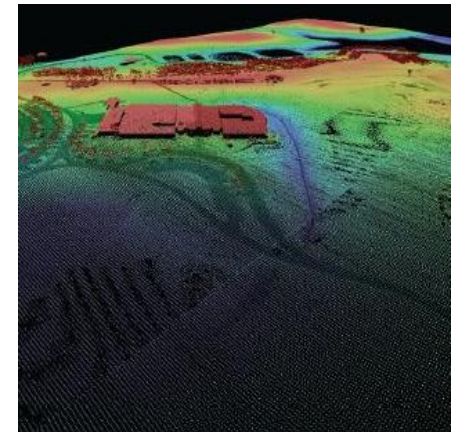
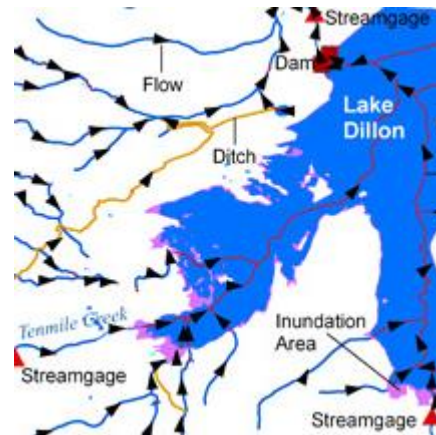
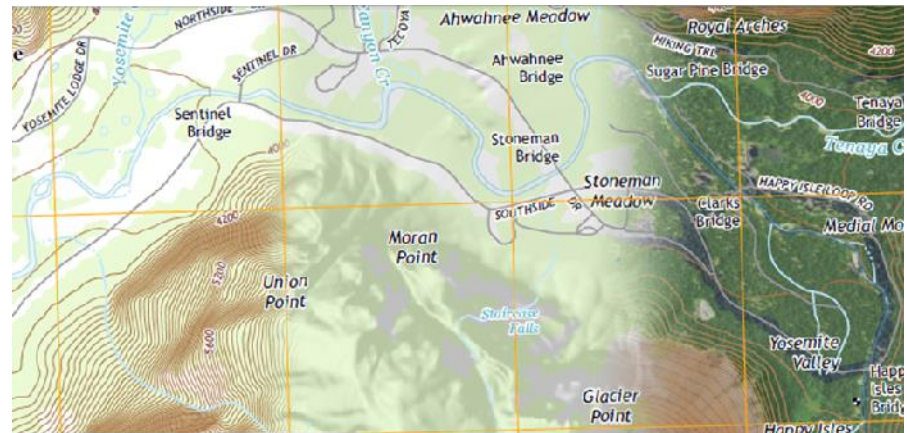


Generalization Quality Metrics in the Age of Big Geospatial Data



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**The
National
Map**

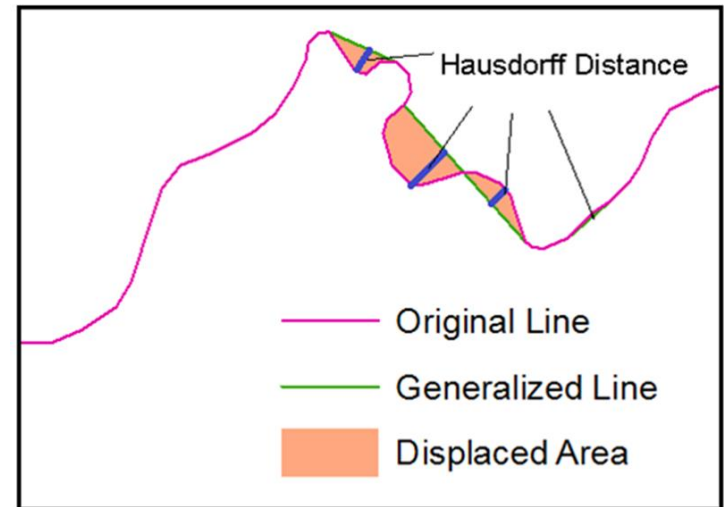
Your Source for Topographic Information

+ Motivation for generalization quality assessment tools

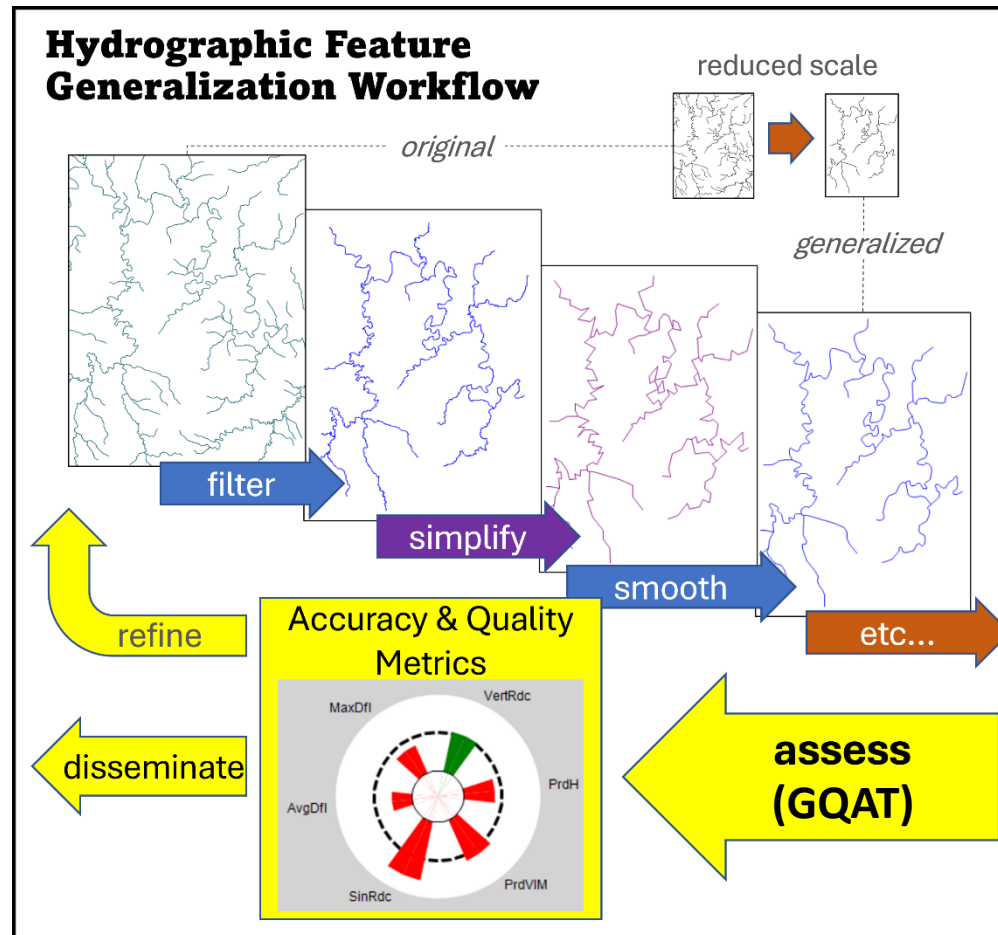
- Developing automated methods for consistent assessment of the quality of generalized geospatial data
 - Compare workflows
 - Assess quality of 1:100,000-scale USGS topographic maps
 - Assist development of multiscale geologic dataset
 - Fitness for use
- Guide development of standards for generalization

+ Generalization quality assessment tools

- Positional accuracy
 - Maximum displacement distance (Hausdorff distance)
 - Average displacement
 - Number of vertices
- Visibility
 - Change in feature density
 - Legibility
- Retention of properties
 - Feature density variations
 - Sinuosity
 - Structure, shape, pattern

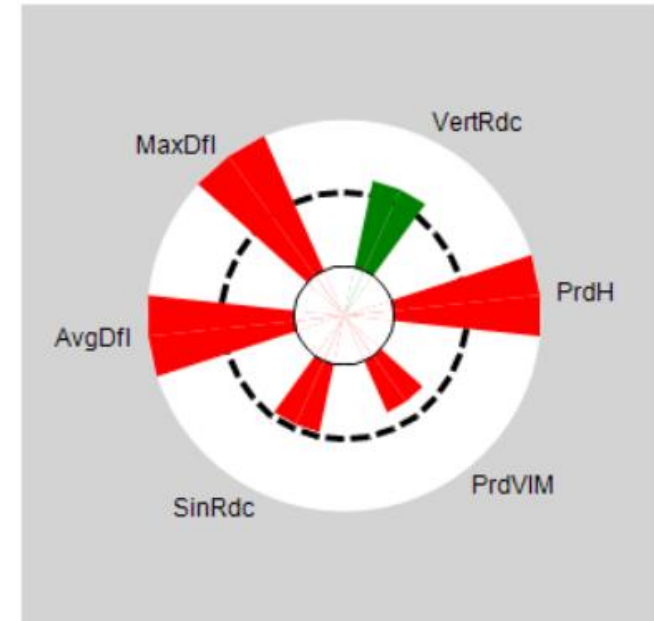


+ Generalization Quality Assessment Tools (GQAT)



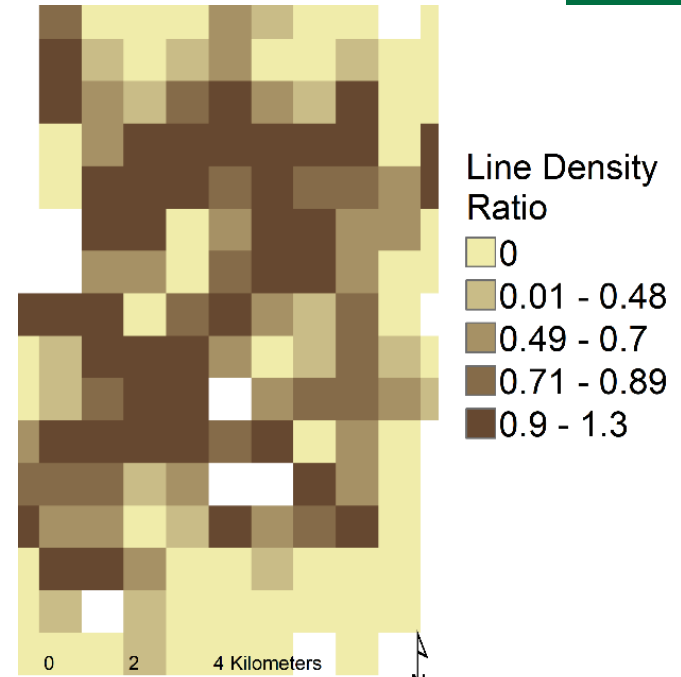
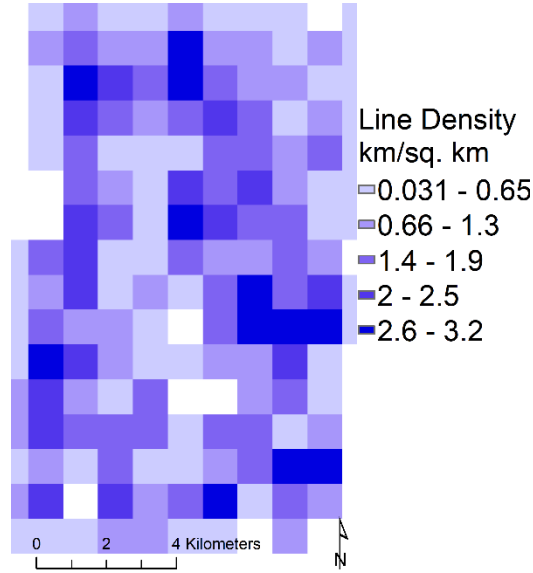
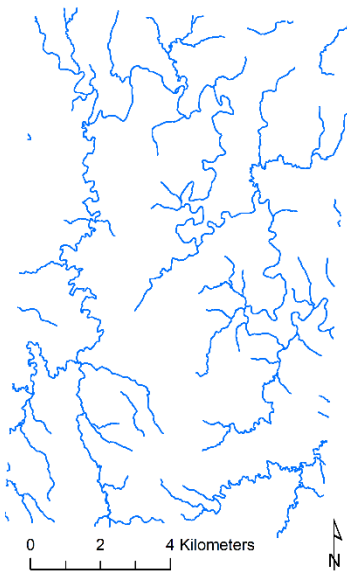
+ Example assessment goals and metrics for linear features

1. **PrdH:** Maximum producer's modified Hausdorff distance (m)
2. **PrdVIM:** Average producer's VIM distance (m)
3. **SinRdc:** Sinuosity reduction (%)
4. **AvgDfl:** Average angular deflection for successive segments ($^{\circ}$)
5. **MaxDfl:** Maximum deflection for successive segments ($^{\circ}$)
6. **VertRdc:** Vertex Reduction (%)
7. *Legibility: Avoid narrow gaps (m)*
8. *Feature Density Reduction (%)*

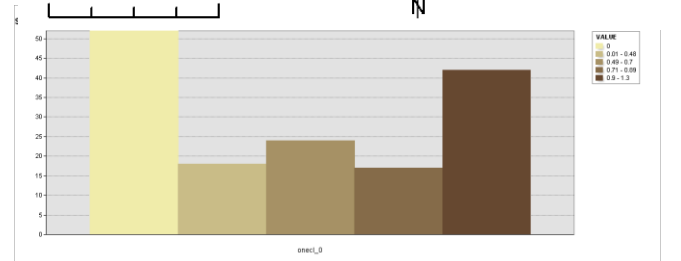
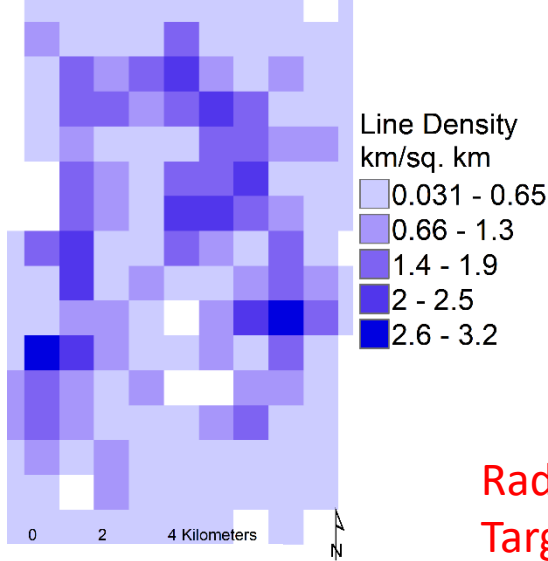


+ Feature density retention: hydrography 1:24,000 Sheep's Creek Dam, ND quadrangle

24k



100k



Flowlines

Line Density

Radical Law
Target Density
0.49

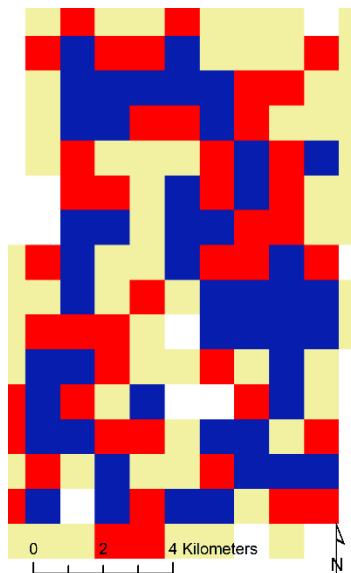
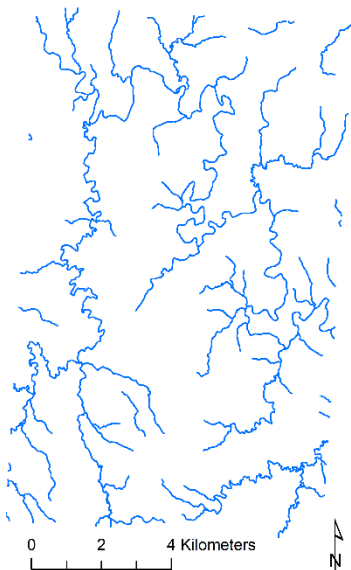
Line Density Ratio

Min: 0.00
Max: 1.31
Mean 0.50
St. Dev: 0.41

+ Feature density retention: hydrography

1:24,000 Sheep's Creek Dam, NV quadrangle

24k



24k Line Density Class

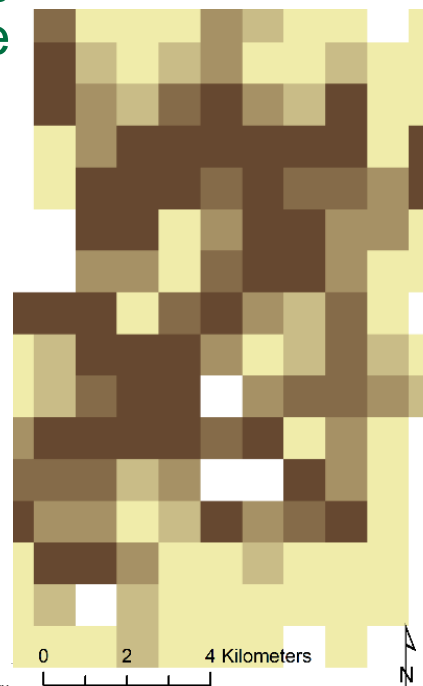
- Low
- Medium
- High

Three 24k Line Density Classes

100k

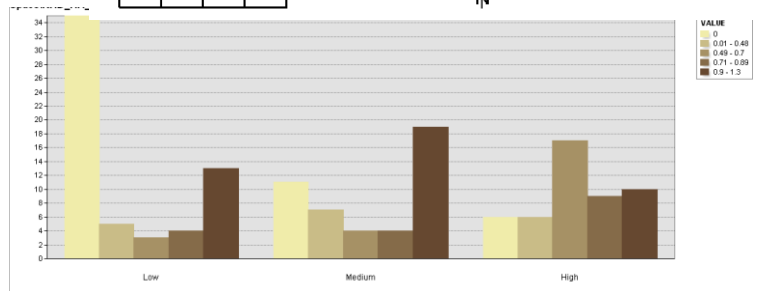


Flowlines



Line Density Ratio

- 0
- 0.01 - 0.48
- 0.49 - 0.7
- 0.71 - 0.89
- 0.9 - 1.3



Three Class Line Density Ratio Statistics

Class	Count	Min	Max	Mean	St. Dev.
Low	60	0.00	1.31	0.33	0.43
Medium	45	0.00	1.01	0.60	0.40
High	48	0.00	0.99	0.61	0.30

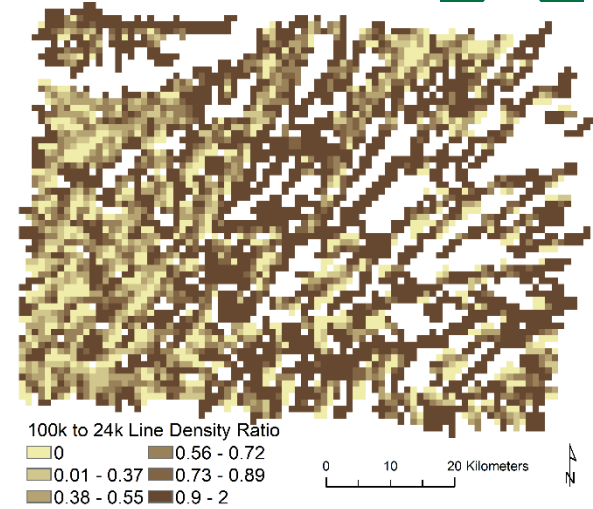
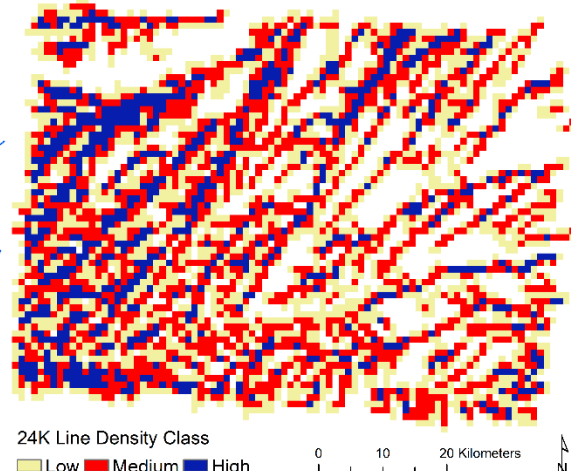
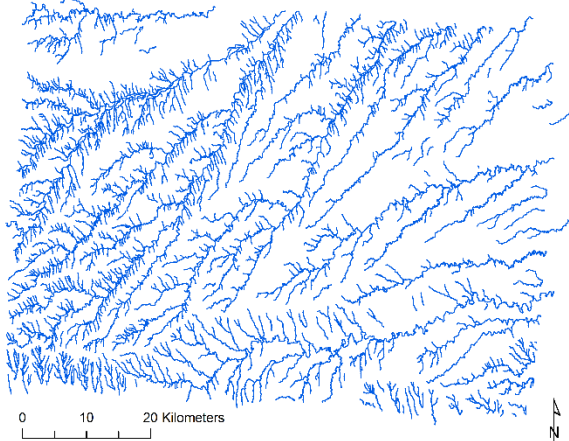
+ Feature density retention: hydrography

1:100,000 Burlington, CO, Topographic Map

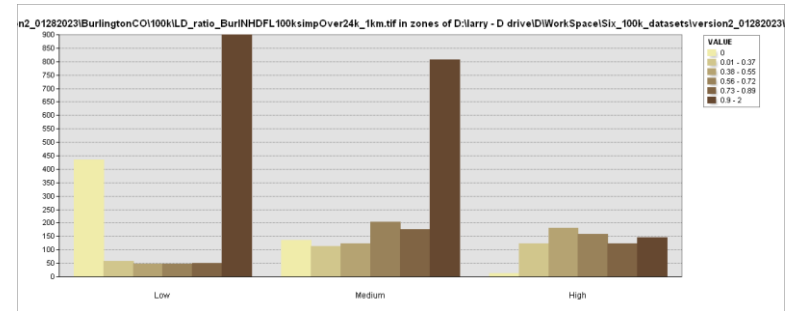
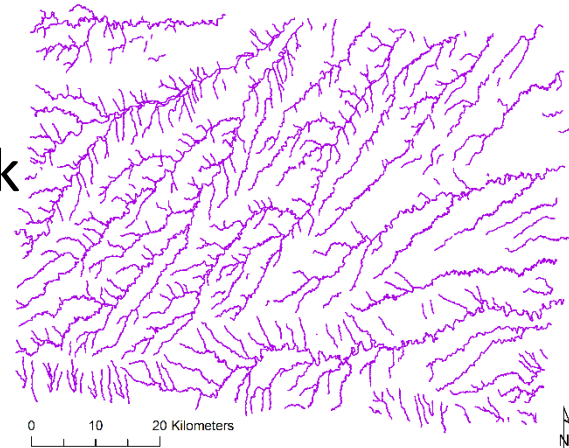
Flowlines

Three 24k Line Density Classes

24k



100k

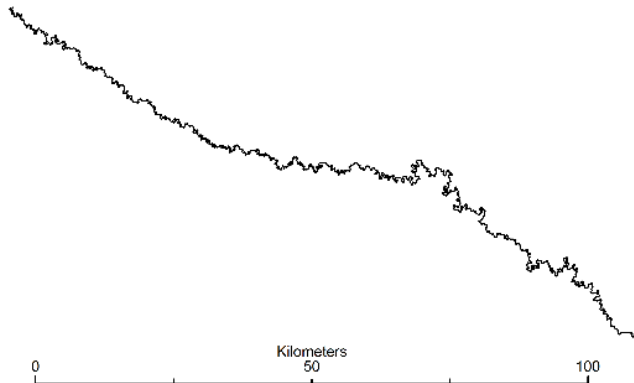


Three Class Line Density Ratio Statistics

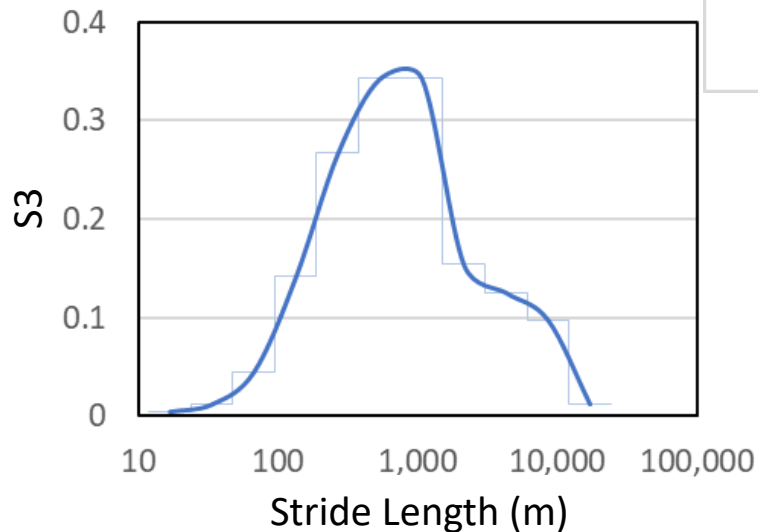
Class	Count	Min	Max	Mean	St. Dev.
Low	1540	0.00	2.04	0.64	0.45
Medium	1556	0.00	1.09	0.73	0.33
High	742	0.00	1.01	0.62	0.26

+ Scale-specific sinuosity metric (S3) to estimate change in sinuosity from simplification

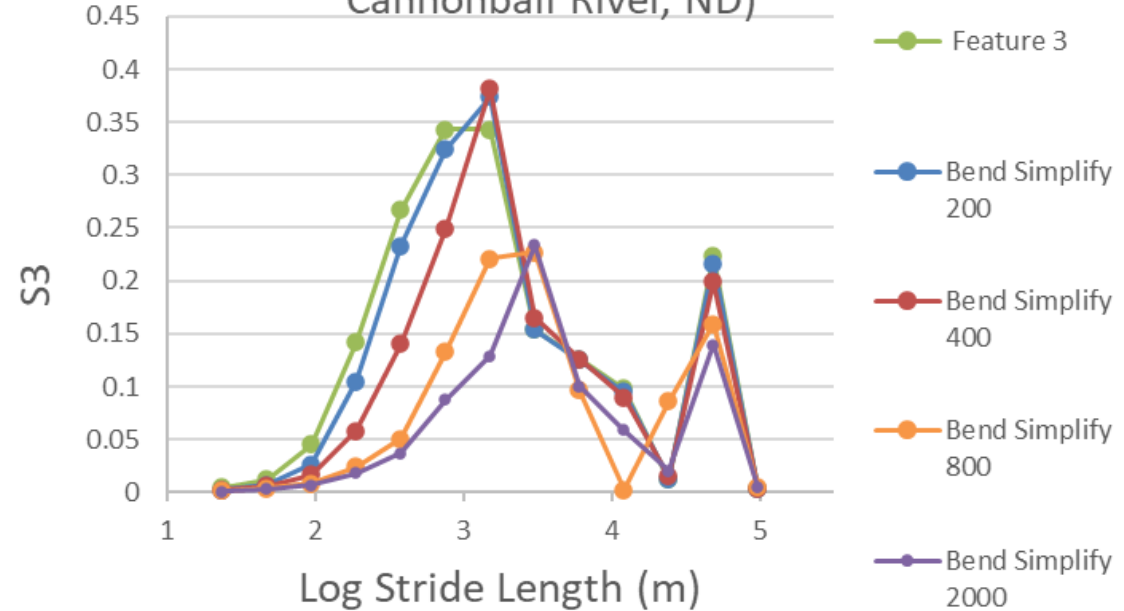
Cannonball River, North Dakota



S3 Plot



Change in S3 with simplification
Cannonball River, ND)



+ Summary

Development of generalization quality assessment tool

- Enables comparisons and refinement of generalization workflow
 - Assist USGS multiscale topographic mapping
 - Assist development of USGS multiscale geological database
 - Provide fitness for use of generalized data of resource managers and data users.
-
- Guide development of standards for generalization
 - Applicable to any generalized datasets.
 - Contribute work to national and international standards for generalization

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