Tongass National Forest Restoration Monitoring

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Tongass National Forest

USFS/NRCS Large Wood Workshop
Craig, September 2023

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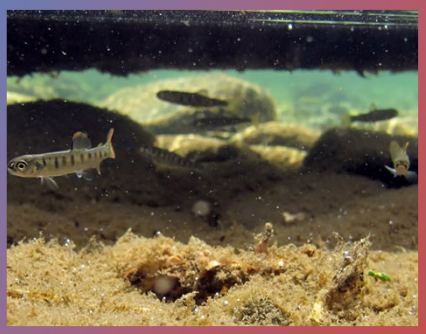

Key Messages

- We <u>should</u> monitor our projects!
- Monitoring objectives should tie to restoration objectives
- Consider ability to implement monitoring plans.
- Streams adjust for years/decades after restoration.
- <u>Need to improve reporting</u>

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Why Monitor?

- Accountability
- Critical for adaptive management
- Determine ecosystem linkages
- Test hypotheses and conduct field experiments
- Continued support for these projects

Kuiu Is. restoration

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Define project goals and objectives and the suite of indicators to assess project success

Define questions, hypotheses and monitoring scale

Select monitoring design

Determine sampling scheme for indicator collection – indicators and number of sites and years to monitor

Implement monitoring program

Analyze and communicate results:
- maintenance measures,
- Make adaptations,
- Incorporate lessons for future projects

Suggested Restoration Monitoring Template

Modified from Woolsey et al. 2007. A strategy to assess river restoration success. Freshwater Biology 52, 752-769 and Roni 2005. Monitoring Stream and Watershed Restoration.

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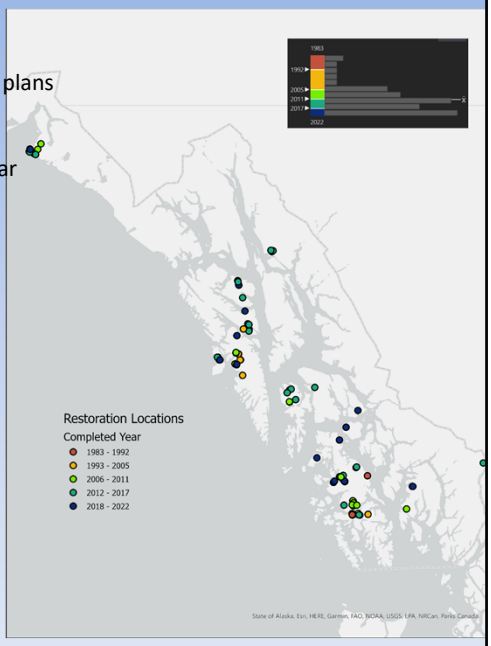
What are we currently doing?

- ✓ Including a monitoring plan in our project plans
- ✓ Focusing the monitoring requirements on restoration objectives.
- ✓ Successfully monitored at the 1,2,5, 10 year post-restoration intervals.
- ✓ Conducted a Forest-wide effectiveness monitoring program (In Analysis with FSL)
- X **Written concise monitoring reports**
- ✓ Adapted our methods based on our monitoring.



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General Tongass In-stream Restoration Goals

Large Wood Placement in Streams

- Maintain existing and increase pool habitat
- Maintain and increase in-stream habitat complexity
- Accelerate recovery of riparian areas and function; reduce timeframe for future input
- Improve stream bank stability

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Alaska Region Core Aquatic Habitat Restoration Monitoring Guidance

- Three Components/Phases:
  - Pre-restoration measurements of core parameters
  - Assessment of immediate post-restoration habitat conditions and compare to reference
  - Monitoring of the same core parameters at longer time intervals to detect trends

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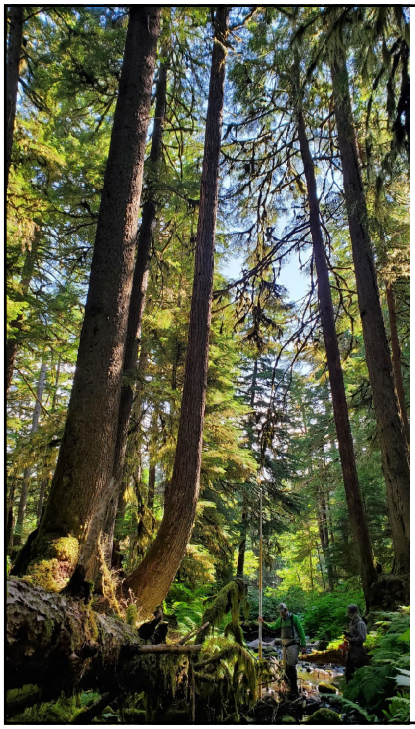

Core Aquatic Habitat Parameters

- Tongass dataset – over 300 stream reaches (*Statistical Update in Progress*)
- **Core Habitat Parameters** for floodplain and moderate gradient mixed control reaches:
  - Width/depth ratio
  - Key Wood
  - Pool frequency
  - Pool quality
  - Other metrics provide context*

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Example of Interpretation of Project Results

Values of Habitat Management Objectives for a Large Flood Plain Channel (bankfull width >20m)

Habitat Management Objectives for *FPL*	Pools/Km	Pool length/ meter	Pool Space*	RPD/C BW	TLW/M	TKW/M
25th percentile (fair condition)	10	0.18	3.2	0.03	0.15	0.02
25th-50						
50th percentile (good condition)	20	0.42	2.7	0.03	0.17	0.03
50-75th						
75th percentile (excellent condition)	25	0.44	1.7	0.03	0.46	0.08

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Harris River Restoration example

Habitat Response Variable Values for the Harris River Intensive Monitoring Reach

Habitat Response Variable	Year				
	2008 pre	2009 pre	2009 post	2010	2011
Total Mainstem Distance Surveyed (m)	628	653	493	597	598
Average Channel Bed Width (m)	25.5	25.2	28.2	28.2	28.2
Number of Pools per Kilometer (Pools/Km)	29	34	32	28	33
Average Residual Pool Depth (m)	1.06	0.89	0.99	1.17	0.98
Average Residual Pool Depth/Average Channel Bed Width(RPD/CBW)	0.04	0.04	0.04	0.04	0.03
Pool Length per Meter (Plength/M)	0.65	1.01	0.99	0.94	1.05
Pool Space	1.37	1.18	1.09	1.25	1.06
Average Max Pool Depth	1.4	1.18	1.34	1.50	1.25
Total Wood	245	673	1651	1589	1657
Total Key Pieces	40	38	124	97	101
Total Wood per Meter (TLWD/M)	0.39	1.03	3.35	2.66	2.77
Total Key Wood per Meter (TKWD/M)	0.06	0.06	0.25	0.16	0.17

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Structure Objectives and Photo-Point Monitoring

Jam number:	01A	Begin Dist:		GPS Coordinates:	Placement: ☐Heli X:HvyEqu ☐Hand
Picture #:		End Dist:		Type of Structure:	X Formidable Multifaceted ☐ Apex Jam ☐ Porous Jam ☐ Bar Buddy ☐ Other
Location:	X Main Channel ☐ Side Channel ☐ Inside Bend ☐ Outside Bend X Straight Reach ☐ Downstream Right Bank X Downstream Left Bank ☐ Mid-channel ☐ Island				
Current Primary Habitat Association:	☐ Pool X Riffle ☐ Gravel Bar ☐ Bank ☐ Floodplain ☐ Off Channel				
Design Objectives: Identify the original Primary, Secondary and Tertiary objectives of the structure by **numbering them 1-3.**					
_1_ Develop/Enhance Pool			2 Enhance/Create Cover for Fish		3 Protect Bank (small scale)
Is the primary objective currently being met? ___Yes ___No **Are the secondary and tertiary objectives currently being met?** ___Yes ___No					
Rationale:	Long featureless run with little complexity, between 2 riffles. Bank deteriorating. Structure will aim to develop pool and provide cover while also preventing additional bank deterioration.				

Photo Tag and Stake Location: Tag on DRB, 15 feet from edge of bank. Stake on DRB 10 feet back from bank, inline between tag and stream.
Camera Location Description: On stake.
Photo Description with Orientation (upstream, downstream etc.) Looking across channel at DLB and FMF jam. 3 shots in panorama.

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Floodplain Complexity and Connectivity

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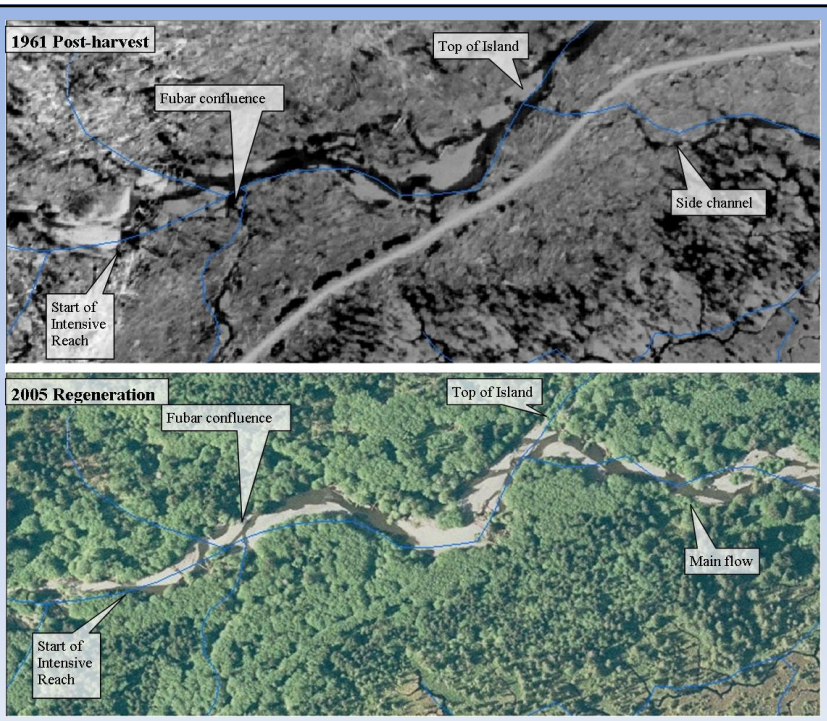

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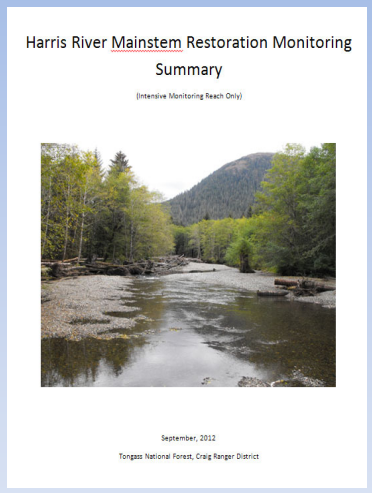
Presentation of Results

- Project narrative
- Project timeline
- Specific targets
- Implementation narrative
- Costs
- Monitoring summary
  - Maps
  - Quantitative tables
  - Structure intentions
  - Photo point and aerial photo depiction of change



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Forest-wide Restoration Retrospective Monitoring - Questions

- Does large wood placement improve habitat in the restored reaches?
  - Does large wood placement increase pool frequency and quality?
  - Does large wood placement increase habitat complexity?
  - Does large wood placement improve stream bank stability?
- What are the juvenile salmonid trends in the restored reaches?
  - Summer relative juvenile fish abundance
  - Summer fish size, K (condition factor), and age structure and
  - Fish species composition (diversity)

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Rotating Panel Design for Watershed Restoration Effectiveness Monitoring Number of Sample Reaches and Periodicity of Sampling

Category	2013	2014	2015	2016	2017	2018	2019	2020
	Panel 1				Panel 2			
Treated	Group 1				Group 1			
Mangaged	Group 1				Group 1			
Reference	Group 1				Group 1			
Treated		Group 2				Group 2		
Mangaged		Group 2				Group 2		
Reference		Group 2				Group 2		
Treated			Group 3				Group 3	
Mangaged			Group 3				Group 3	
Reference			Group 3				Group 3	
Treated				Group 4				Group 4
Mangaged				Group 4				Group 4
Reference				Group 4				Group 4*

n = six sites per group (18/yr)

Category
Treated (<1970s riparian harvest, large wood placement >2006)
Managed Control (<1970s riparian harvest, not restored but suitable for restoration >2018)
Reference (un-managed watershed)

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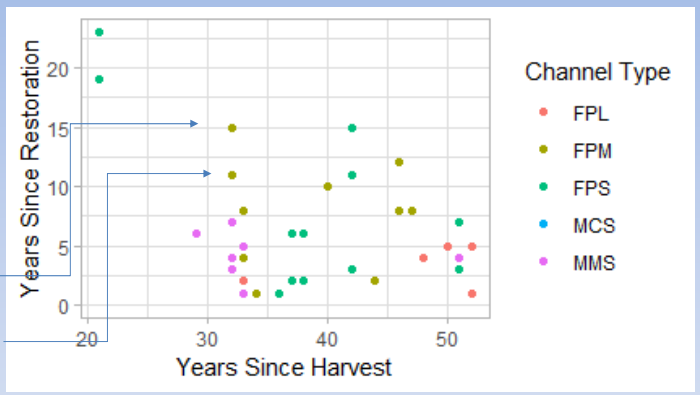
WREM restoration panel

Panel 2

Panel 1



WREM monitored 24 restoration sites for two sample periods after restoration was implemented.
Very little was similar about the sites except for the use of LW as the primary tool

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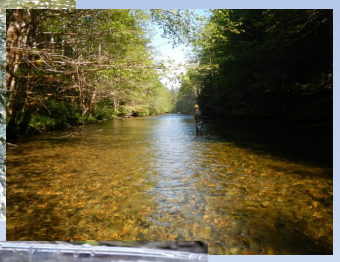
Tongass-wide Restoration Effectiveness Monitoring Tracking Metrics



Physical Metrics

- Channel Morphology
- Aquatic Habitat Condition

Biotic Metrics

- Summer relative juvenile fish abundance, fish size, K, age structure and diversity

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Physical - Channel Morphology

Cross Sections

- Width to Depth Ratio

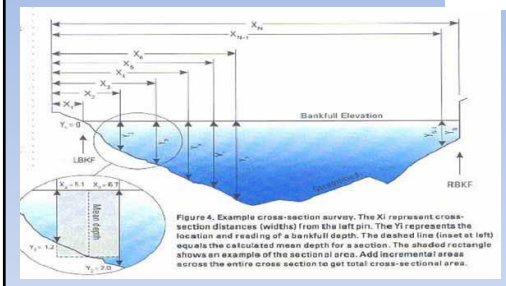
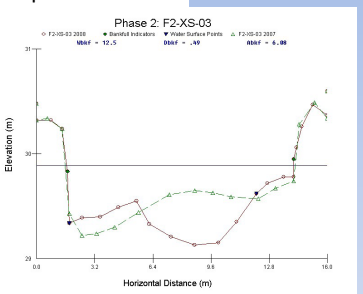
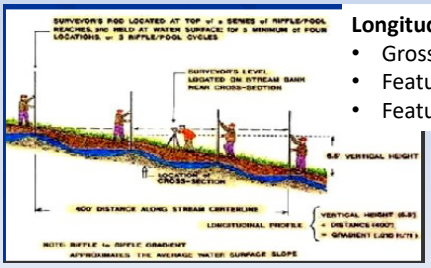


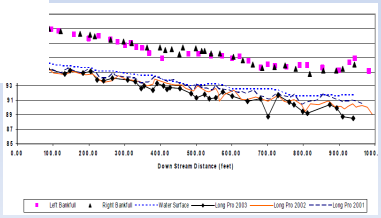
Figure 4. Example cross-section survey. The Xi represent cross-section distances (widths) from the left pin. The Yi represents the location and reading of a bankfull depth. The dashed line (inset at left) equals the calculated mean depth for a section. The shaded rectangle shows an example of the sectional area. Add incremental areas across the entire cross section to get total cross-sectional area.



Longitudinal Profile

- Gross bedform
- Feature slopes
- Feature locations





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Physical - Aquatic Habitat Condition

Habitat Response Variable	Equation	Data Collection Methods
Pools/Km (POOLS/KM)	Total Number of Pools / Meters Surveyed * 1000	Total count of pools. Total length of stream surveyed.
Pool Length/Meter (PLNGTH/M)	Total Pool Length / Total Length of Stream Surveyed	Sum of all pool lengths. Total length of stream surveyed.
Pool Spacing (POOL SPACE)	Length of Stream Surveyed / Channel Bed Width / Total Number of Pools	Total length of stream surveyed. Average channel bed width (width of active channel bed from bottom of bank to bottom of bank) averaged for the reach. Total number of pools.
Residual Pool Depth/ Channel Bed width (RPD/CBW)	Average of all pool residual depth / average channel bed width	Residual Pool depth = maximum pool depth – pool tail depth. Average channel bed width.
Total Large Wood pieces / Meter (TLWD/M)	Total Pieces / Meters Surveyed	Total count of large wood pieces >1 m long and 0.1m in diameter. Total length of stream surveyed.
Total Key Pieces Large Wood/Meter (TKWD/M)	Total Key Pieces / Meters Surveyed	Total count of key large wood pieces. (Key piece size based on average channel bed width of stream surveyed.) Total length of stream surveyed.

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Biotic Metrics

Biotic metric	Notes
Summer relative juvenile fish abundance	Based on one 90 minute minnow trapping event in small and medium channels; based on snorkel count in large channels
Summer fish size, K (condition factor), and age structure	Based on minnow trap event to sample subset of fish in reach
Fish species composition (diversity)	Based on above sampling
Fish species condition (K)	Quantitative comparison of the condition of fish between categories based on weight and length by species
Stream temperature	Celcius reading at time of fish sampling

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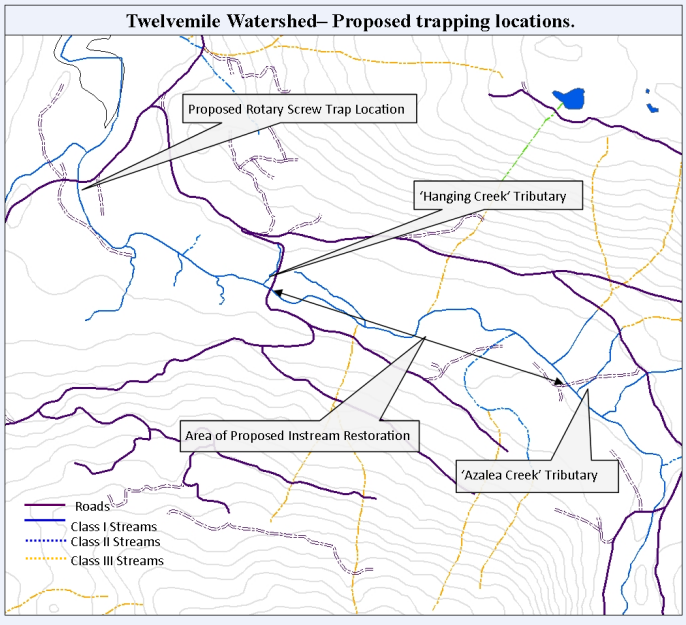
Smolt Monitoring – Watershed scale



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Preliminary Findings

- WREM (TBD winter/spring)
  - Testing new variables (complexity, substate methods, fish)
  - Post-restoration change continues for decades.
  - Fish move!
- Management Indicator Species Monitoring (MIS)
  - Fish populations stable but big storm events cause changes across all species.
  - Annual fish monitoring detects changes better than 4-year panel.
  - Habitat slow to change
- All Data Project (Statistical mining)
  - Some differences in LW in managed streams
  - Some changes in the variable significance
  - In preparation for publication
  - More work ahead!

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Final Thoughts

- *While the focus is on instream Large Wood we must consider the watershed as a whole.*
- *Each part of the watershed has seasonal, species-specific and life stage specific values.*
- *Long term effects of roads that affect hillslope processes and connectivity.*
- *Aiming for resiliency in the long term.*

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