The Creation of Multiple Scale Databases in the NHGIS

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Overview

- Generalization Special Project
- Done in conjunction with tract/county editing
- Goal: produce different versions of the boundary databases differing by level of generalization
  - Example target scales
    - 1:150,000
    - 1:400,000
    - 1:1,000,000
Presentation Overview

- Illustrate three topics
  - Generalization problems
  - Automatic categorization of lines
  - Initial look an approach we are experimenting with
- Next steps
Effects of Uniform Generalization

Douglas-Peucker Algorithm

Original Map

Generalized to 350m

- Desired appearance for scale
- Critical points lost

aprox. 1:250000 when displayed on a 8.5" x 11" page
Fundamental Problem

- Applying common line simplification procedures uniformly to our boundary files is deemed unacceptable
  - Based on visual examination
- Manual intervention is also unacceptable
  - Due to size of database
Trendlines

- Trendline – line connecting inflection points
  - Highly correlated with fractal dimension
  - Based on work by Philippe Thibault
- Generate a complexity measure from trendline
Trendlines:
A line connecting the inflection points of the original line
More Complex:
- Trendline intersects original line multiple times
- Trendline is shorter

Less Complex:
- Trendline nearly matches original line
Sinuosity as a Complexity Measure

Sinuosity = line length / trendline length

Mean = 1.058663
S.D. = 0.144226

- <= 1.058663
- 1.058663 to 1.202889 (+ 1 S.D.)
- > 1.202889 (> 1 S.D.)
Current Experimentation

- Two-pass procedure for generalizing coastal areas
  - Visvalingam’s algorithm
  - Leung’s algorithm
    - Kai Chi Leung – an NHGIS RA
Visvalingam's Algorithm

- Generalized for a target scale of 1/150,000
- Tolerance: 8,000 sq. meters
1st pass:
Visvalingam's Algorithm
2nd pass:
Leung's Algorithm

- Generalized for a target scale of 1/150,000
- Tolerances:
  Visvalingam's: 8,000 sq. meters
  Leung's: 20,000 sq. meters
Visvalingam's Algorithm

Generalized for a target scale of 1/150,000
Tolerance used: 8,000 sq. meters
Two Pass Method

Generalized for a target scale of 1/150,000
-Tolerances used:
  Visvalingam’s: 8,000 sq. meters
  Leung’s: 20,000 sq. meters
Two Pass Method
Target Scale: 1/400,000

-Tolerances:
Visvalingam's: 60,000 square meters
Leung's: 200,000 square meters
Two Pass Method

Generalized for a target scale of 1/400,000
-Tolerances used:
Visvalingham's: 60,000 sq. meters
Leung's: 200,000 sq. meters

Visvalingham Only
After 2nd Pass w/ Leung’s Algorithm
Visvalingam's Algorithm
Target Scale: 1/1,000,000

Tolerance: 400,000 square meters
Two Pass Method
Target Scale: 1/1,000,000

-Tolerances:
Visvalingam: 400,000 square meters
Leung: 1,000,000 square meters
Two Pass Method

Generalized for a target scale of 1/1,000,000
-Tolerance used:
Visvalingam 400,000 sq. meters
Leung's 1,000,000 sq. meters
Next Steps

- Continue to test complexity measures
- Experiment with the application of smoothing procedures after simplification
- Test methods on other places
  - Maine coastline
  - Louisiana delta