Network Structure as a Modulator of Disturbance Impacts in Streams

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EISI Study Area: H.J. Andrews Experimental Forest

From Jones et al., 2000:

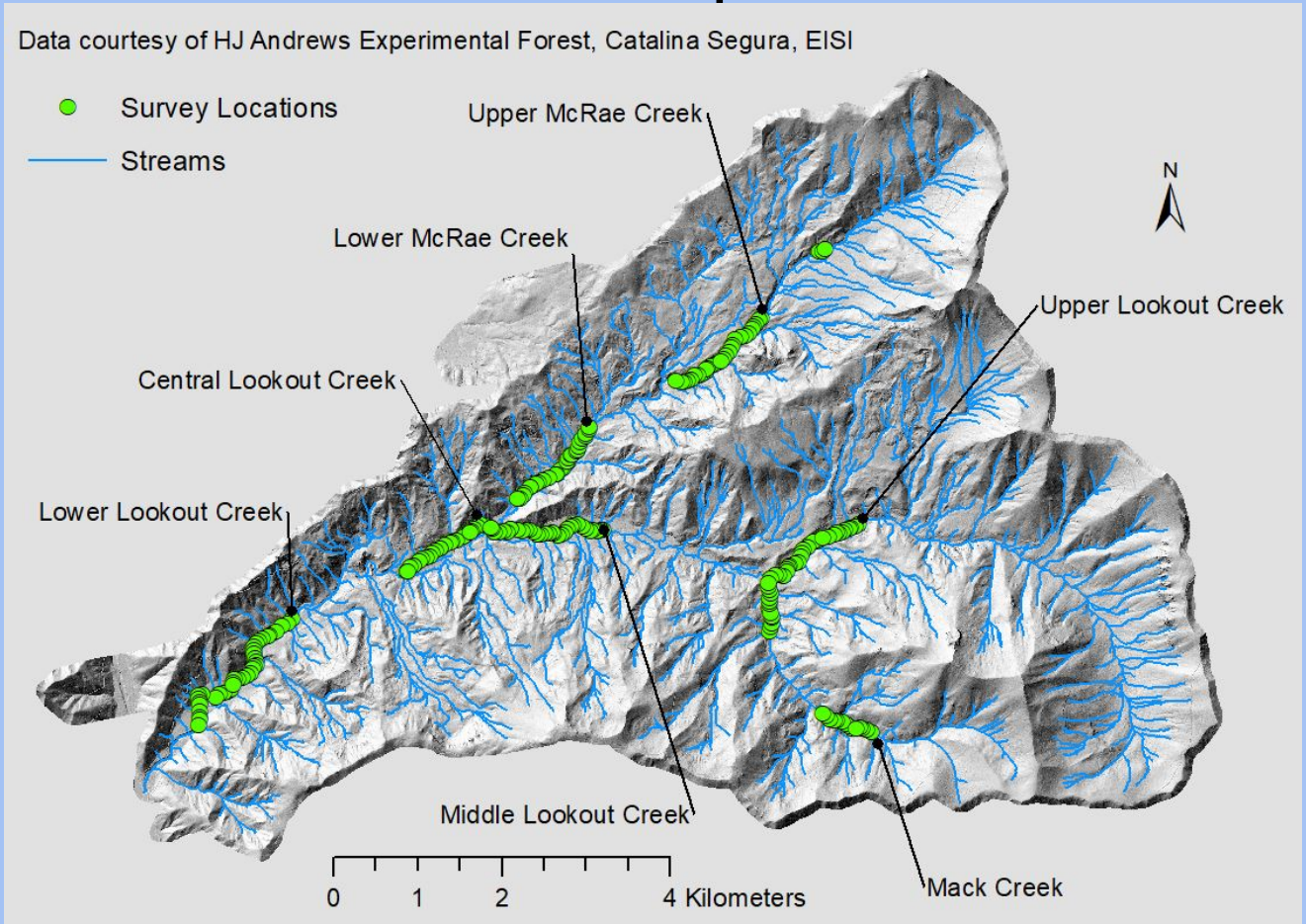
- Western Cascade Range, OR
- 64 km^2
- Old-growth Douglas-fir
- ~ 25 % of area harvested
- High road density (~2km/km^2)

Brent Davis (2017)

From Swanson, 1975:

- Volcanic influences (lava flows, pyroclastic deposits)

Study Area: H.J. Andrews Experimental Forest



Methodology

- Wolman particle counts with gravelometers
    - Logarithmic transformation
- Channel geometry & gradient measurements
- Large woody debris size class estimates
    - Czarnomski et al. (2008)
- GPS locations
- Photos

Brent Davis (2017)

Segments

Segment	Average Elevation (m)	Average Drainage Area (km^2)	Average Gradient	Average Wood Volume per 50 Meters (m^3)	Average Channel Width (m)
Upper McRae Creek	761	8.055	8.20%	66.3	9.1
Lower McRae Creek	592	15.514	3.50%	39.1	13
Upper Lookout Creek	713	17.016	4.50%	49.2	13.6
Middle Lookout Creek	571	34.188	2.70%	85.1	18.5
Central Lookout Creek	537	53.613	1.90%	31.2	31.4
Lower Lookout Creek	451	62.419	1.40%	23.3	18.2
Mack Creek	812	8.573	9.90%	124	9.2

Road and Harvest Disturbances

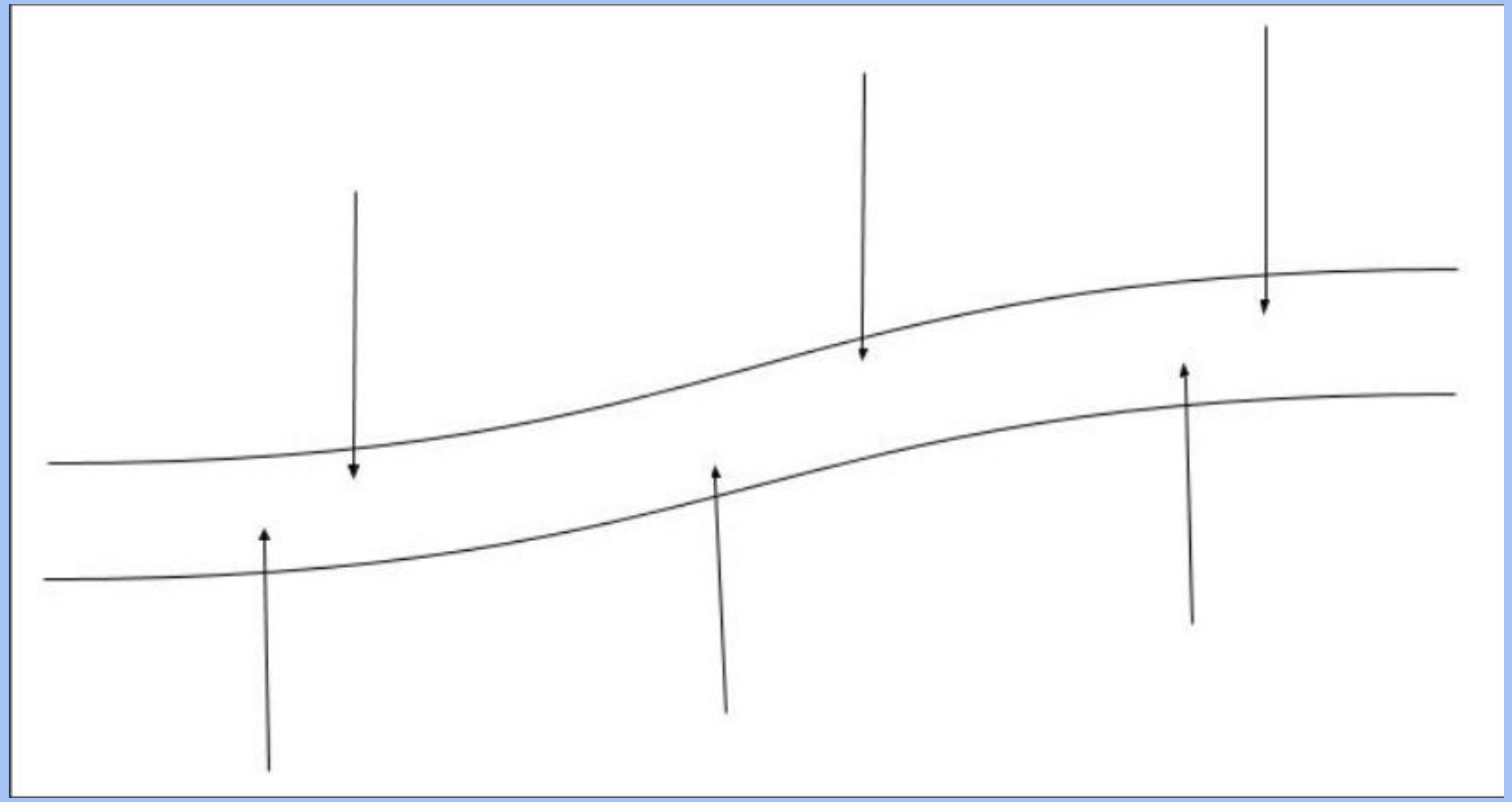
Potential impacts of roads:

- Conduits for sediment and water (Jones et al., 2000)
- Interactions with slope mass movements (Jones et al., 2000)
- “Plugged” culverts (Wemple et al., 2001)

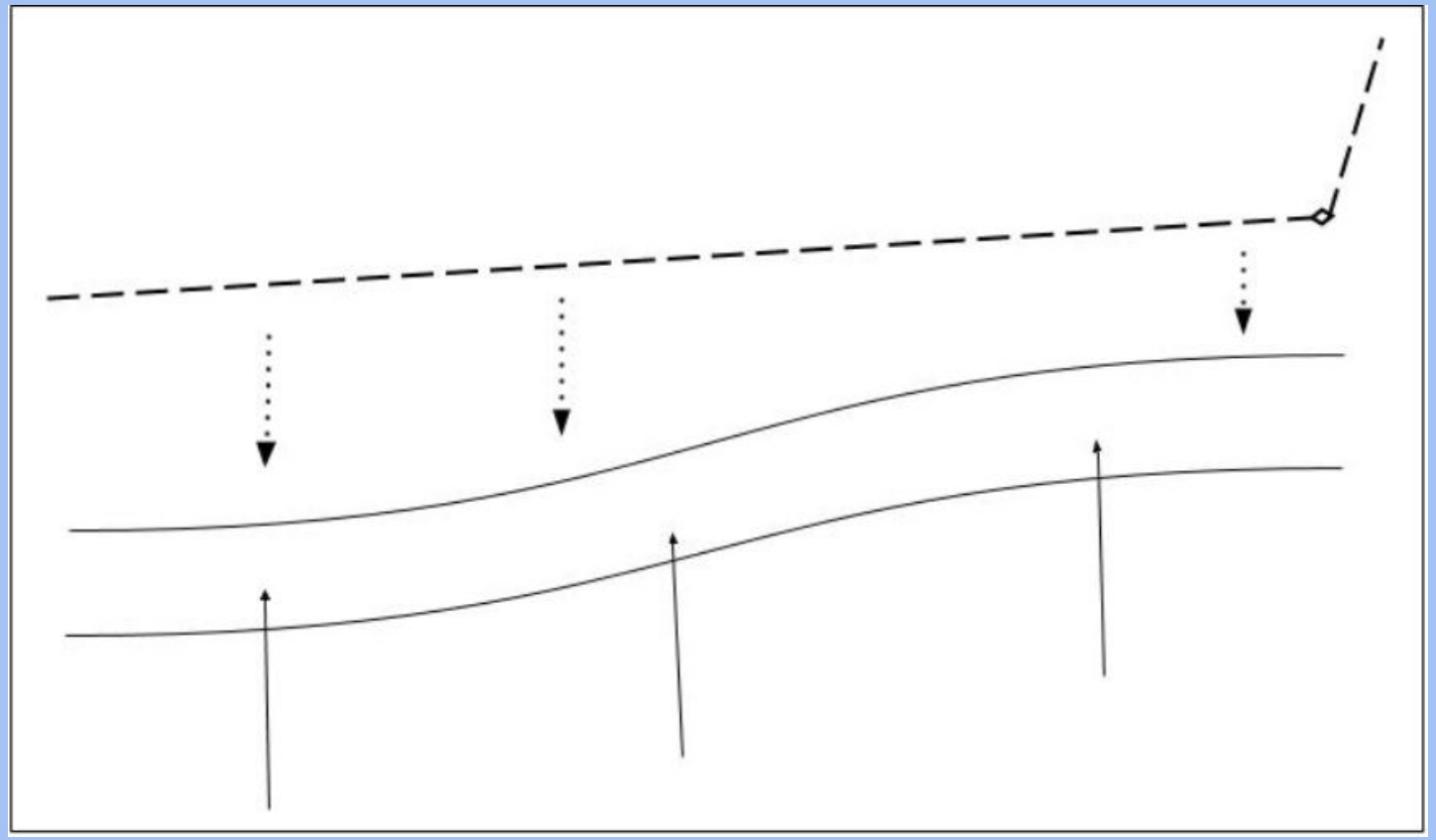
Potential impacts of both road and harvest activities:

- Removal of sources of large woody debris to streams (Jones et al., 2000, Czarnomski et al., 2008)
- Destabilization of hillslopes (Swanson & Dyrness, 1975)

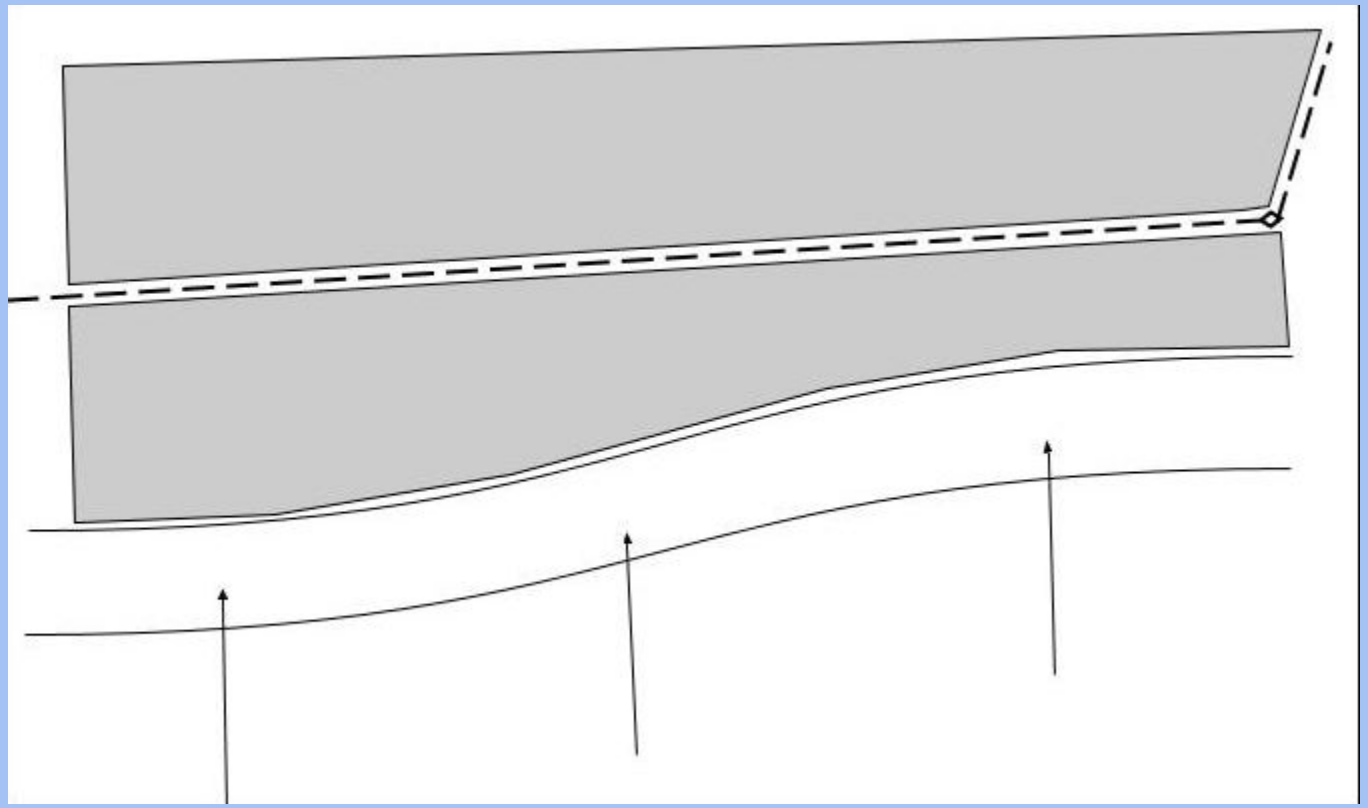
Conceptual Models for Disturbance Impacts



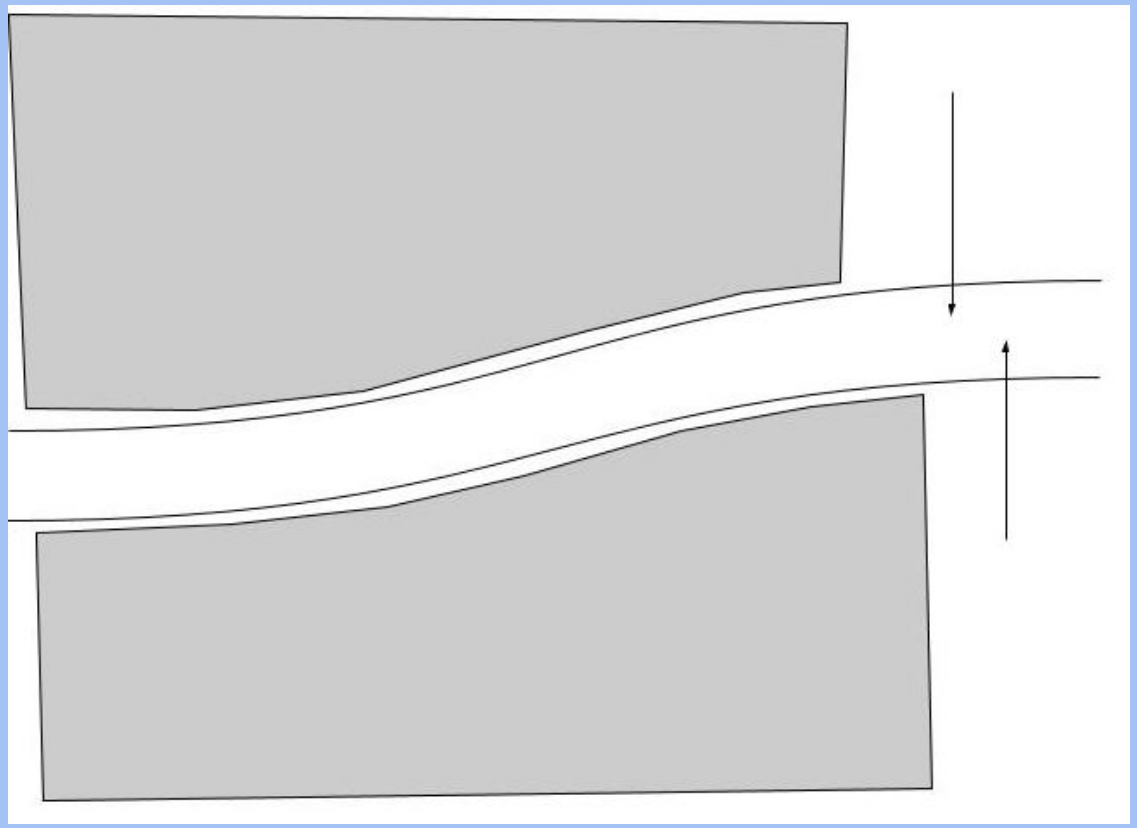
Conceptual Models cont’d



Conceptual Models cont’d



Conceptual Models cont’d

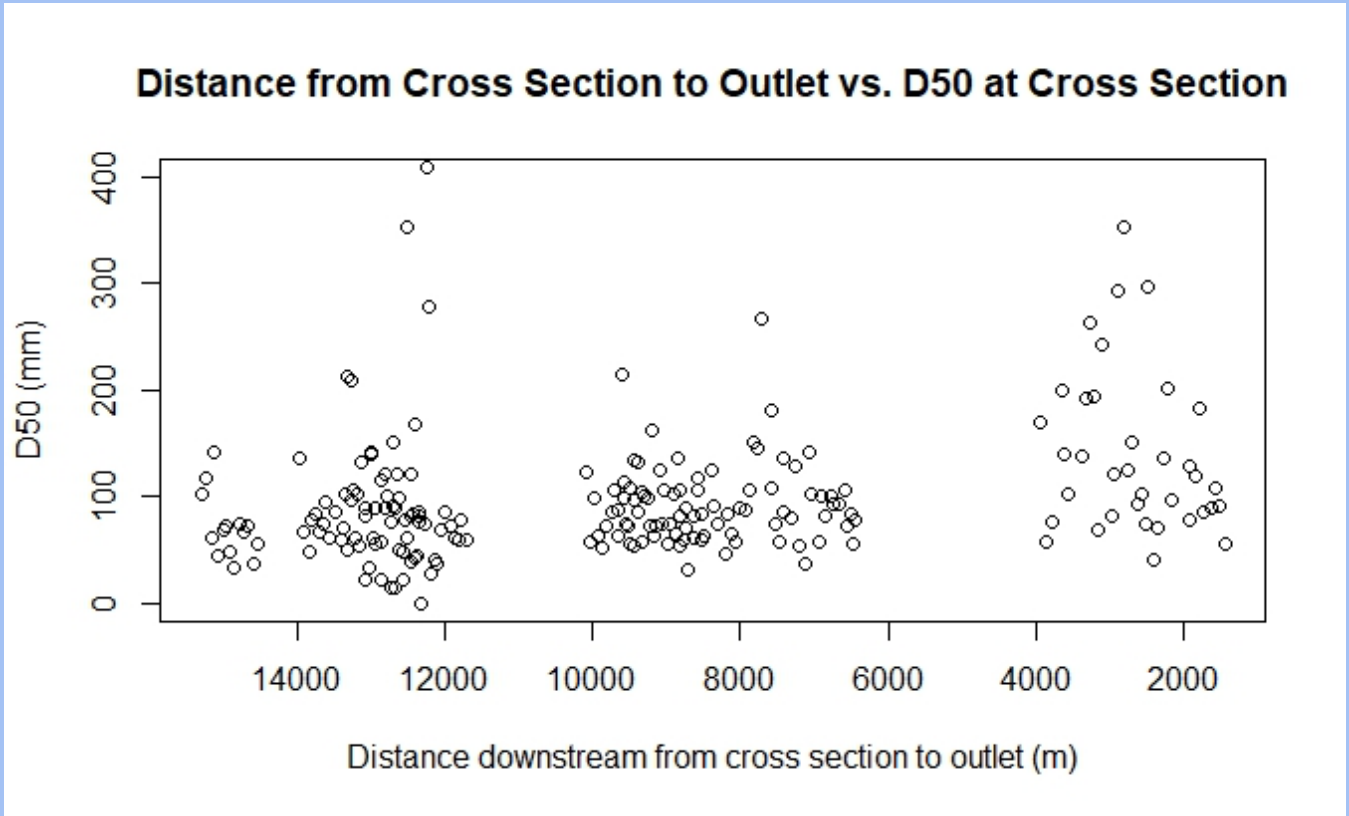


Study Questions:

1) Does the proximity of roads and forest harvest areas to streams affect sediment size?

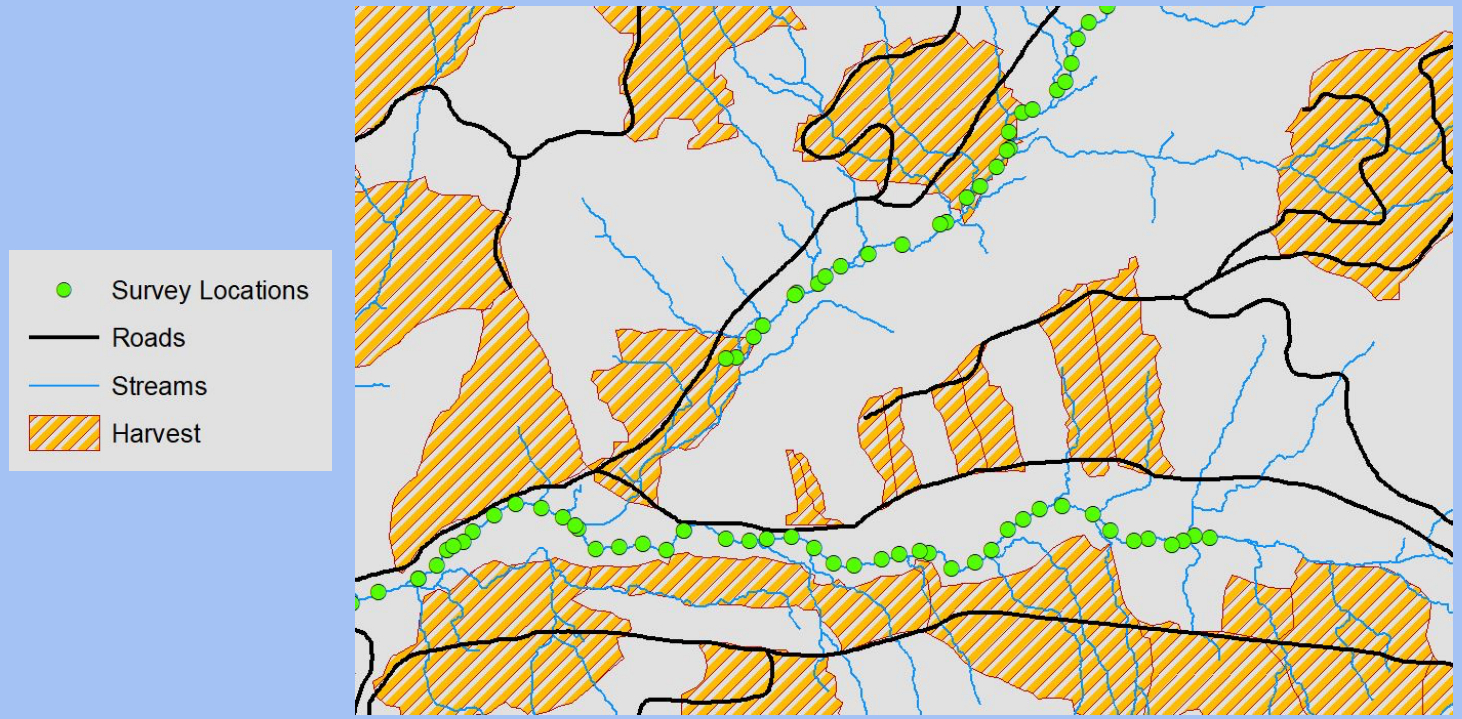
1) If the above disturbance impacts are observed, how might the quantitative structure of the river network influence the location and magnitude of the above effects on channel substrate?

Longitudinal Trends in Grain Size



Spatial Analysis

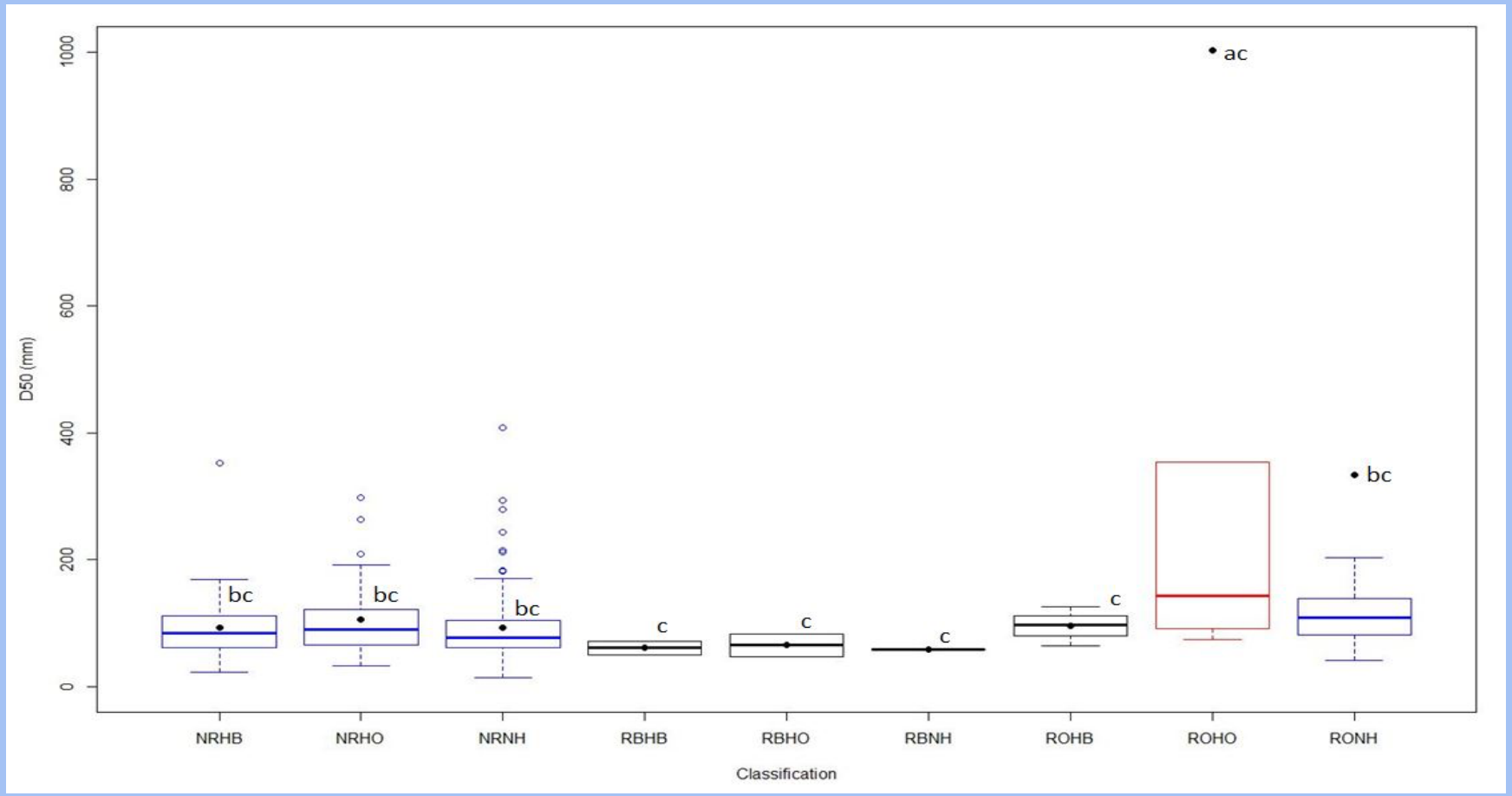
- Classifications based on proximity to roads, harvest areas in ArcMap



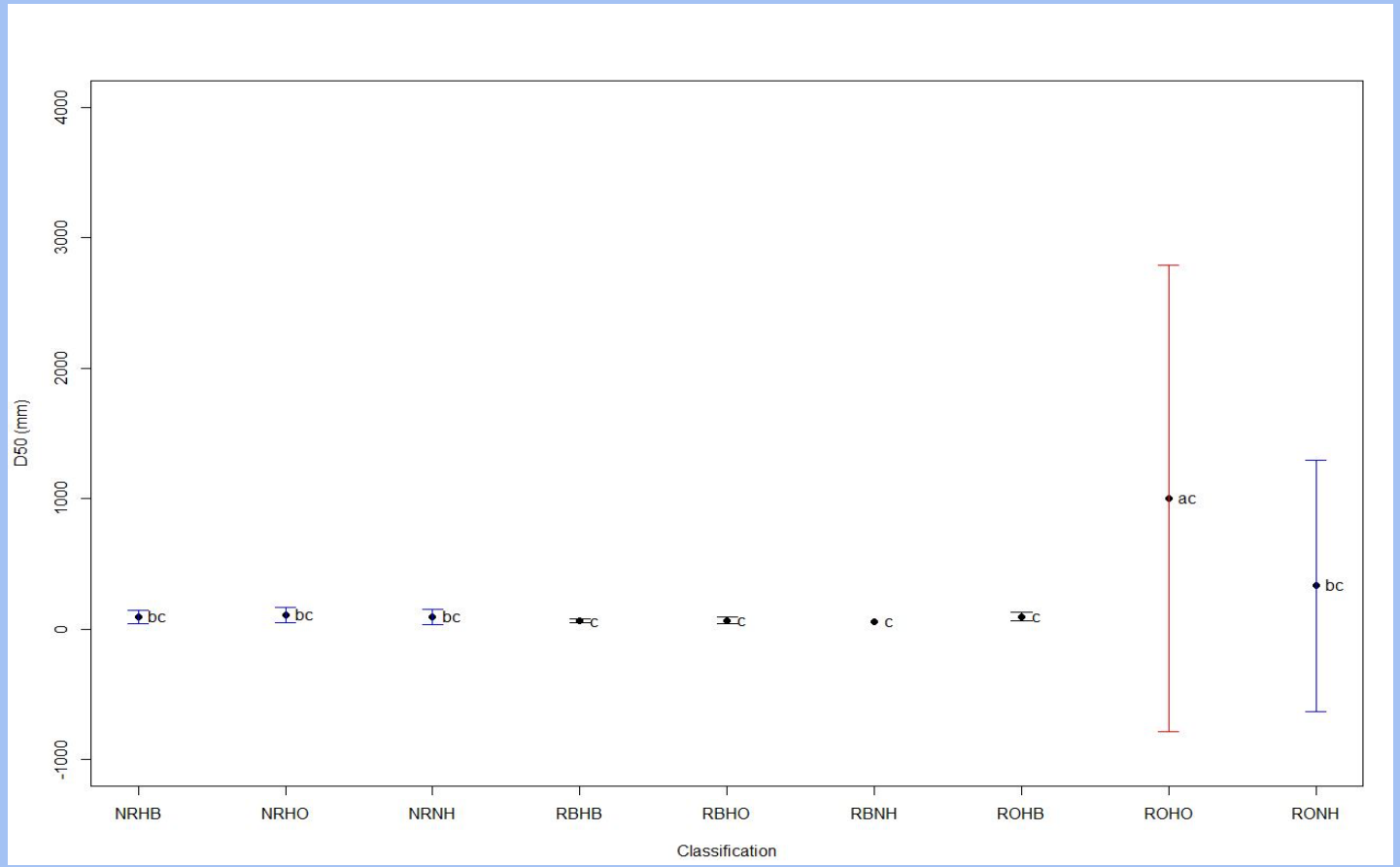
ANOVA and Tukey HSD Results

Treatment	N	Mean D50 (mm)
No roads on either side, no harvest on either side	96	92.6bc
No roads on either side, harvest on one side	32	106.2bc
No roads on either side, harvest on both sides	51	92.8bc
Roads on one side, no harvest on either side	20	333.3bc
Roads on one side, harvest on one side	10	1002.7ac
Roads on one side, harvest on both sides	3	95.3c
Roads on both sides, no harvest on either side	1	58.1c
Roads on both sides, harvest on one side	2	65.1c
Roads on both sides, harvest on both sides	2	60.7c

ANOVA & Tukey HSD Results cont'd

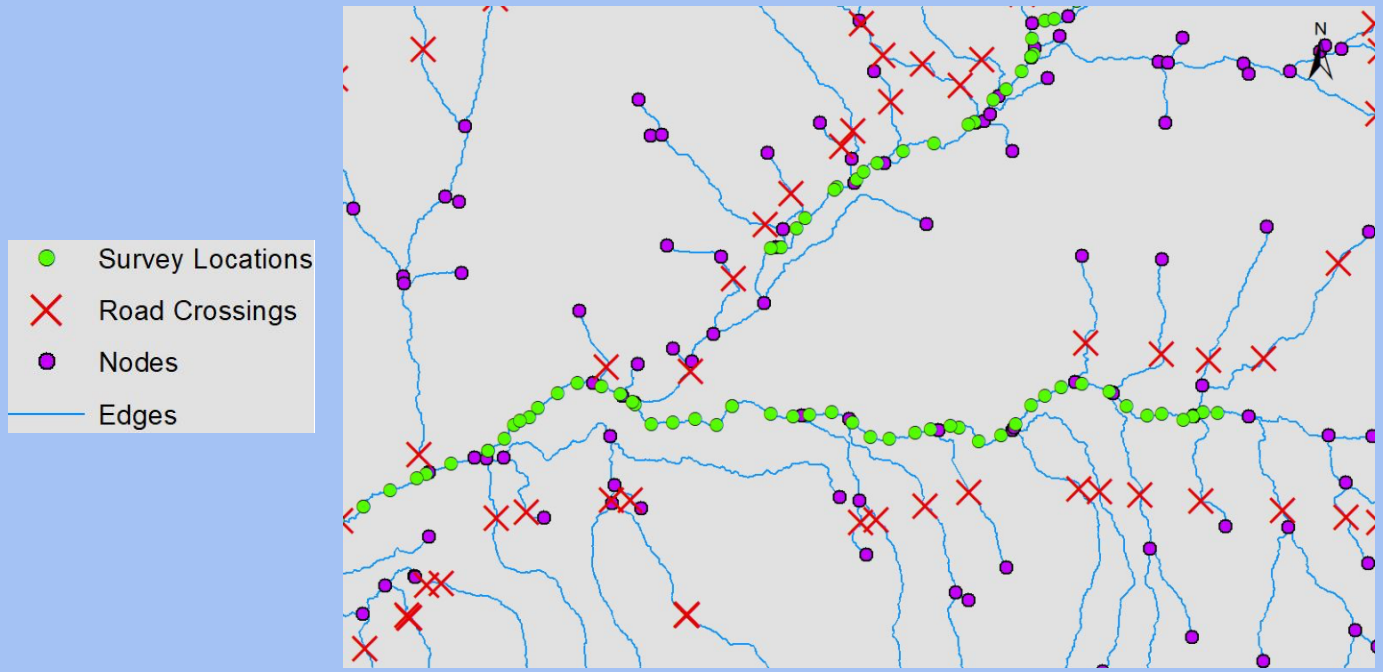


ANOVA & Tukey HSD Results cont'd



Network Influences?

- Cluster analysis and non-metric multidimensional scaling (NMDS)



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