Using GIS to Target Road Management in the Lake Tahoe Basin

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USFS Lake Tahoe Management Unit

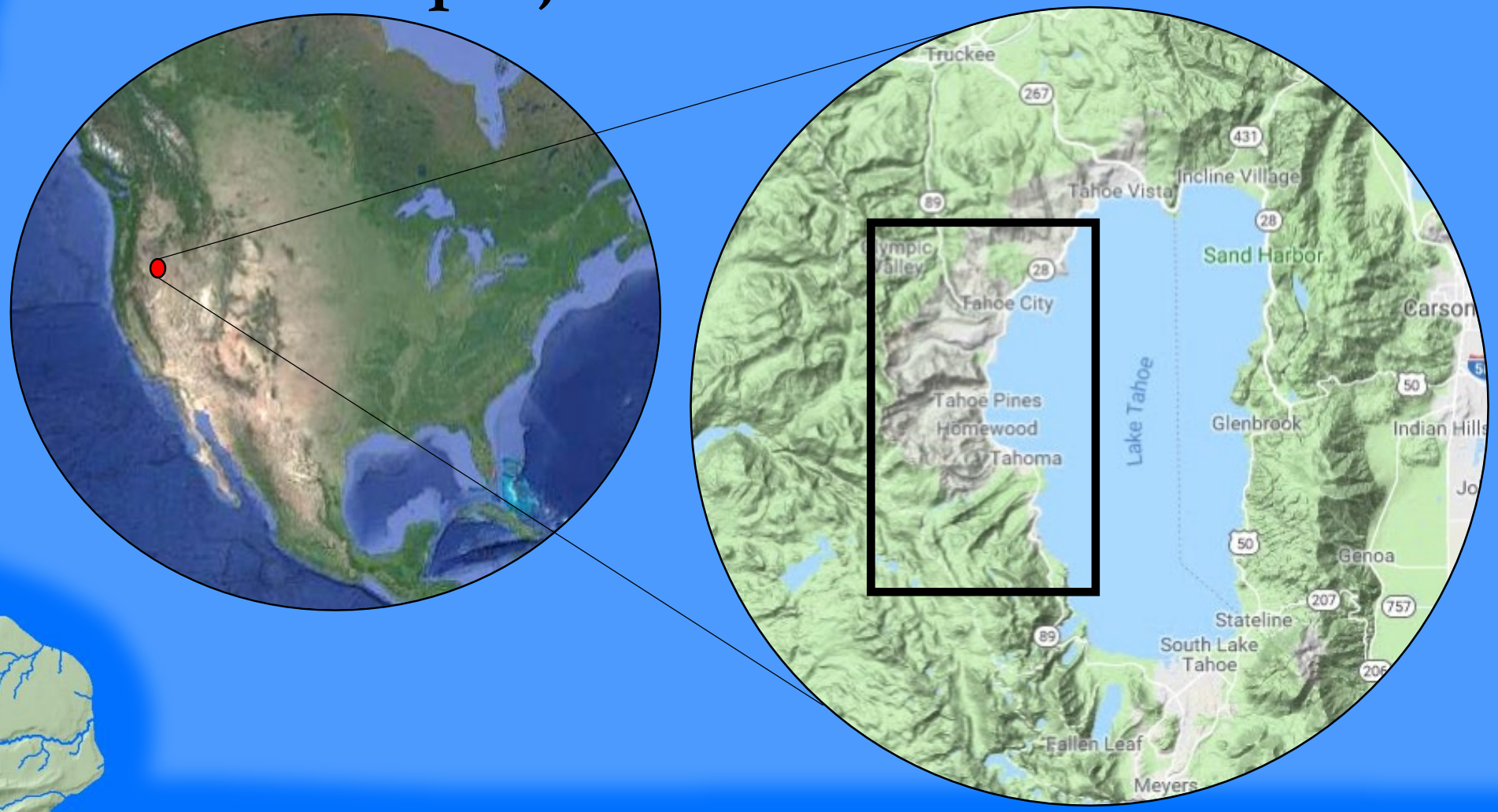
BLM Southern Nevada Public Land Management Act (SNPLMA)

Approach

- Motivation
- Methods
- Model results
- Limitations

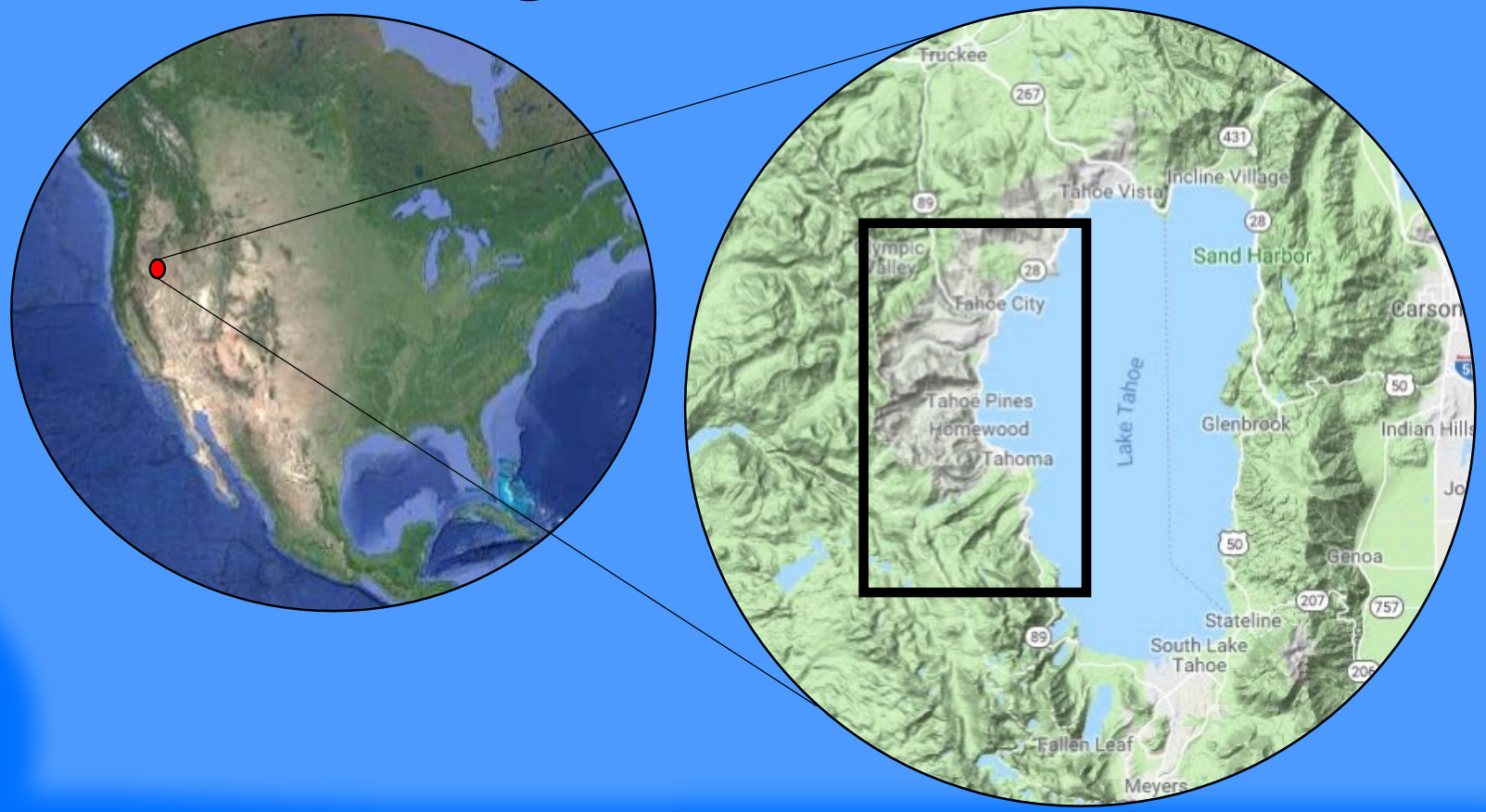
Motivation

- Preservation – low impact watershed restoration projects.



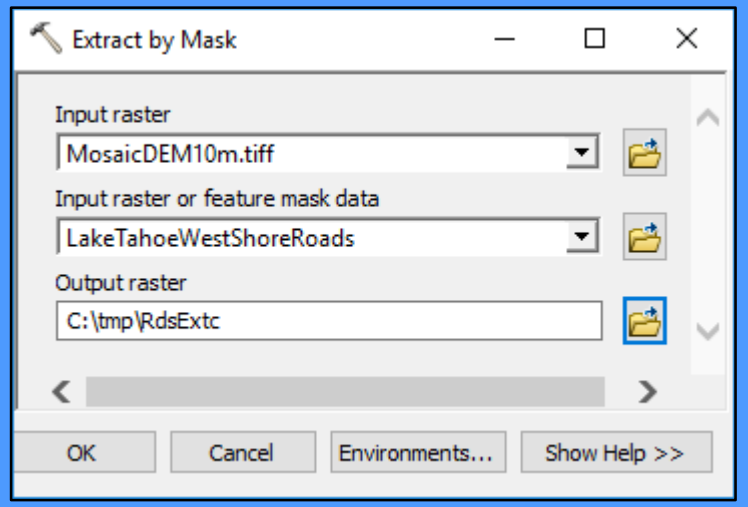
Motivation

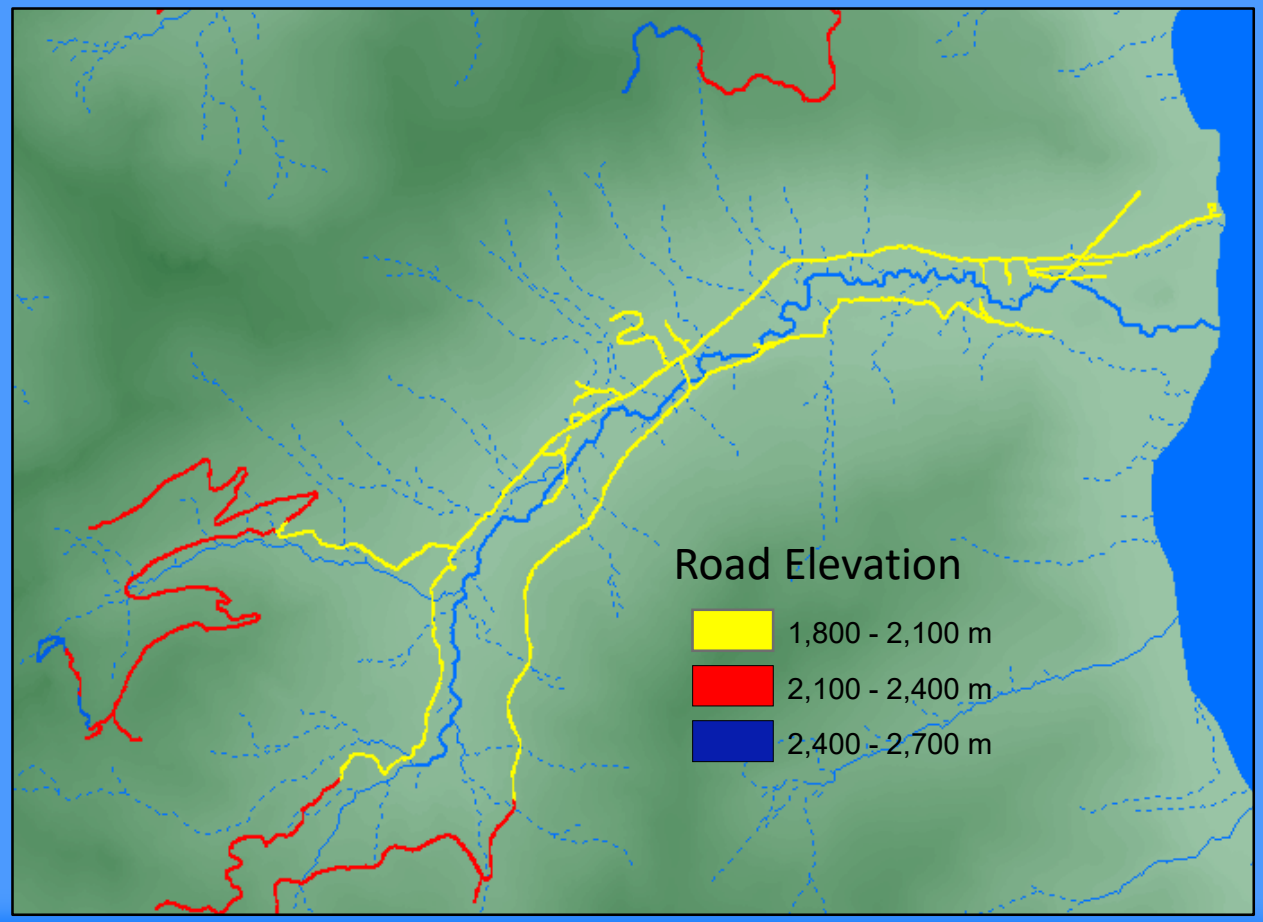
- Preservation – low impact watershed restoration projects.
- Roads – limiting sources of sediment



Methods

- Analysis method developed by Longxi Cao
  - Extraction of the road elevation with a 10 m DEM





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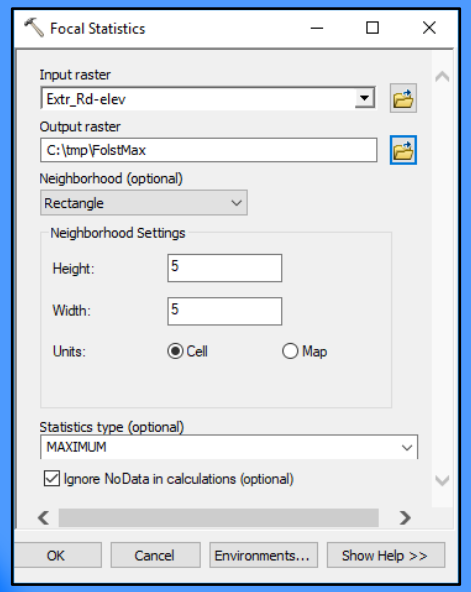

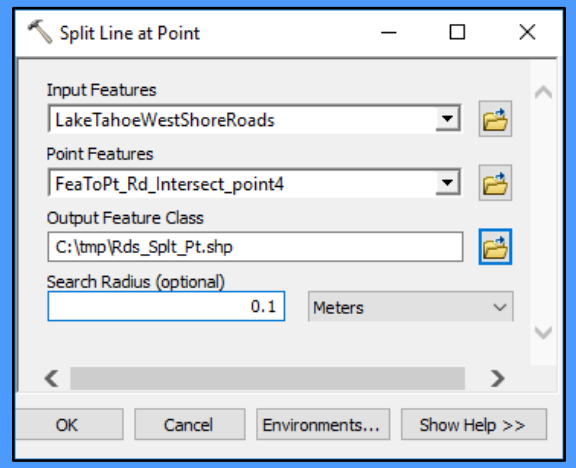

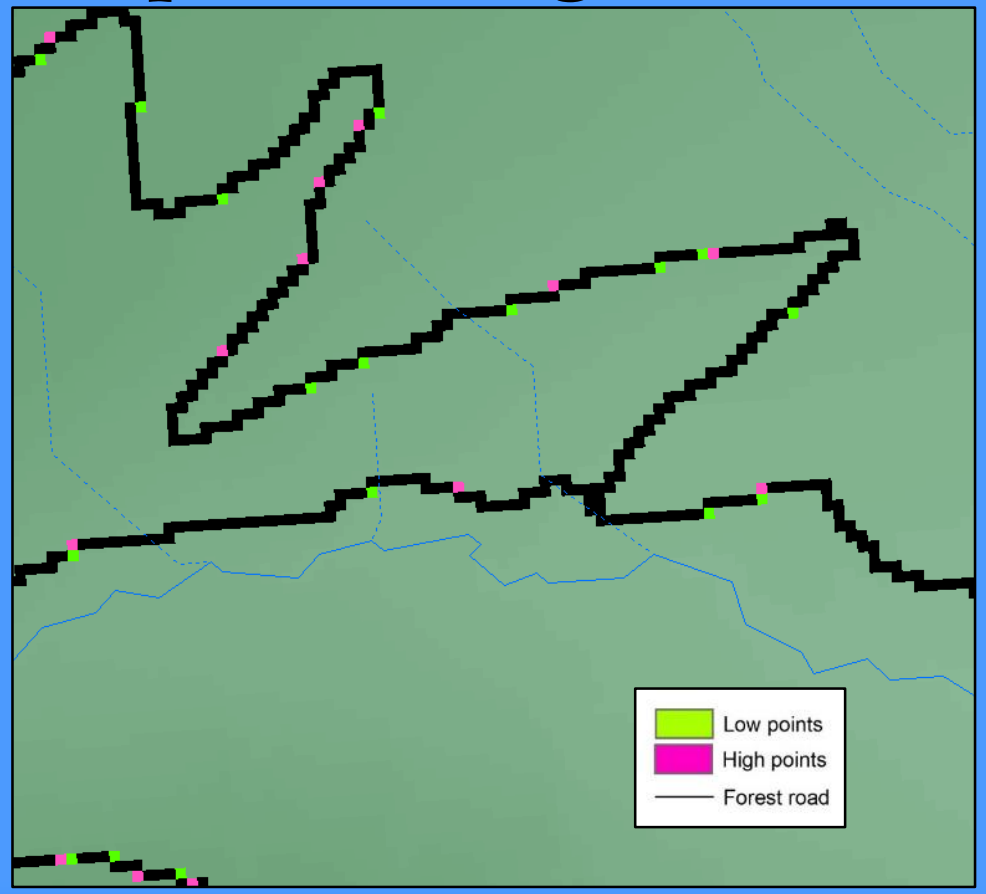

Methods

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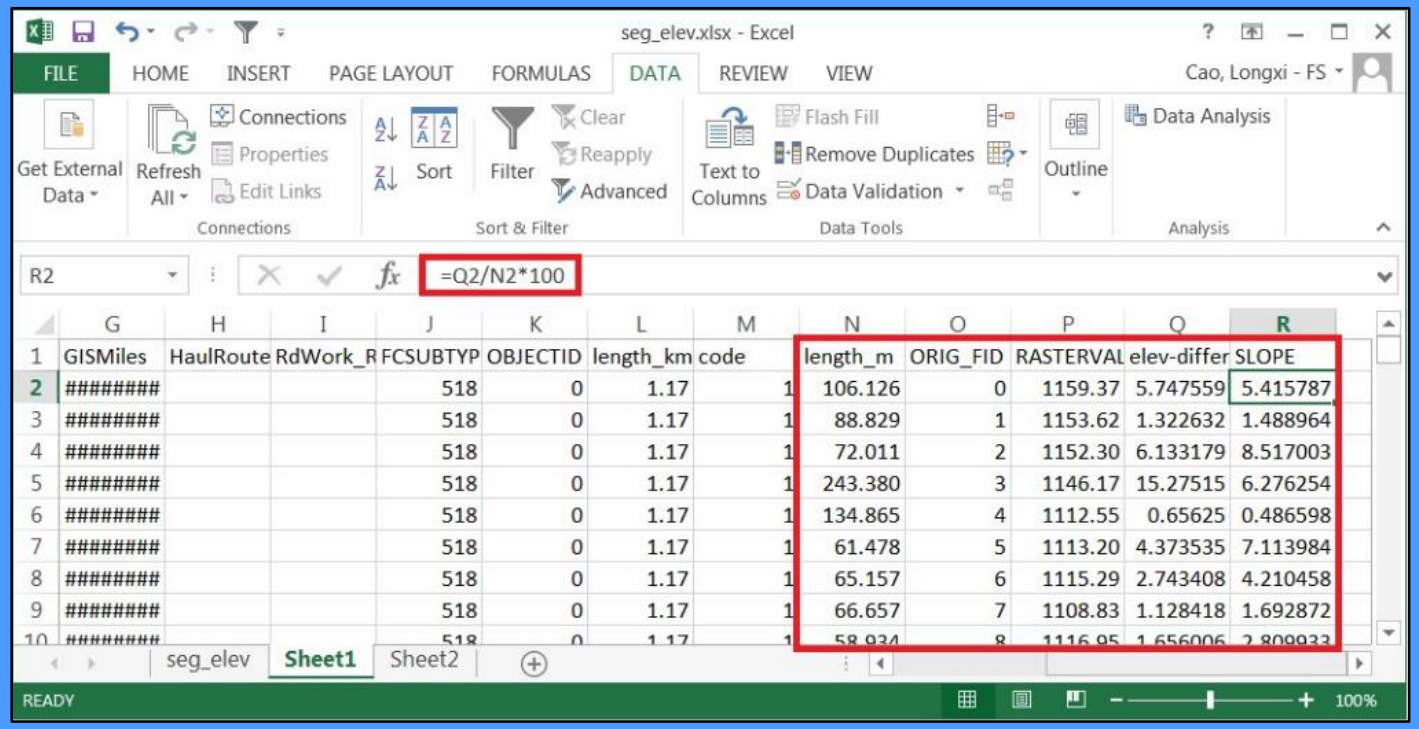
  - Extraction of the road elevation with a 10 m DEM
  - Determine high and low elevation points along road and split at points
  - **Calculate road segment length, and slope gradient**

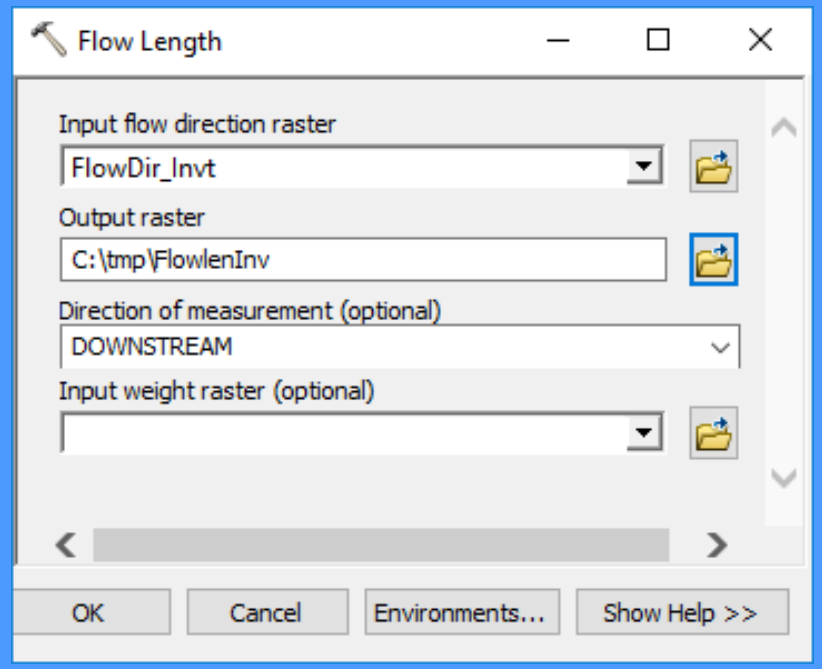
- 1360 road segments
- Average length ≈ 133 m
- Road grade ≈ 5.4%



	G	H	I	J	K	L	M	N	O	P	Q	R
1	GISMiles	HaulRoute	RdWork_R	FCSUBTYP	OBJECTID	length_km	code	length_m	ORIG_FID	RASTERVAL	elev-differ	SLOPE
2	########			518	0	1.17	1	106.126	0	1159.37	5.747559	5.415787
3	########			518	0	1.17	1	88.829	1	1153.62	1.322632	1.488964
4	########			518	0	1.17	1	72.011	2	1152.30	6.133179	8.517003
5	########			518	0	1.17	1	243.380	3	1146.17	15.27515	6.276254
6	########			518	0	1.17	1	134.865	4	1112.55	0.65625	0.486598
7	########			518	0	1.17	1	61.478	5	1113.20	4.373535	7.113984
8	########			518	0	1.17	1	65.157	6	1115.29	2.743408	4.210458
9	########			518	0	1.17	1	66.657	7	1108.83	1.128418	1.692872
10	########			518	0	1.17	1	58.934	8	1116.95	1.656006	2.809933

Methods

- Analysis method developed by Longxi Cao
  - Extraction of the road elevation with a 10 m DEM
  - Determine high and low elevation points along road and split at points
  - Calculate road segment length, and slope gradient
  - **Determine flow length from roads to streams = road buffer**



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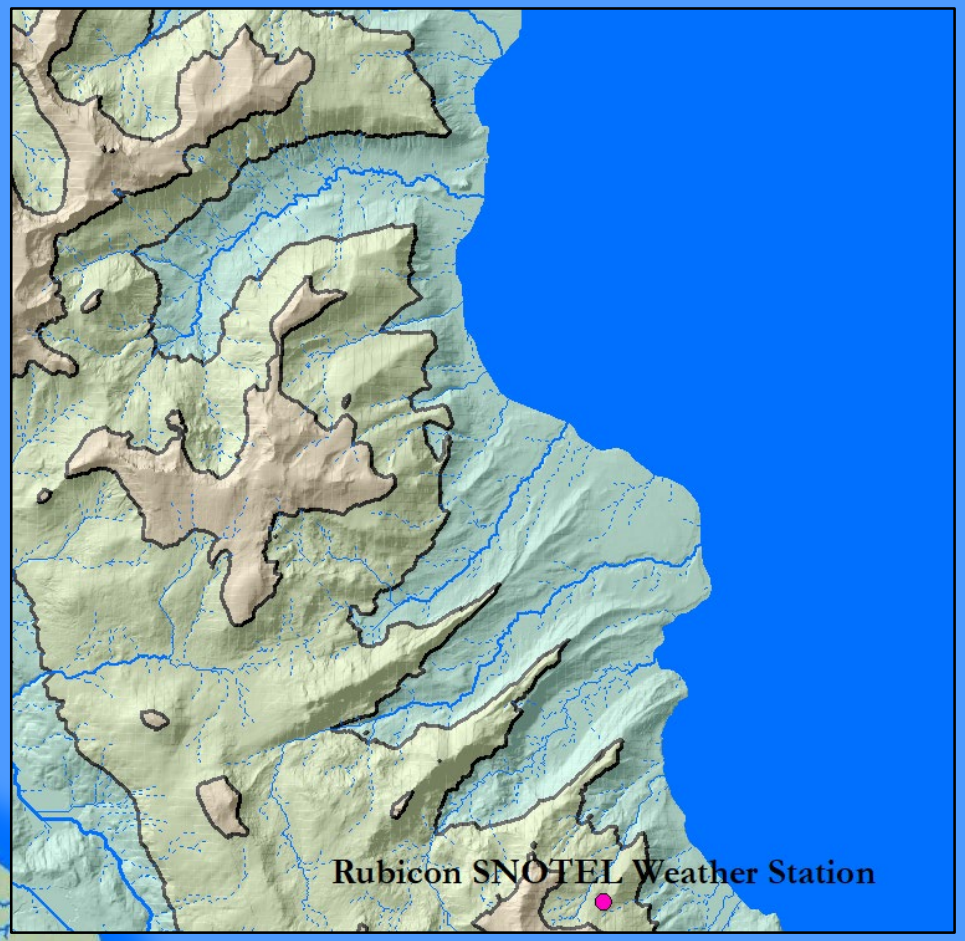
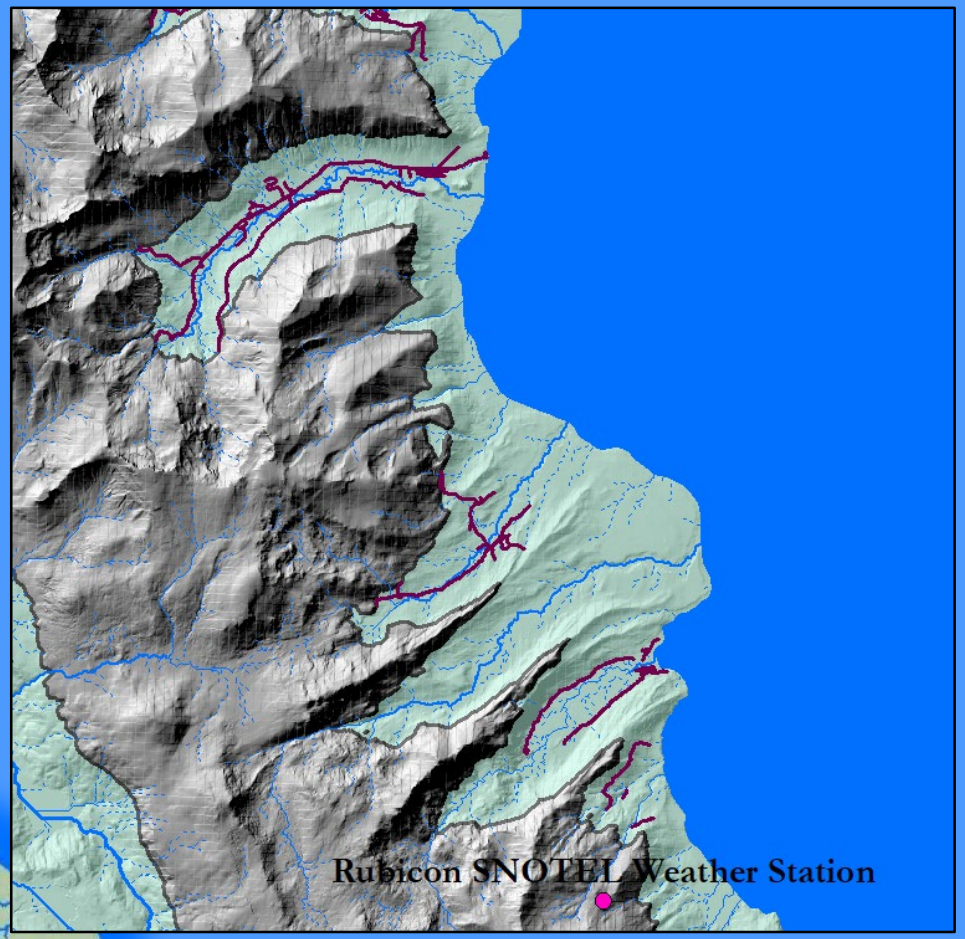


Using PRISM and Rubicon Snow Tel weather records, define climate layers.

- **300 meter division**

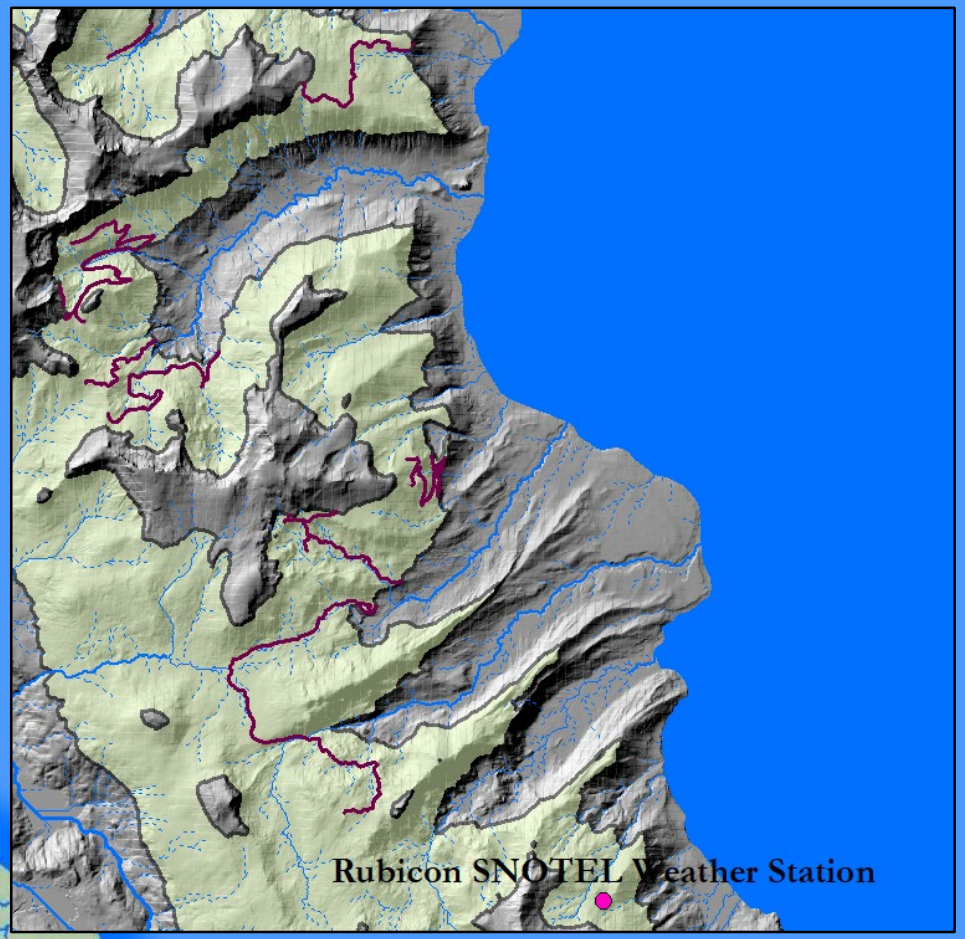
Methods



Using PRISM and Rubicon Snow Tel weather records, define climate layers.

- 300 meter division
- 1800-2100 m

Methods



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- 300 meter division
- 1800-2100 m
- 2100-2400 m

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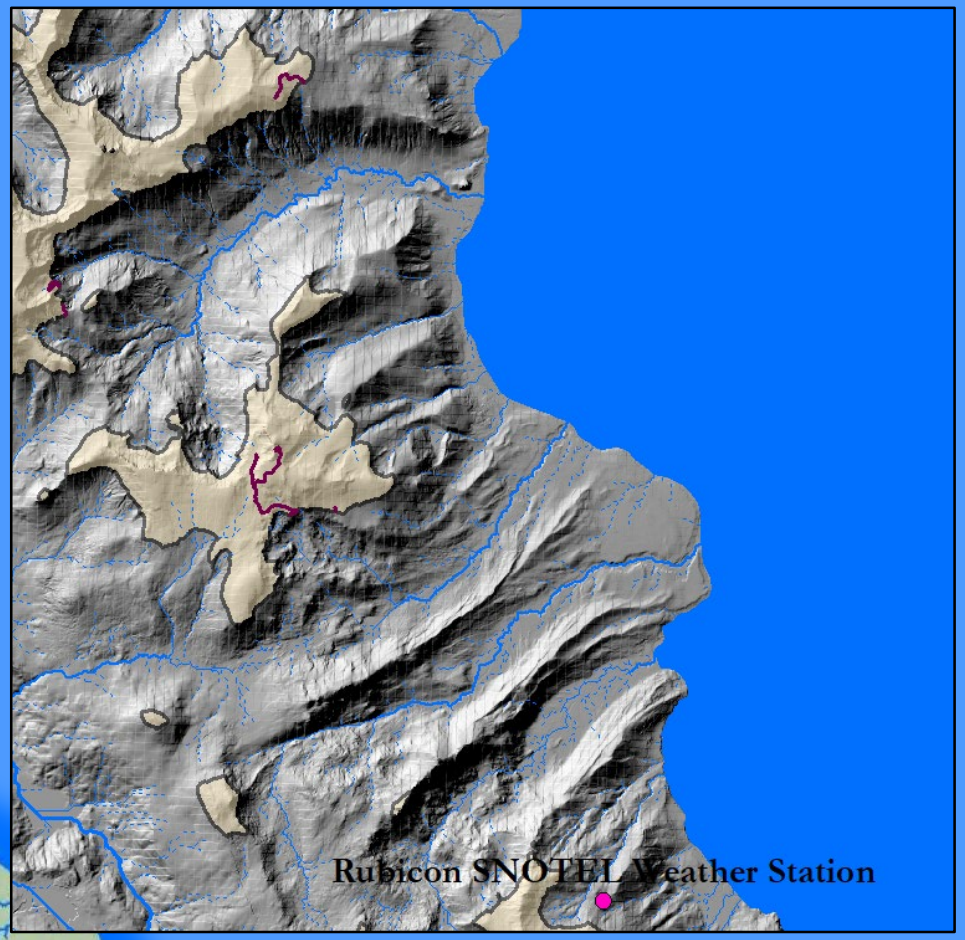


Using PRISM and Rubicon Snow Tel weather records, define climate layers.

- 300 meter division
- 1800-2100 m
- 2100-2400 m
- 2400-2700 m

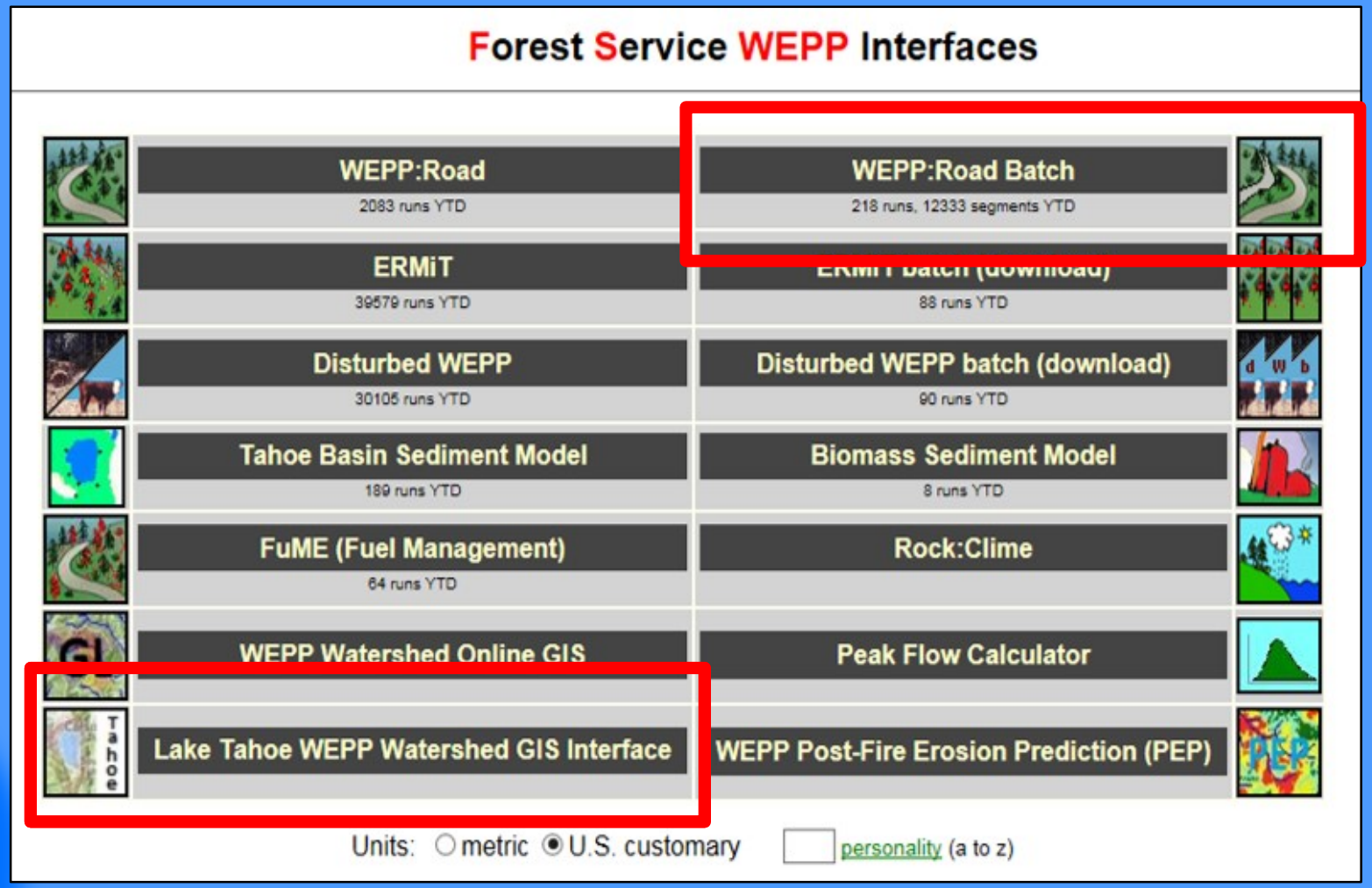
Methods

Develop cross-walk between Lake Tahoe West (LTW) design and database categories

LTW Designation	Design	Surface (default if not specified)	Traffic	Road width	Rk Frag	Tahoe Current Maintenance Levels*
Not maintained	OU	Native surface	no	12	rock 20%	0 - hold over - ignore
Basic custodial care (closed)	OU	Native surface	no	12	rock 20%	1- These are roads that have been placed in storage between intermittent uses.
High clearance vehicles	OU	Native surface	low	12	rock 20%	2 - Assigned to roads open for use by high clearance vehicles. ped - out sloped - 4x4 road
Suitable for passenger cars	OU	Native surface	low	18	rock 20%	3 - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.
Moderate degree of user comfort	OU	paved	high	24	na	4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.
High degree of user comfort	OU	paved	high	24	na	5 - Assigned to roads that provide a high degree of user comfort and convenience.
Decommissioned roads**						may use as future logging road
		Bituminous				4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.
		Improved native material				Graveled road - assigned to Levels 1 through 3 above.
Road lengths are at approx 140 m						

FS WEPP Road Batch

https://forest.moscowfsl.wsu.edu/fswepp/



Methods

Three scenarios:

- Current Conditions

Methods

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- Logged = high traffic

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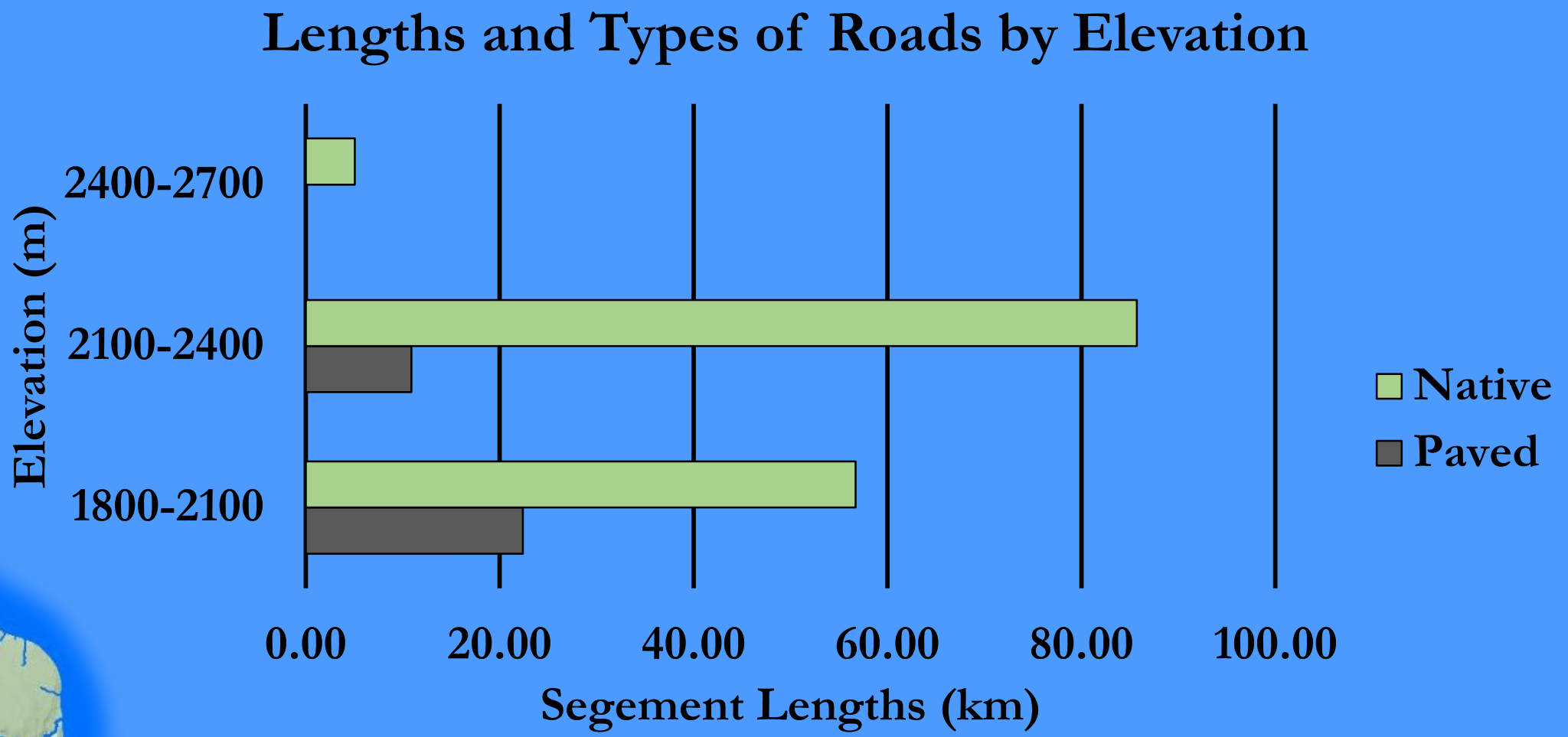
Three scenarios:

- Current Conditions
- Logged = high traffic
- Closed = no traffic

Model Results: Current Condition



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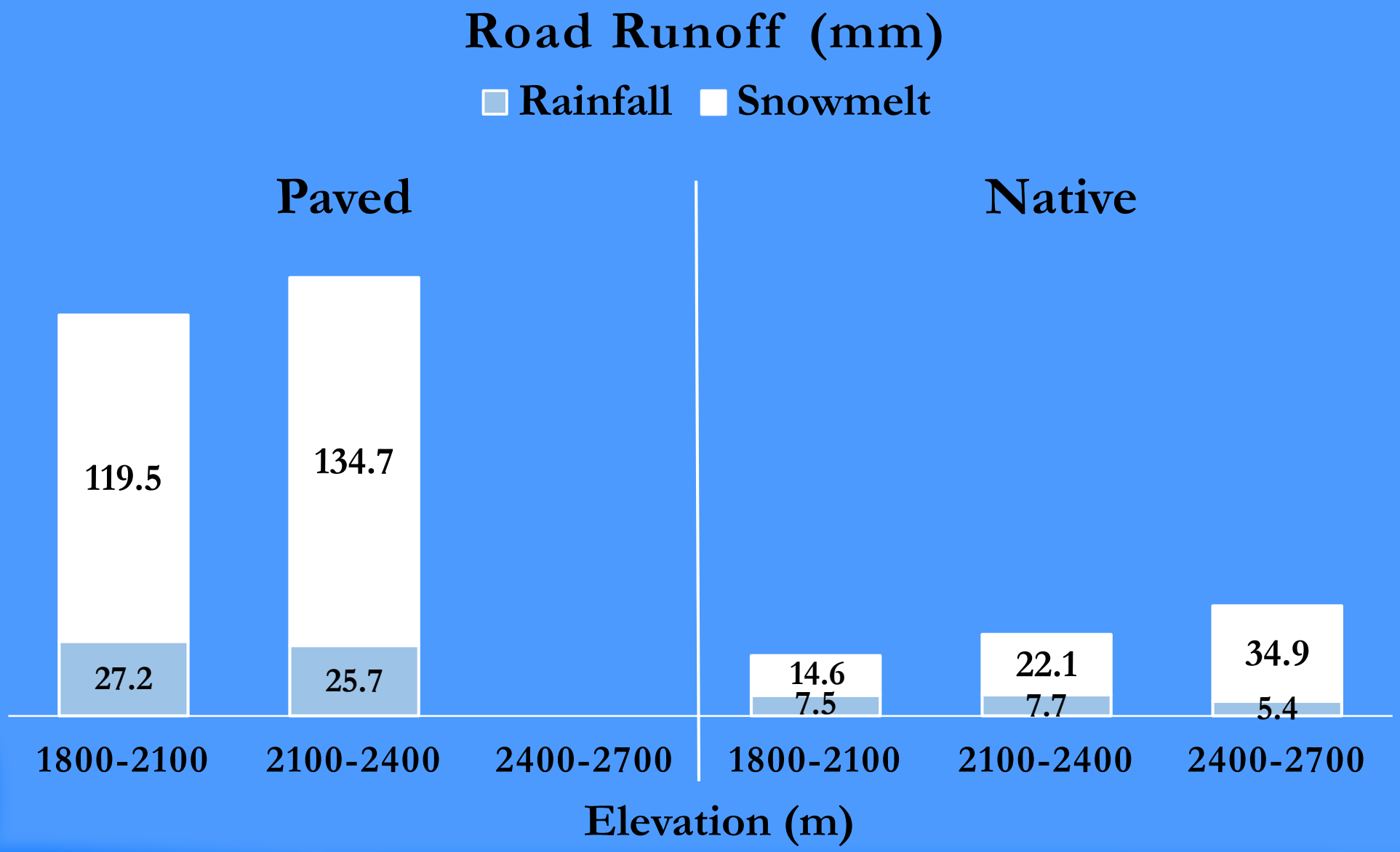

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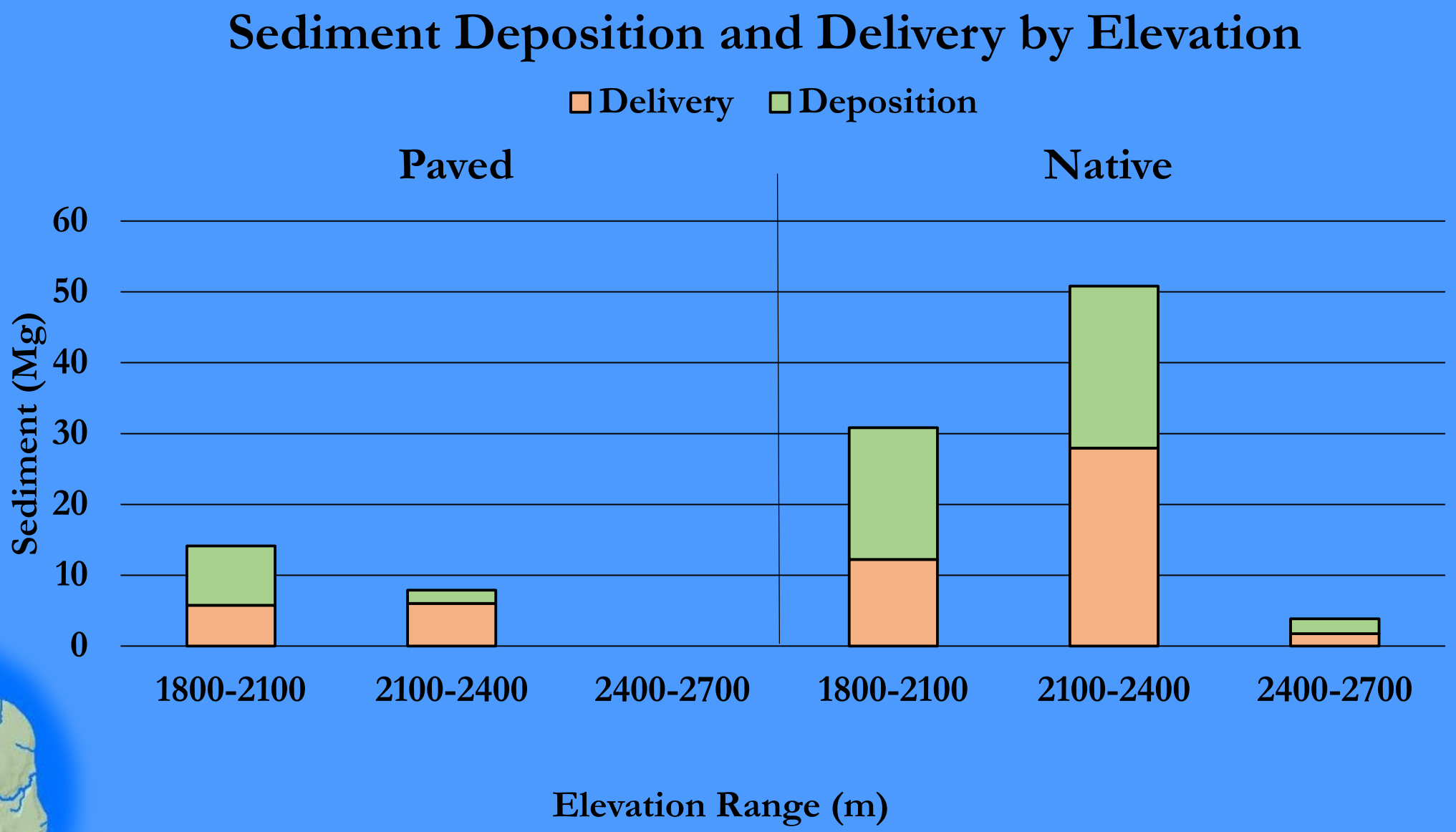

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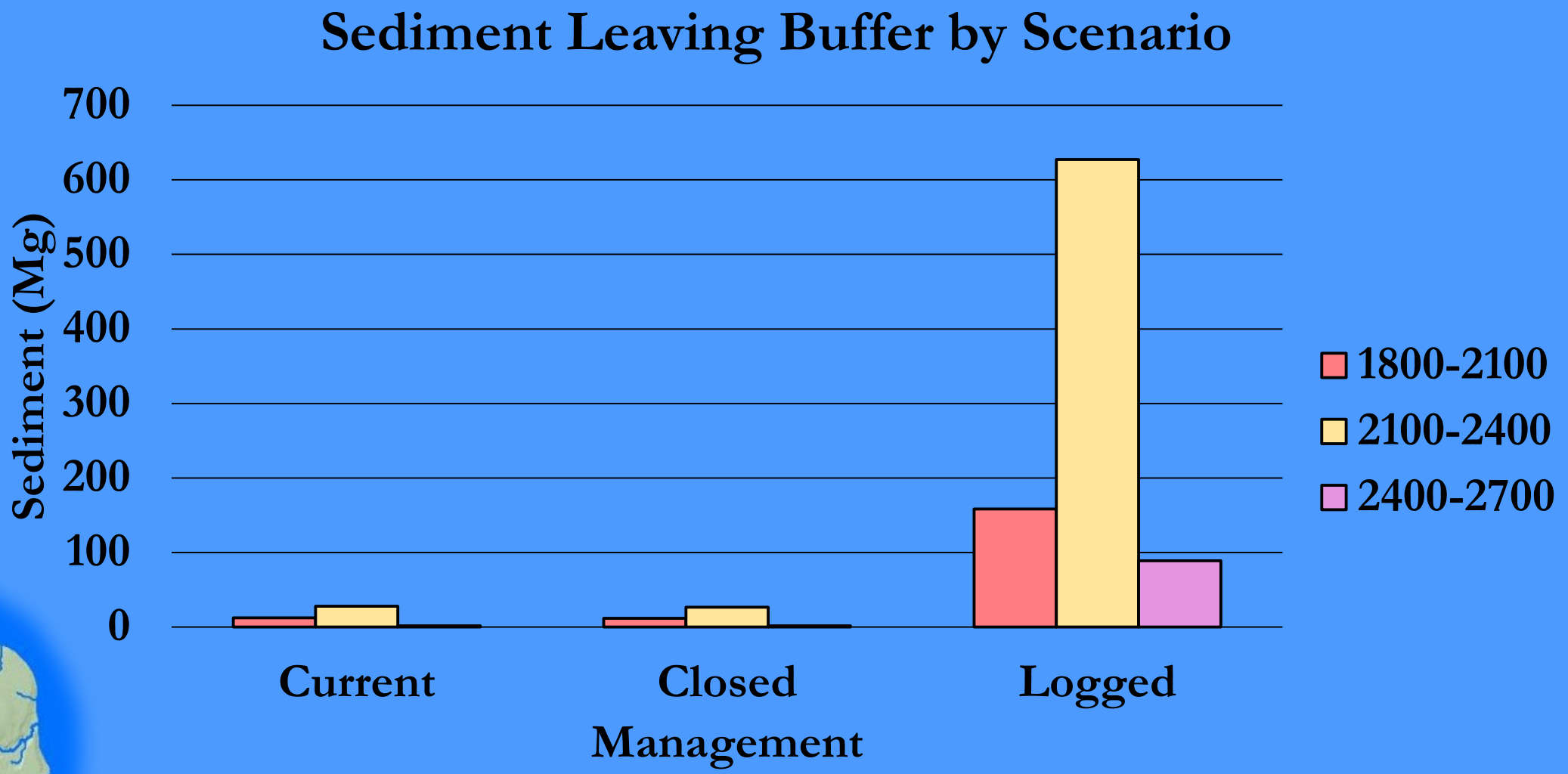
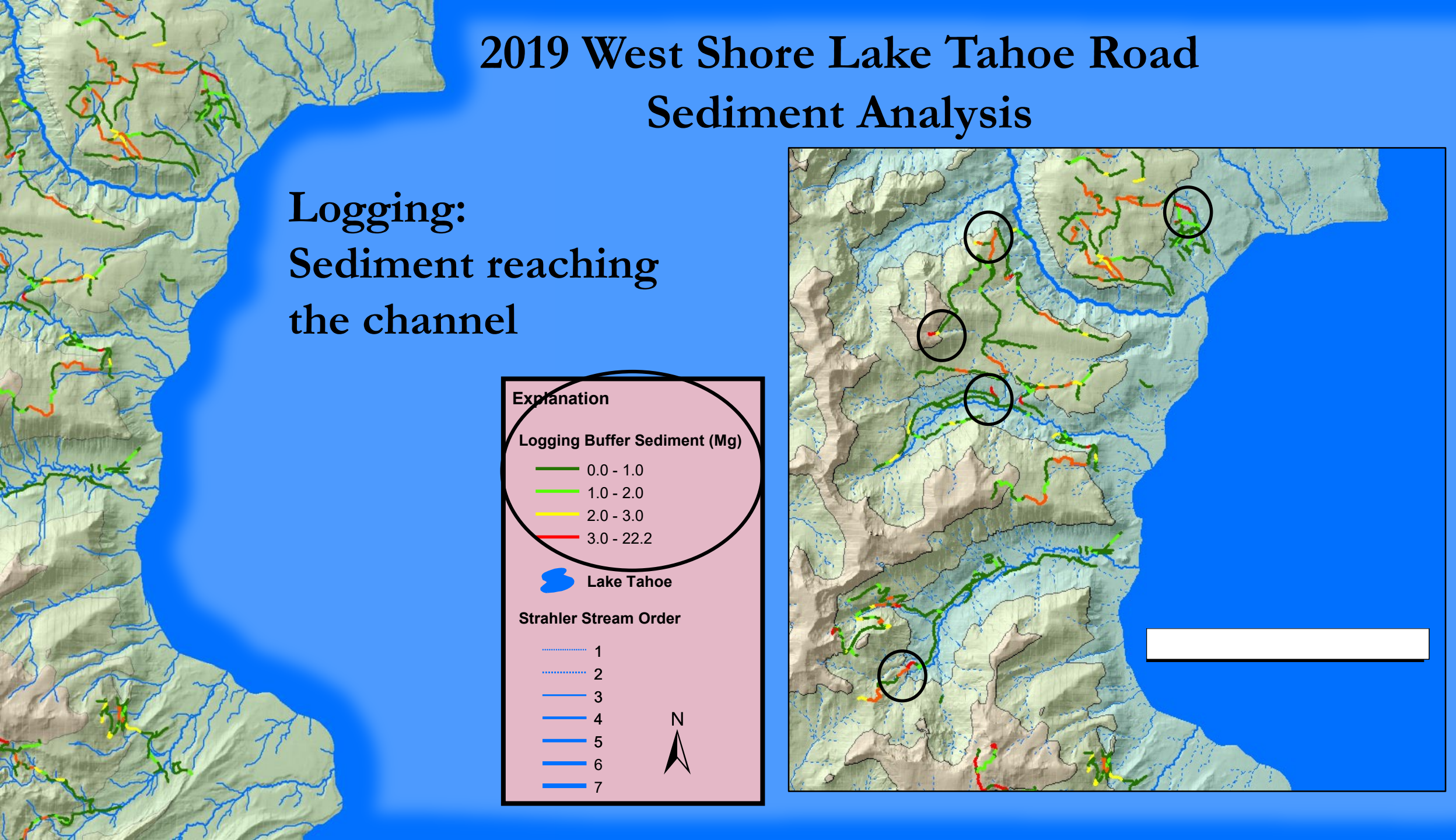


2019 West Shore Lake Tahoe Road Sediment Analysis

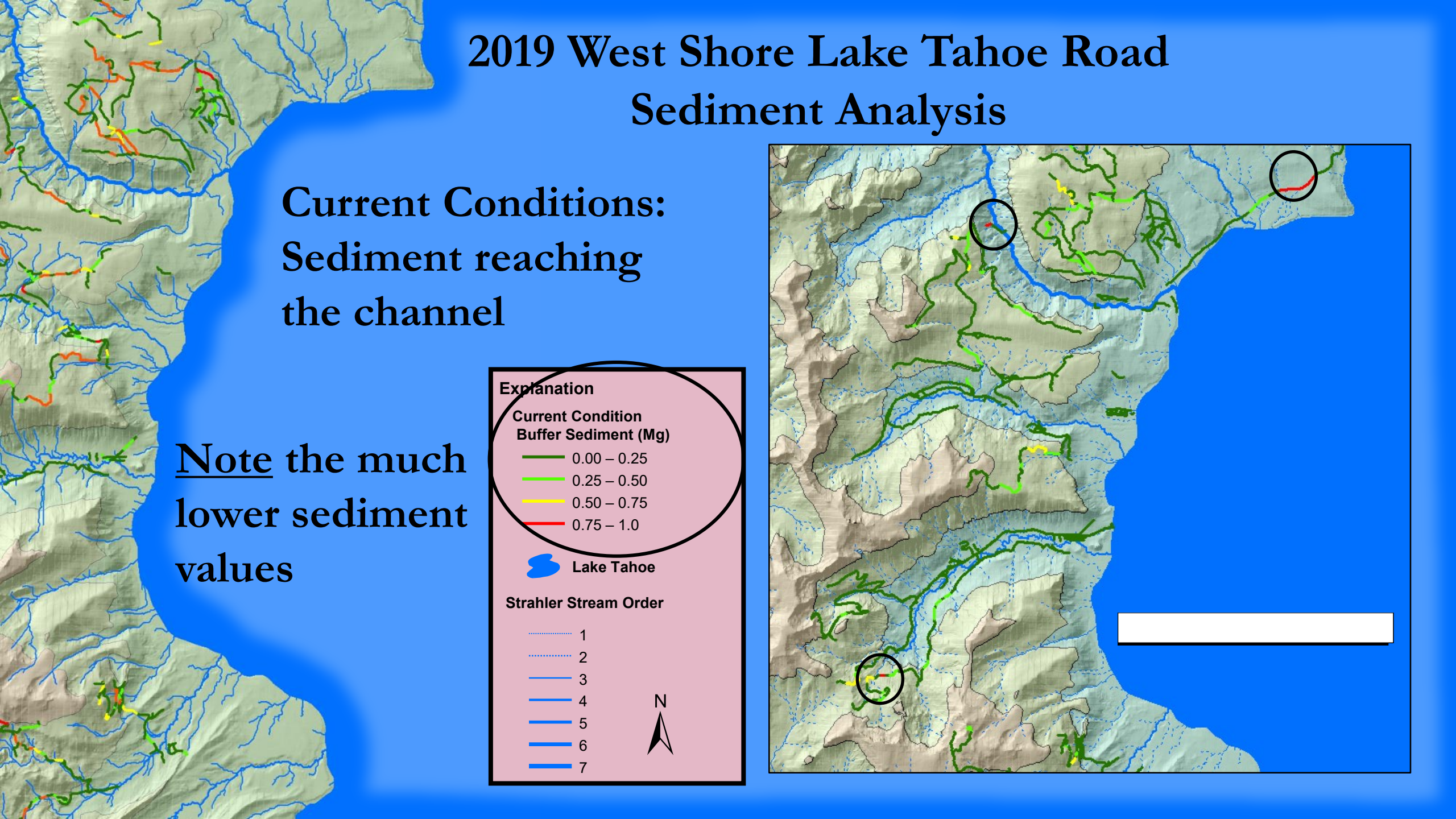
Logging: Sediment reaching the channel

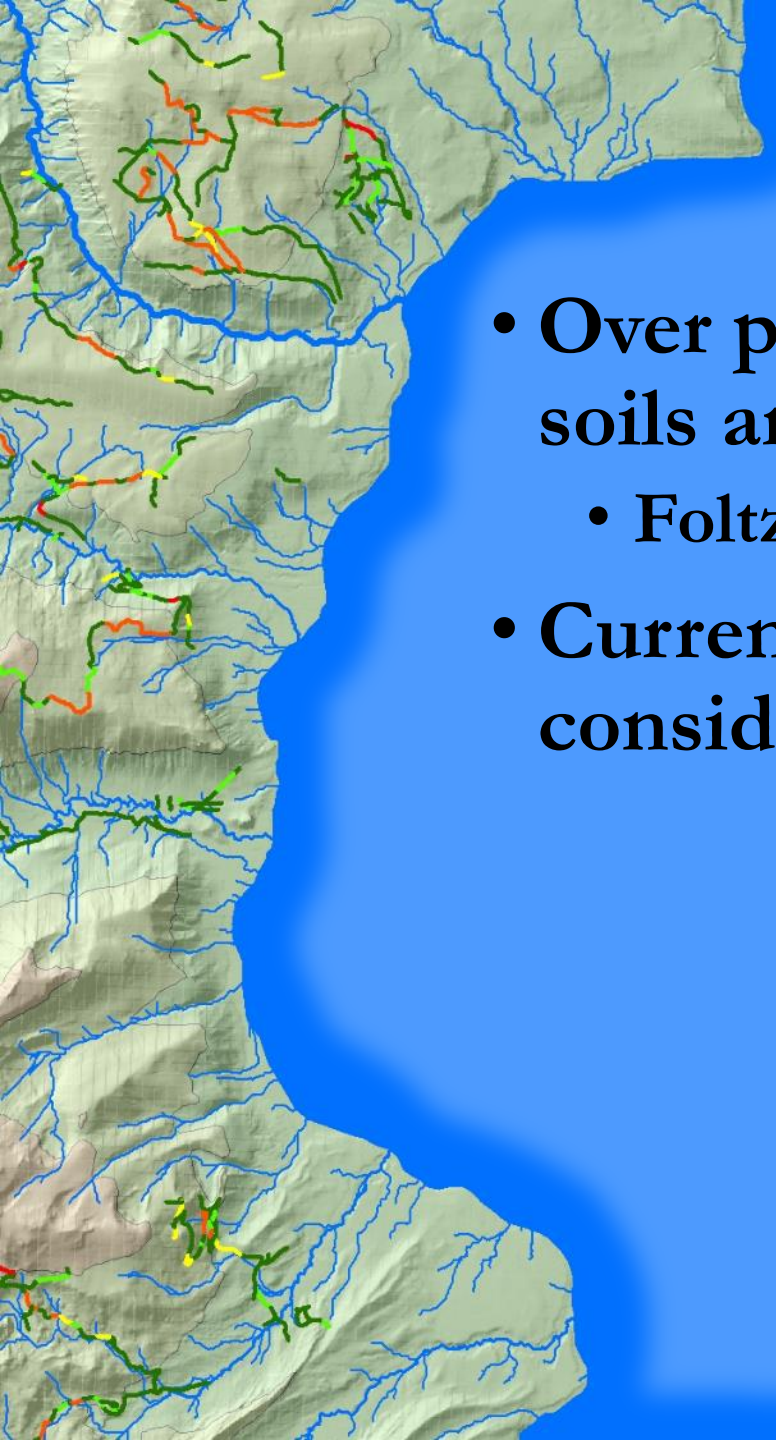


2019 West Shore Lake Tahoe Road Sediment Analysis

Current Conditions: Sediment reaching the channel

<u>Note</u> the much lower sediment values





Limitations

- Over prediction of sediment erosion? WEPP:Road soils are subject to erode more than Tahoe Soils
  - Foltz et al., 2011 suggest maybe 5 times as much
- Current sediment management practices were not considered in analysis

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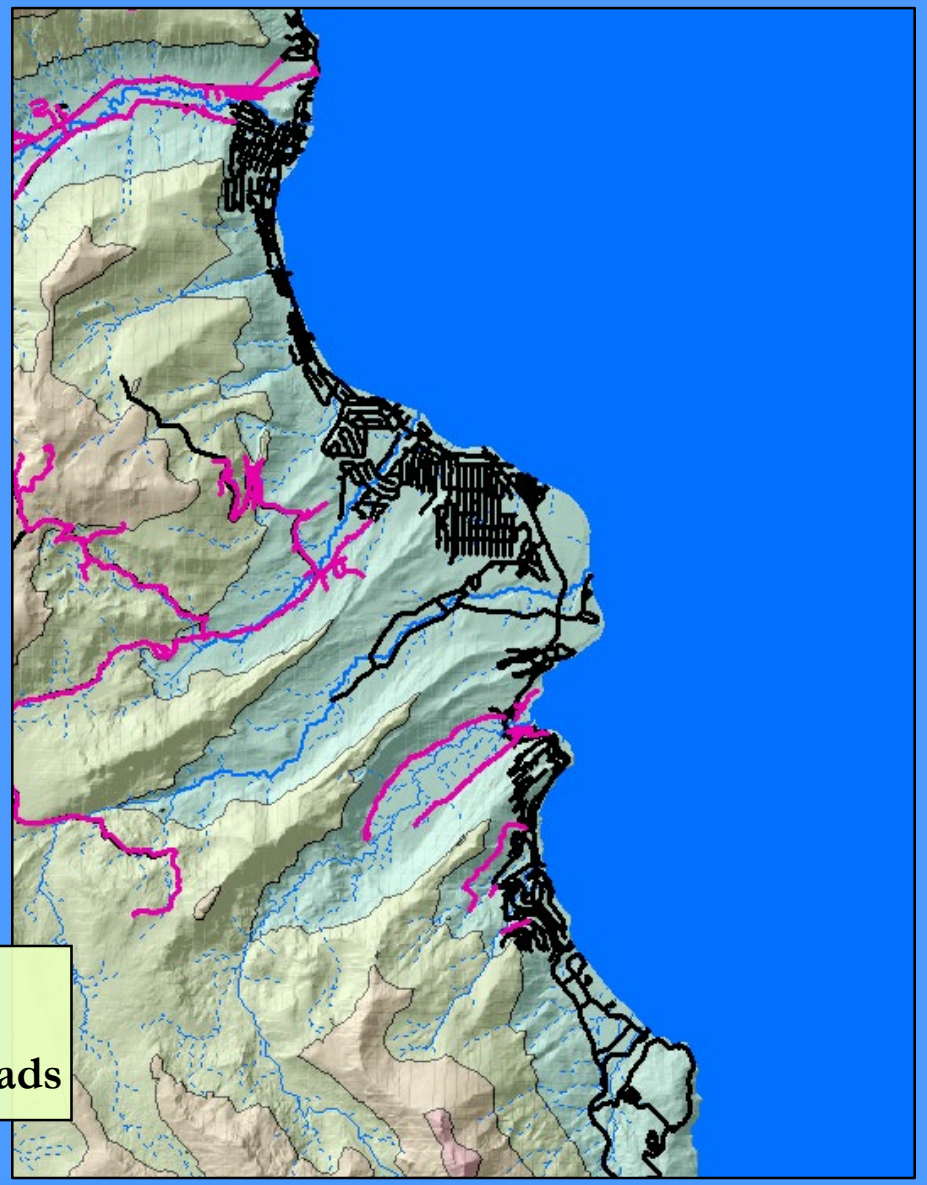
  - Foltz et al., 2011 suggest maybe 5 times as much
- Current sediment management practices were not considered in analysis
- **Roads layer did not include all roads**



Questions?

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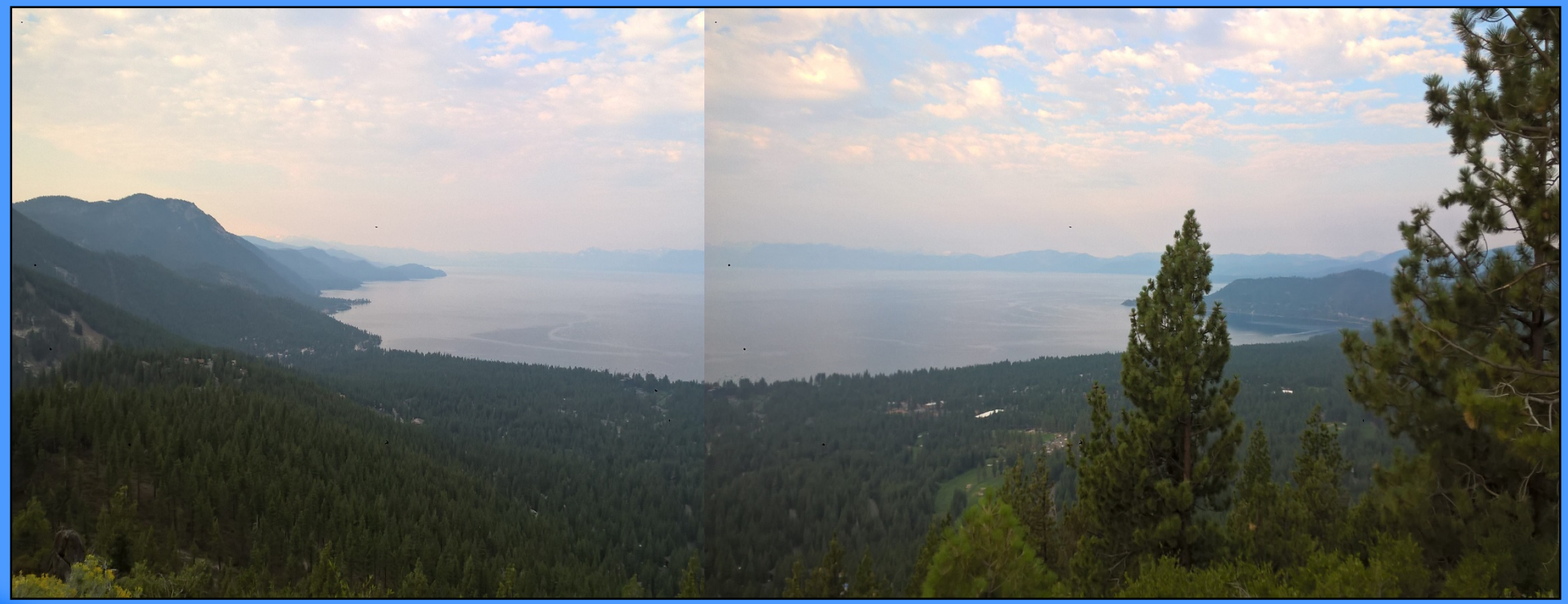

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