Slough	Reconnect side channel	\$80,000	363,600	\$0.22
Skinny Sauk Pond	Off-channel pond	\$37,700	45,300	\$0.83
Zander Pond	Off-channel pond	\$23,750	8,665	\$2.75
Finney Pond	Off-channel pond	\$25,000	7,690	\$3.25
Falls Creek	Wood placement	\$12,400	1,525	\$8.13
Circle Creek	Wood placement	\$4,700	340	\$13.82
Clear Beaver Cr.	Wood placement	\$18,000	815	\$22.08

## Cost-effectiveness example

Site	Project Type	Cost	Estimated smolts	Cost/smolt
Little Park Creek	Culvert (fish passage)	\$130,000	271,050	\$0.48
Boundary Creek	Culvert (fish passage)	\$81,000	129,375	\$0.61
Deepwater Slough	Reconnect side channel	\$242,000	205,875	\$1.18
Barnaby Slough	Reconnect side channel	\$80,000	363,600	\$0.22
Skinny Sauk Pond	Off-channel pond	\$37,700	45,300	\$0.83
Zander Pond	Off-channel pond	\$23,750	8,665	\$2.75
Finney Pond	Off-channel pond	\$25,000	7,690	\$3.25
Falls Creek	Wood placement	\$12,400	1,525	\$8.13
Circle Creek	Wood placement	\$4,700	340	\$13.82
Clear Beaver Cr.	Wood placement	\$18,000	815	\$22.08

## Cost-effectiveness example

Site	Project Type	Cost	Estimated smolts	Cost/smolt
Little Park Creek	Culvert (fish passage)	\$130,000	271,050	\$0.48
Boundary Creek	Culvert (fish passage)	\$81,000	129,375	\$0.61
Deepwater Slough	Reconnect side channel	\$242,000	205,875	\$1.18
Barnaby Slough	Reconnect side channel	\$80,000	363,600	\$0.22
Skinny Sauk Pond	Off-channel pond	\$37,700	45,300	\$0.83
Zander Pond	Off-channel pond	\$23,750	8,665	\$2.75
Finney Pond	Off-channel pond	\$25,000	7,690	\$3.25
Falls Creek	Wood placement	\$12,400	1,525	\$8.13
Circle Creek	Wood placement	\$4,700	340	\$13.82
Clear Beaver Cr.	Wood placement	\$18,000	815	\$22.08

## Summary

1. Specify values in goals and prioritization scheme
2. Use values to develop prioritization scheme
3. Use watershed assessment to identify necessary actions and get information for priority setting
4. Set priorities