GRAIP_Lite: A Tool for Large Scale Assessment of Road Erosion

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Forest Roads

- Provide access
- Produce sediment

Goals

- Quickly prioritize small watersheds based on road-related sediment production and delivery
- Work with simple inputs
- Reliably predict road related contribution in stream at scales smaller than 6^{th}-code HUCs

Different Scales of Information

GRAIP_Lite and GRAIP

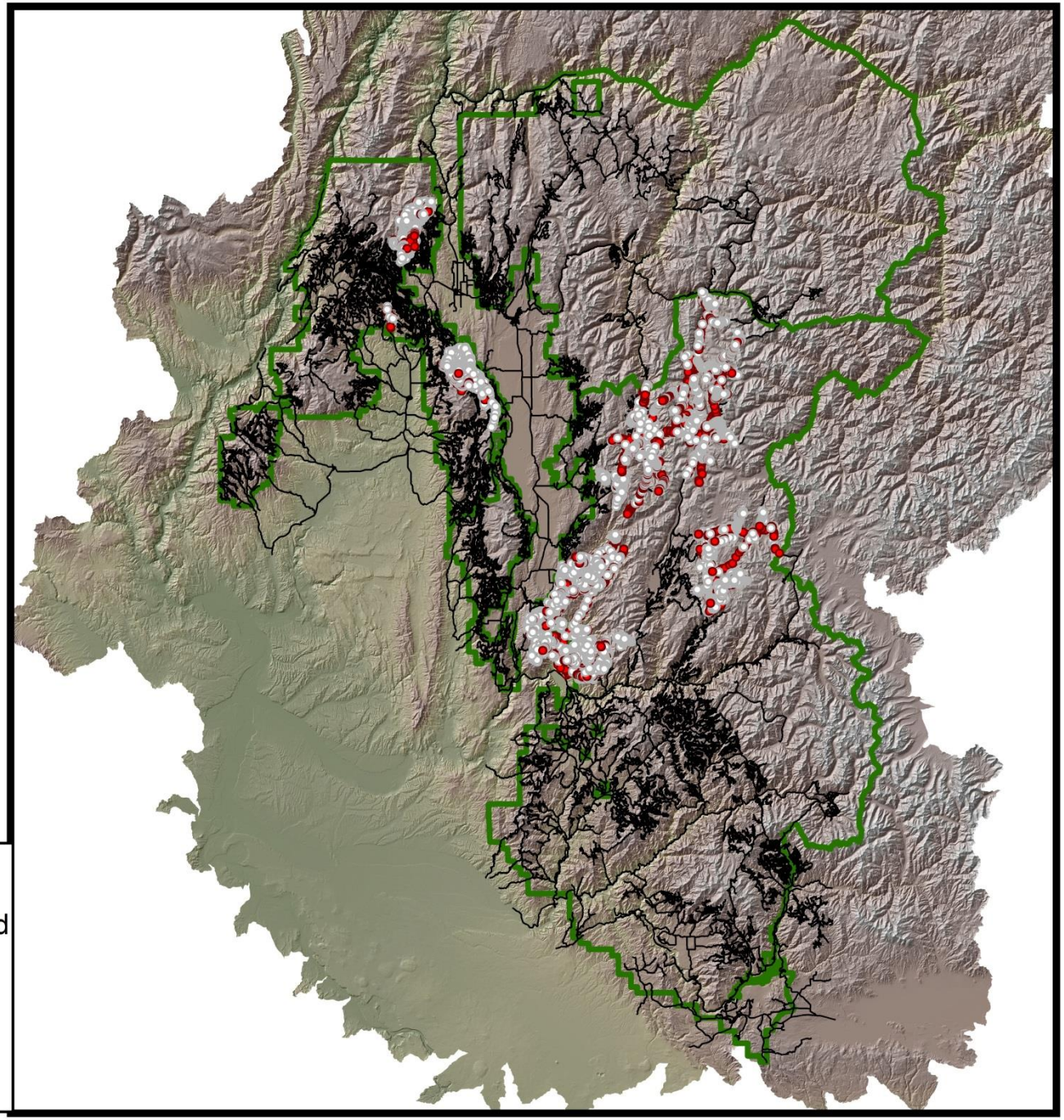
GRAIP_Lite

- Uses calibration data to estimate flowpath vegetation and stream connection
- Uses GIS to estimate drainpoint and road segment locations
- Only road surface sediment contributions

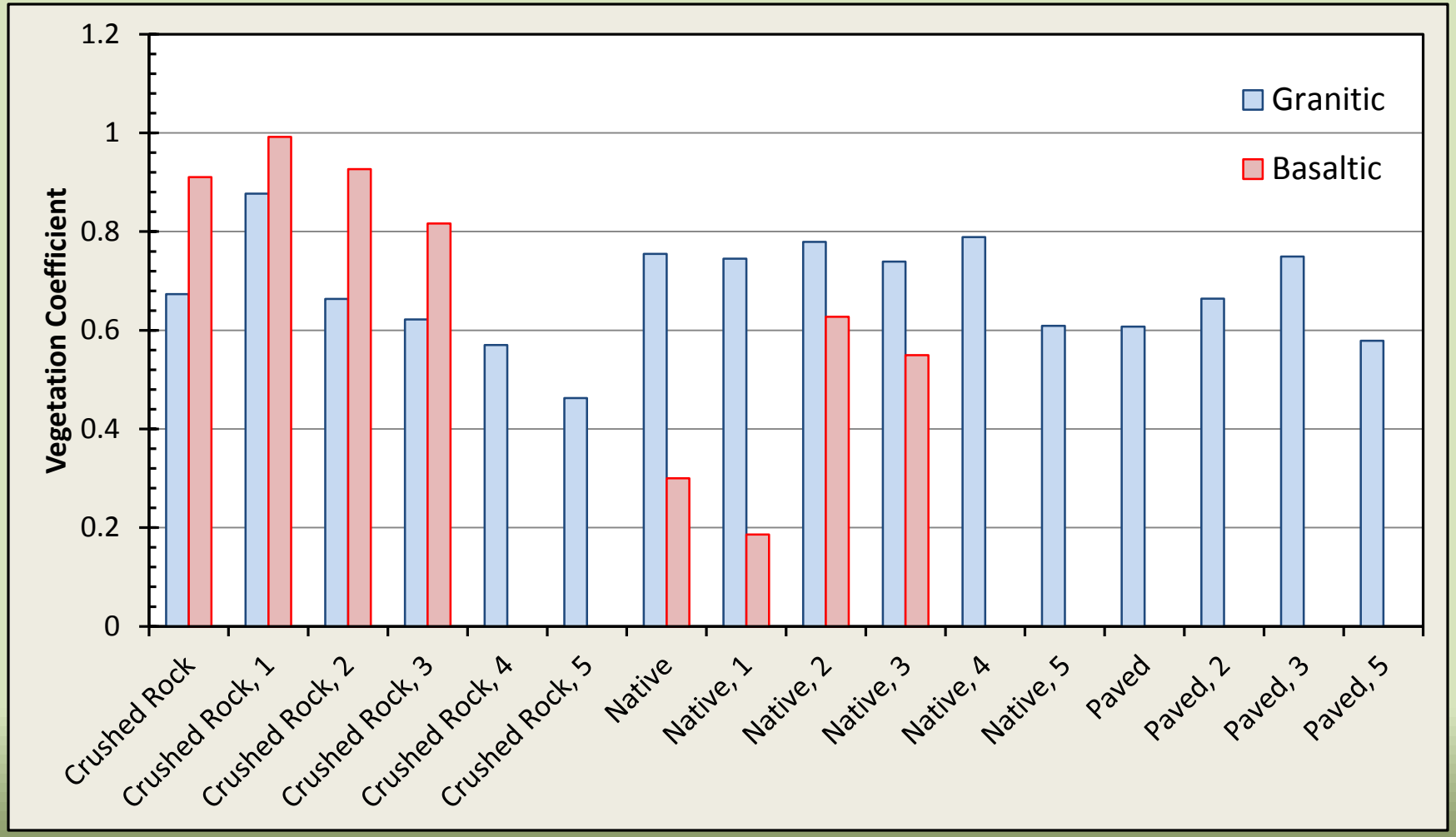
GRAIP

- Uses observations to determine flowpath vegetation and stream connection
- Uses observations to determine drainpoint and road segment locations
- Road surface sediment, fill erosion, gully and landslide risks, full inventory

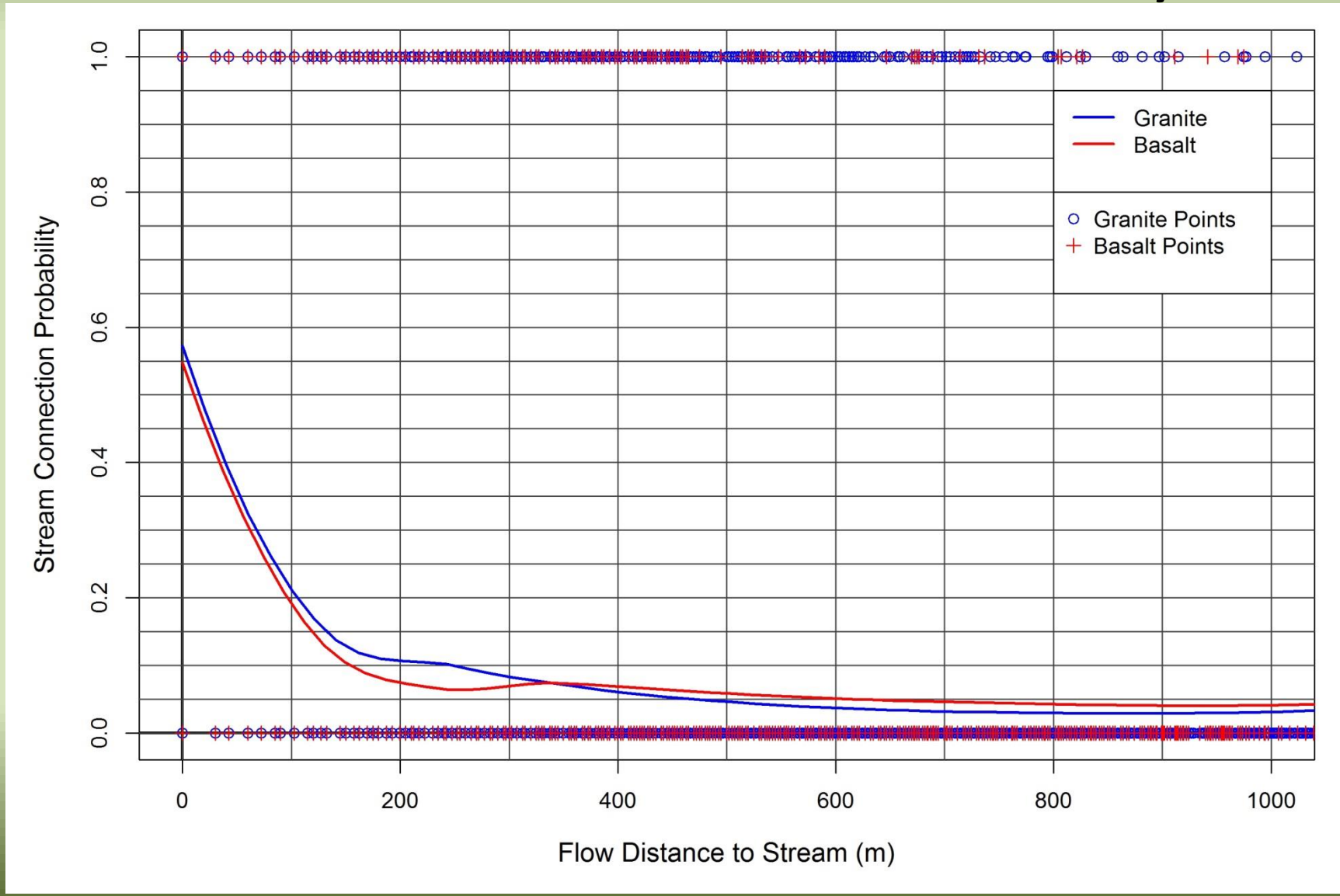
Inputs


Calibration Data
Not Stream Connected
Stream Connected
Roads
National Forest Lands

Calibration Data: Vegetation Coefficients



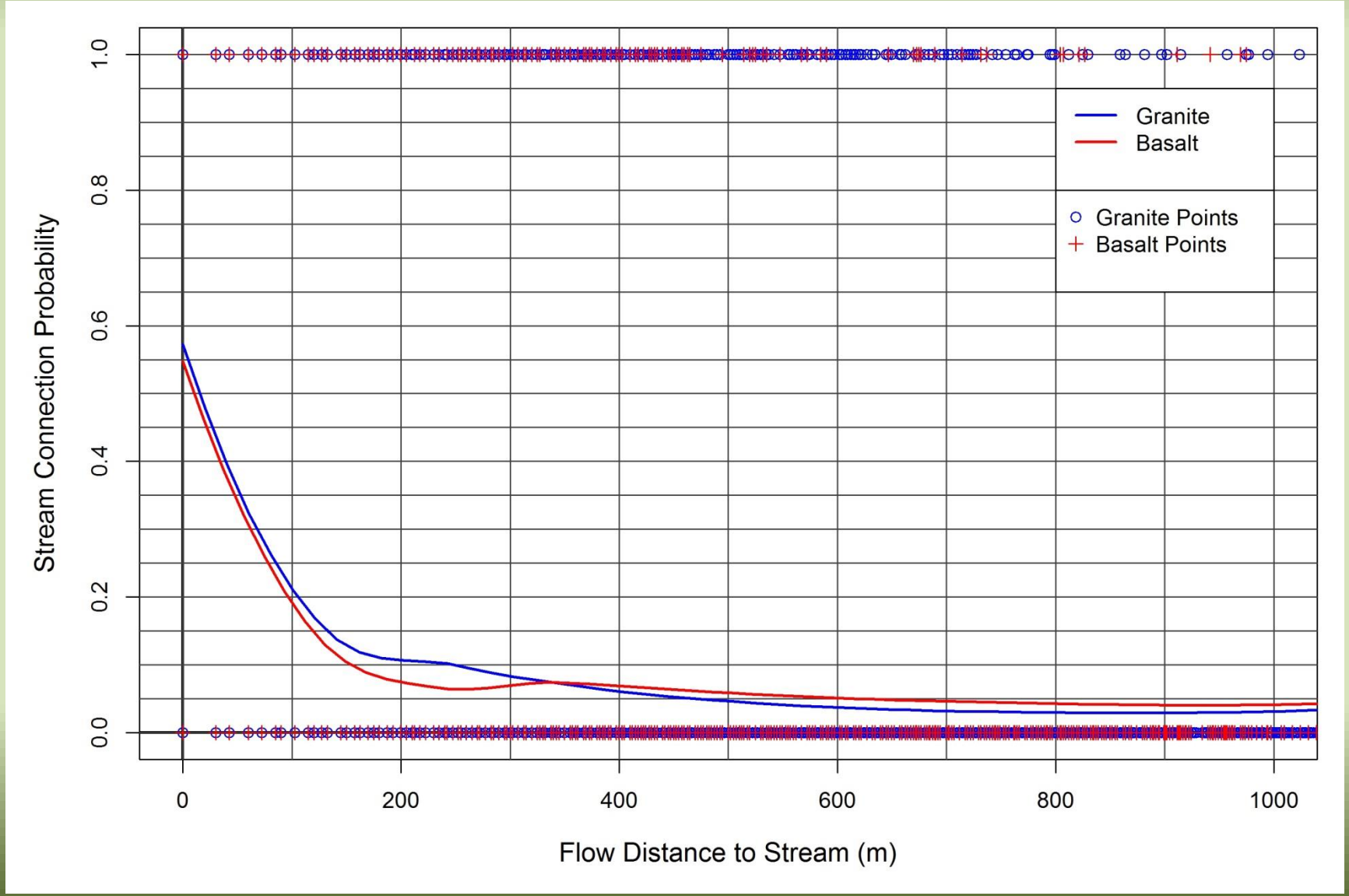
Calibration Data: Stream Connection Probability



Road Sediment Production

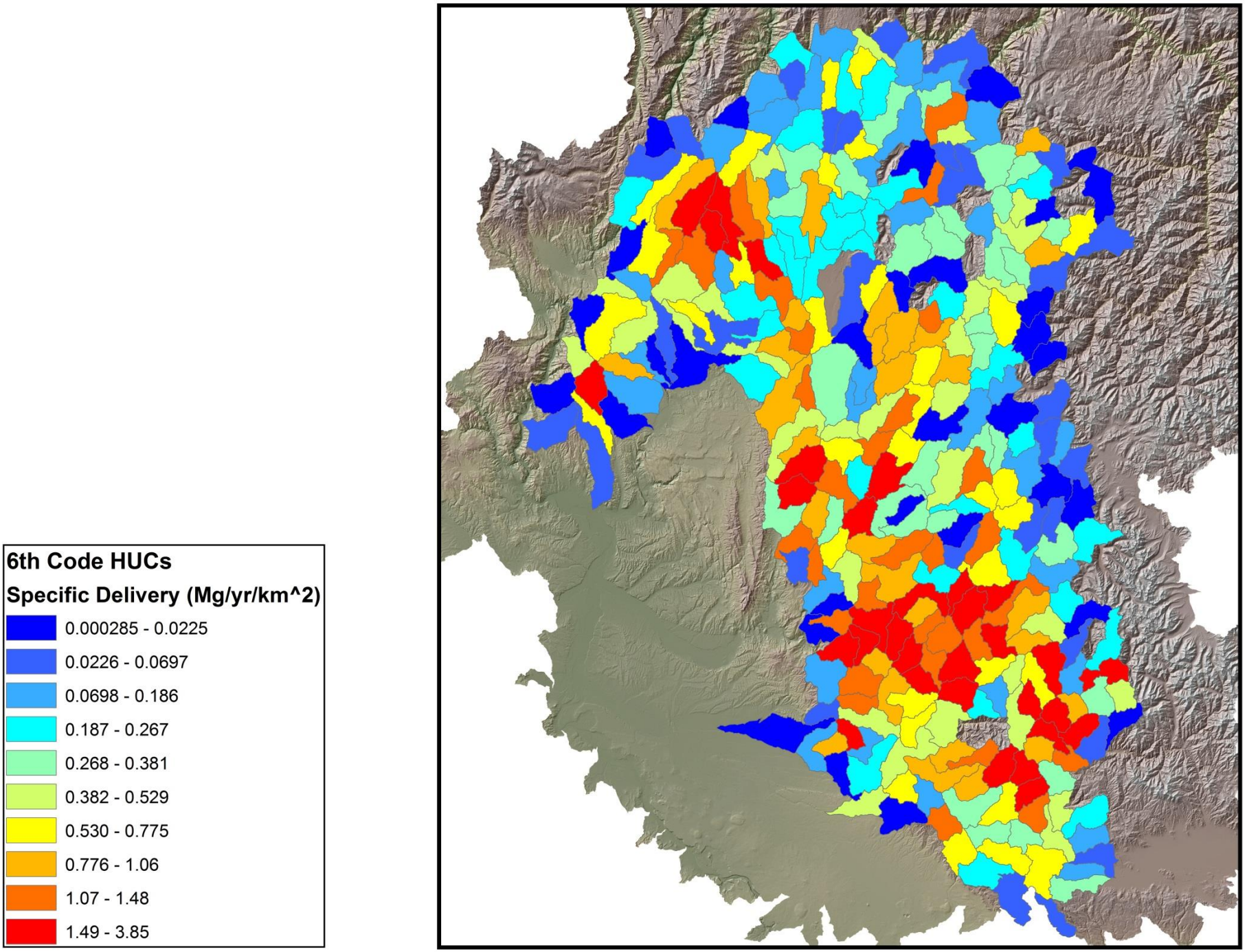
- $E = B*R*S*V$
  - E = Sediment Production
  - B = Baserate
  - R = Elevation difference between endpoints
  - S = Surface Factor
  - V = Vegetation Factor
- $V = 1 - 0.86*x$
  - x = Fraction of the road where flowpath vegetation is >25%

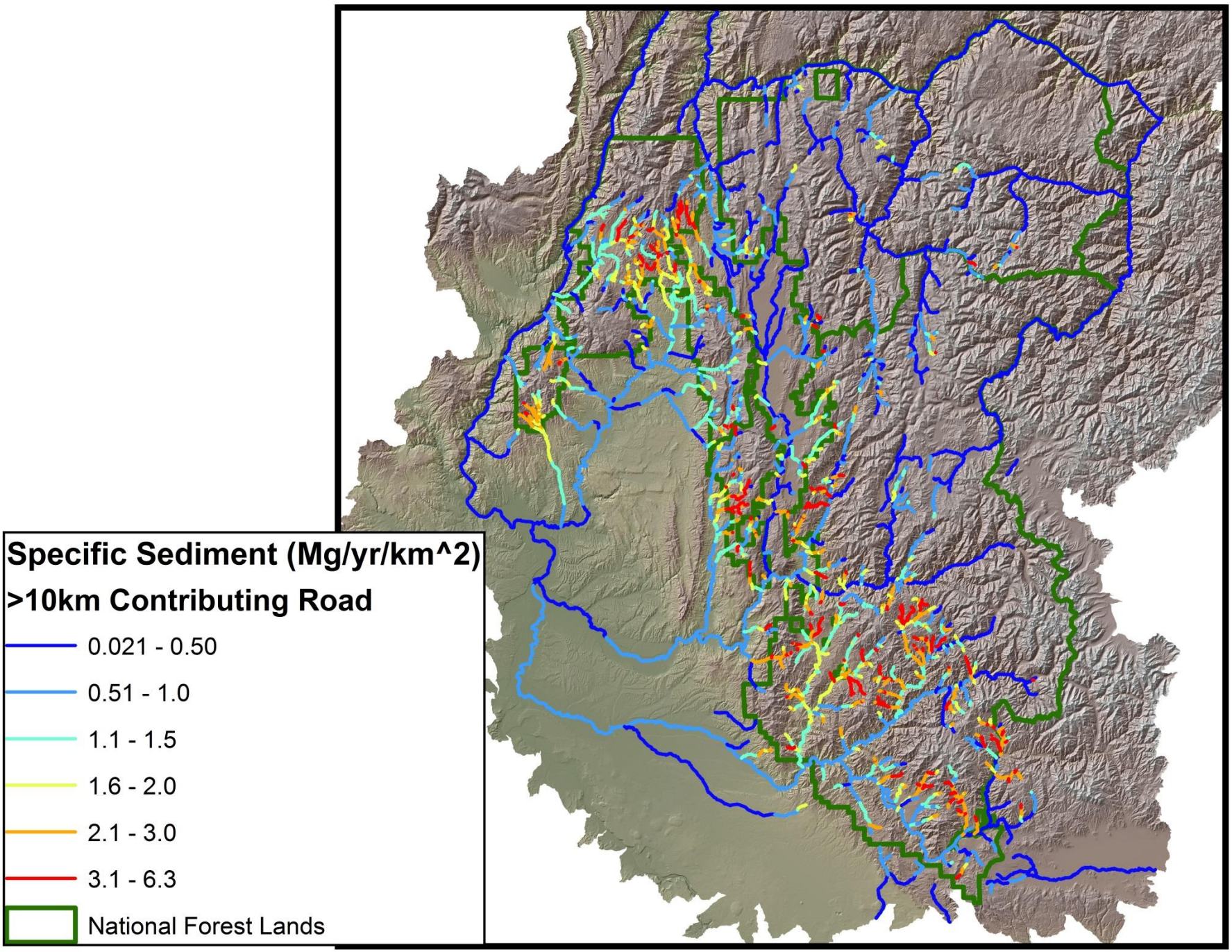
Fractional Sediment Delivery

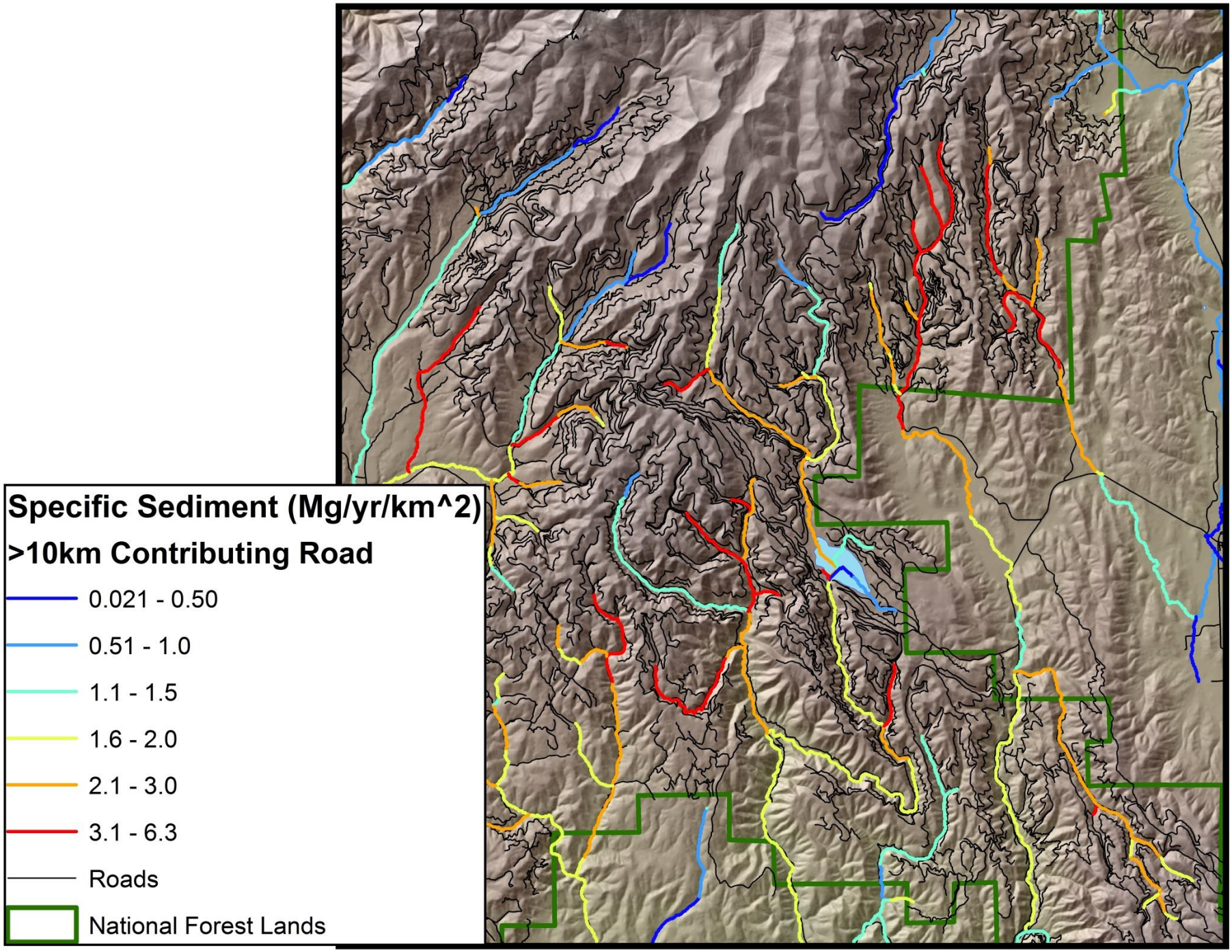


Stream Sediment Accumulation

- Route sediment using D8 Contributing Area Function
- Extract to stream shapefile
- Calculate specific sediment


6th Code HUCs
Specific Delivery (Mg/yr/km^2)
0.000285 - 0.0225
0.0226 - 0.0697
0.0698 - 0.186
0.187 - 0.267
0.268 - 0.381
0.382 - 0.529
0.530 - 0.775
0.776 - 1.06
1.07 - 1.48
1.49 - 3.85


Specific Sediment (Mg/yr/km^2)
>10km Contributing Road
0.021 - 0.50
0.51 - 1.0
1.1 - 1.5
1.6 - 2.0
2.1 - 3.0
3.1 - 6.3
National Forest Lands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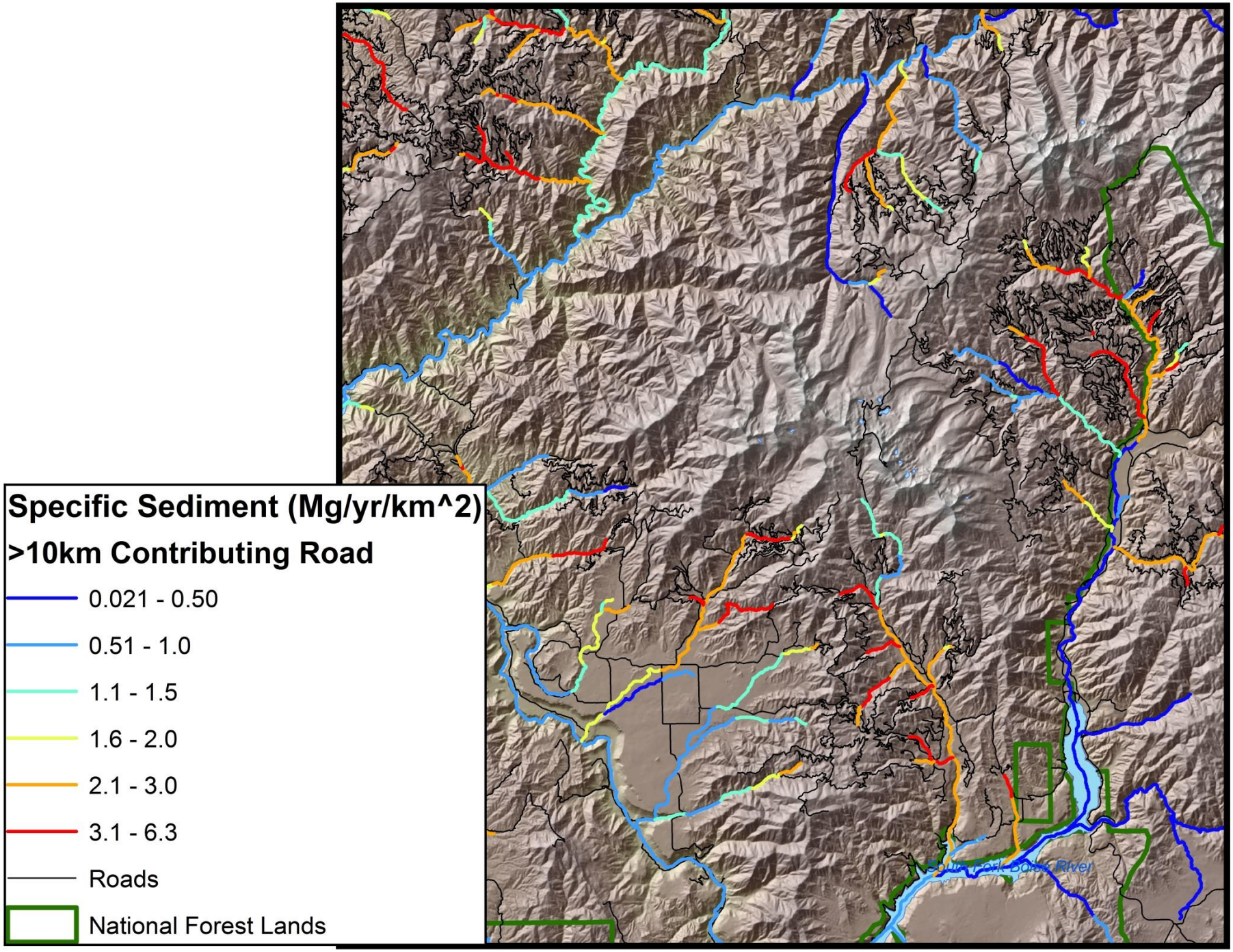
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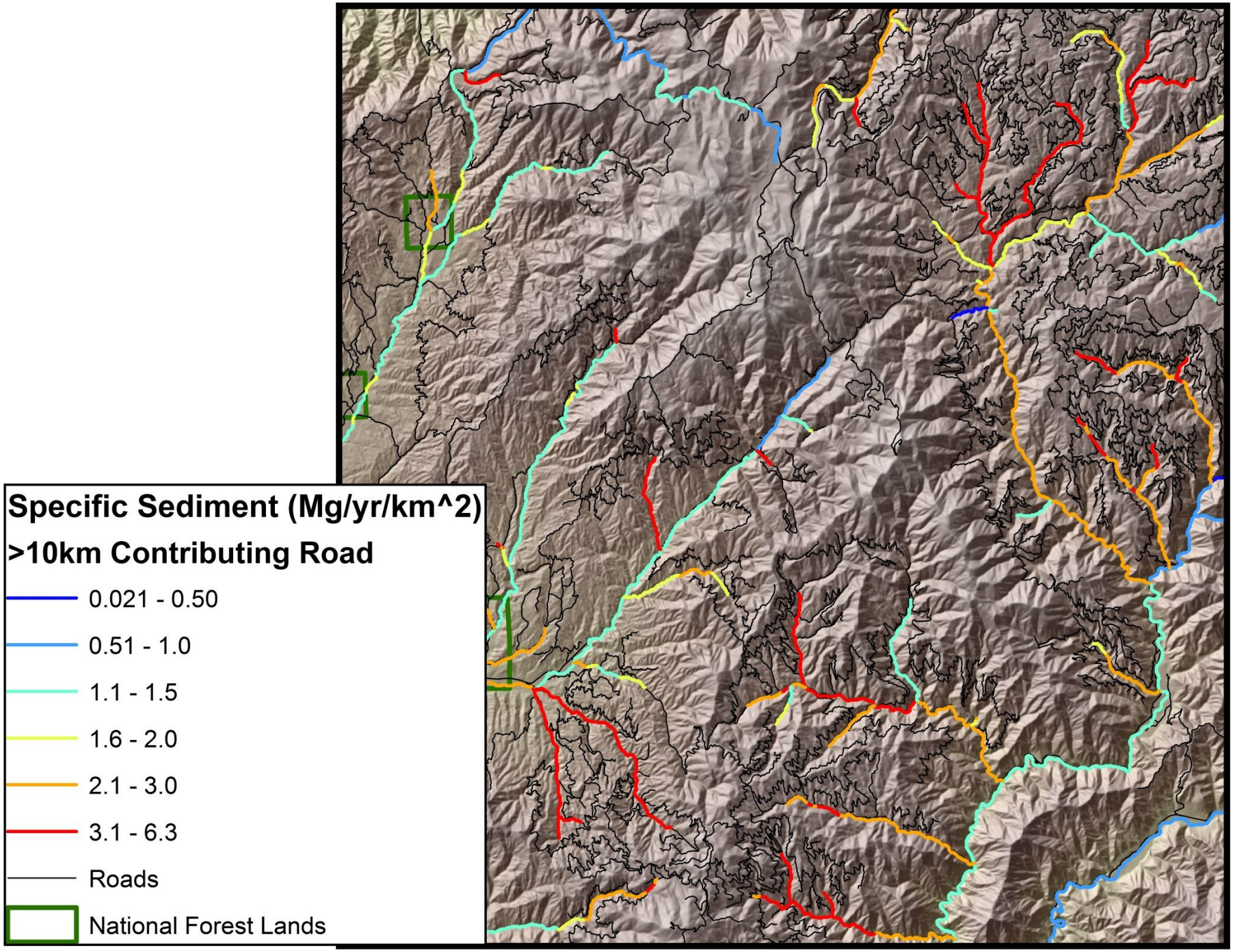
Roads
National Forest Lands
South Fork Boise River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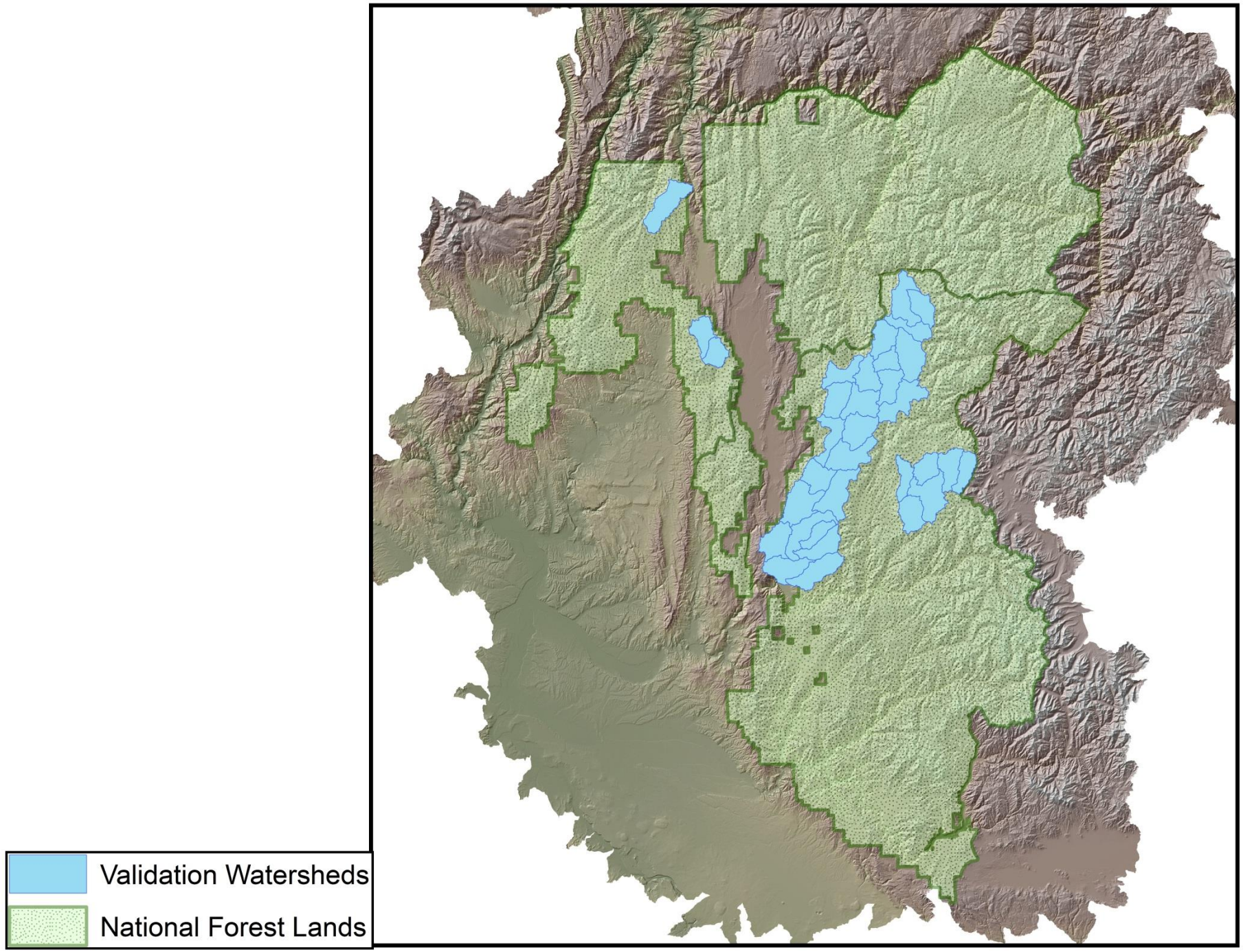
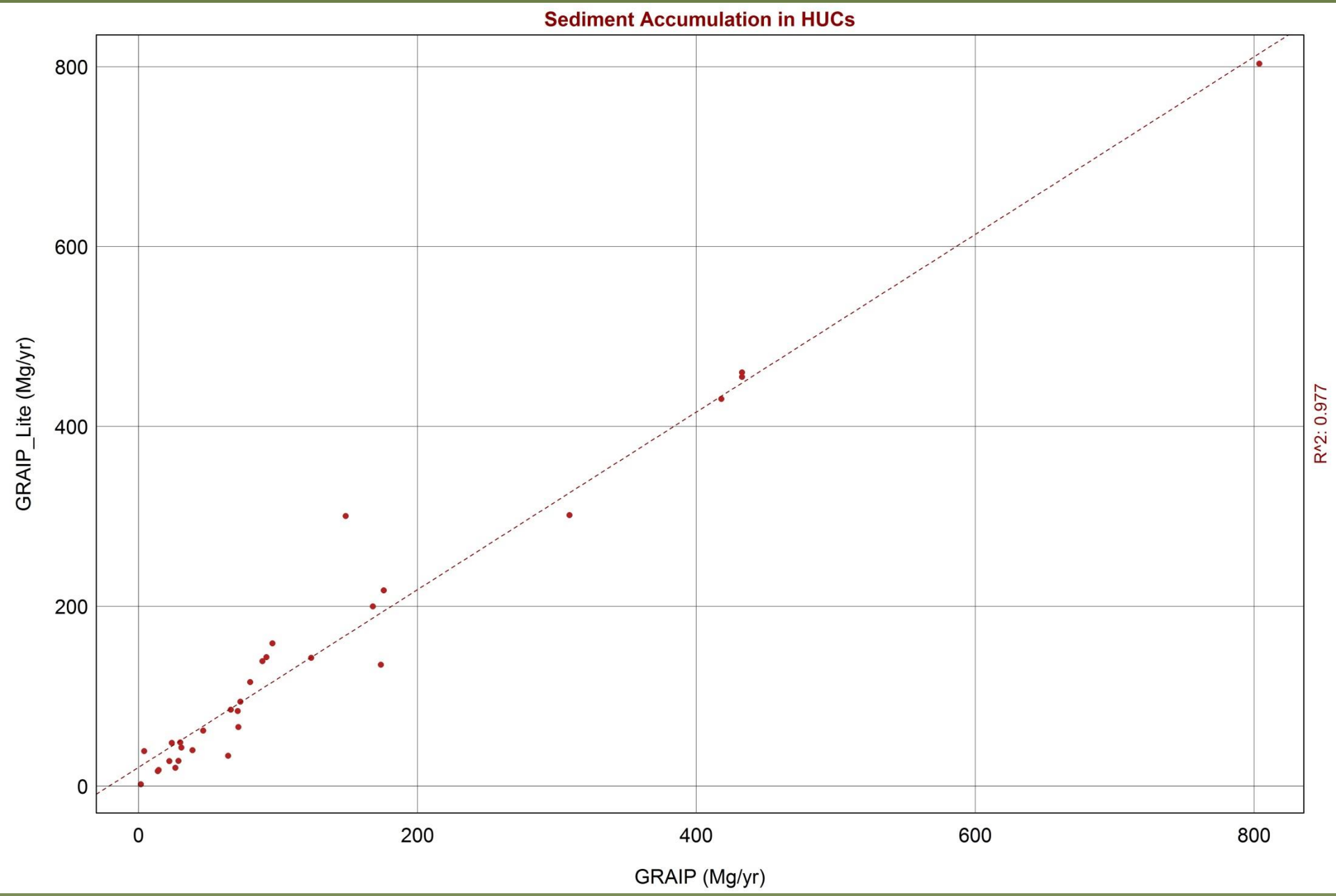
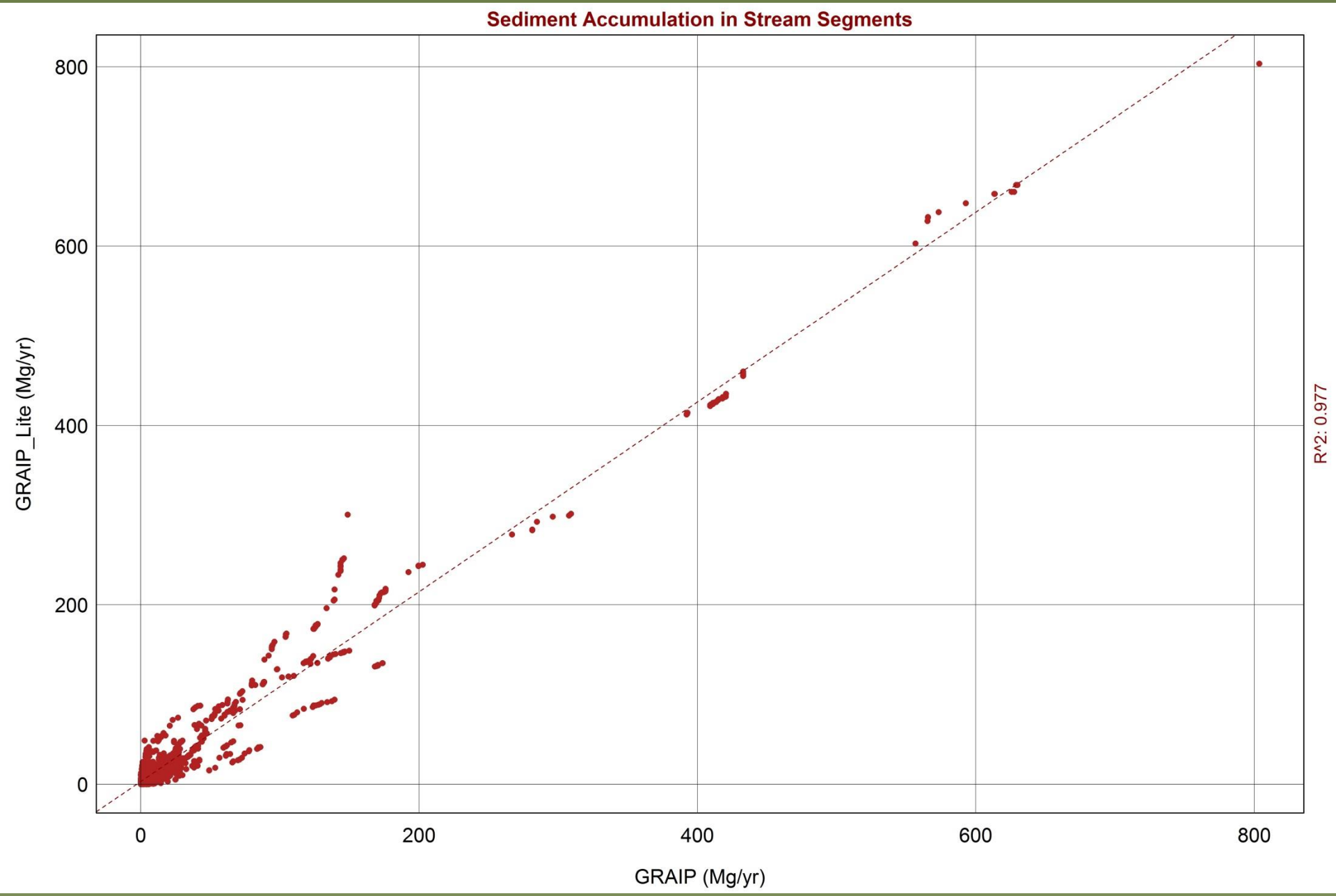
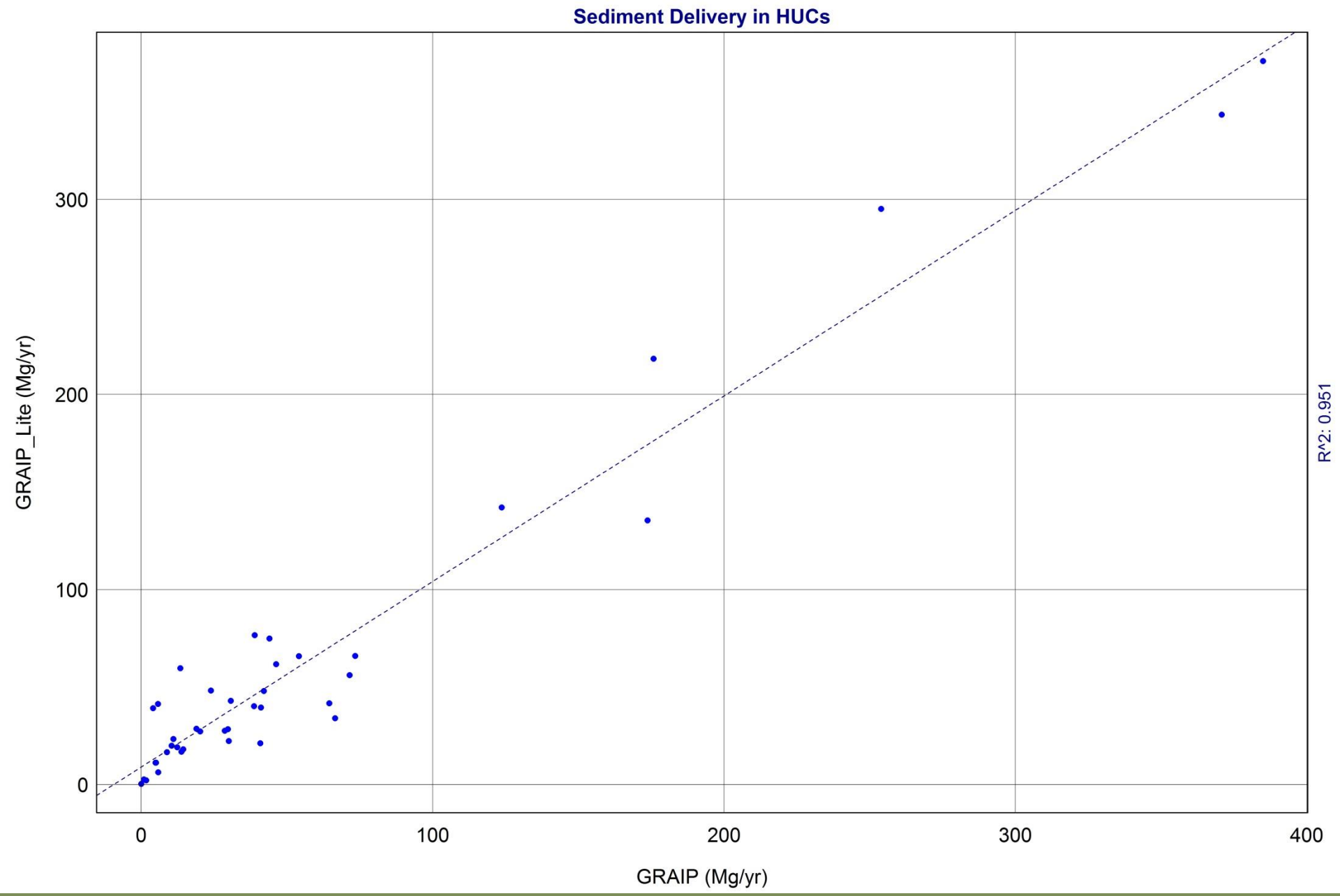
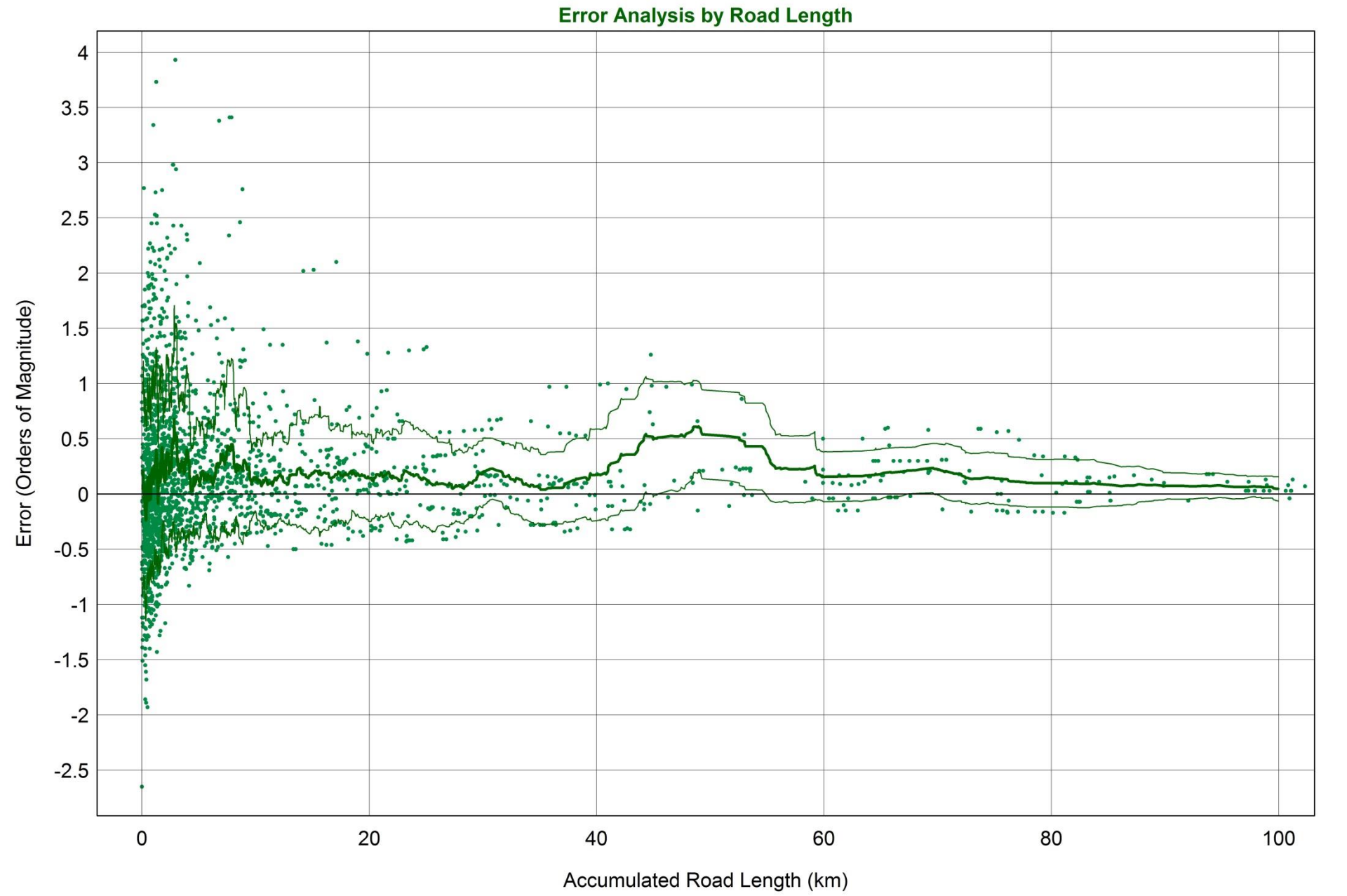
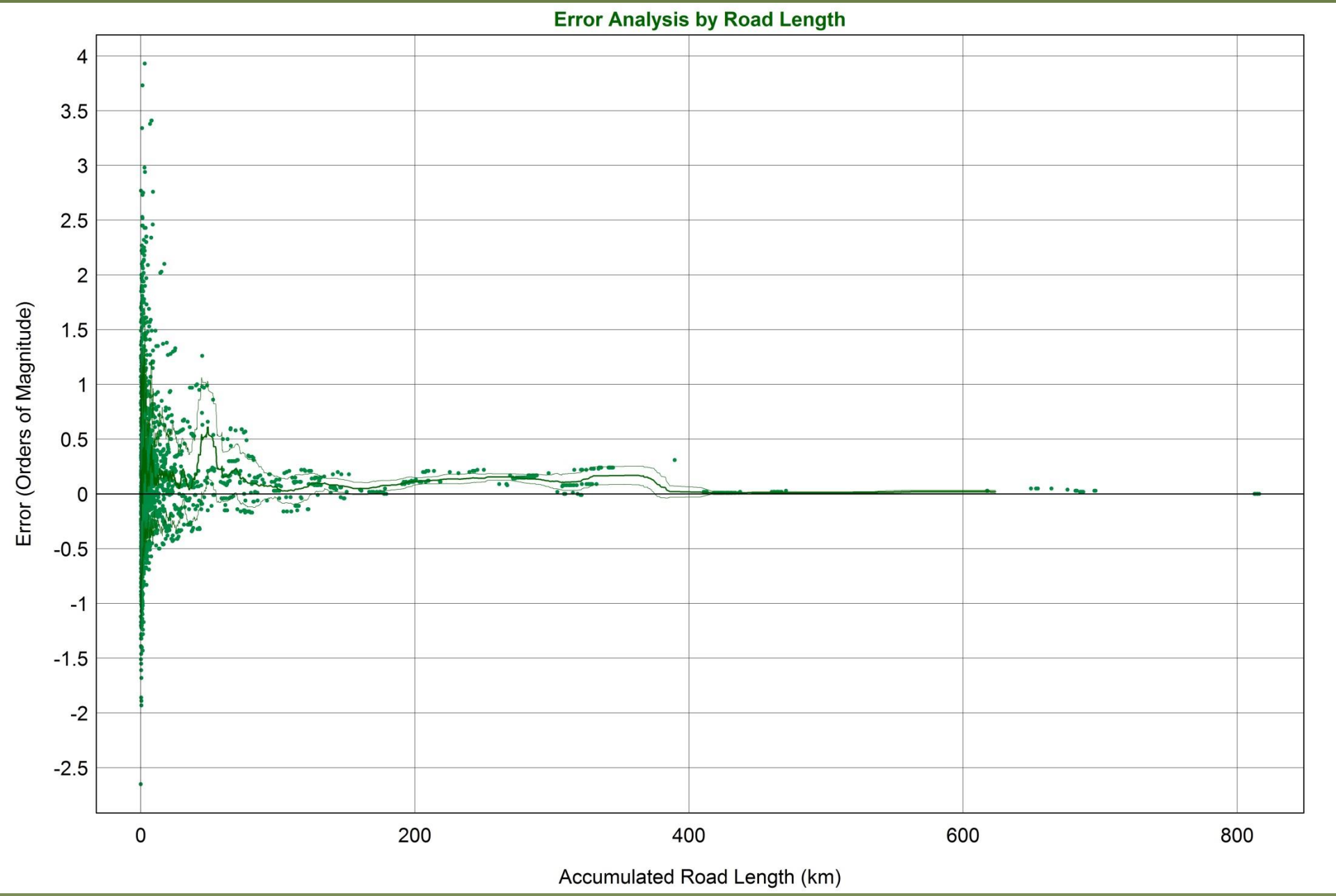

Validation Watersheds
National Forest Lands


Sediment Accumulation in HUCs
GRAIP_Lite (Mg/yr)
GRAIP (Mg/yr)
R^2: 0.977
0
200
400
600
800


Sediment Accumulation in Stream Segments
GRAIP_Lite (Mg/yr)
GRAIP (Mg/yr)
R^2: 0.977
0
200
400
600
800


Sediment Delivery in HUCs
GRAIP_Lite (Mg/yr)
GRAIP (Mg/yr)
R^2: 0.951
0
100
200
300
400


Error Analysis by Road Length
Error (Orders of Magnitude)
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
20
40
60
80
100
Accumulated Road Length (km)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3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
200
400
600
800
Accumulated Road Length (km)

Conclusions

- Requires only a modest field effort
- Can be run over large areas
- Allows small areas (20 – 50 km^2) to be prioritized for future work, i.e. GRAIP or other more detailed analysis
- Only as accurate as the input data