

Effects of livestock exclusion on stream banks and riparian vegetation in Washington and Oregon

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Background

- Livestock grazing near streams can lead to changes in:
 - Riparian vegetation
 - Bank erosion
 - Fine sediment
- Salmon Recovery Funding Board (SRFB) has invested \$1+ billion in salmon recovery and habitat restoration efforts, including livestock exclusion



Background

- Salmon Recovery Funding Board (SRFB) project effectiveness (PE) monitoring program created in 2004
 - 8 categories of commonly implemented project types selected for monitoring
 - Detailed protocols developed for each project type
- SRFB partnered with Oregon Watershed Enhancement Board (OWEB) to create a coordinated monitoring program for livestock exclusion projects
- Monitoring began in 2004 by a previous contractor and Cramer Fish Sciences completed monitoring in 2017



Questions

1. Are livestock excluded from the riparian area?
2. Has bank erosion been reduced in the treatment (impact) reach?
3. Has exclusion led to improvements in riparian condition including cover and structure?
4. Are fine sediment levels reduced in the treated reach?



Study Design

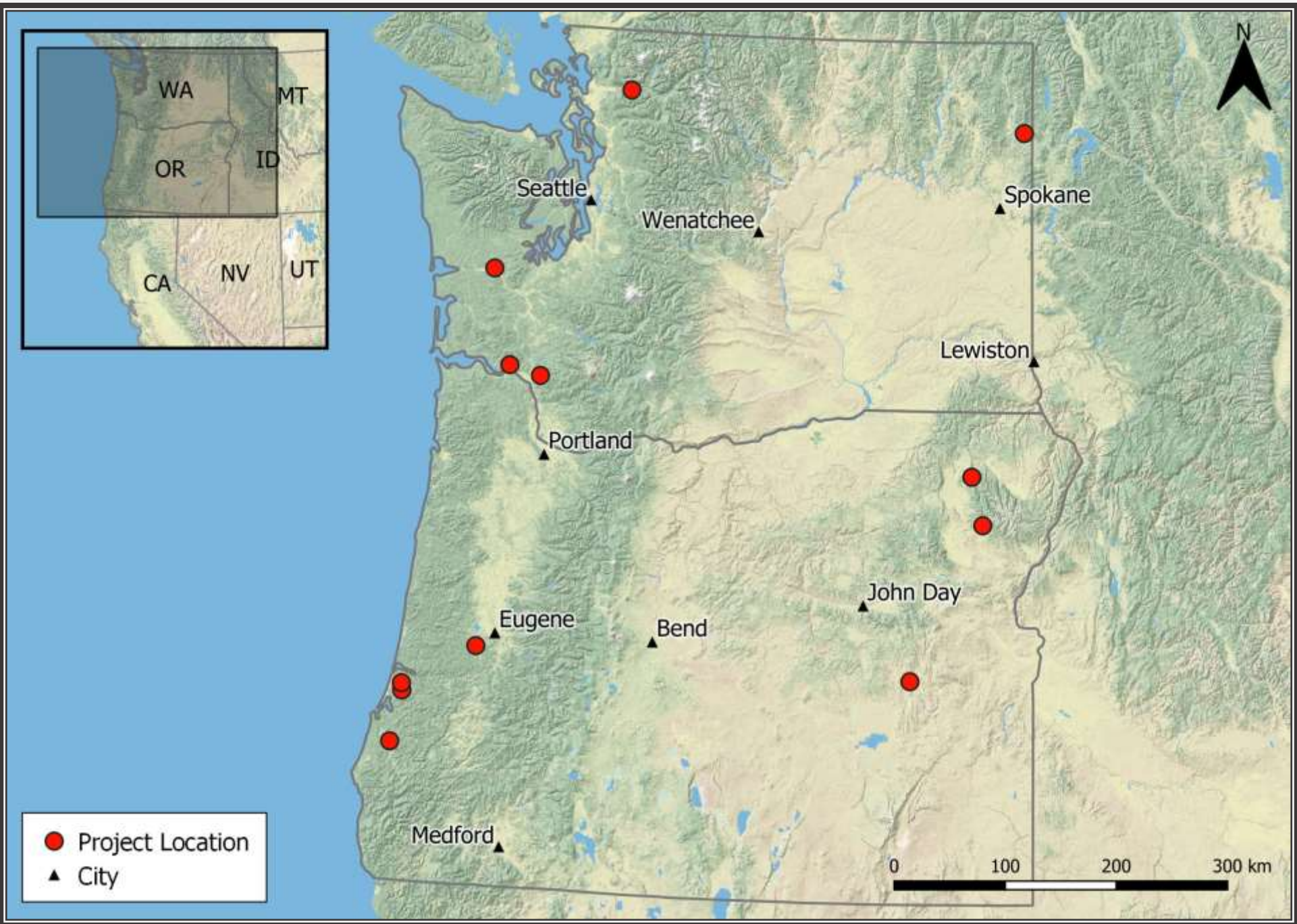
- Before-after control-impact (BACI) experimental design
- Monitoring conducted one year before (year 0) and several years after (years 1, 3, 5, and 10*) project implementation

Treatment (Impact) Reach



Control Reach



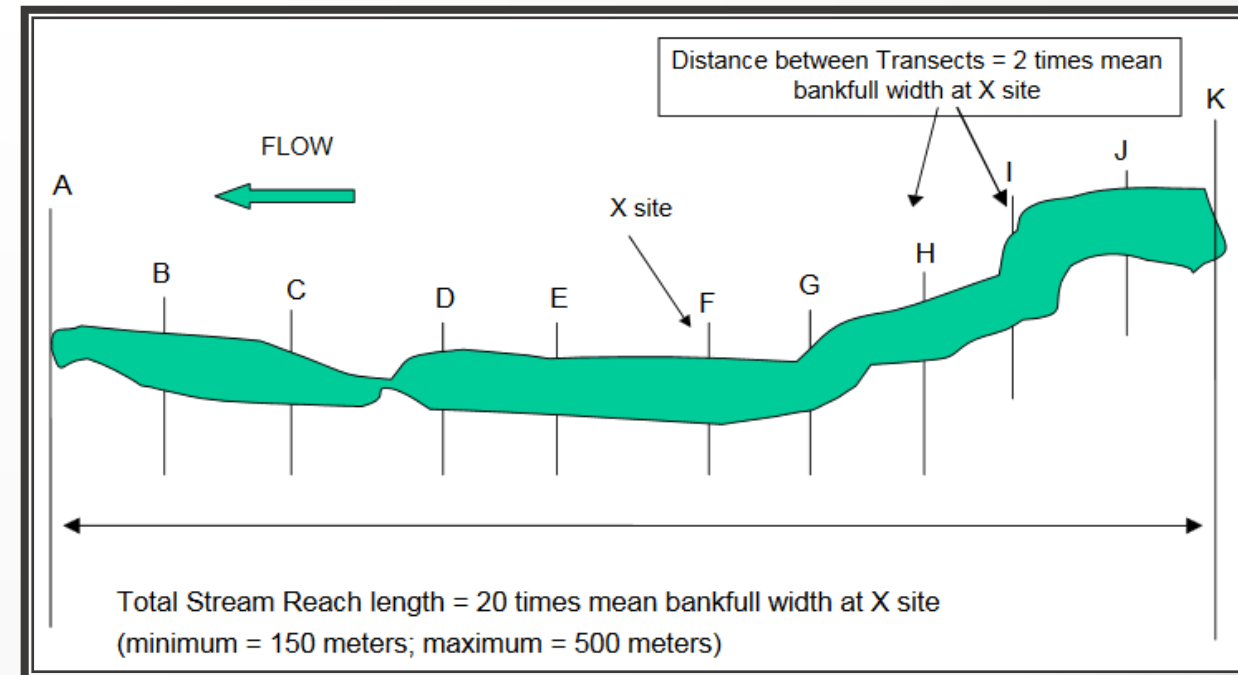
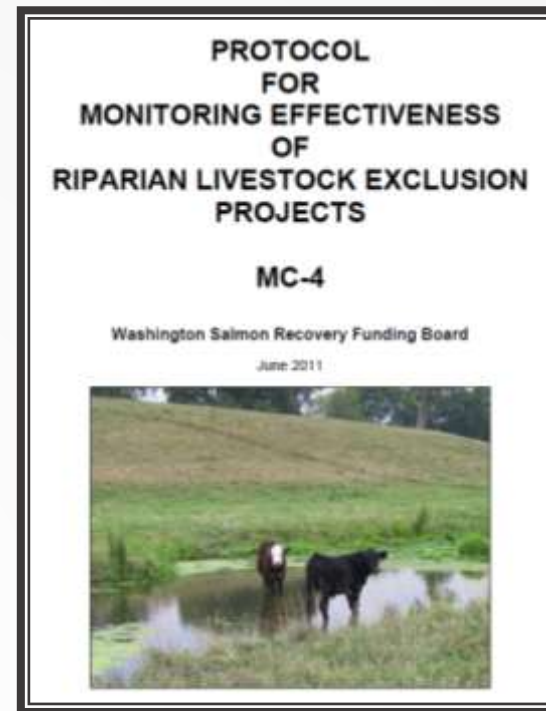


Site name	County (State)	Site elev. (m)	Precip. (cm/yr)	WW (m)	Treatment description
Abernathy	Cowlitz (WA)	27	202	7.5	Fencing, riparian plantings
Hoy	Skagit (WA)	34	267	115.4	Fencing, riparian plantings
Vance	Grays Harbor (WA)	12	168	5.6	Fencing, riparian plantings
Indian Creek-Yates	Pend Oreille (WA)	744	93	5.0	Fencing, fish passage improvements
Rauth Coweeman	Cowlitz (WA)	73	151	3.2	Fencing, instream structures, and fish passage improvements
Bottle	Union (OR)	1,463	89	3.1	Fencing (replace temporary electric fence with barbed wire lay down fence)
NF Clark	Union (OR)	1,387	86	2.7	Fencing (replace temporary electric fence with barbed wire lay down fence)
Greys	Coos (OR)	9	160	2.4	Fencing
Jordan	Lane (OR)	143	132	3.0	Fencing, off-channel watering, blackberry removal, riparian plantings
Johnson	Coos (OR)	21	193	3.9	Fencing
Noble	Coos (OR)	24	194	2.0	Fencing, riparian plantings
MF Malheur	Harney (OR)	1,073	54	14.0	Fencing, instream structures, riparian plantings



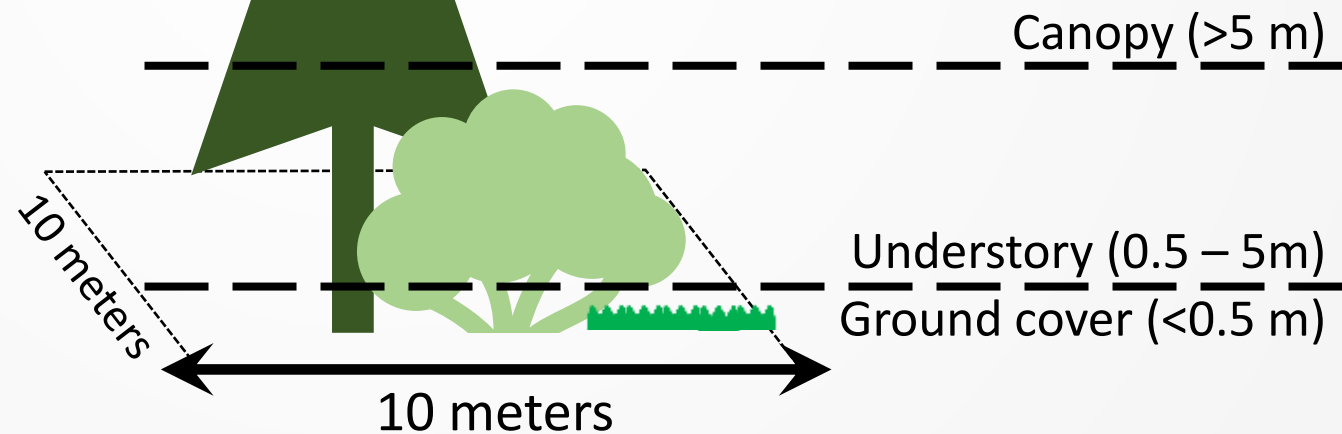
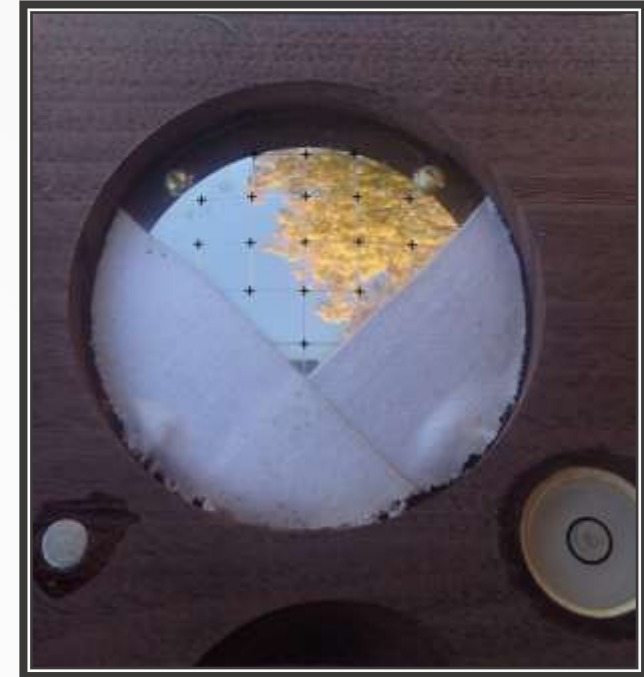
Methods – Field

- Protocols developed by SRFB
- Reach length and layout
 - 20x the average bankfull width
 - 11 equally spaced transects



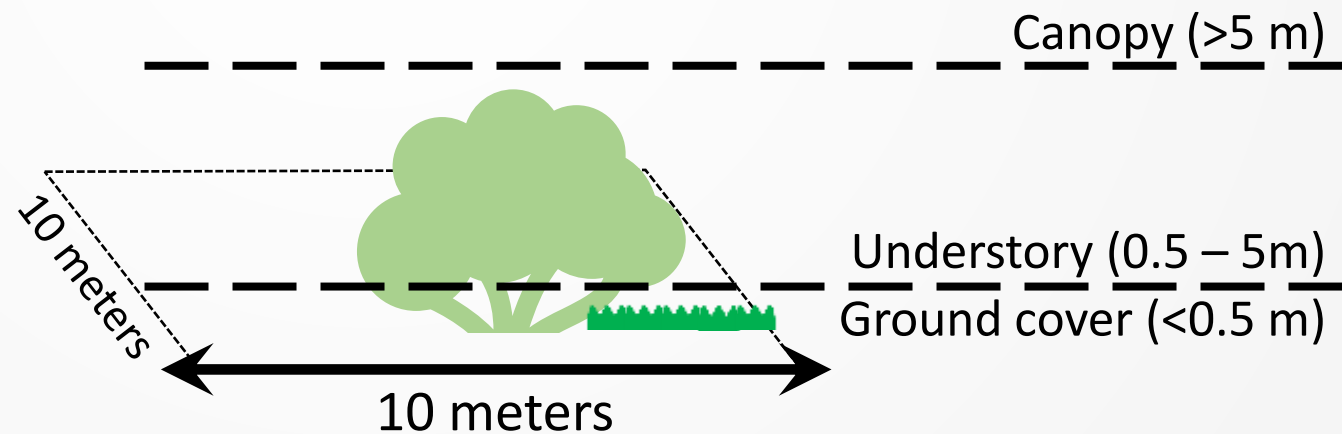
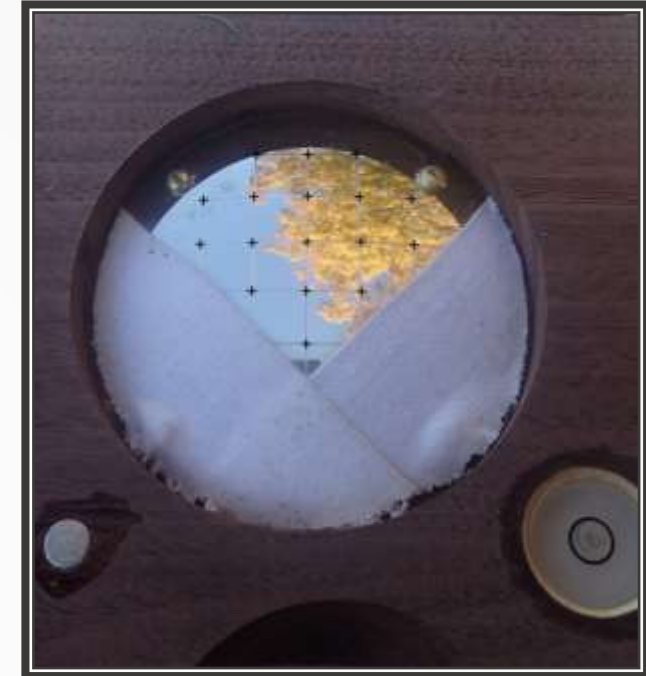
Methods – Field

- % bank erosion
- Riparian vegetation structure
- Bank canopy cover/shade



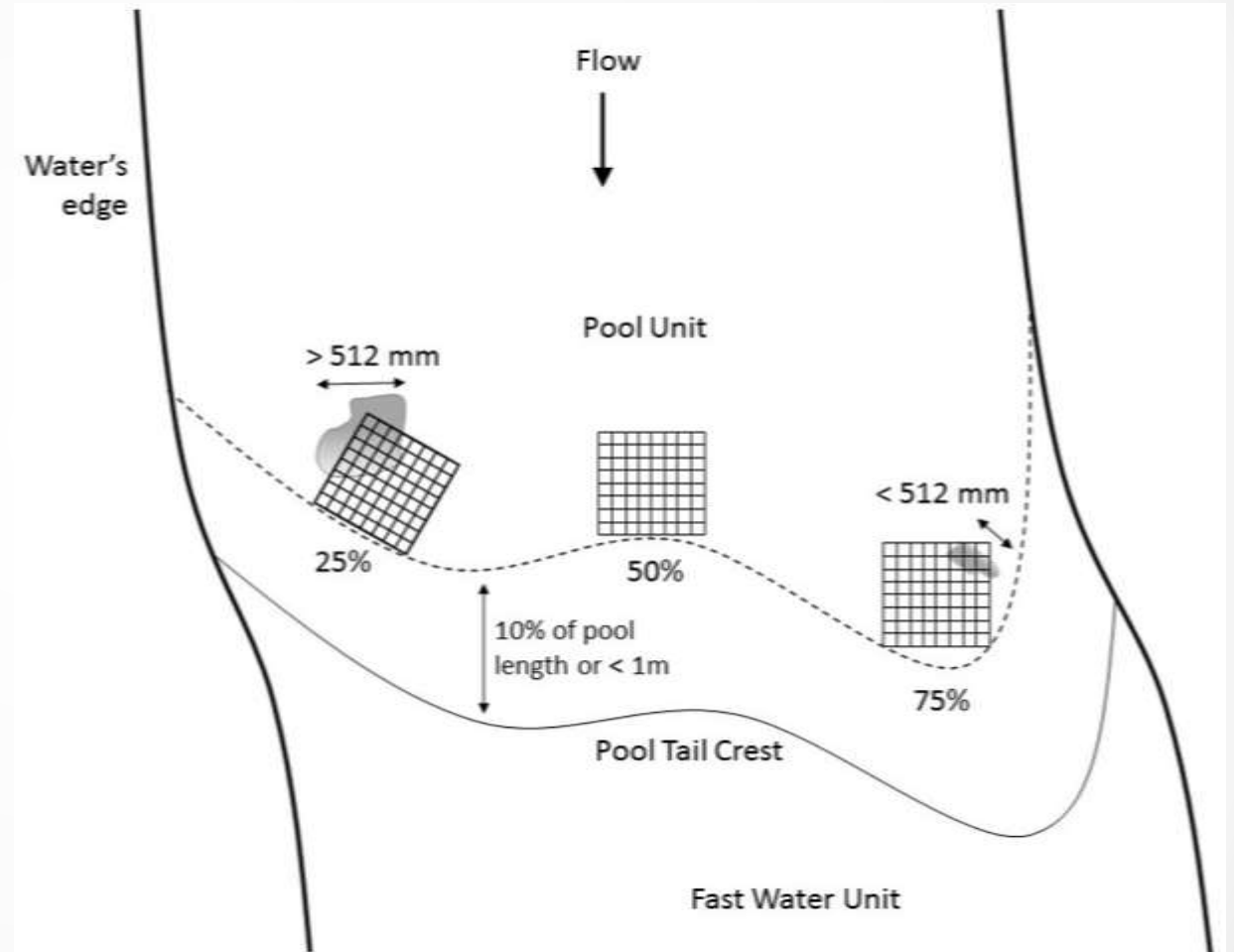
Methods – Field

- % bank erosion
- Riparian vegetation structure
- Bank canopy cover/shade



Methods – Field

- Pool tail fines*
- Livestock presence and fencing assessment

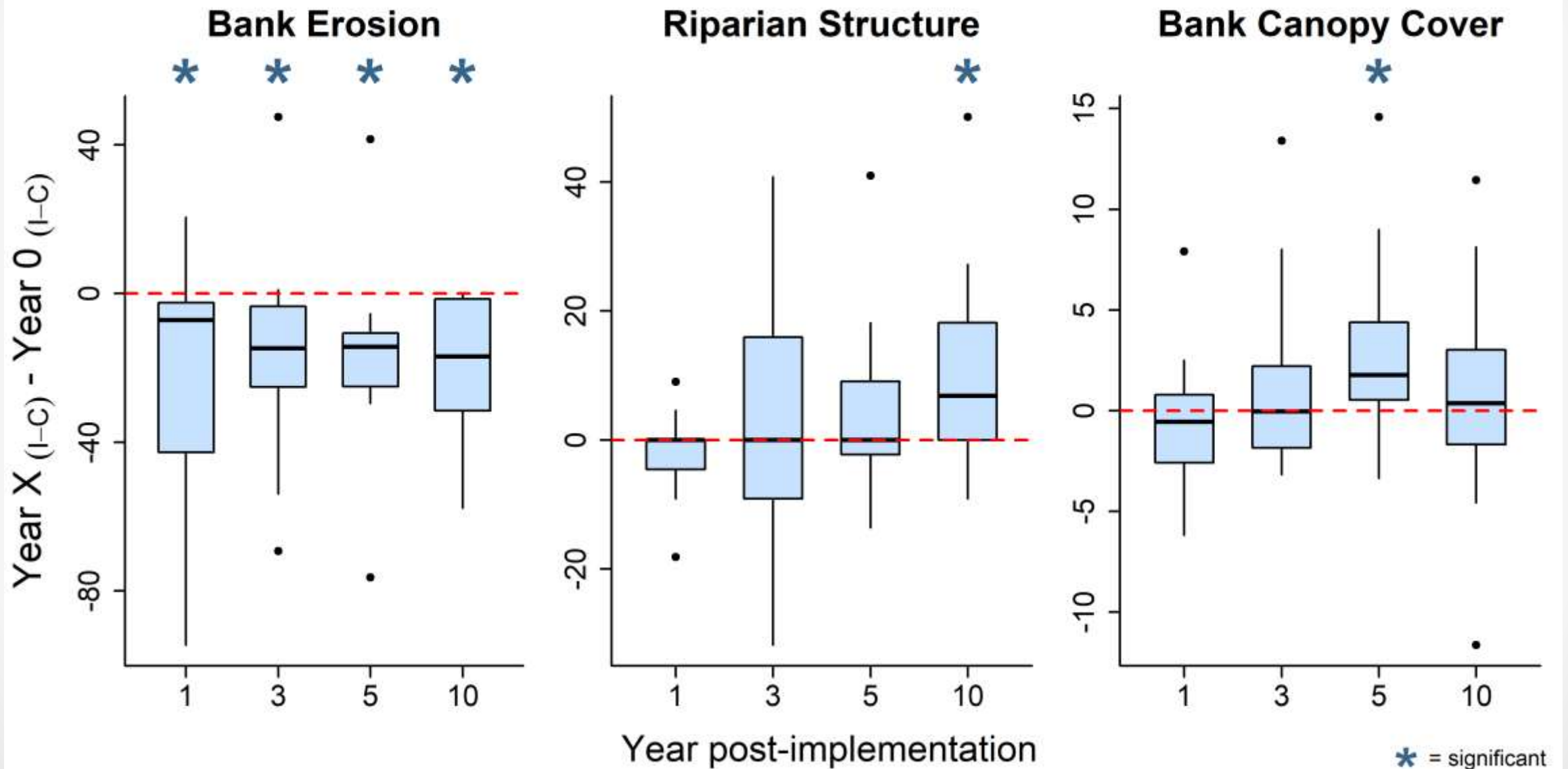


Methods – Analysis

Metric	Yr 0 (I-C) vs. Yr 1 (I-C)	Yr 0 (I-C) vs. Yr 3 (I-C)	Yr 0 (I-C) vs. Yr 5 (I-C)	Yr 0 (I-C) vs. Yr 10 (I-C)
Bank erosion	Wilcoxon	<i>t</i> -test	<i>t</i> -test	Wilcoxon
Riparian vegetation structure	<i>t</i> -test	<i>t</i> -test	Wilcoxon	Wilcoxon
Bank canopy cover	Wilcoxon	Wilcoxon	<i>t</i> -test	Wilcoxon
Metric	Paired Impact vs. Control			
Pool tail fines	<i>t</i> -test			



Results



Results

- Pool tail fines: Significantly lower in impact than control reaches for both <2 mm and <6 mm
- At least one project with fencing that had recent signs of livestock each post-implementation year



Exclusion assessment in impact reach	Yr 1	Yr 3	Yr 5	Yr 10
# sites with signs of livestock	1	3	5	4
# sites with fencing not functioning as intended	0	1	4	4

Conclusions

- Results for bank erosion and riparian structure are consistent with the literature
 - Gradual response of vegetation
 - Protocols and metrics could be improved



Recommendations

- More rigorous selection of impact and control reach pairings
- Monitor biota (fish, invertebrates) and in-channel features
- Focus on implementation and compliance monitoring



Questions?

