Constraint-based Approach in Geological Map Generalization

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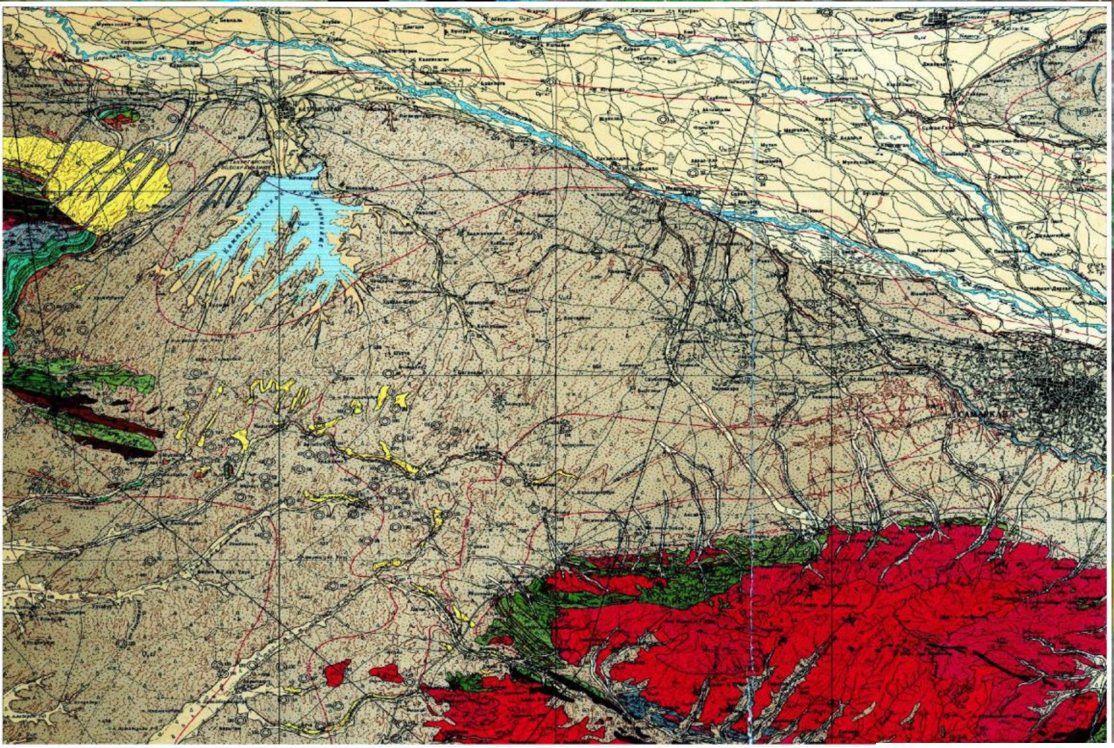
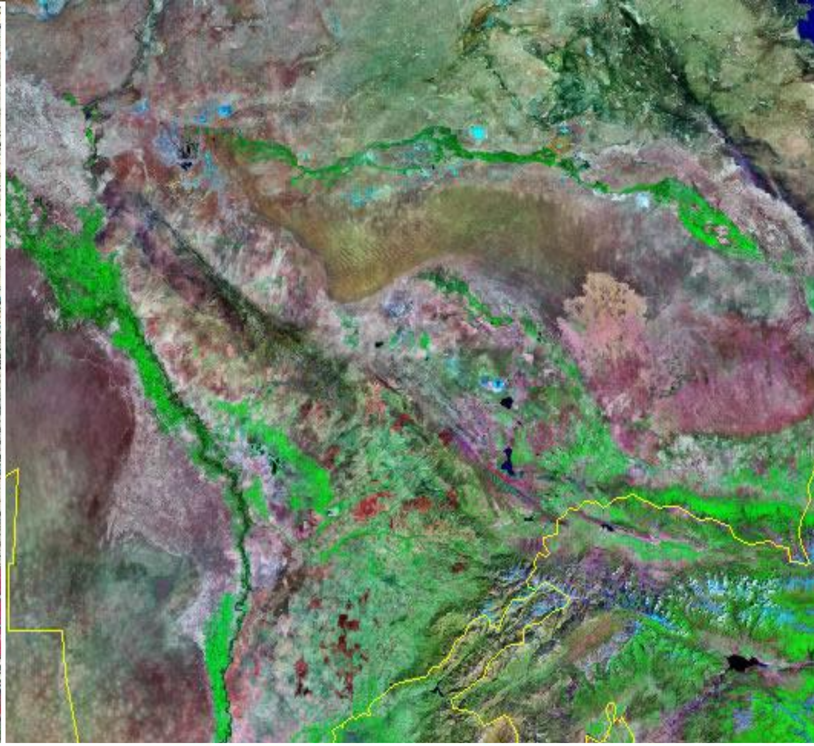
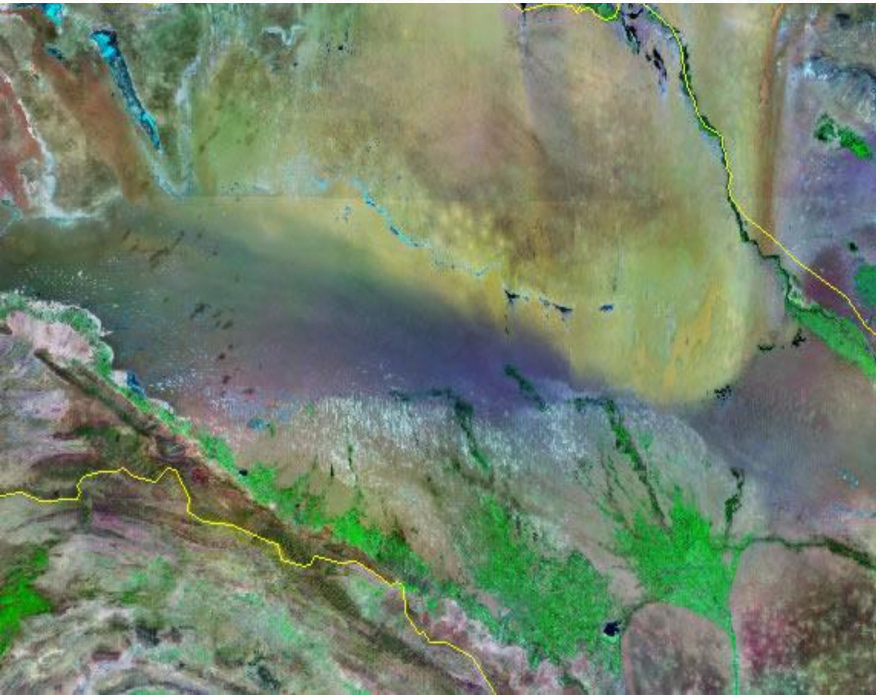
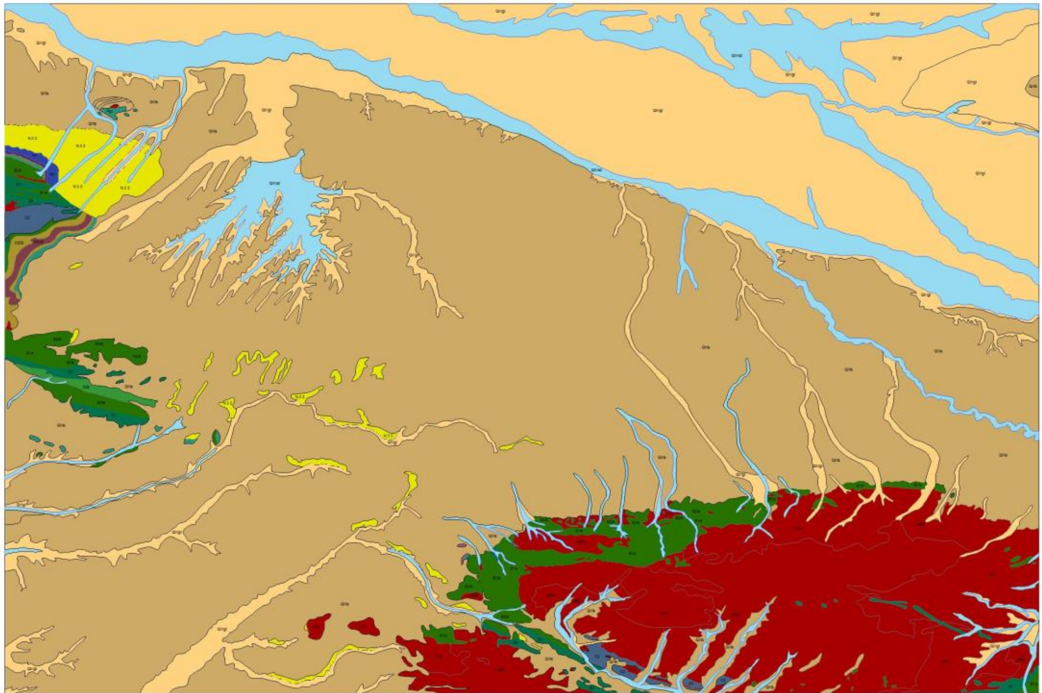
Content

1. Motivation
2. Geological map structures
3. Related Research
4. Methods
5. Experiments and results

Content

1. **Motivation**
2. Geological map structures
3. Related Research
4. Methods
5. Experiments and results

Motivation

Practical:

Demand for more flexible, reliable and more objective methods of geological map generalization

Theoretical:

Necessity for improvement of existing approaches for geological map generalization

Content

1. Motivation
2. **Geological map structures**
3. Related Research
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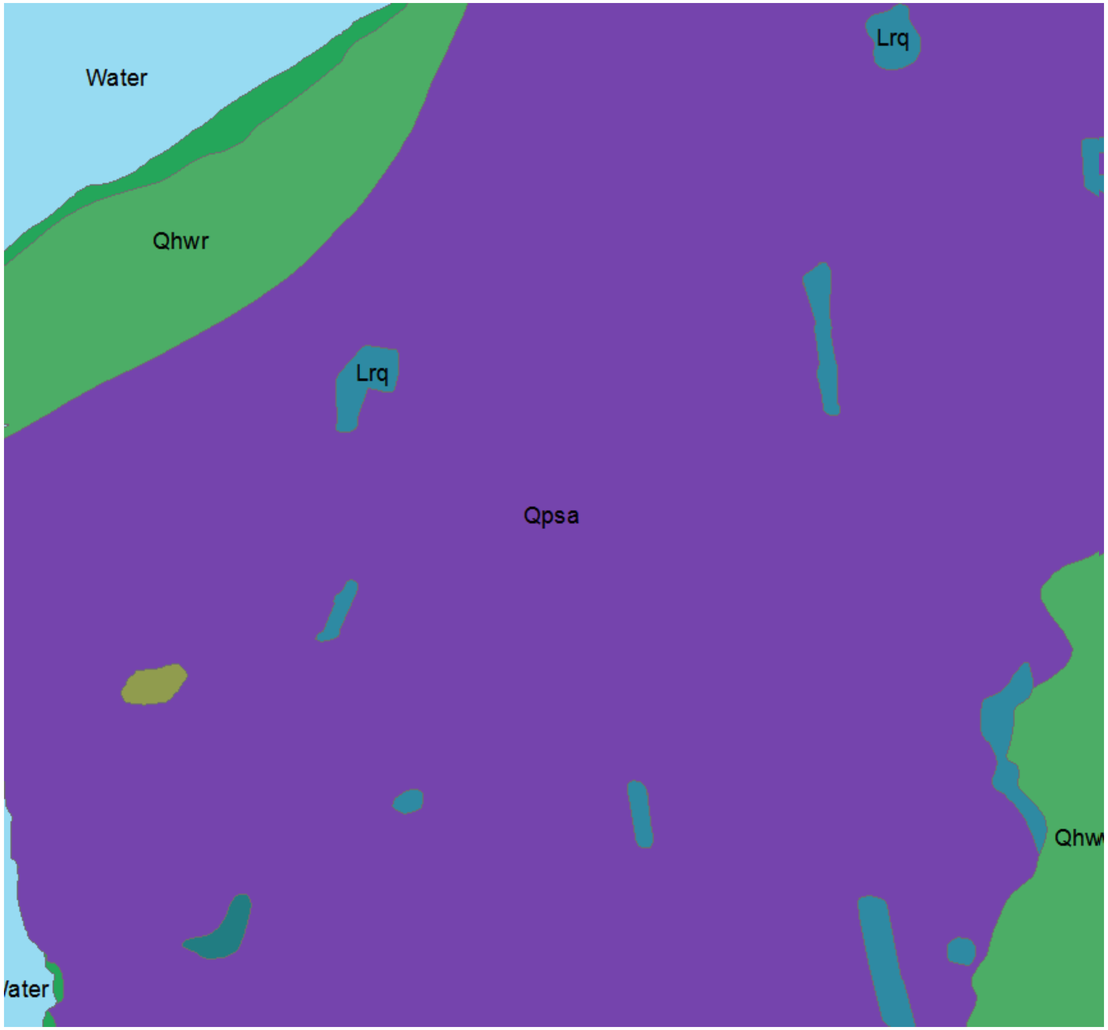
Geological map

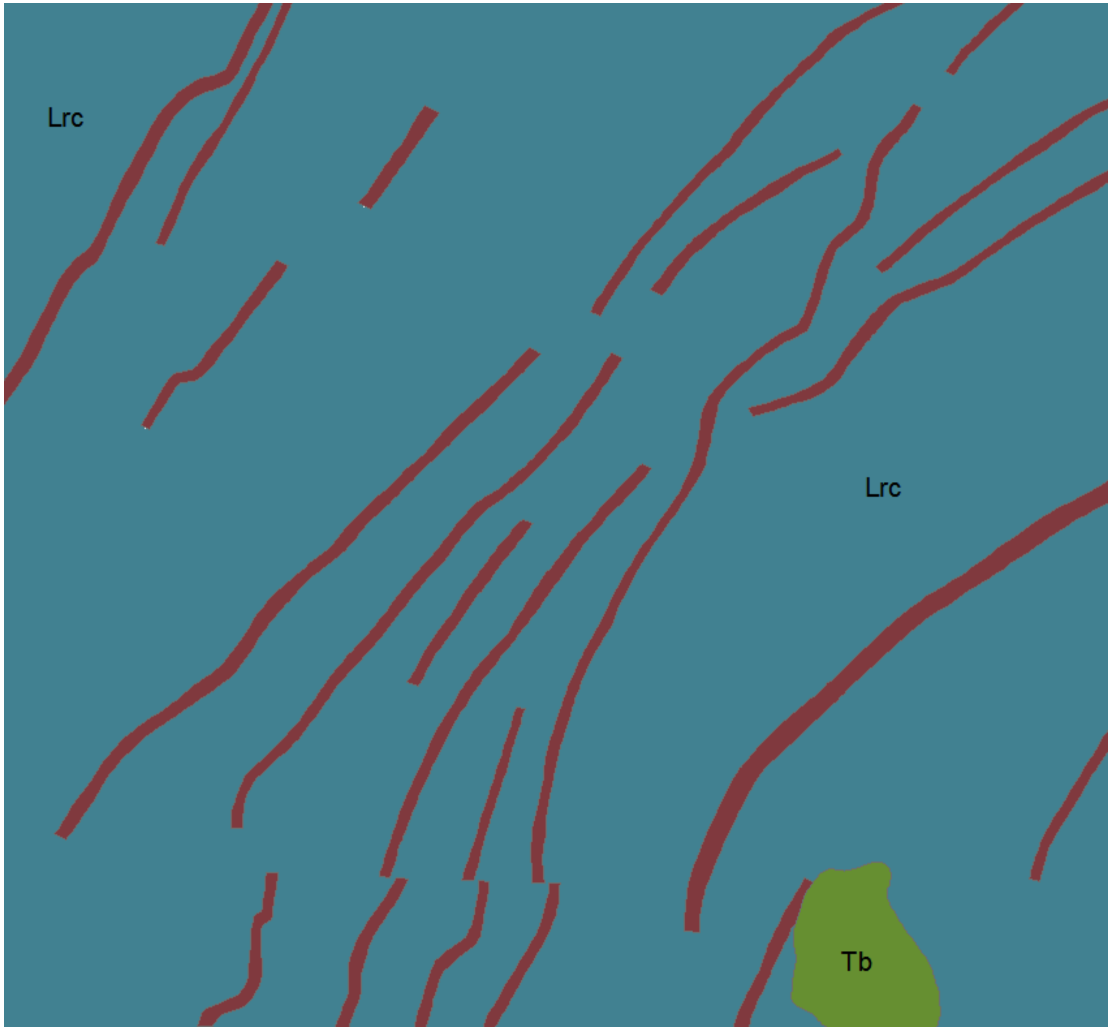
- Uniquely suited to solving problems involving Earth resources, hazards, and environments
- A graphical presentation of geological observations and interpretations on a horizontal plane
- A complex map consisting of different structures and shapes on the map

Geological structures on the map

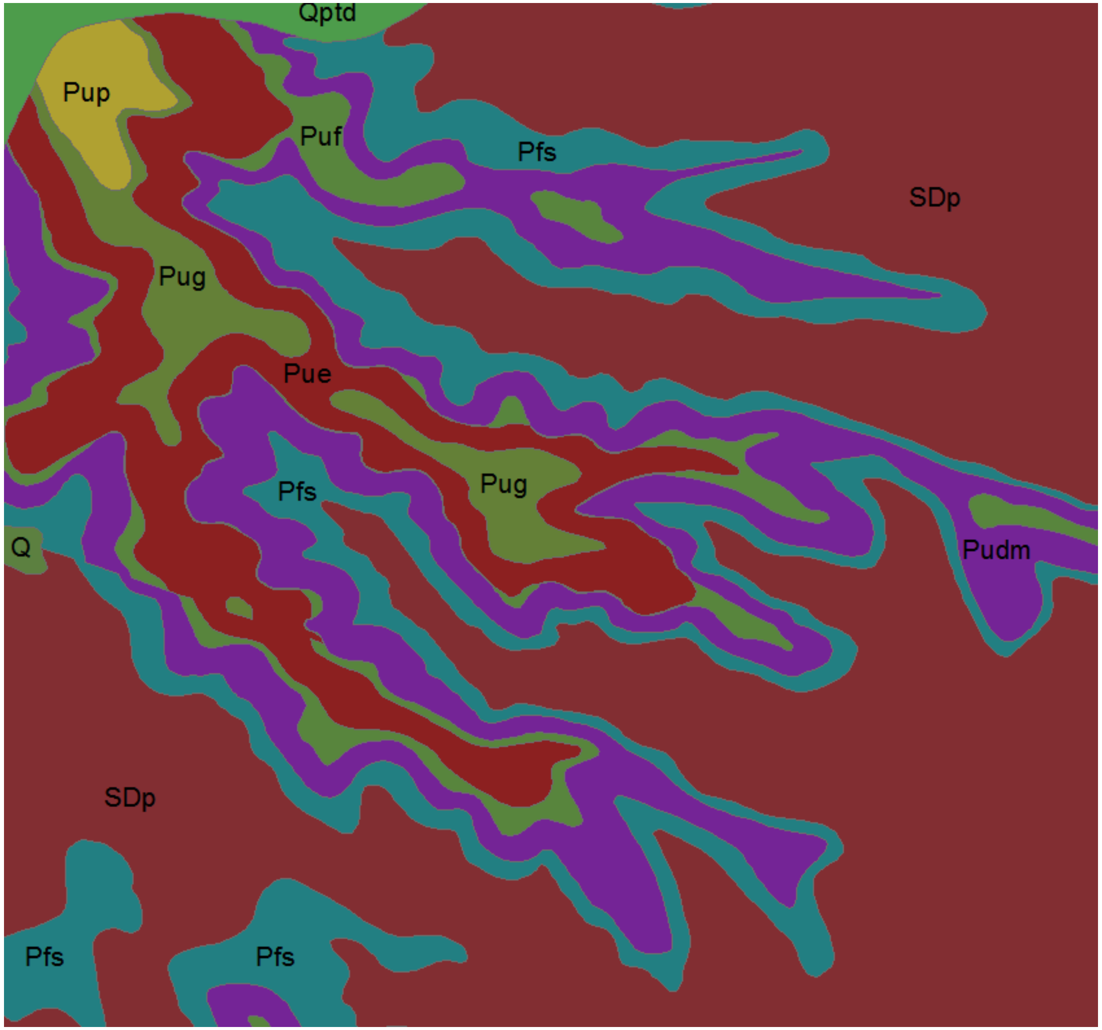
Geological structures on the map



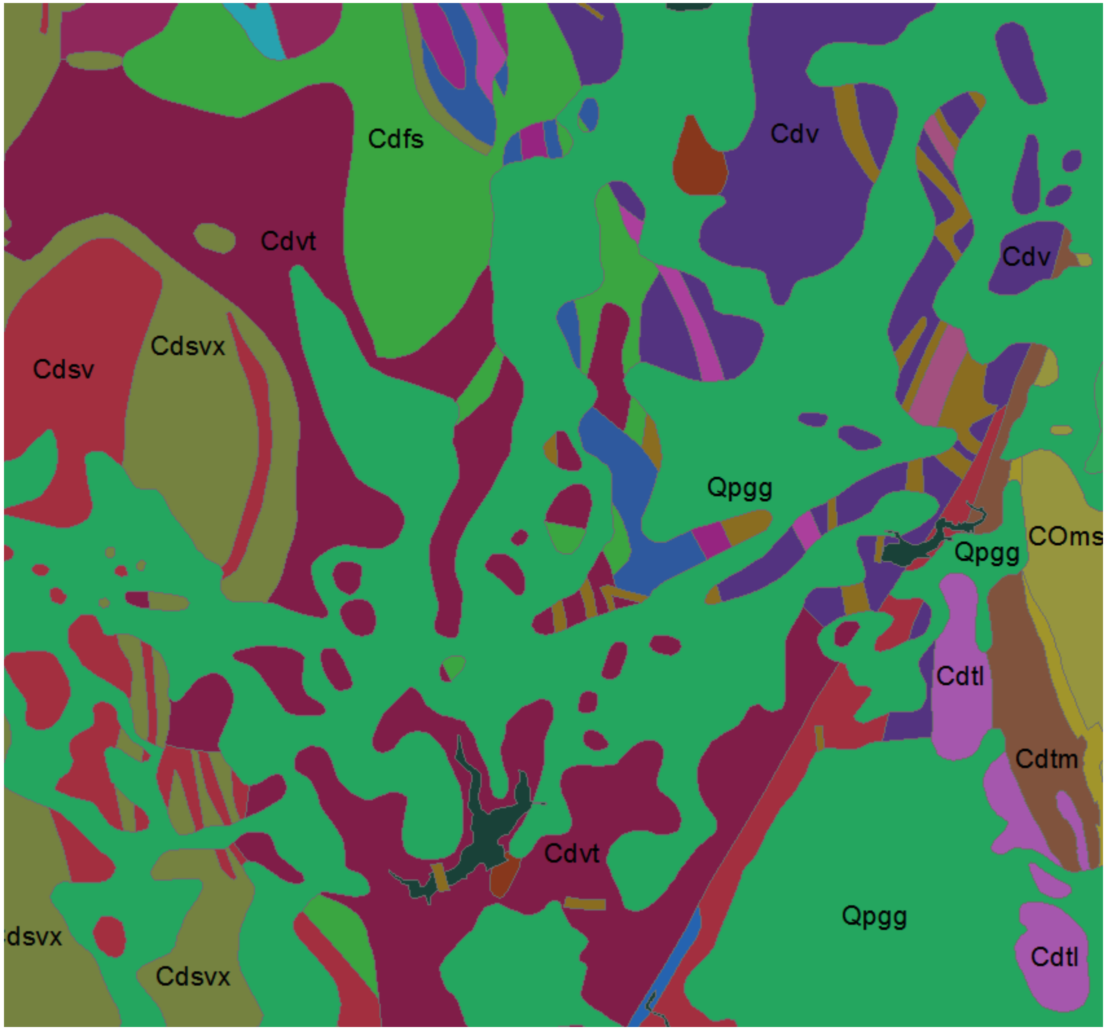
Geological structures on the map



Geological structures on the map



Geological structures on the map



Content

Galanda, 2003

- Defined constraints for polygonal map generalization
  - Can be reused for the research
- Based on agent-based approach
  - Makes reasoning process complex
  - Less flexible in adding more generalization operators
- Generic solution for categorical map generalization
  - Exclusively on geological map generalization
  - Pragmatic definition of constraints and generalization algorithms

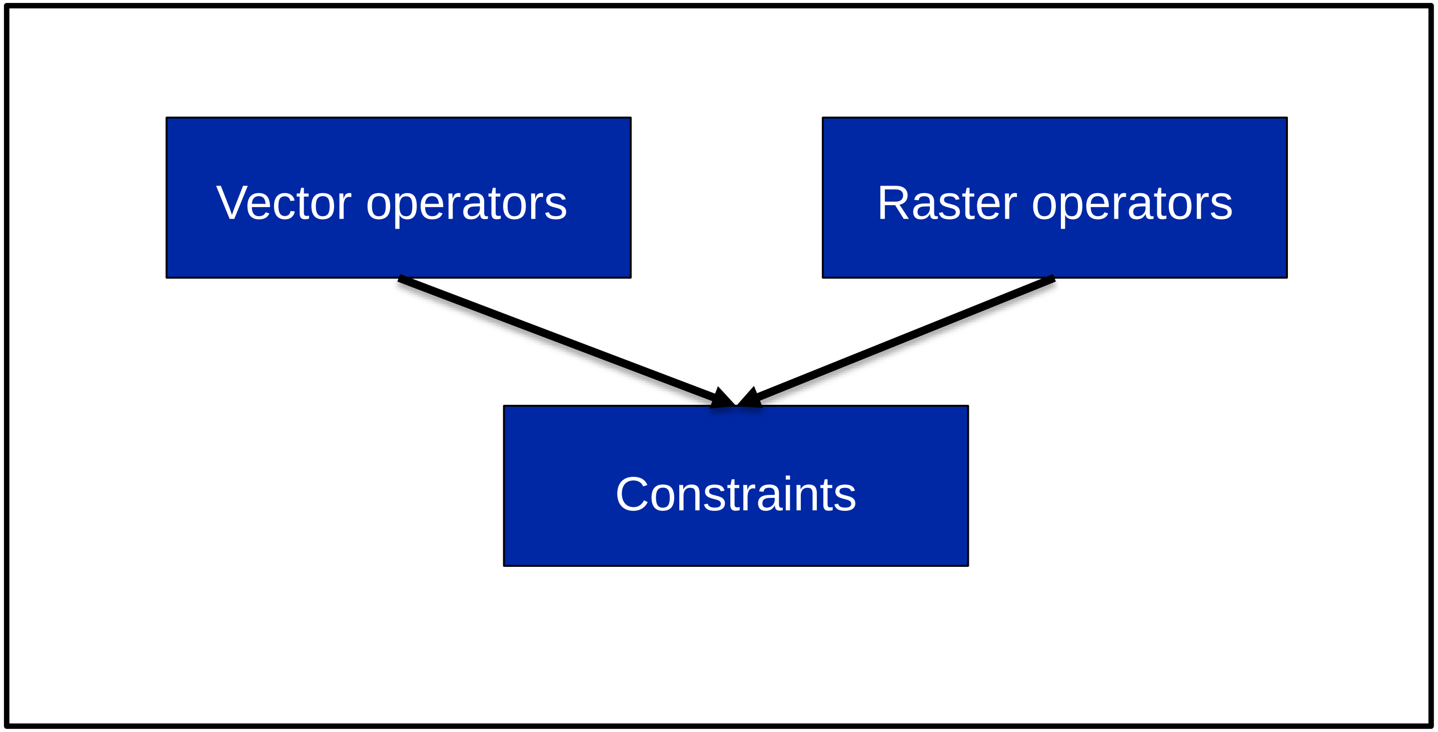
Peter, 1999, 2001

- Early conceptual steps of an integrated raster/vector approach
  - Can be used for the research
- Defines constraints for categorical data
  - Related to patches
  - Related to categories
  - Related to group of patches
- Highlights some advantages of raster generalization
  - Local data conversion
- Inspires the continuation of research on raster-based generalization.

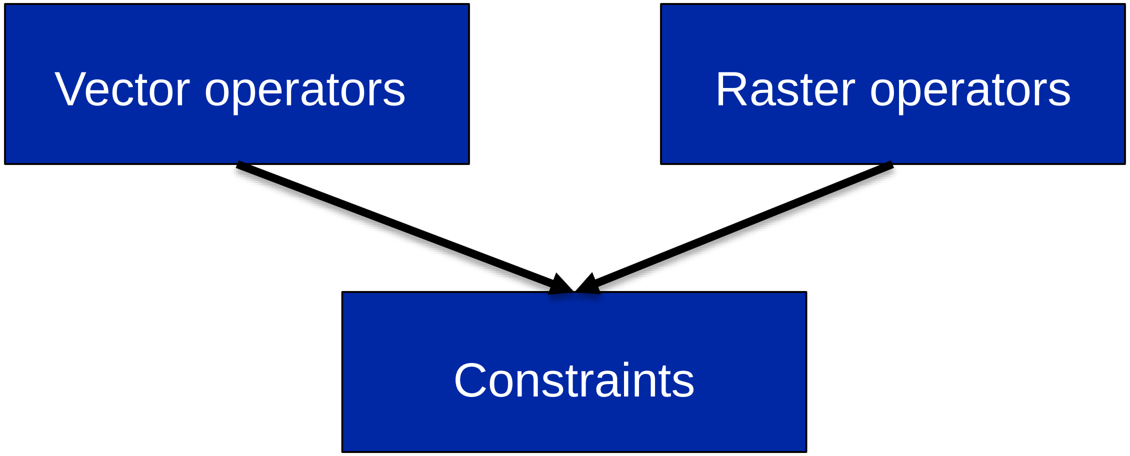
Content

Methods

- **General approach:** Using constraints to control the overall process, and combing the advantages of the vector- as well as raster-based generalization.

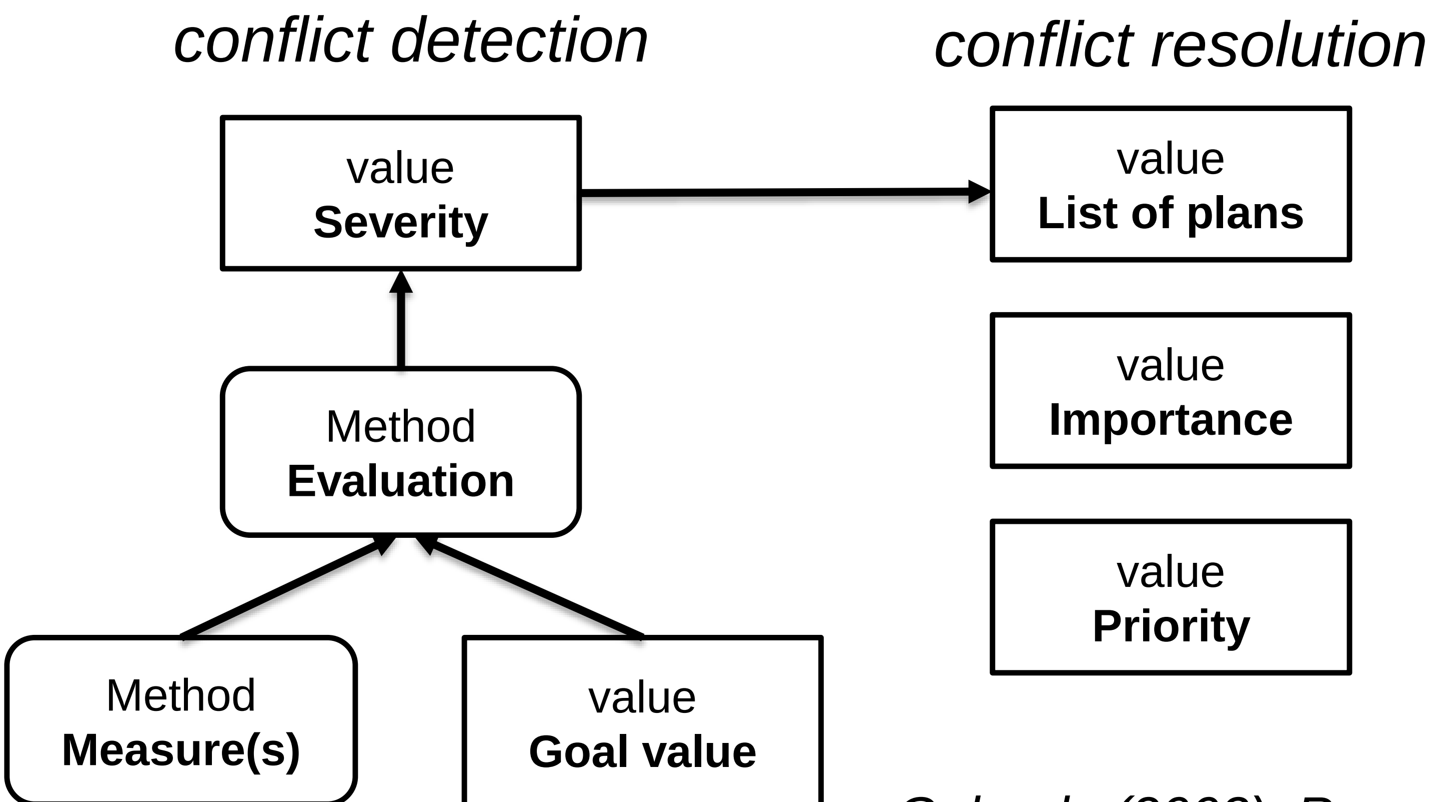


Methods



Methods

Constraints

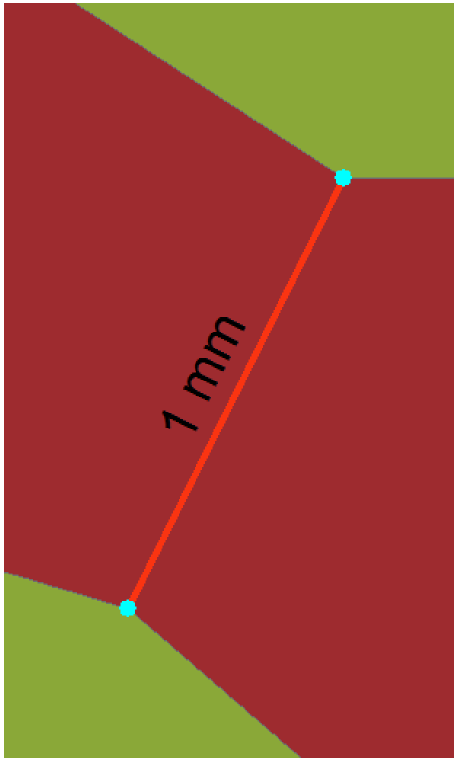


Galanda (2003), Ruas (1998)

Methods

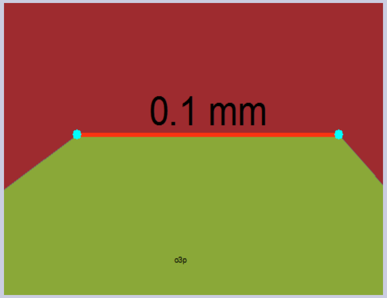
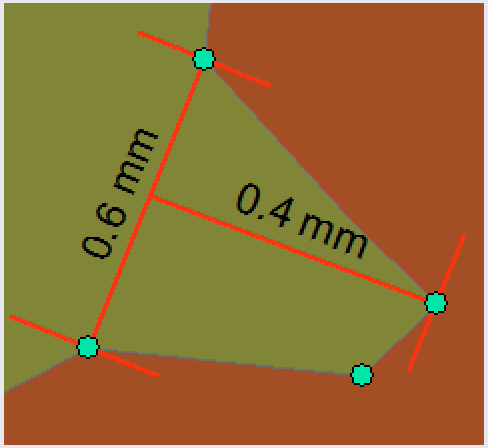
Modelling constraints

Constraints	The distance between two polygons should not be less than minimum distance (i.e. minimum visual separability).
Goal Value	1 mm
Measure	Shortest distance between polygons
Plans	1. Displace 2. Exaggerate 3. Aggregate 4. Typify



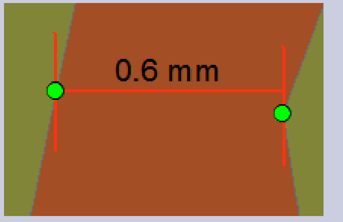
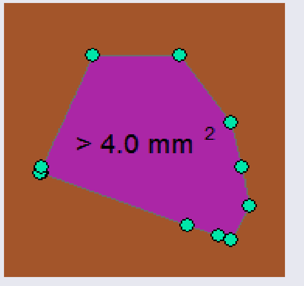
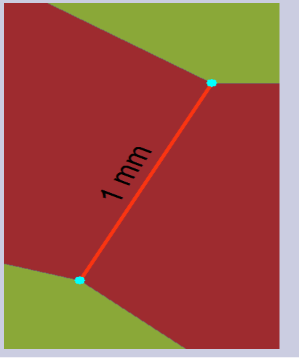
Galanda (2003)

Vector environment

Name	Description	Goal value	Example
Minimum distance between consecutive vertices	Distance between consecutive vertices must not be less than the readability unit.	0.1 mm	
Minimum shape width	Width and height of polygon less than goal value must be eliminated	0.6 mm	
Minimum shape height	Width and height of polygon less than goal value must be eliminated	0.4 mm	

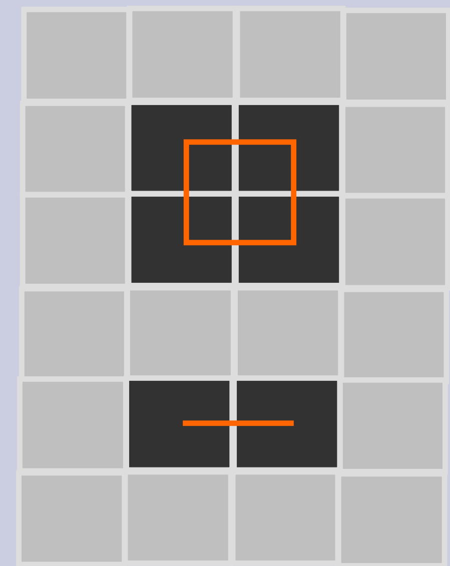
Galanda (2003)

Vector environment

Name	Description	Goal value	Example
Interior width	The interior width of polygons must not be less than minimum separability unit	0.6 mm	
Minimum size	Polygons must not be smaller than the differentiation size	4.0 mm^2	
Polygon separability	The distance between two polygons must not be less than minimum readability unit	1 mm	

Galanda (2003)

Raster environment

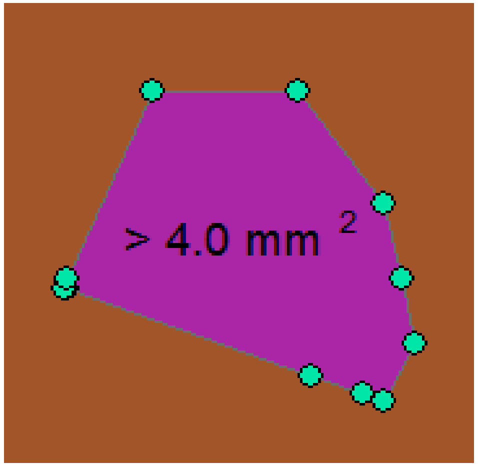
Name	Description	Goal value	Example
Polygon separability	Polygons should be differentiated from each other	At least four pixels (for 1:25 000)	
Line separability	Lines must be differentiated from each other	At least two pixels (for 1:25 000)	

Steiniger et al. (2008)

Methods

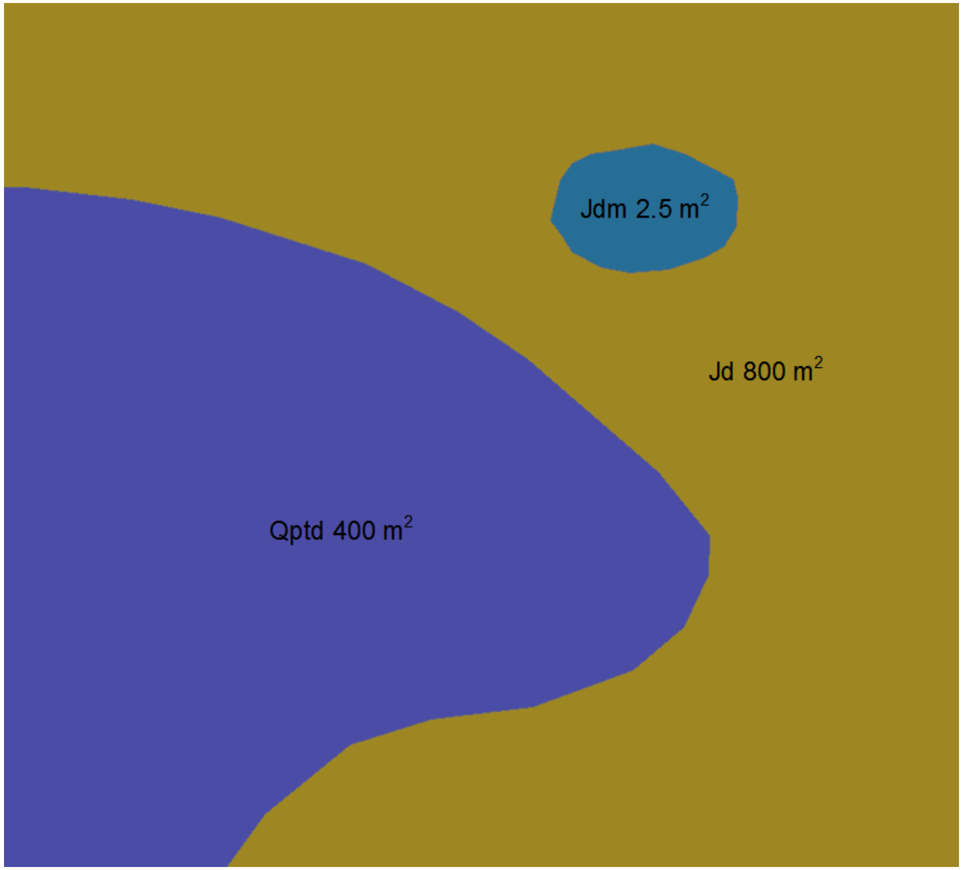
Modelling constraints

Constraints	Polygons must not be smaller than the differentiation size
Goal Value	4.0 mm^2
Measure	Area measurement methods
Plans	1. Enlarge 2. Aggregate 3. Eliminate

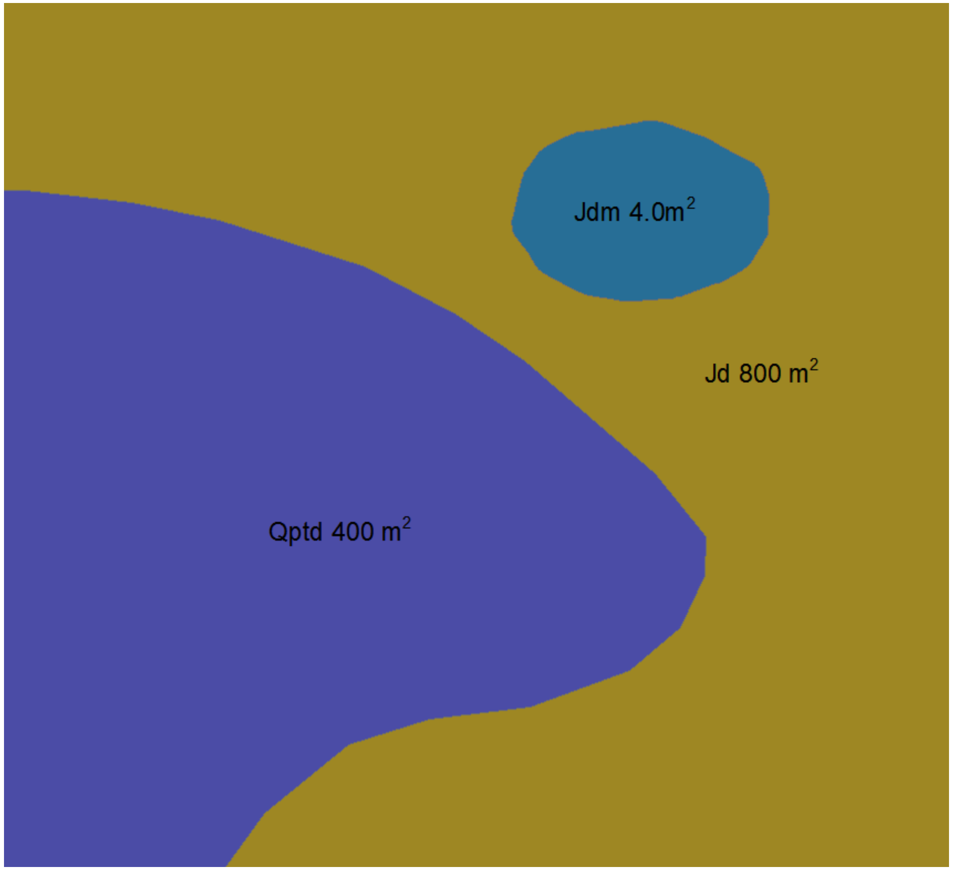


Galanda (2003)

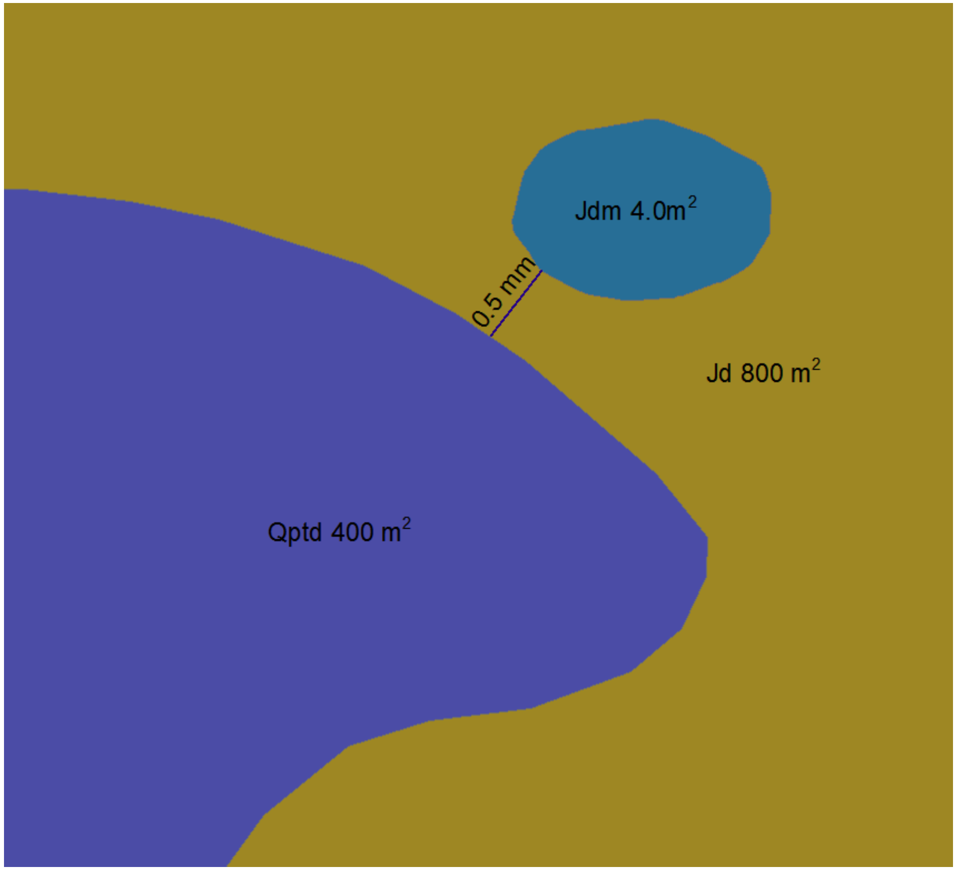
Methods



Methods



Methods



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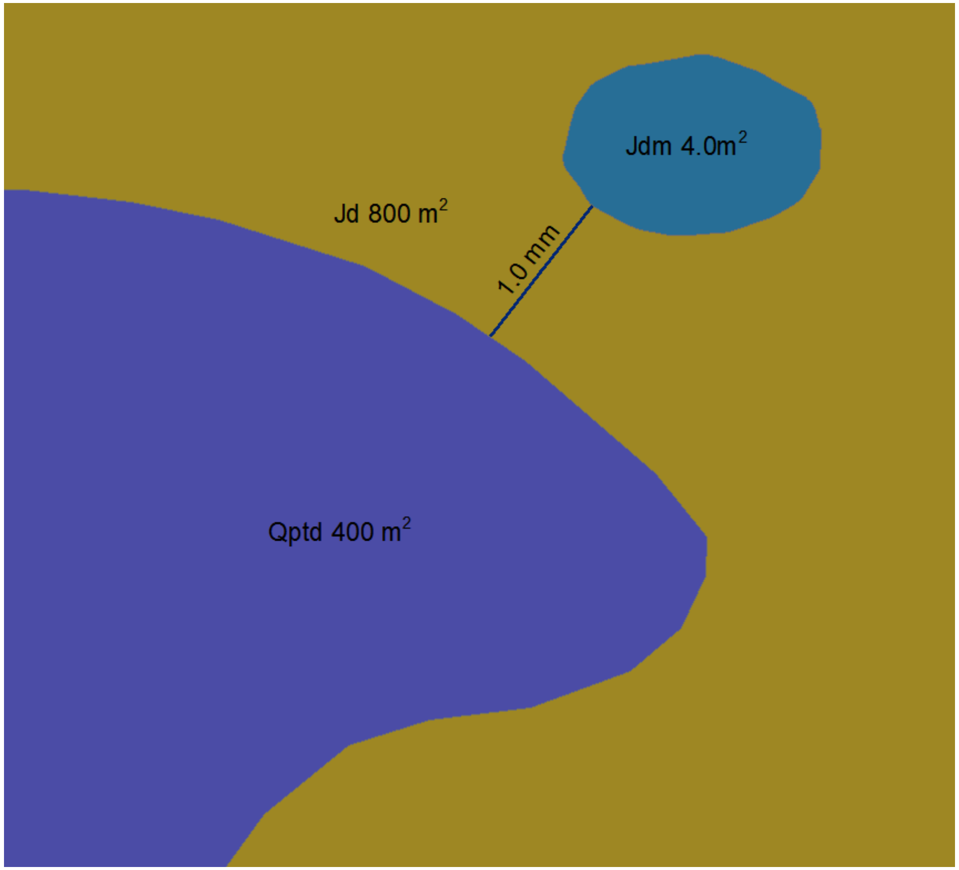

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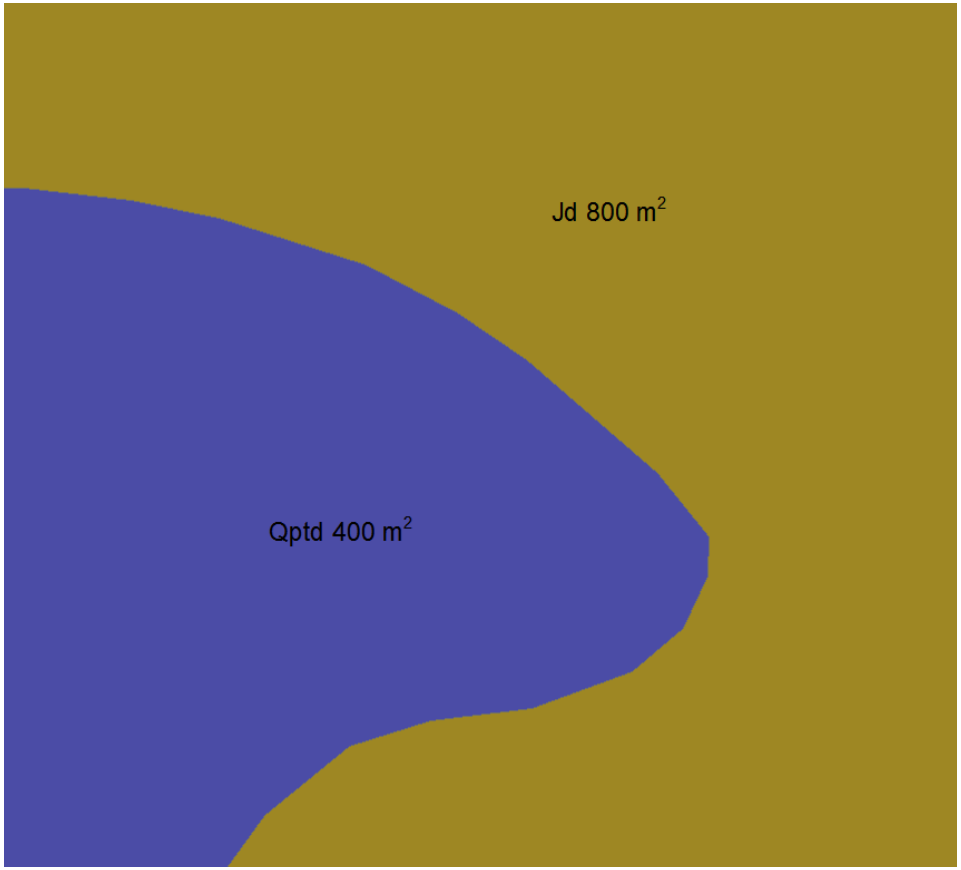


Content

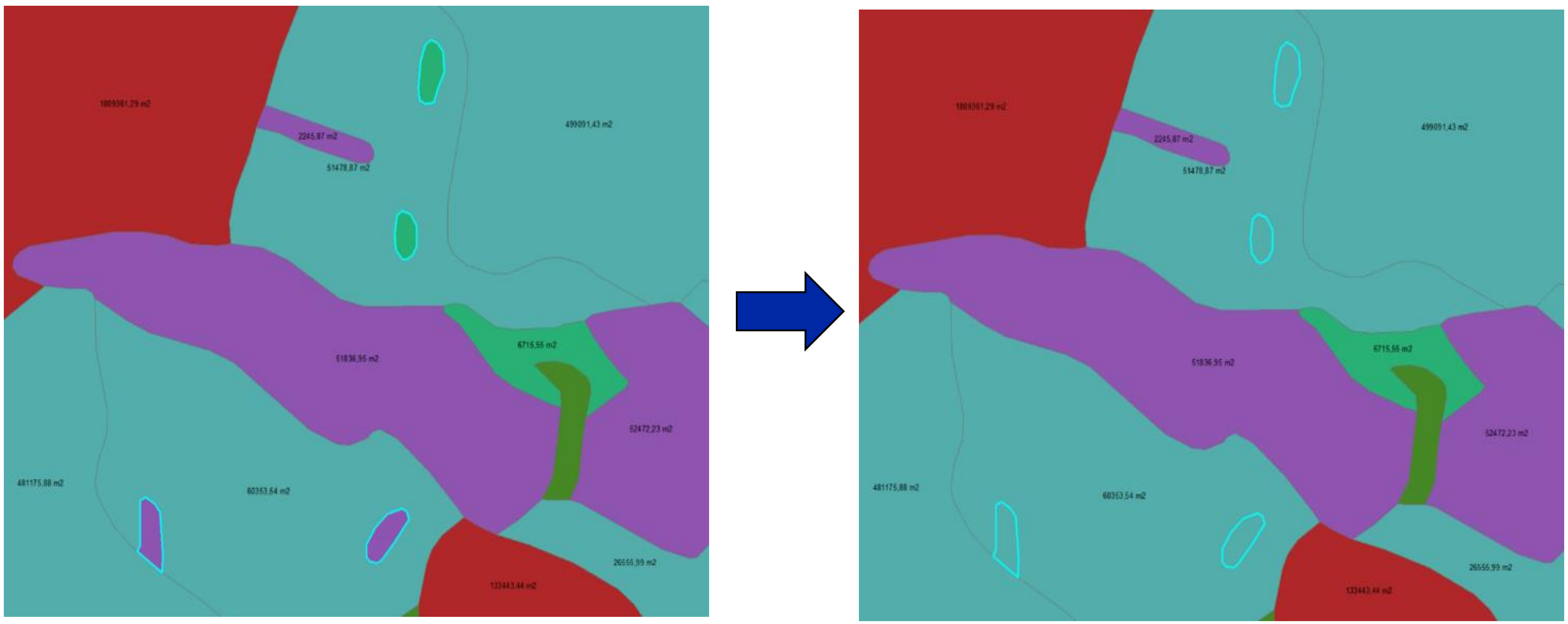
Experiments and results

- Eliminate
- Exaggeration (enlargement)
- Simplify
- Smooth
- Amalgamate
- Collapse
- Displacement

Constraint for:

- Operator and algorithm selection
- Appropriate prioritizing

Experiments and results

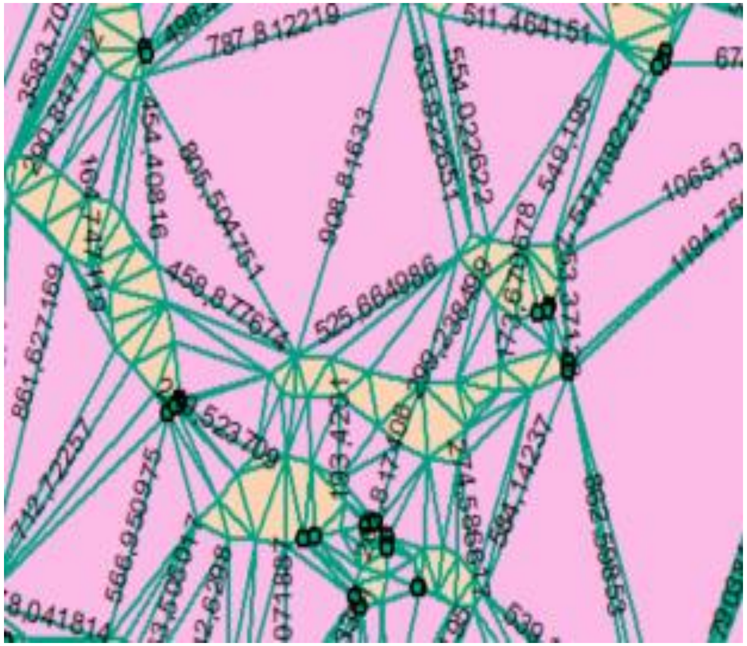


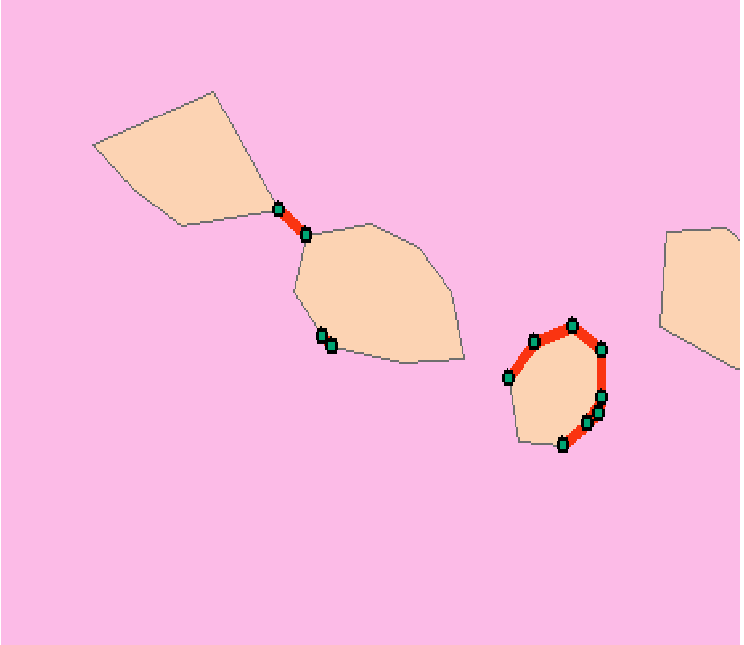
Before

After

Merging polygons that are too small with a neighbouring polygon.

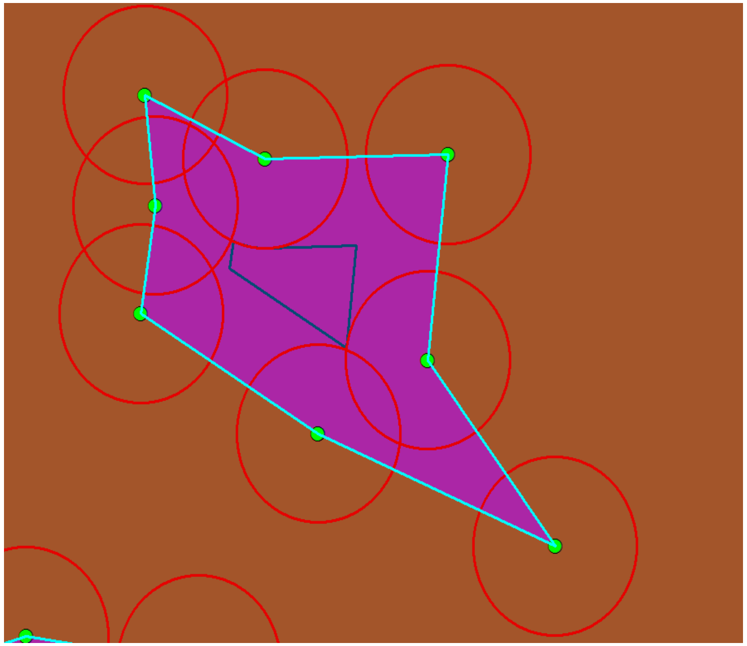
Experiments and results

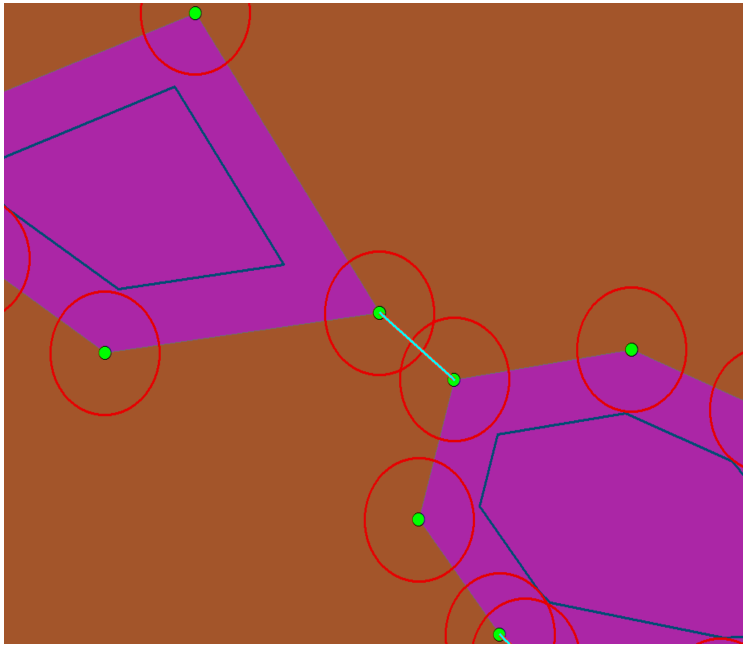




Identification of minimum distance between vertices and polygons.

Experiments and results





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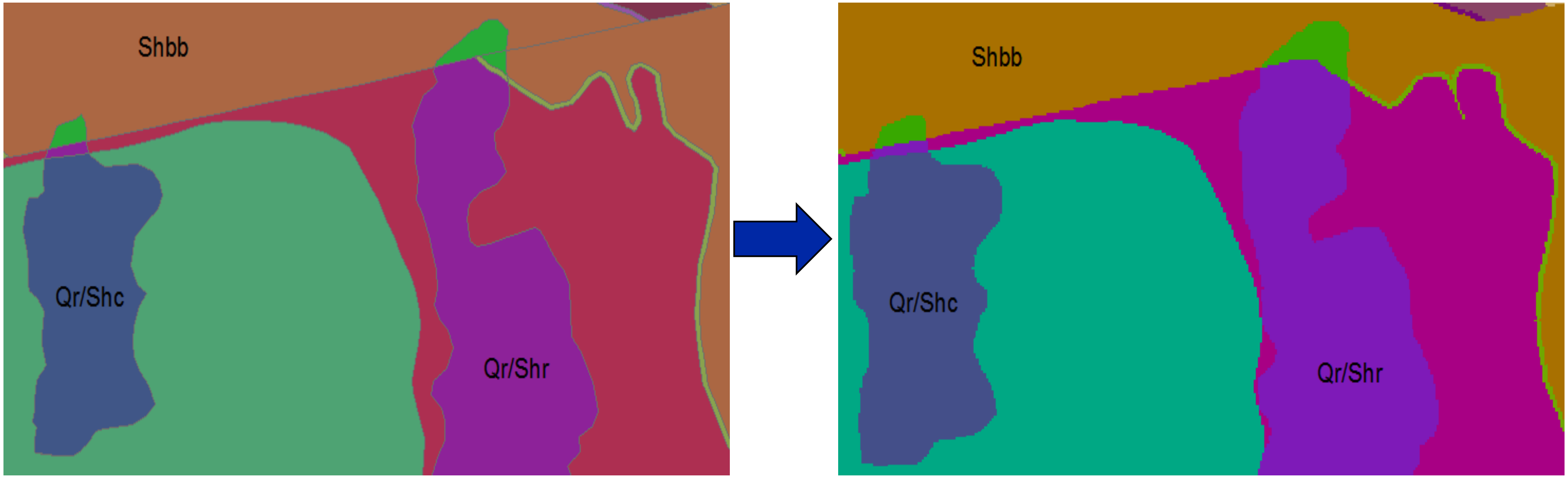
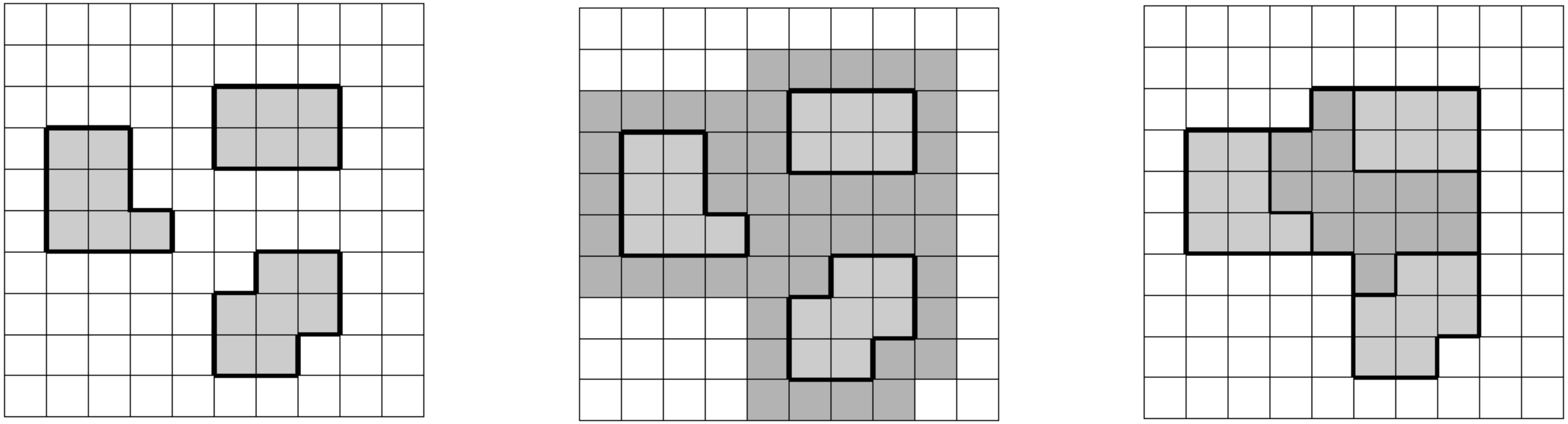


Before

After

Raster Generalization using Morphological Operator Dilate 3x3 kernel size

Experiments and results



Grow-and-shrink algorithm for the amalgamation operator.
Peter, Weibel 1999

Vector and Raster vs Vector or Raster

- More efficient
- More accurate
- More flexible

Summary

- Present geological knowledge
- Define constraints for geological map generalization;
- Identify operators and develop/implement algorithms that best suit vector- vs raster-based generalization;
- Compare and contrast the results for improvement of geological map generalization.

Thank you!

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