Multi-variate regression of in-stream wood – Whole network to segment scale statistical modeling

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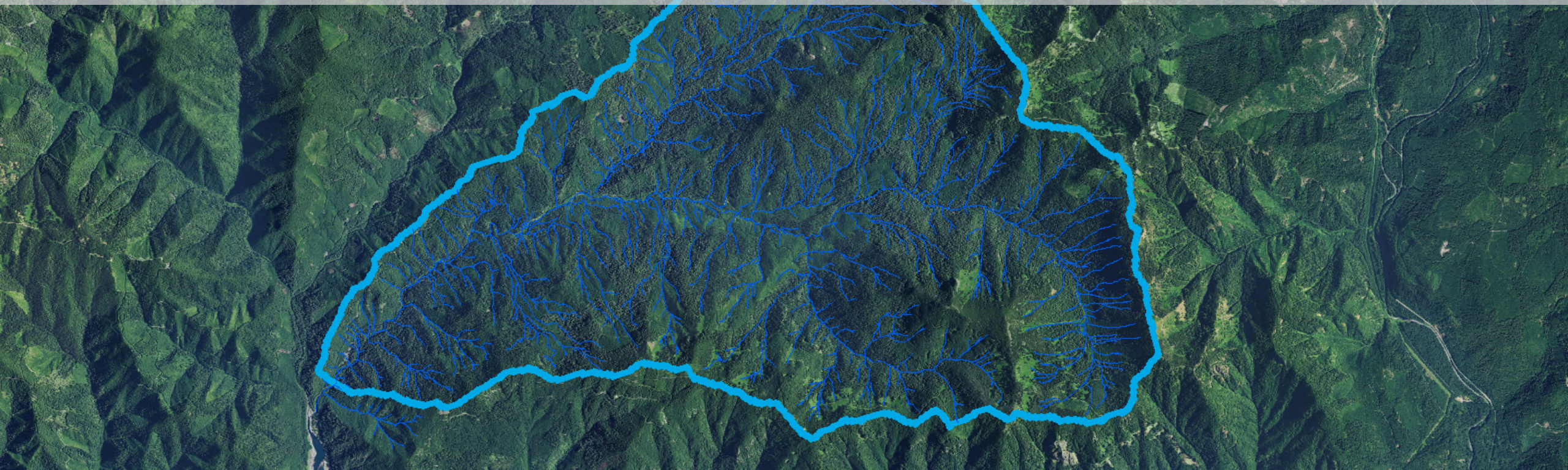
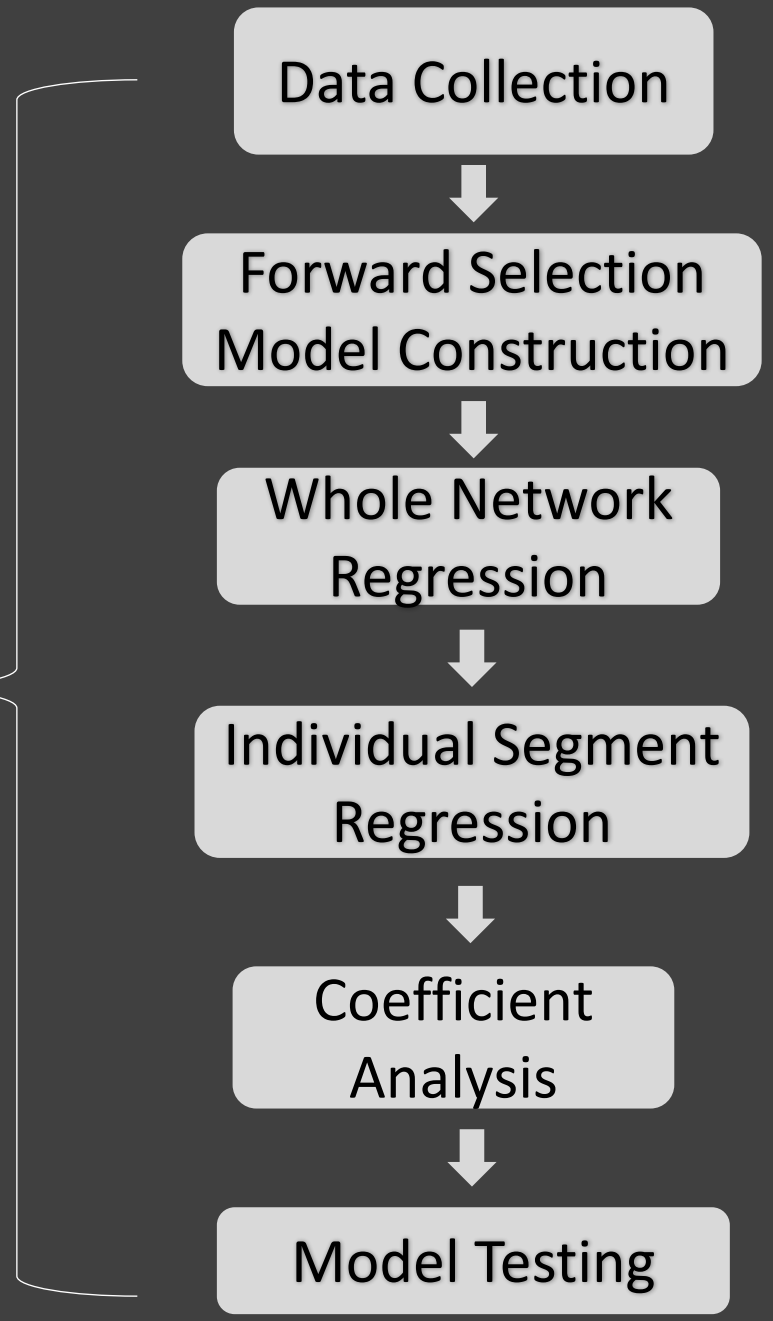
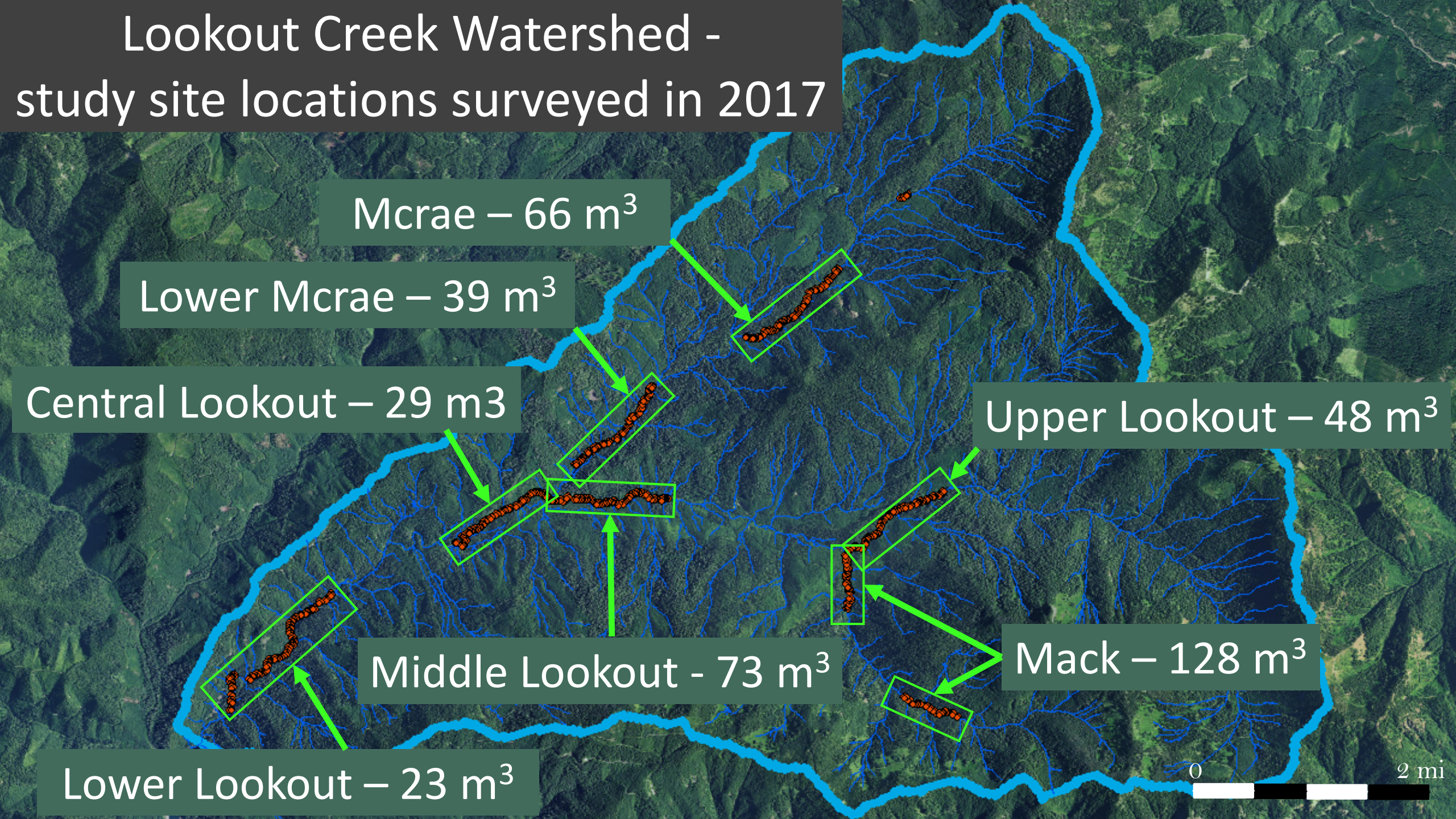


Study Question

How do forest harvests, road construction, and channel morphology affect in-stream wood and how do the dominant processes affecting wood variability change throughout the network?

Approach




Lookout Creek Watershed -
study site locations surveyed in 2017
Mcrae – 66 m3
Lower Mcrae – 39 m3
Central Lookout – 29 m3
Upper Lookout – 48 m3
Middle Lookout - 73 m3
Mack – 128 m3
Lower Lookout – 23 m3
0
2 mi

Measured Variables Used in the Regression

Type	Symbol	Description	Source
Response	WV	Wood volume per 50m stretch	Field data
Predictor	W	Active channel width averaged upstream/downstream	Field data
Predictor	E	Elevation averaged upstream/downstream	HJA 10M DEM
Predictor	G	Channel gradient	Field data
Predictor	S	Surrounding hillslope	HJA 10M DEM
Predictor	H	Area of historic harvest in 100-meter radial buffer	Harvest.shp
Predictor	R	Length of road in 100-meter radial buffer	HJA_Road.shp

Regression Results – Whole Network

$$\sqrt{WV} = 2.57\ln(W) + 8.49\sqrt{G} + 0.0151\,E - 0.00588\,R - 0.000104\,H + 3.17\sqrt{S} + 9.98\,S - 10.5$$

Variable	Coefficient Estimate	p-value	Overall Model Fit Statistics				
			R^2	Adjusted R^2	p-value	F-stat	n
(Intercept)	1.05E+01	7.54E-05					
Harvest [H]	-1.04E-04	2.42E-03					
Road [R]	-5.88E-03	2.97E-02					
Ln(Width) [W]	2.57E+00	9.10E-07					
Sqrt(Gradient) [G]	8.49E+00	9.40E-02	0.403	0.382	2.2E-16	19.92	215
Elevation [E]	1.51E-02	6.08E-05					
Sqrt(Slope) [S]	3.17E+00	4.39E-01					
Sqrt(Slope) [S]	9.98E+00	1.04E-02					

Upper Half Fit – Mack, Mcrae, Upper Lookout

Variable	Coefficient Estimate	p-value	Overall Model Fit Statistics				
			R^2	Adjusted R^2	p-value	F-stat	n
(Intercept)	-2.11E+01	2.03E-04					
Harvest [H]	-1.08E-04	1.74E-02					
Road [R]	-6.92E-03	2.87E-01					
Ln(Width) [W]	3.45E+00	2.04E-05	0.597	0.562	1.56E-13	16.94	91
Sqrt(Gradient) [G]	-3.62E-01	9.54E-01					
Elevation [E]	2.93E-02	1.56E-04					
Sqrt(Slope) [S]	1.13E+01	9.63E-03					
Sqrt(Slope) [S]	2.55E-01	9.38E-01					

Lower Half Fit – Central, Middle, Lower Lookout

Variable	Coefficient Estimate	p-value	Overall Model Fit Statistics				
			R^2	Adjusted R^2	p-value	F-stat	n
(Intercept)	-9.04E+00	1.31E-01	0.209	0.147	0.003	3.357	97
Harvest [H]	9.96E-06	9.09E-01					
Road [R]	-8.34E-03	4.71E-02					
Ln(Width) [W]	2.11E+00	1.60E-02					
Sqrt(Gradient) [G]	1.58E+01	1.08E-01					
Elevation [E]	1.25E-02	2.25E-01					
Sqrt(Slope) [S]	-1.43E+00	7.94E-01					
Sqrt(Slope) [S]	1.89E+00	6.60E-01					

R^2 Vs. Avg. Elevation

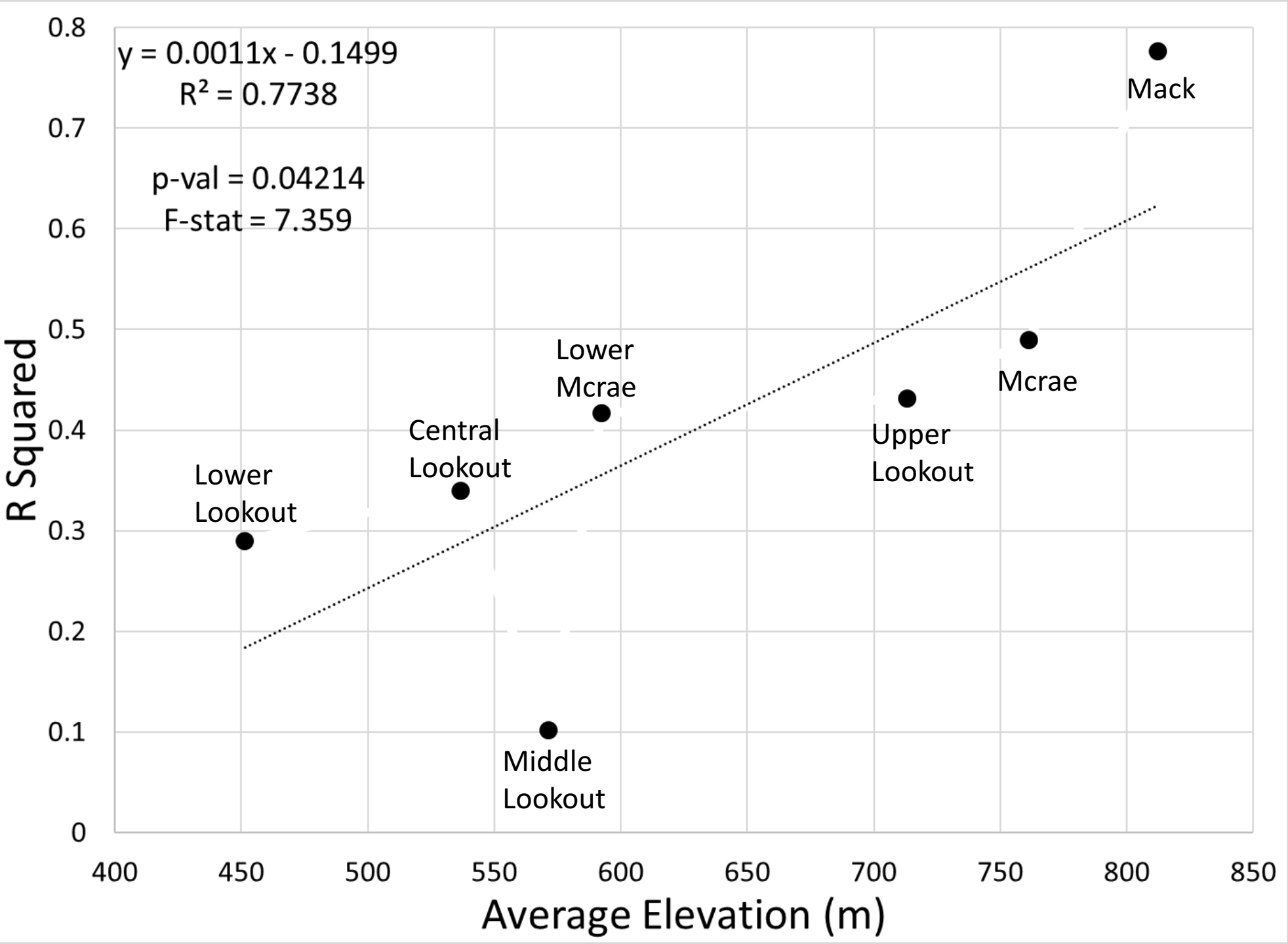
P–value < 0.05 indicates correlation

Higher elevation =

Less drainage area

Steeper hillslopes,

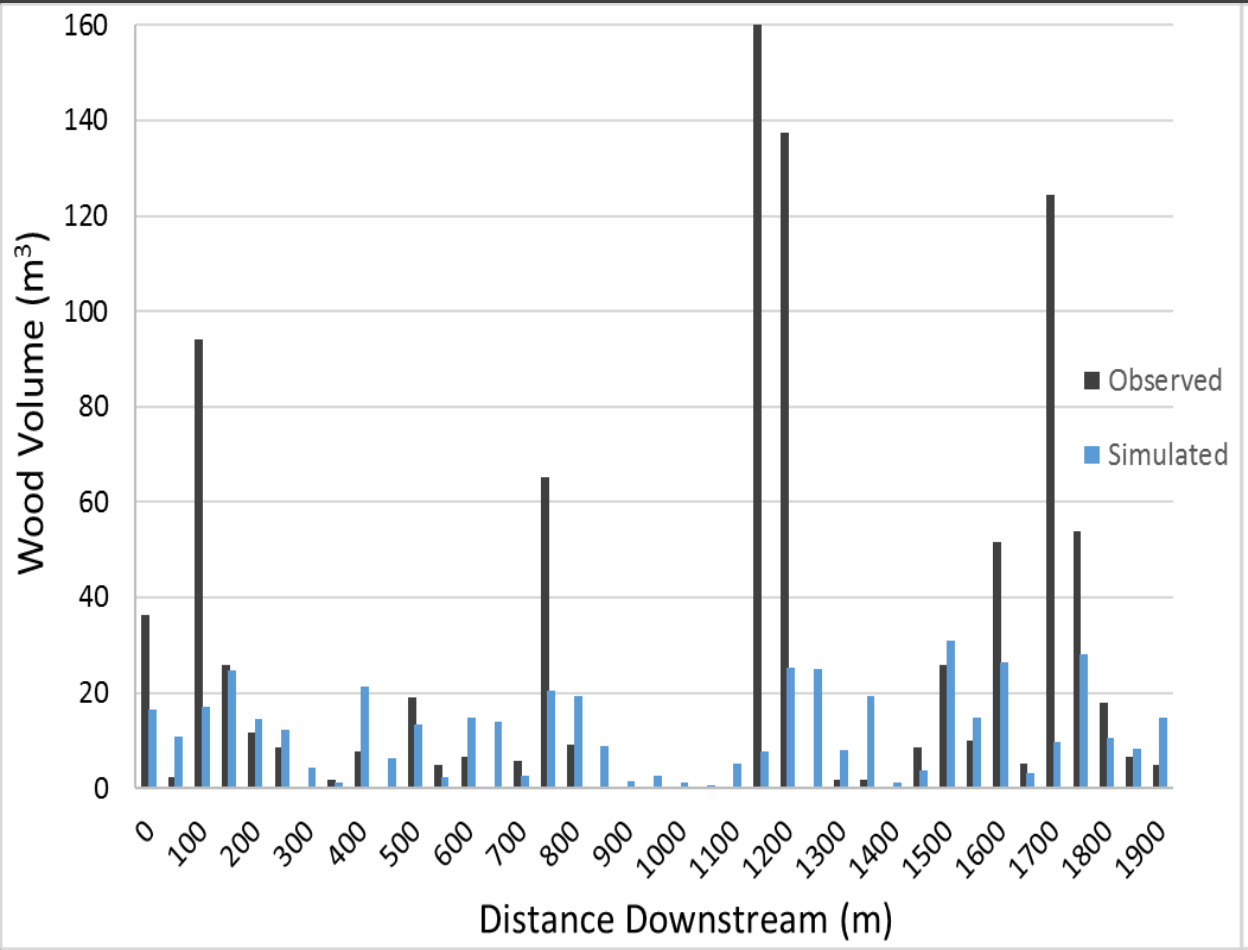
Less accessibility



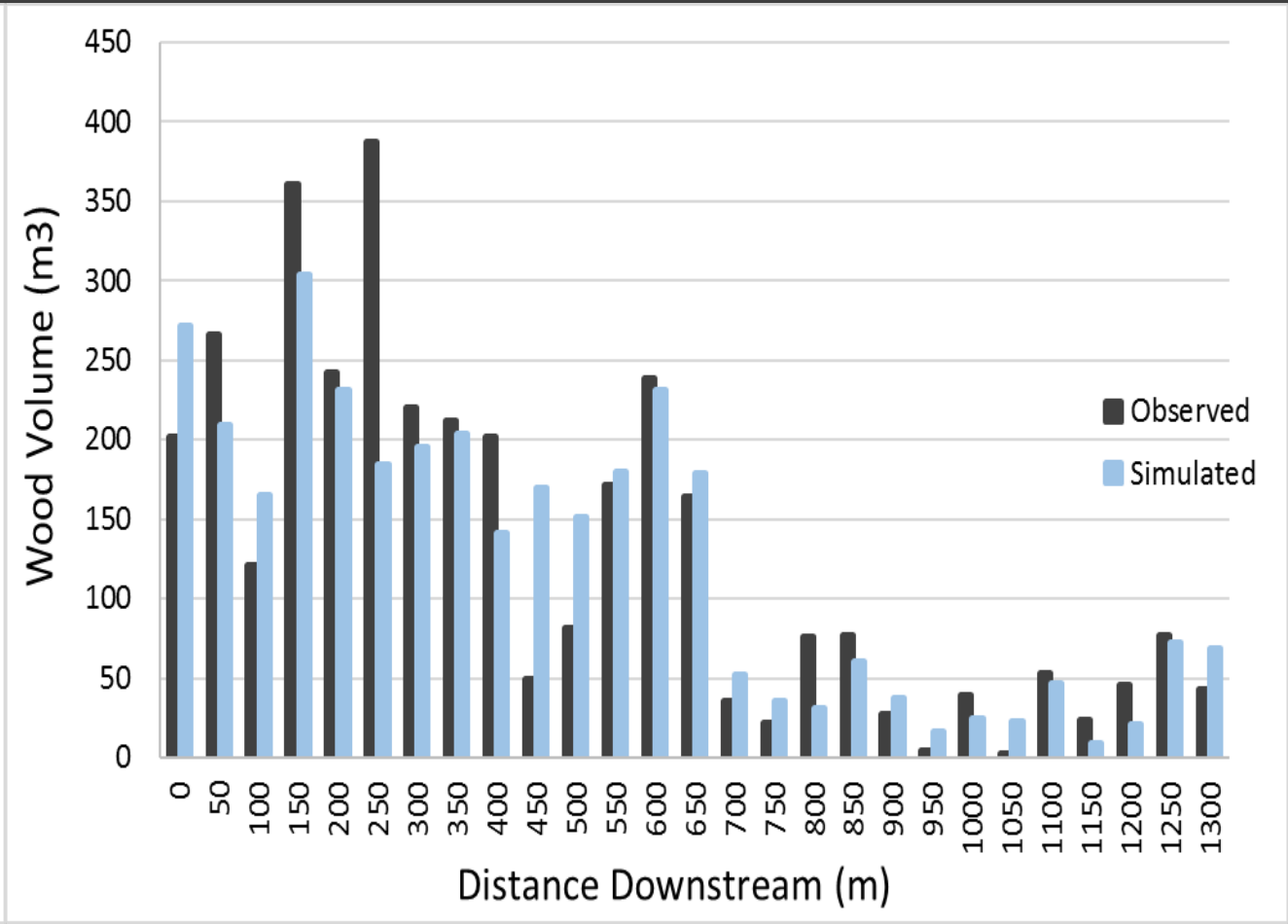
Simulated vs. Observed

Why? What's going on?

Lower Lookout



Mack Creek



Discussion

- In general, ↑ elevation → ↑ in-stream wood volume
- Road and harvest negative correlation with in-stream wood
- Locations high in network require analysis of wood input
- Locations low in network require analysis of wood input, fluvial transport potential, wood accumulation potential
- Log jams are common culprits for model inaccuracy

Questions?

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