

# Kartografska generalizacija

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# Kartografska generalizacija

- Proces uopćavanja geografskog sadržaja karte
- Geografski sadržaj izvorne karte se putem kartografske generalizacije pretvara u sažetiji vid geografskog sadržaja
- Bitna uloga geografa (!!!)
- Generalizacija je jedan od glavnih problema geografskog aspekta karata



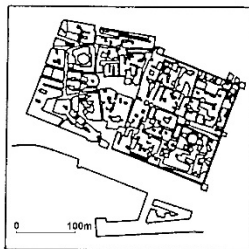
# Kartografska generalizacija

- Kartografska generalizacija se izvodi na temelju unaprijed definiranih kriterija
- Kriteriji se razrađuju ovisno o karti

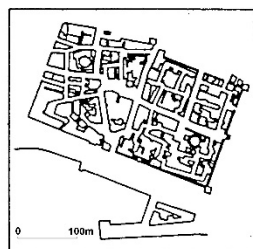


# Kartografska generalizacija

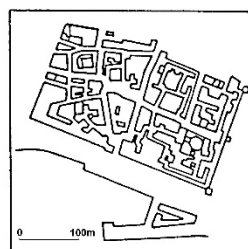
- Manualna i automatizirana



a



b



c

Primjer kartografske generalizacije prikaza naselja (Split)

(a-negeneralizirani prikaz, b - prikaz dobiven pomoću programa ARC INFO, c - doručeni prikaz)

Izvor: Frančula, 2002.



# Osnovni faktori o kojima ovisi stupanj generalizacije

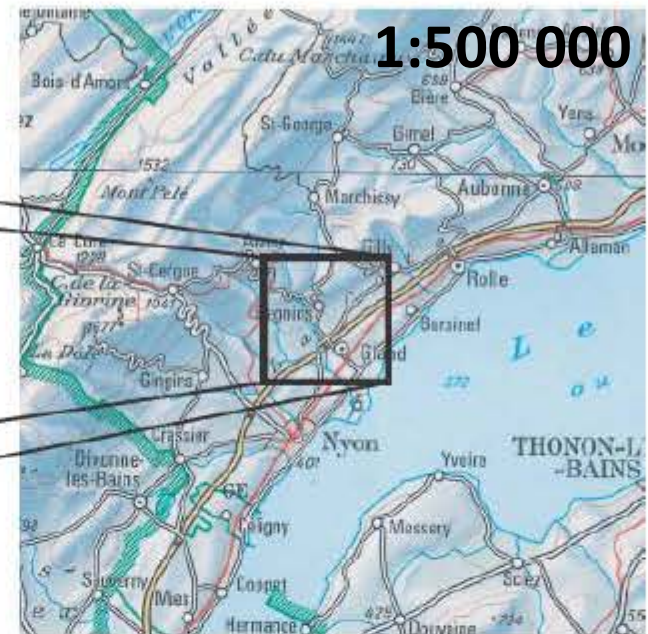
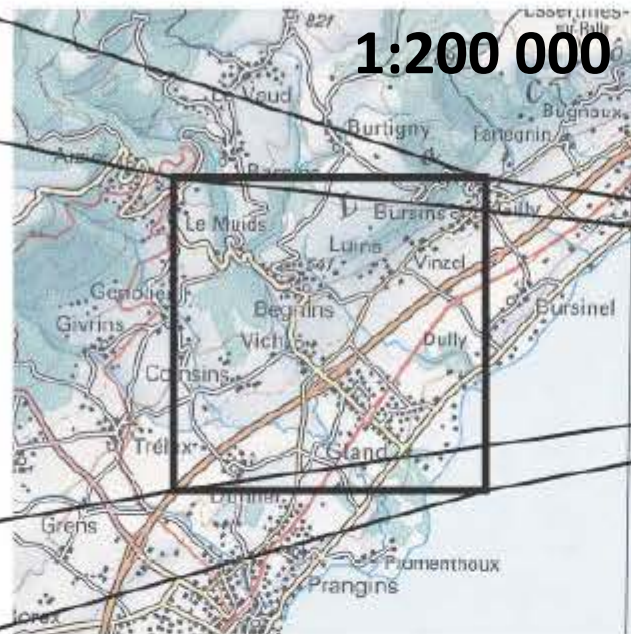
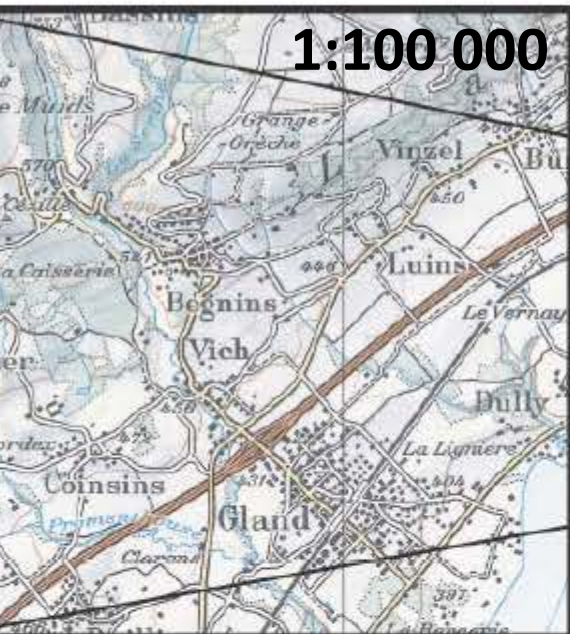
- Mjerilo karte
- Namjena karte
- Minimalne veličine
- Geografska obilježja prostora



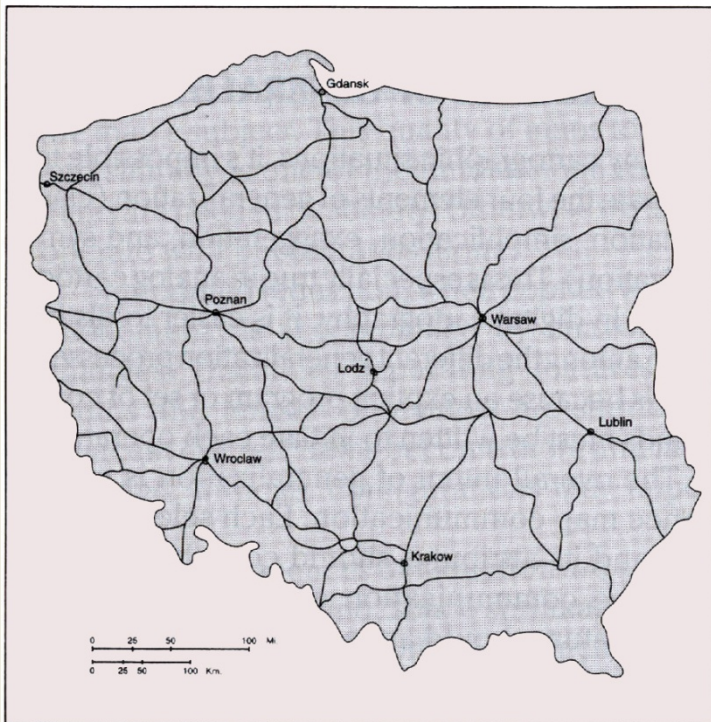
# Mjerilo

- Najvažniji faktor
- Sitnije mjerilo – smanjuje se površina za prikaz na karti
- Smanjuje se mogućnost detaljnog prikaza – prag čitljivosti karte
- Usporedba s brzinom putovanja
- Što je mjerilo sitnije to je viši stupanj generalizacije





# Namjena karte



Izvor: Robinskon, 1995.





# Minimalne veličine

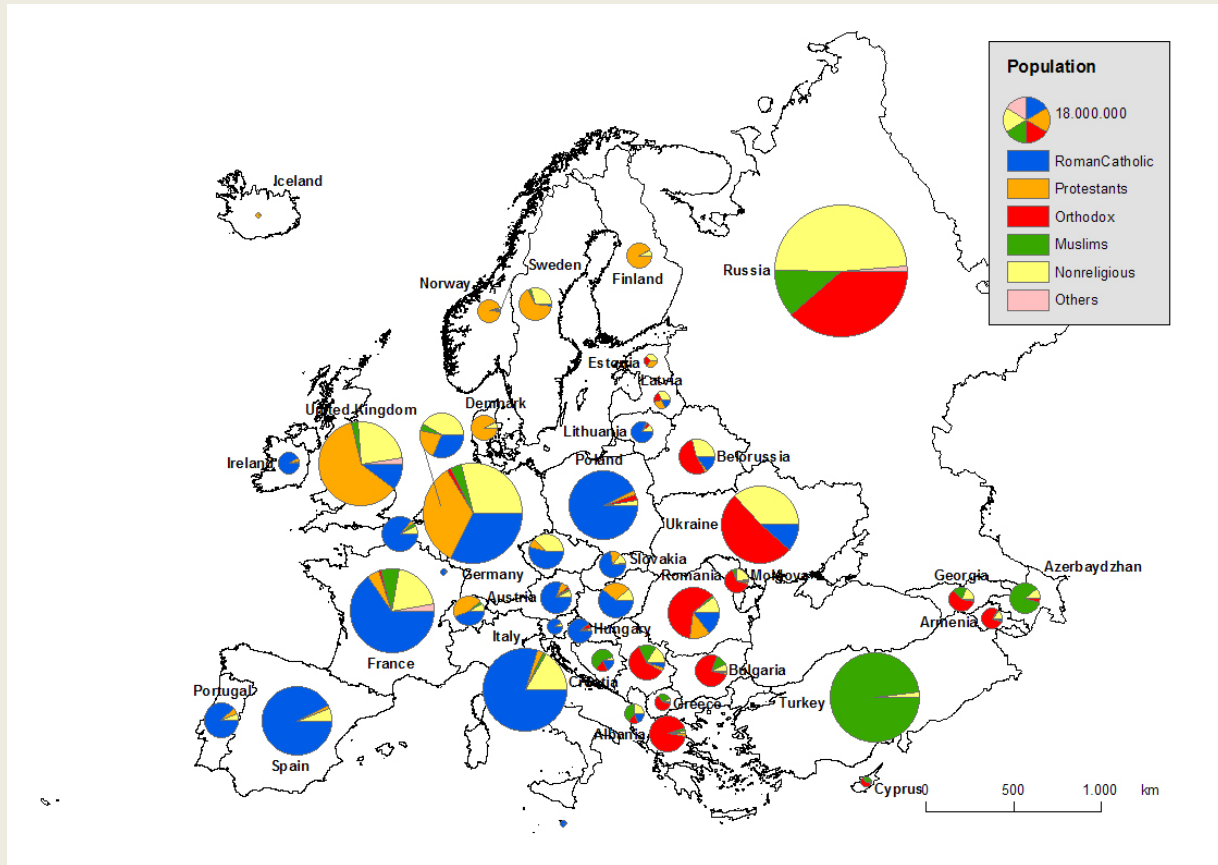
- To je ona veličina ispod koje se neki grafički element po svojem obliku i veličini više ne može raspoznati na karti
- Elementi ispod tog praga se izostavljaju



# Geografska obilježja prostora

- Potrebno ih je poznavati kako bi se sačuvale posebnosti po kojima je neki prostor karakterističan (npr. fjordovi i dr.)
- Geografska obilježja uvjetuju i izbor pojedinih elemenata (npr. rijeke u humidnim i aridnim područjima, manji gradovi u izrazito ruralnim područjima i sl.)





GIS karta



Web Map Viewer - ArcGIS Online - Windows Internet Explorer

http://www.arcgisonline.com/home/webmap/viewer.html?wm=3f61f5al

ArcGIS Online

Portland Web Map

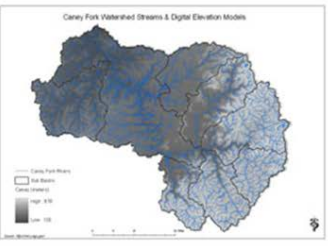
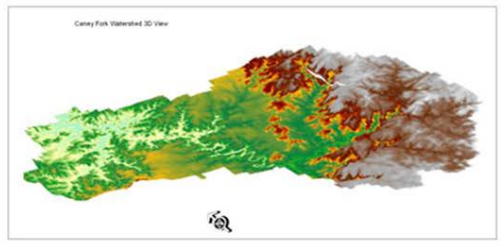
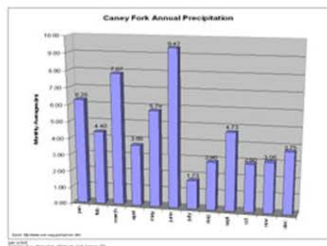
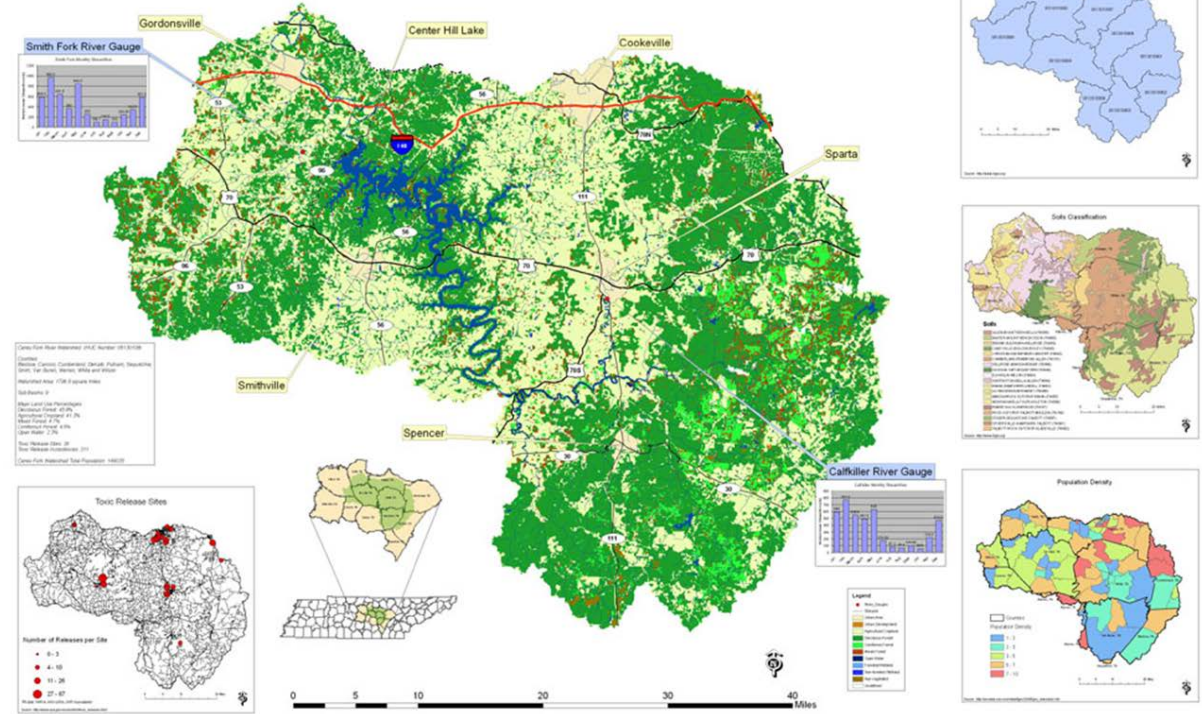
Search for an Address, City, or Location ...

Find Add More Layers Save Map

Copyright: © 2009 National Geographic Society | (c) Taxlots, Zoning: Oregon METRO - http://www.oregonmetro.gov/index.cfm/go/by.web/id=24888; Buildings: City of Portland, OR - Plan Copyright 2009 © ESRI

Done Internet | Protected

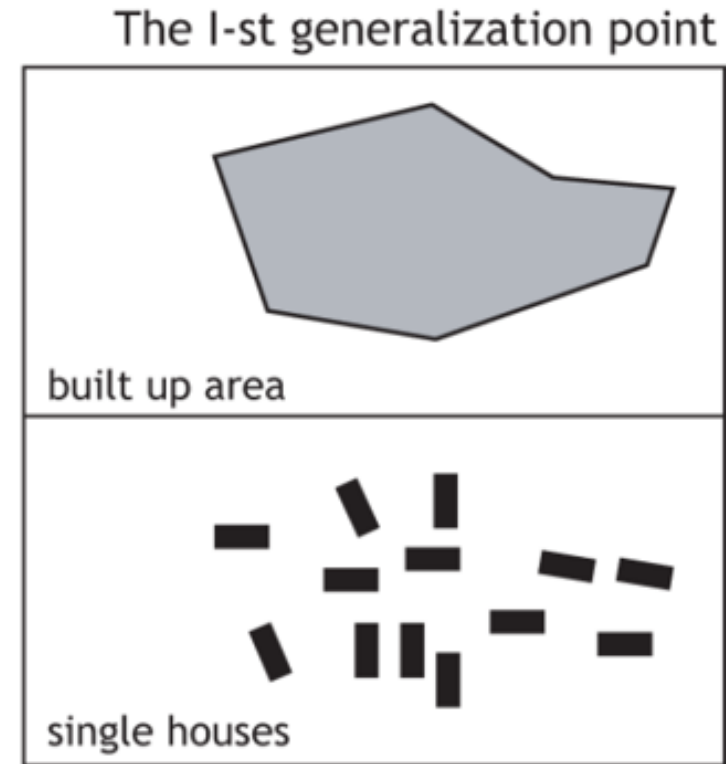
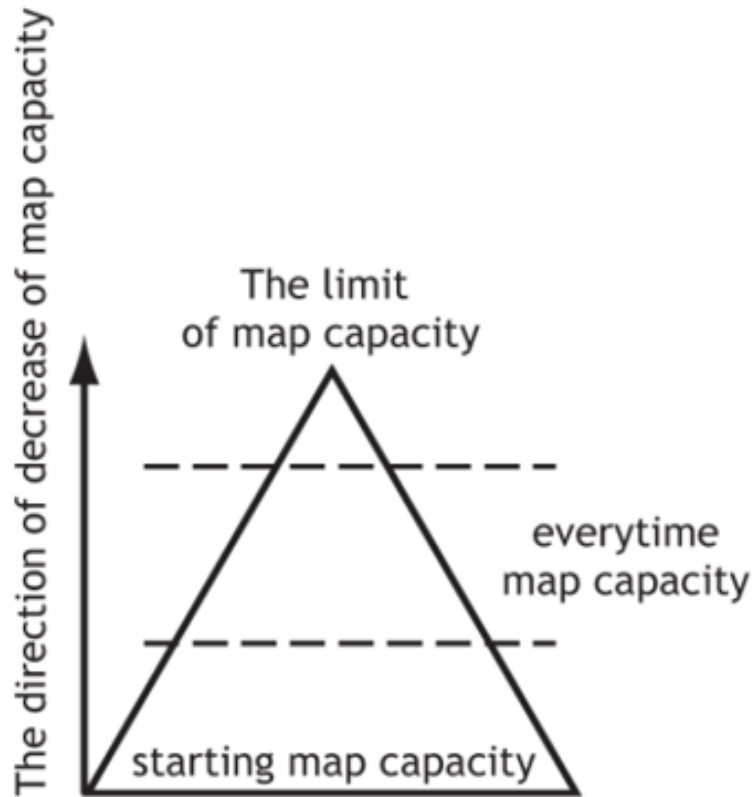
## Caney Fork River Watershed



# Ratajski (1967.) izdvaja dva temeljna tipa procesa generalizacije

- Kvantitativna generalizacija
  - Postupna redukcija sadržaja karte ovisno o mjerilu
- Kvalitativna generalizacija
  - Rezultat je transformacije elementarnih metoda prikaza u apstraktnije metode prikaza





The changing capacity of a map may be represented by a triangle (left). On the right hand side, an example of the first generalization point. Near capacity limit, single houses must be replaced by whole settlement (from Ratajski (1967)).

# Robinson (1995.) navodi četiri postupka generalizacije

- Klasifikaciju (Classification)
- Pojednostavljenje (Simplification)
- Povećanje (Exaggeration)
- Simbolizacija (Symbolization)



# Postupci generalizacije (Frančula, 2000.)

1. Izbor
2. Pojednostavnjenje
3. Sažimanje
4. Povećavanje
5. Pomicanje
6. Pretvorba metode prikaza





# 1. Izbor

- Jedan od najvažnijih postupaka
- Izbor podataka koji će se prikazati
- Prema veličini, značenju



# 1. Izbor

## Töpferov zakon

- Töpferov zakon selekcije – da se automatizira i objektivizira proces generalizacije

$$n_s = n_i \sqrt{\frac{M_i}{M_g}}$$

$n_g$  – broj geografskih podataka na generaliziranoj Karti,  $n_i$  – broj geog. podataka na izvornoj karti,  $M_i$  i  $M_g$  – faktor umanjenosti izvorne i generalizirane Karte

Detaljnije pogledati u Robinson i dr. (1995.):  
Elements of Cartography, str. 456.



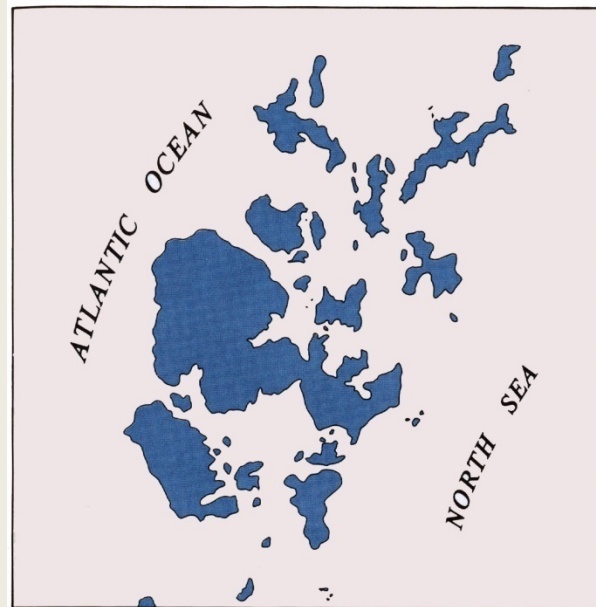
# 1. Izbor

## Töpferov zakon

- Zakon ima teorijsko značenje
- Kazuje nam koliko ćemo geografskih podataka sa izvorne karte zadržati na generaliziranoj karti
- To je statistički zakon – on ne definira koje ćemo podatke izabrati
- Izbor se može temeljiti na atributivnim obilježjima npr. Za naselja broj stanovnika (usporedba zapadnog i istočnog dijela SAD-a – gradovi veći od 100 000 st.)
- Linijski elementi kraći, površinski manji



# 1. Izbor



1:1,000,000

THE  
ORKNEY ISLANDS



1:10,000,000



1:500,000

PART OF THE LAKE REGION  
OF WISCONSIN AND MICHIGAN

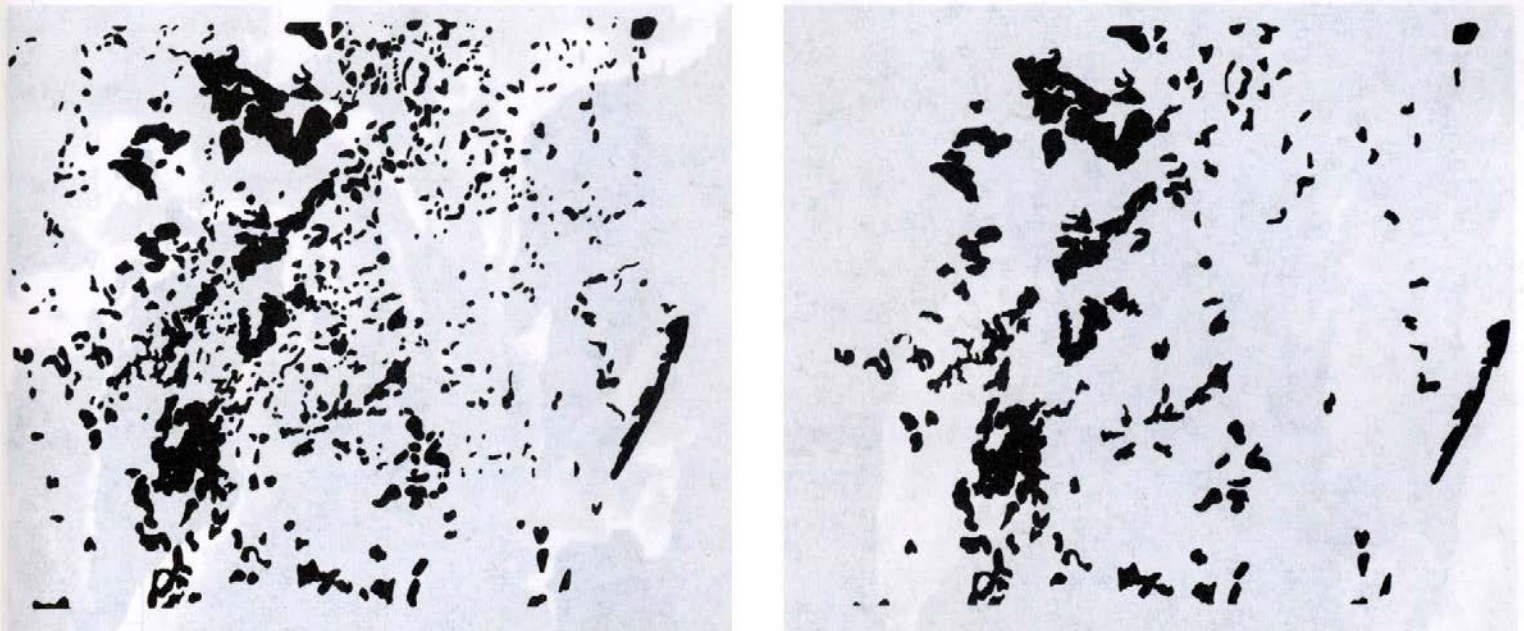


1:2,500,000

Izvor: Robinson, 1995.



# 1. Izbor

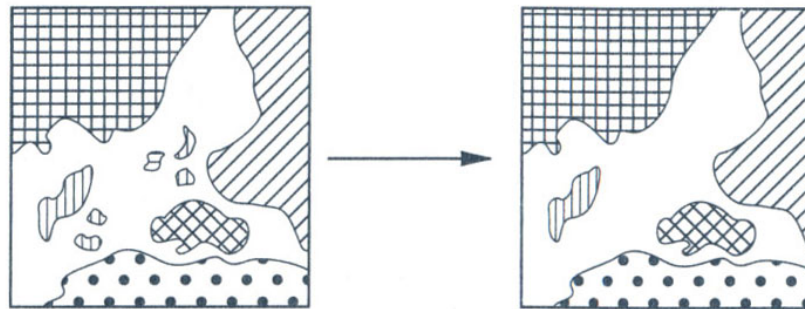


**Figure 24.14** Simplification by feature elimination. Areas on the left map are either shown in their entirety or completely eliminated in the feature-simplified map on the right. (Courtesy of American Congress on Surveying and Mapping).

Izvor: Robinson, 1995.



# 1. Izbor



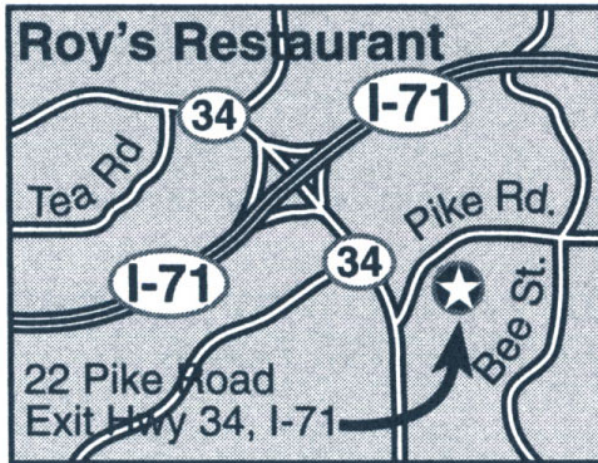
**Figure 24.15** Simplification by area elimination. Example from Intergraph Corporation algorithm using size and proximity to determine which features to eliminate. (Courtesy of D. Lee).

Izvor: Robinson, 1995.

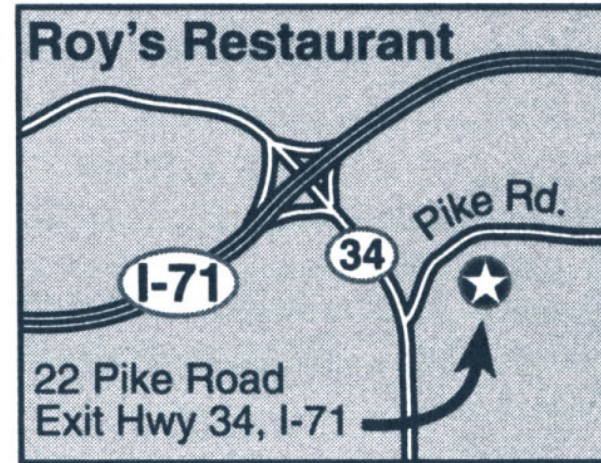


# 1. Izbor

Poor selection:



Good selection:

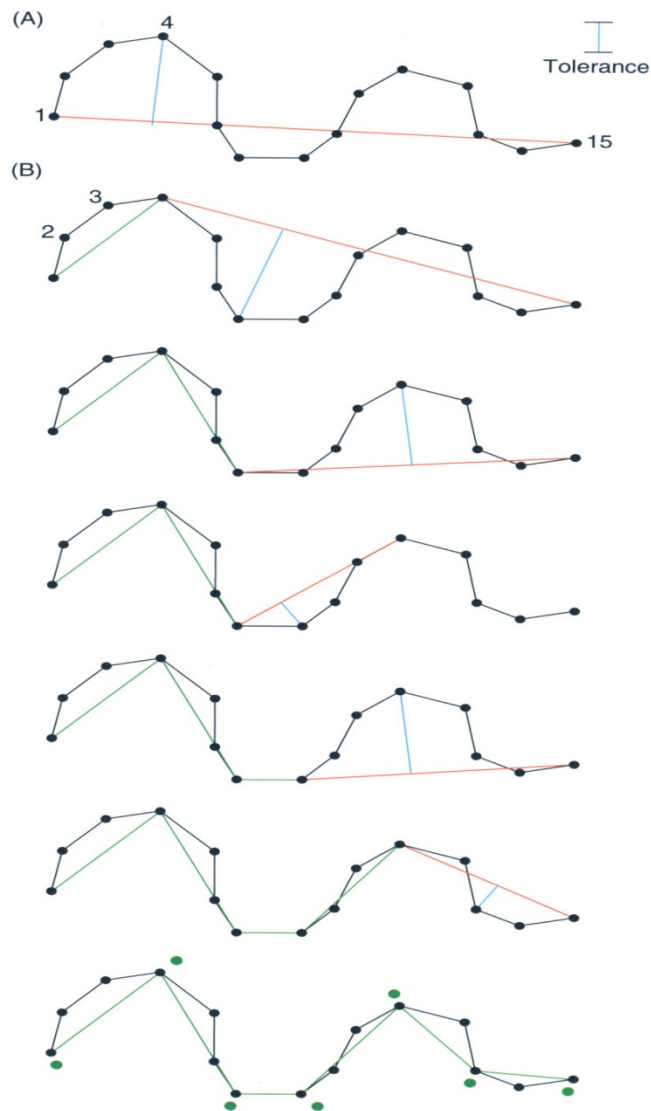


## 2. Pojednostavnjenje

- Najviše se koristi kod linijskih elemenata (ceste, rijeke, izohipse i dr.), ali i za površinske objekte
- Douglas-Peuckerov algoritam za pojednostanjenje linija
- Boyleov algoritam za izgladivanje

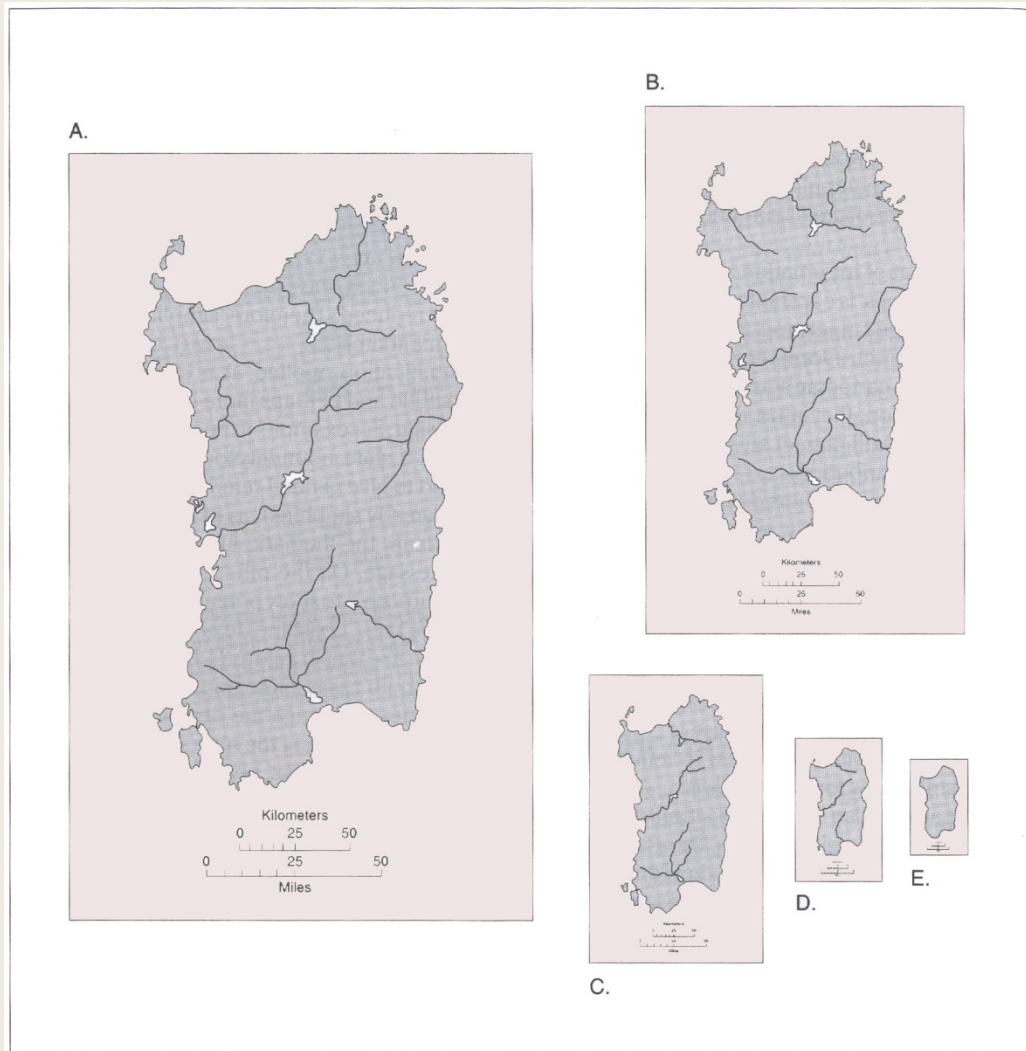






**Figure 3.17** The Douglas–Poiker line simplification algorithm in action. The original polyline has 15 points. In (A) Points 1 and 15 are connected (red), and the furthest distance of any point from this connection is identified (blue). This distance to Point 4 exceeds the user-defined tolerance. In (B) Points 1 and 4 are connected (green). Points 2 and 3 are within the tolerance of this line. Points 4 and 15 are connected, and the process is repeated. In the final step 7 points remain (identified with green disks), including 1 and 15. No points are beyond the user-defined tolerance distance from the line

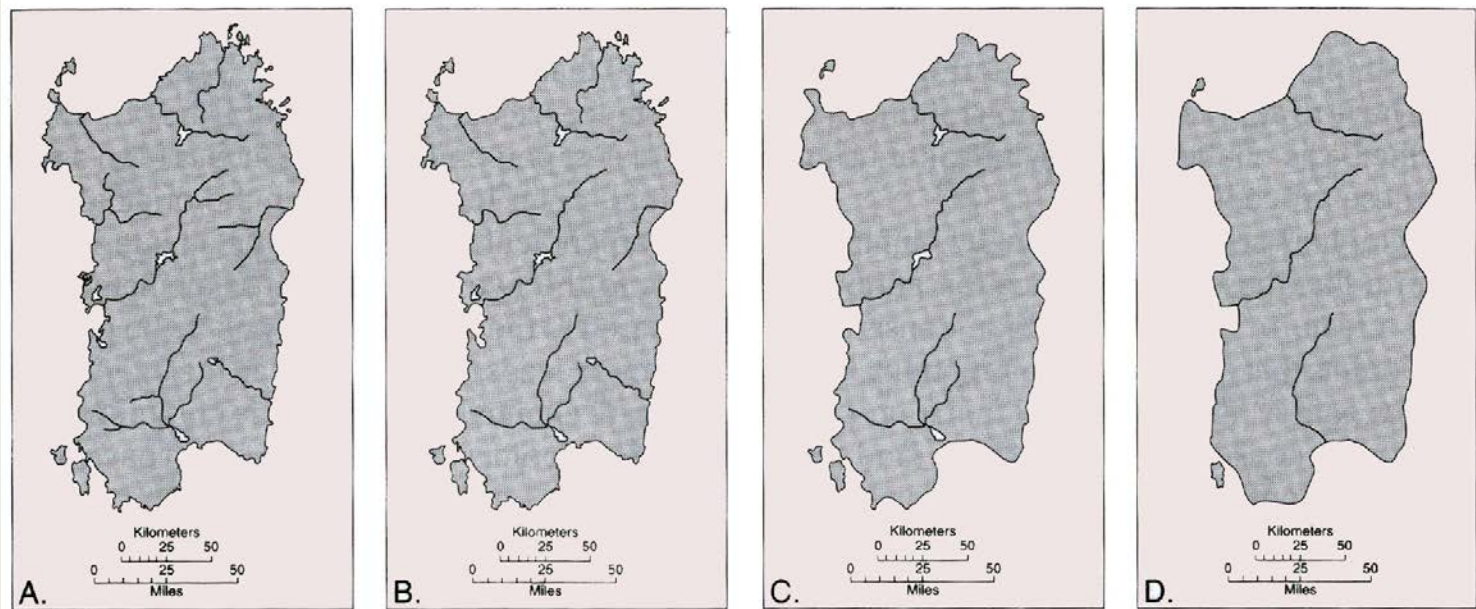




**Figure 24.10** Simplification accompanied by scale reduction. Since the scale is successively reduced from (A) to (E), an increasing number of points in the outline of Sardinia must be eliminated.

Izvor: Robinson, 1995.





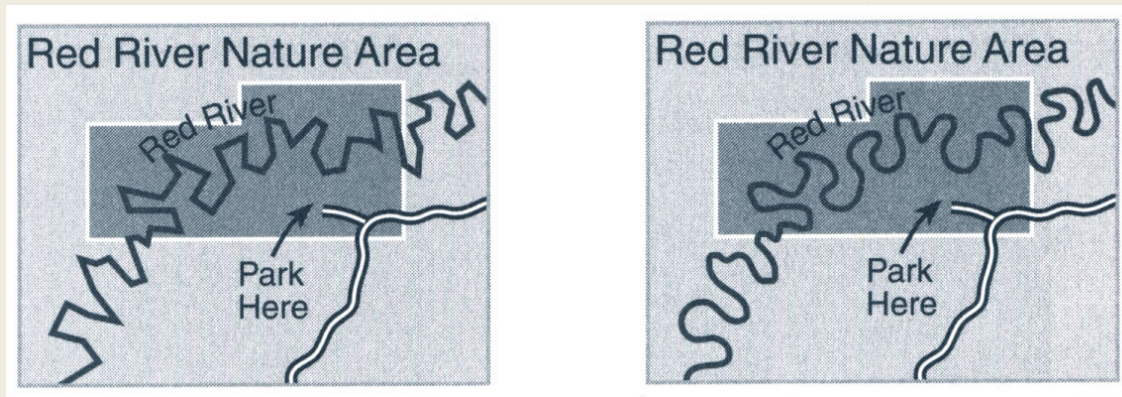
**Figure 24.11** Simplification applied at a constant scale. The four maps of Sardinia (A through D) represent increasing simplifications of the coastline and hydrography.

Izvor: Robinson, 1995.



## 2a. Izgladivanje

- Postupak karakterističan za generalizaciju na digitalnim kartama
- Kod nekih linijskih elemenata nužno zbog njihove prirodne zakrivljenosti npr. meandri rijeke



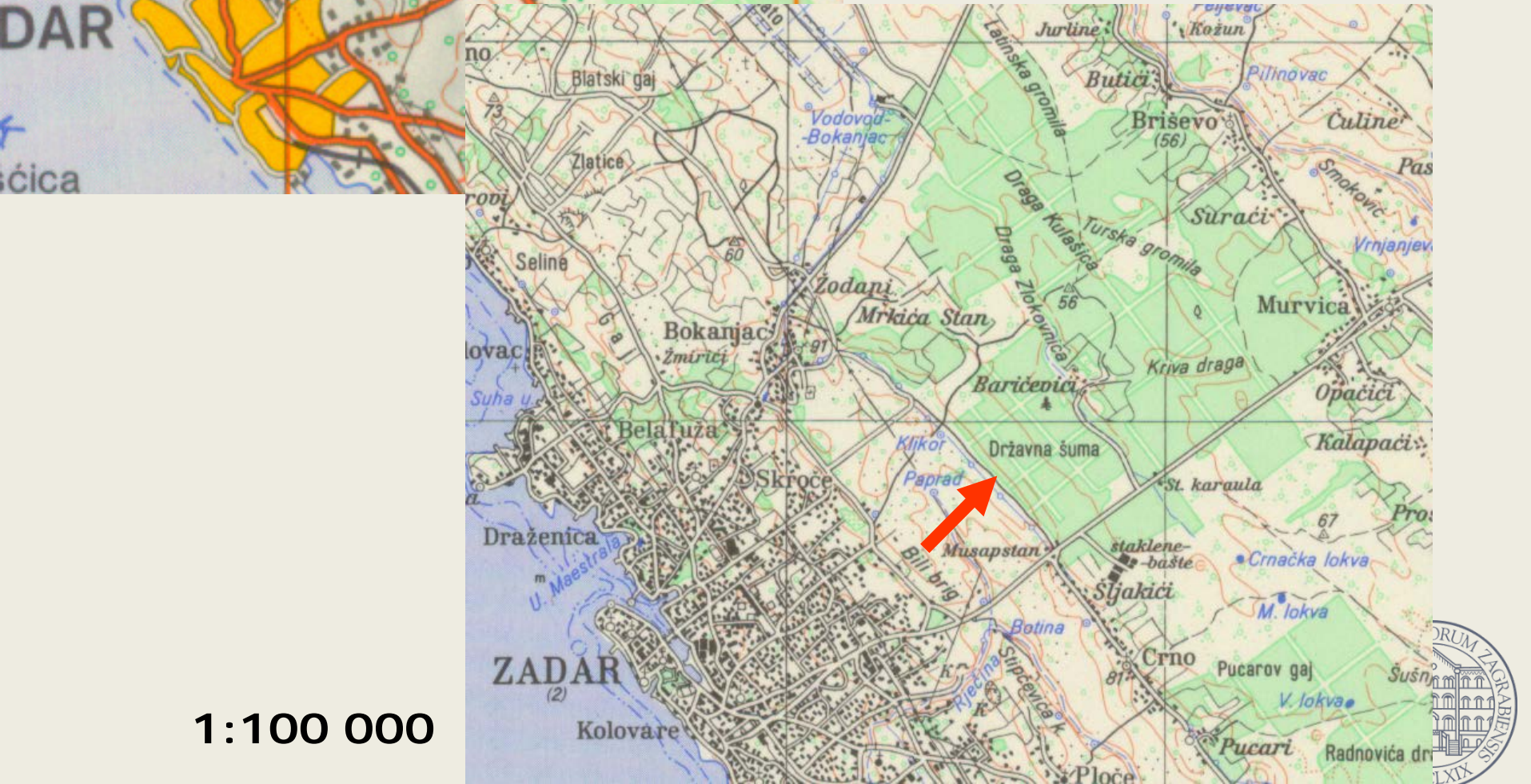
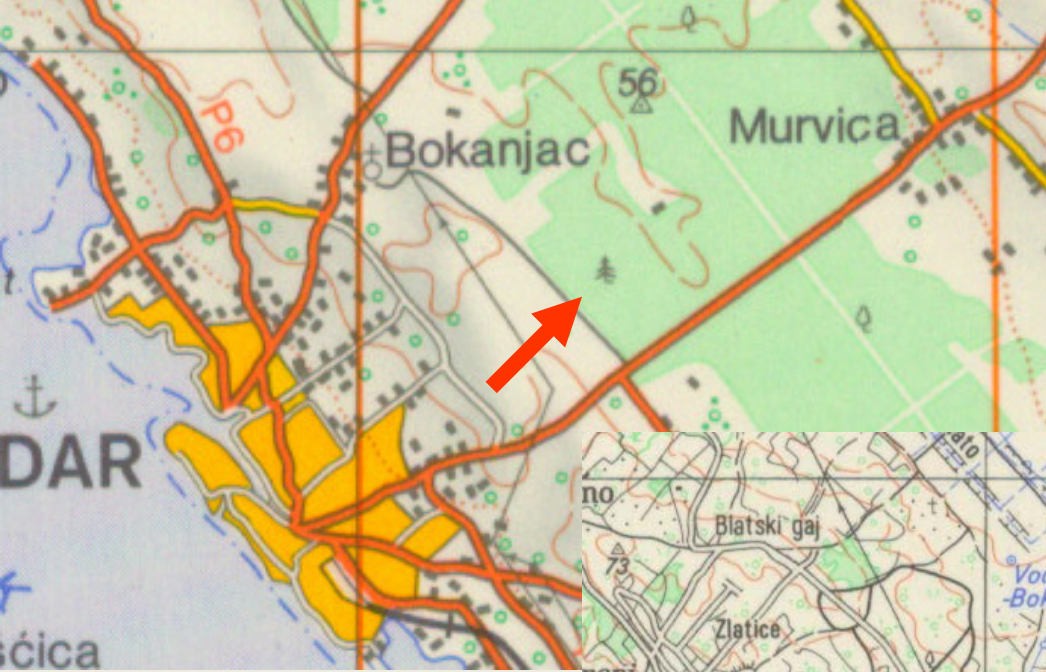
# 3. Sažimanje (spajanje)

Objekti koji se nalaze vrlo blizu spajaju se (sažimaju) u jedan objekt

- primjer 1: šuma s prosjecima bit će prikazana na karti krupnog mjerila s tim međuprostorom, ali na karti sitnijeg mjerila tih prosjeka neće biti
- Primjer 2: više zgrada može se objediniti u jednu

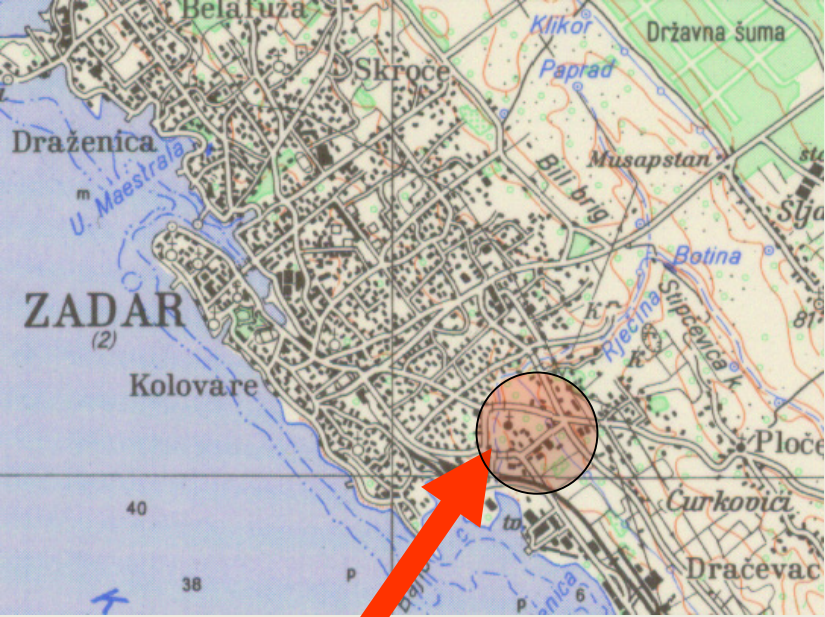


1:200 000



1:100 000





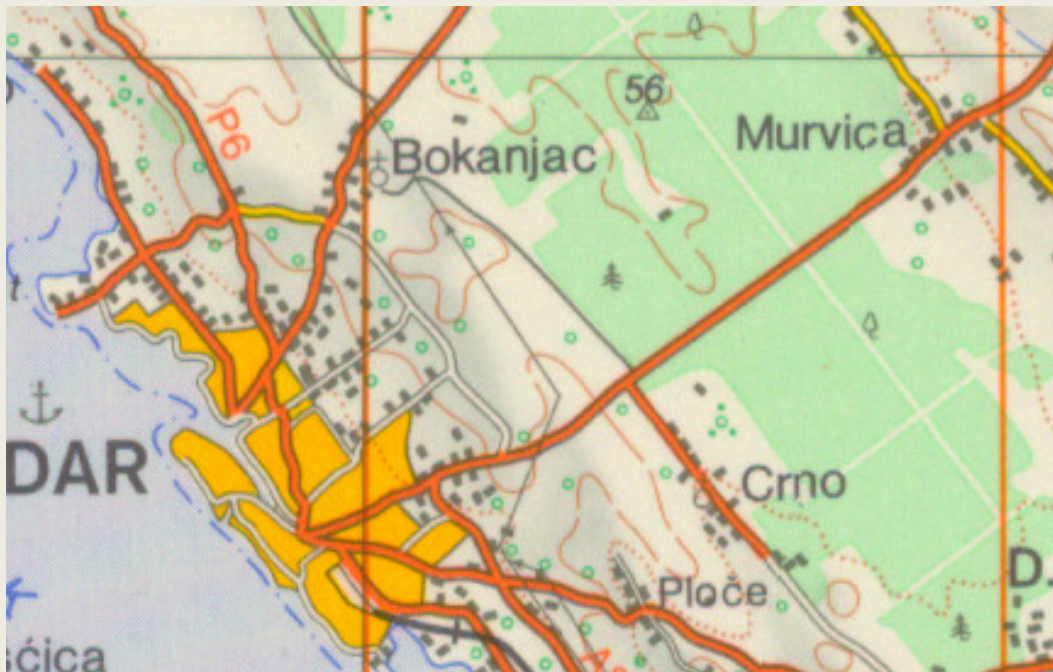
1:100 000



1:25 000

# 4. Povećavanje

- Samo na katastarskim planovima u pravilu se ceste, zgrade, rijeke prikazuju bez povećanja



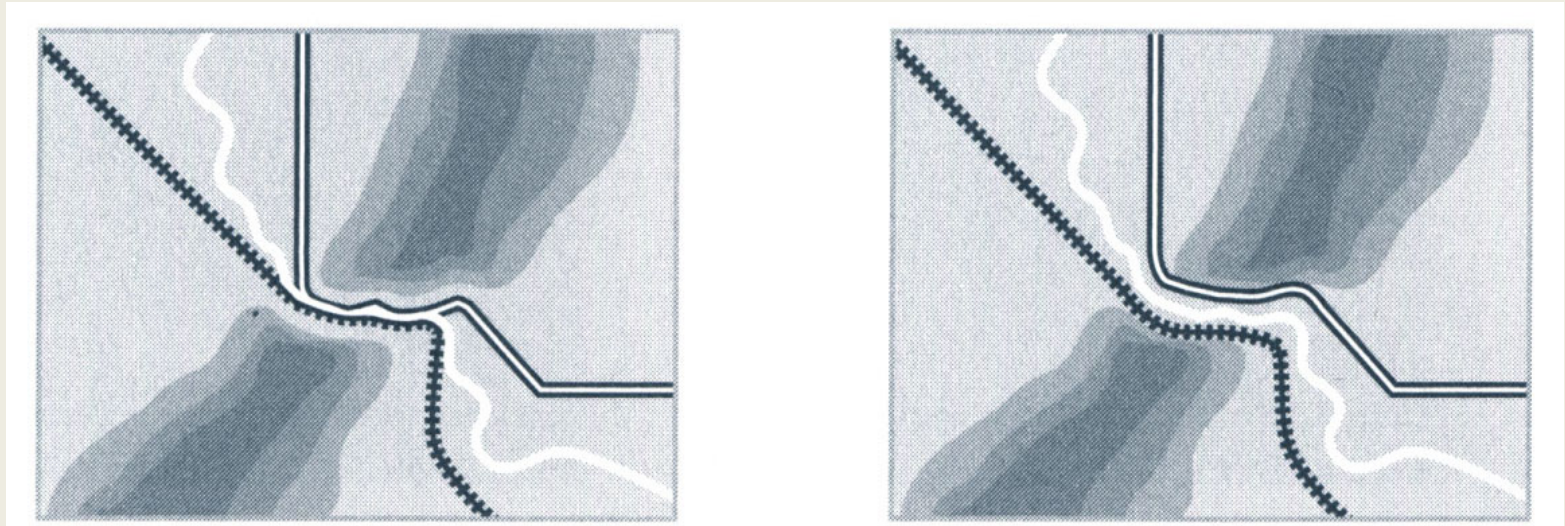
Cesta je na karti debljine 0,8 mm. Prema mjerilu to iznosi 160 m.

1:200 000



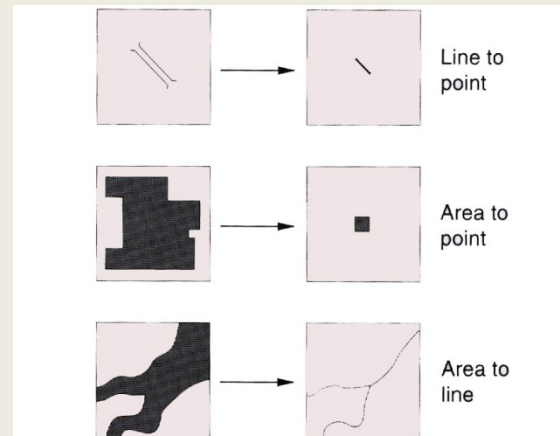


# 5. Pomicanje



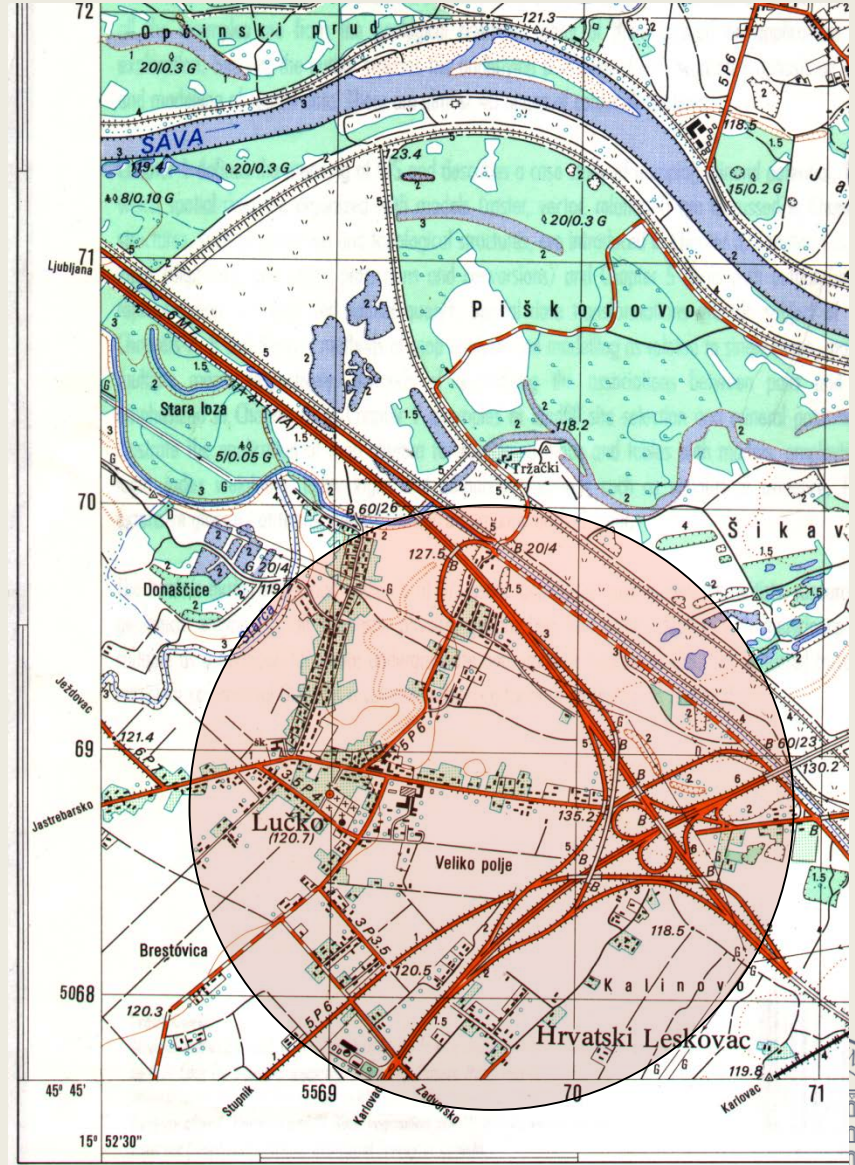
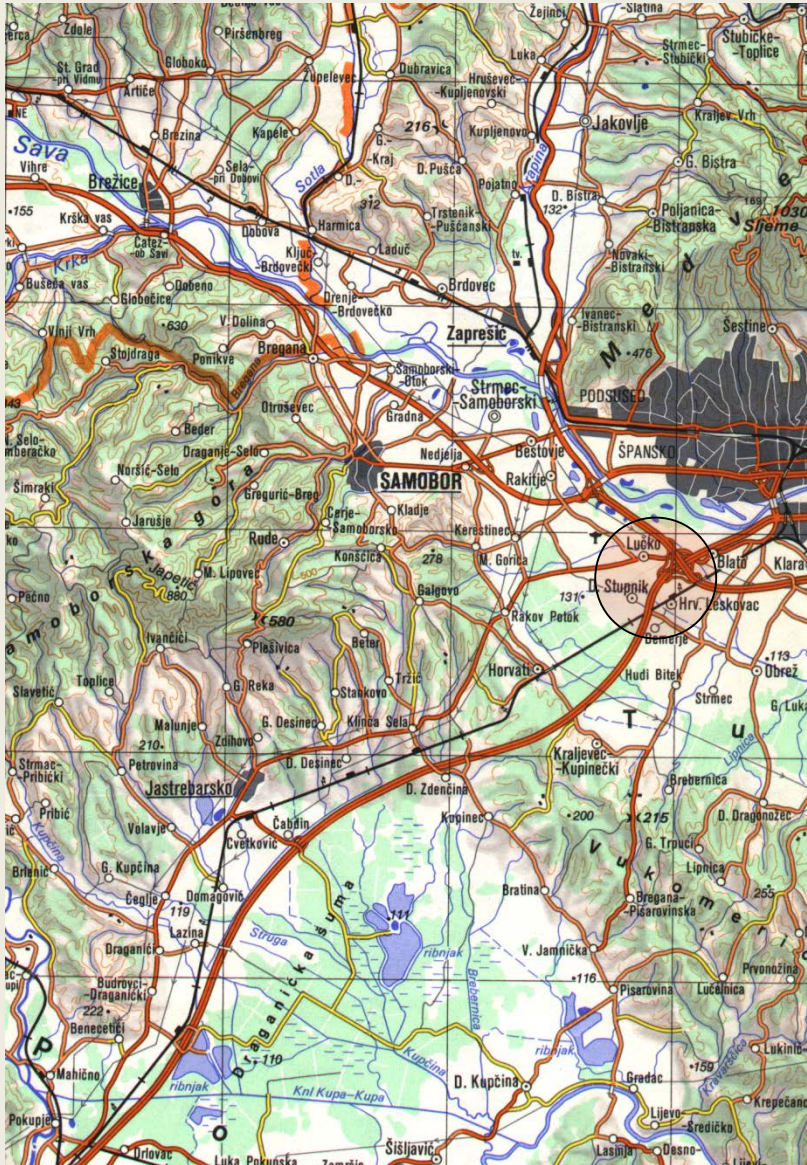
# 6. Pretvorba metode prikaza

- Objekt premali da bi se prikazao u mjerilu karte pa se prikazuje simbolom (npr. Zračna luka – površinski znak-točkasti znak, naselje – P-T, rijeka P-L)



**Figure 24.8** Illustrations of the collapsing process in cartographic generalization. Each feature represented in the left diagrams has lost at least one dimension in its portrayal in the right diagram. (Courtesy of D. Lee).

# 6. Pretvorba metode prikaza



Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Simplification	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Smoothing	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Collapse	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Aggregation	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Amalgamation	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Merge	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Refinement	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Exaggeration	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Enhancement	At Original Map Scale	
	At 50% Scale	

Spatial Transformation (Operator)	Representation in	
	Original Map	Generalized Map
Displacement	At Original Map Scale	
	At 50% Scale	

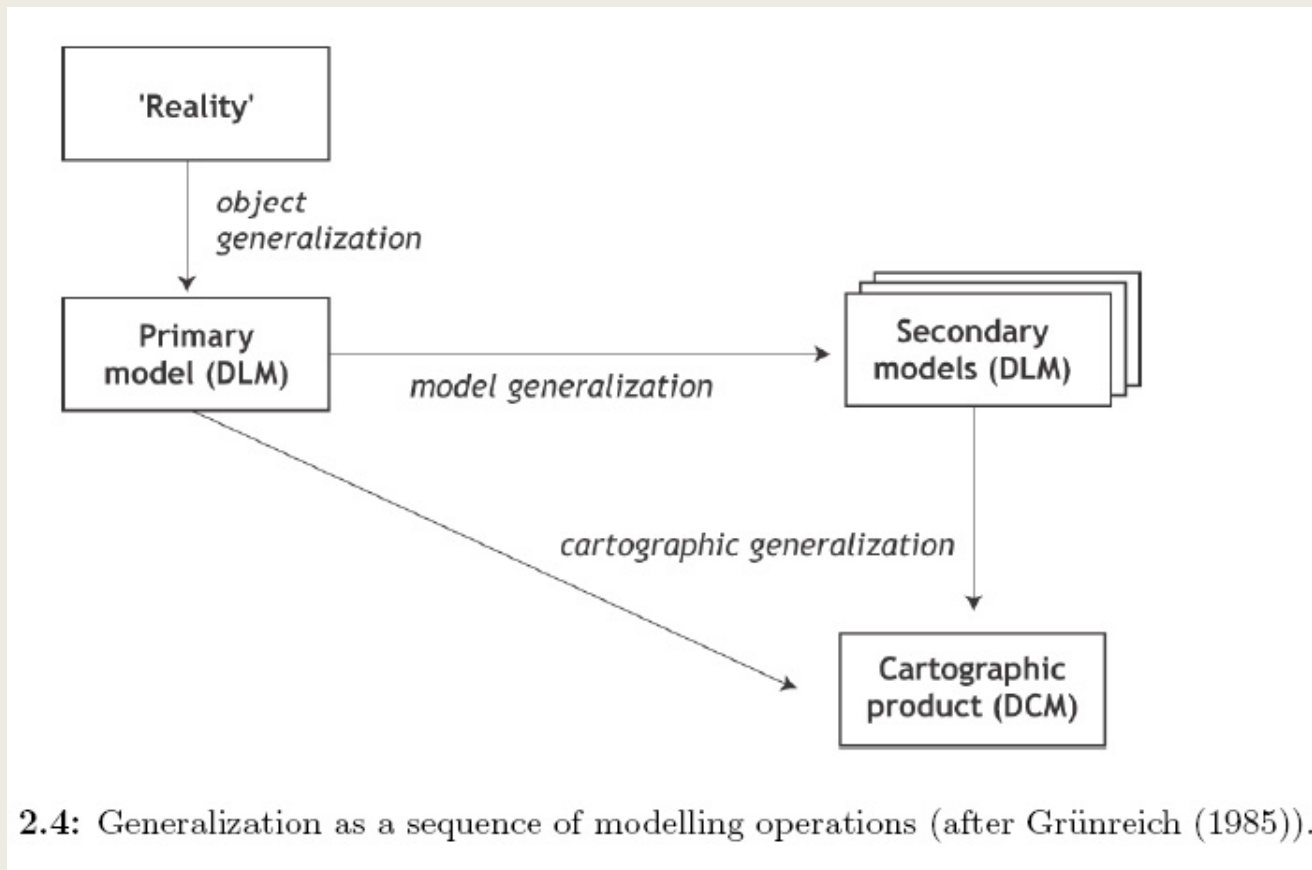
# Neki autori navode više postupaka generalizacije

(McMaster, Shea, 1992.)

Illustrations from McMaster and Shea (1992) of their ten forms of generalization. The original feature is shown at its original level of detail, and below it at 50% coarser scale. Each generalization technique resolves a specific problem of display at coarser scale and results in the acceptable version shown in the lower right



- Object generalization (objektna gen.) - model generalization (modelska generalizacija) - cartographic generalization (kartografska gen.)



# Zaključak

- Generalizacija je vrlo složen postupak
- Digitalna kartografija – potrebno je dobro poznavati postupke kartografske generalizacije (algoritme)
- Automatizacija postupaka sve veća
- Uloga geografa – naglašena zbog potrebe poznavanja bitnih obilježja prostora

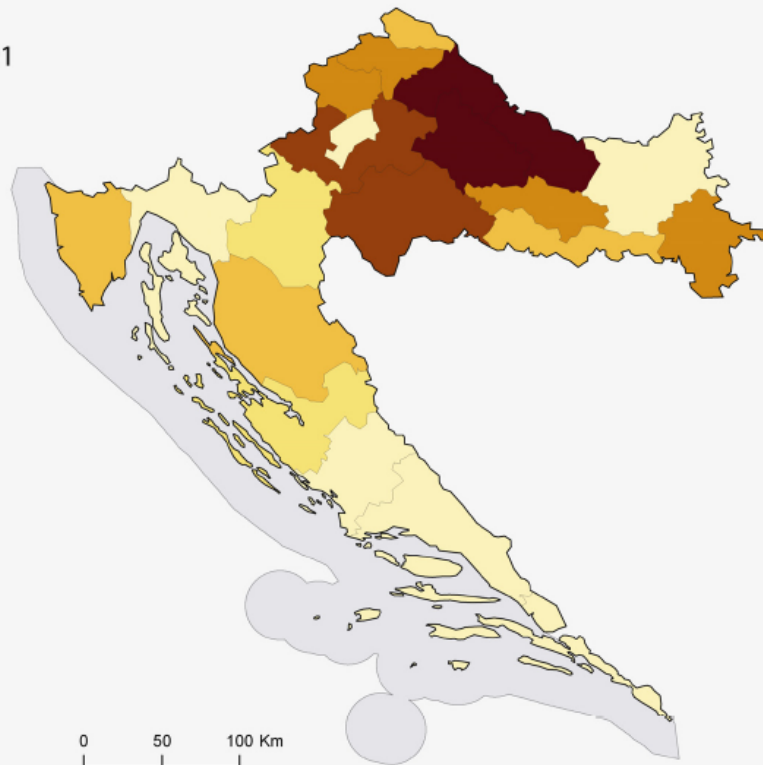
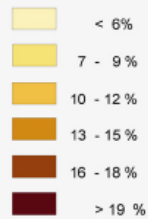


Poljoprivredno stanovništvo  
Agricultural Population 1991  
Ländliche Bevölkerung

Udio poljoprivrednog u ukupnom stanovništvu %

Share of Agricultural Population in % of total Population

Anteil der ländlichen Bevölkerung an der Gesamtbevölkerung in %



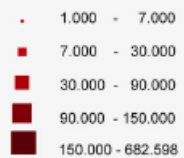
Izvor / Source / Quelle:  
National Bureau of Statistics of the  
Republic of Croatia  
2001 Population and Housing Census  
2001 Universität Potsdam - Institut  
für Geographie - Abt. Geoinformatik  
© 2008 by L. Wede & A. Brakhan.

Fig. 1: DACIS choropleth map: agricultural population 1991; print atlas map prototype



Veličina naselja  
Settlement Size  
Siedlungsgröße

Veličina naselja – broj stanovnika  
Settlement size – Inhabitants  
per Settlement  
Siedlungsgröße – Einwohner  
je Siedlung



Izvor / Source / Quelle:  
National Bureau of Statistics of the  
Republic of Croatia  
2001 Population and Housing Census  
2001 Universität Potsdam – Institut  
für Geographic – Abt. Geoinformatik  
© 2008 by L. Wede & A. Brakhan.

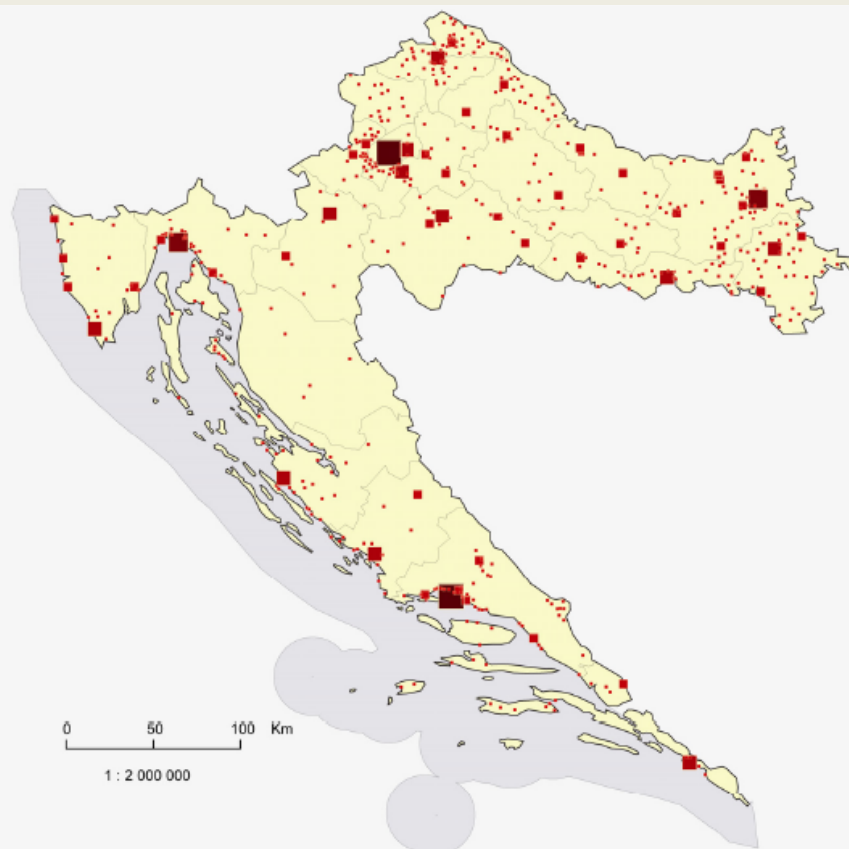


Fig 3: DACIS dot map: distribution of settlements by size; print atlas map prototype



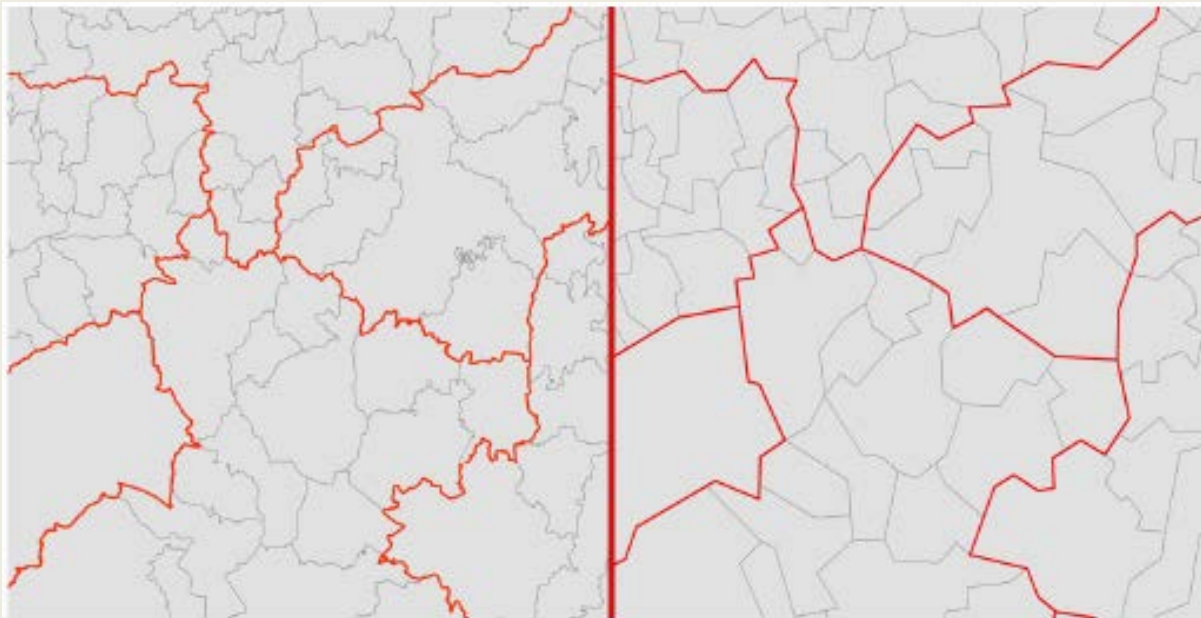


Fig. 4: *DACIS administrative base map: geometry of data model (left), cartographic model (right)*

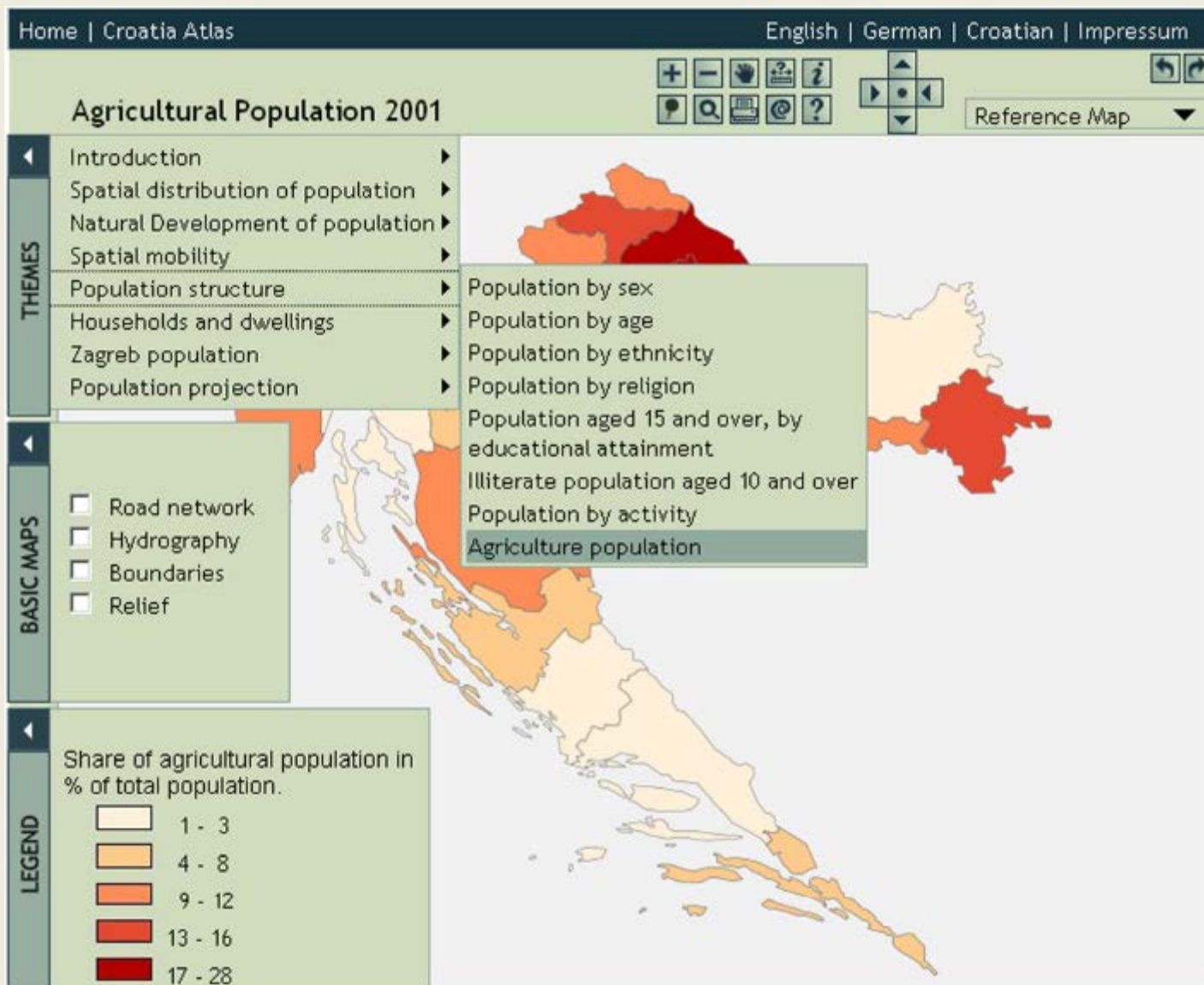
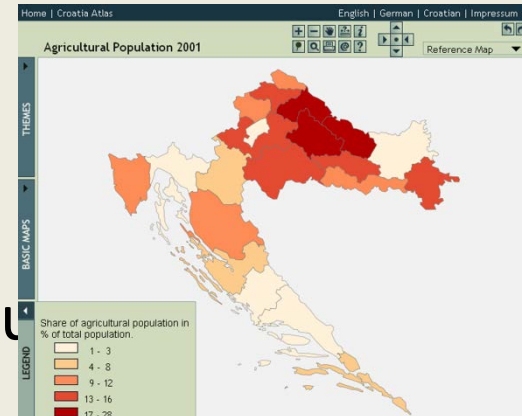


Fig. 6: DACIS web atlas prototype – user interface (screenshot)

# U kojem će mediju biti prezentirana karta?

- Monitor računala
  - 72 dpi (dots per inch)
  - Ograniči veličinu karte – cijela na ekranu
  - Povećaj veličinu slova (14 point)
  - Točkasti i linijski znakovi (15% veći)
  - Manja količina podataka (na jednoj karti)
  - Izbjegavati premale varijacije površine
  - Boja – kvaliteta monitora
  - Bijela – intenzivnija od crne (podloga ili nema pojave)
  - Za web – 72 dpi i veličinu prilagoditi browseru



# ArcGIS Online

Rob Shanks | Sign Out

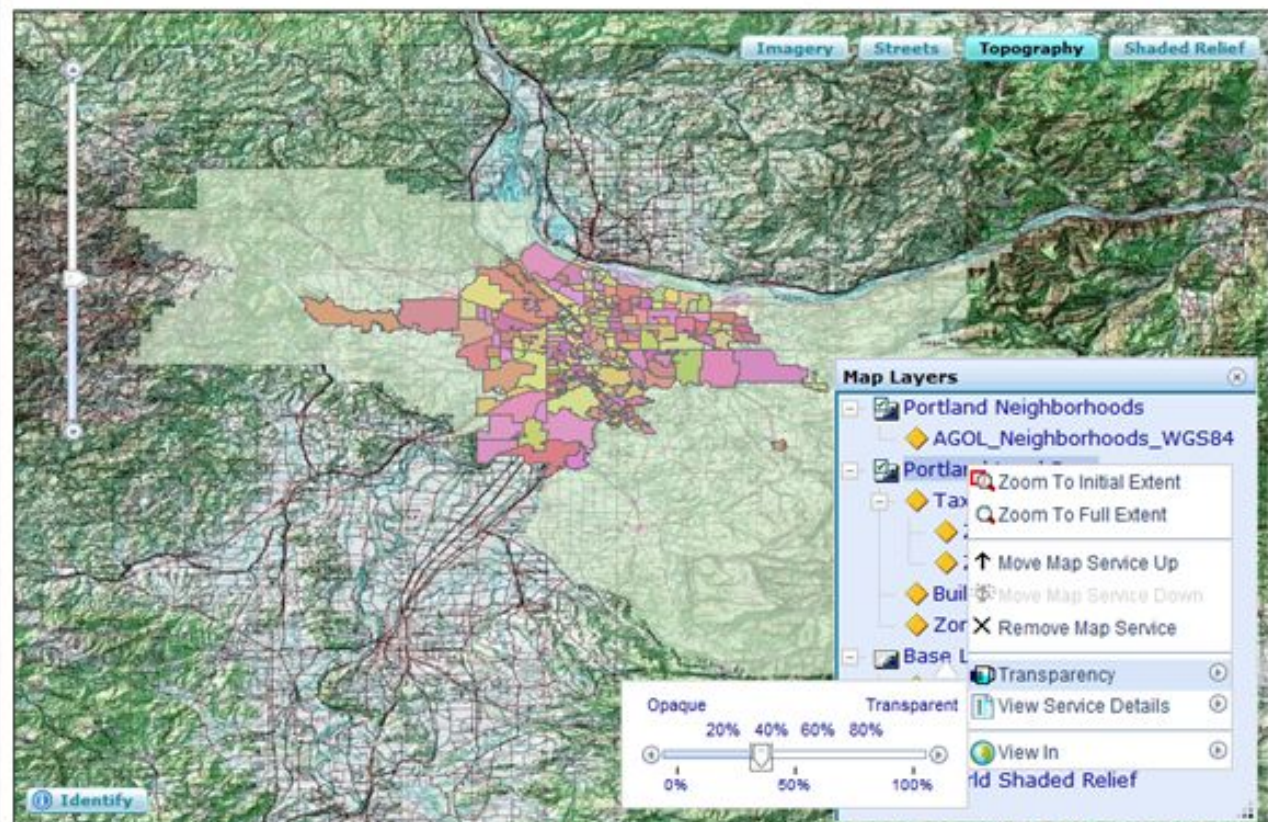
## Portland Web Map

Search for an Address, City, or Location ...

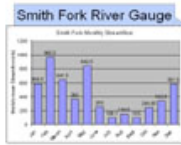
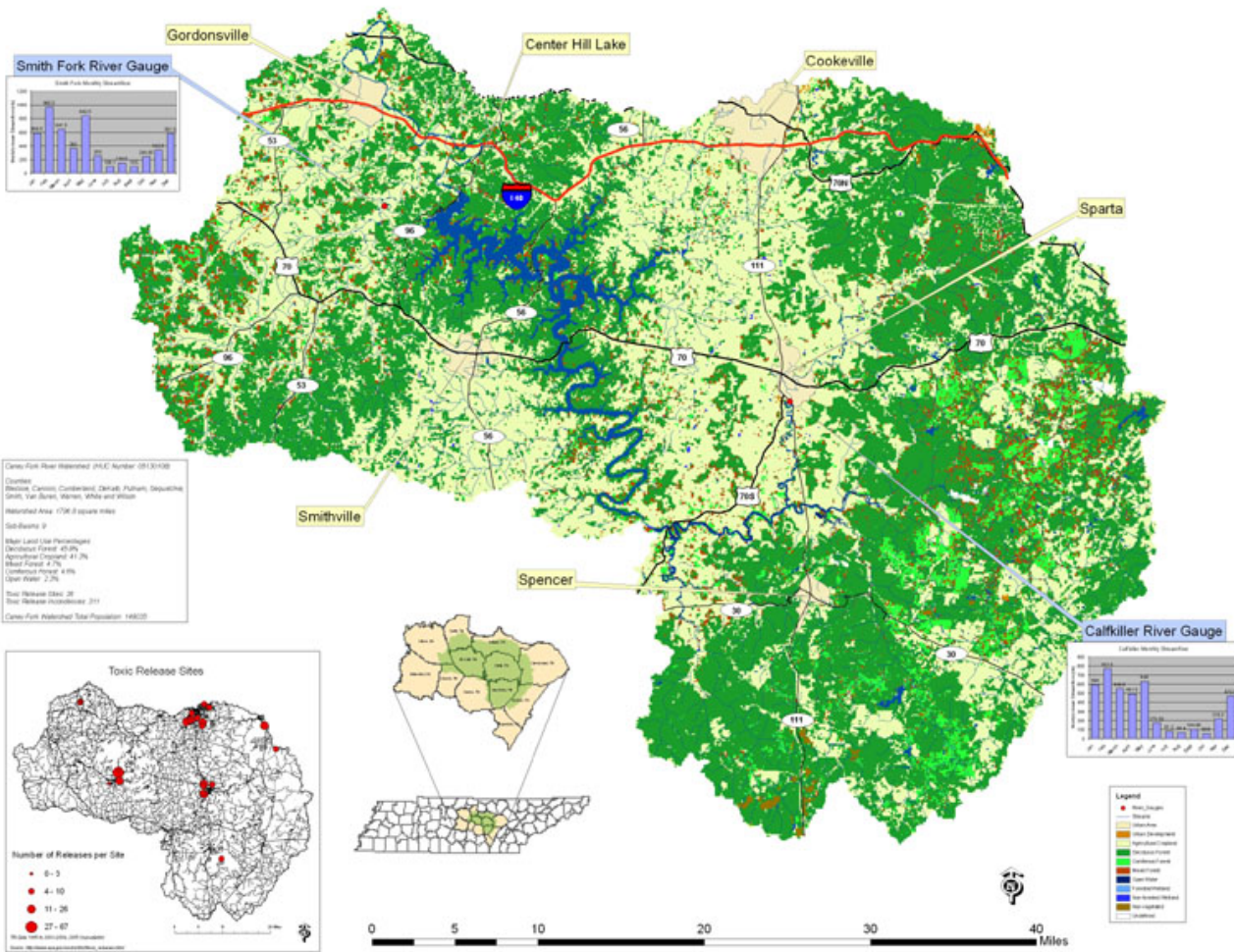
Find

Add More Layers

Save Map



# Caney Fork River Watershed



Caney Fork River Watershed (PLC Number: 0131010)

Counties: Blount, Carroll, Cumberland, DeKalb, Fulton, Sequoyia, Smith, Van Buren, Warren, White and Wilcox

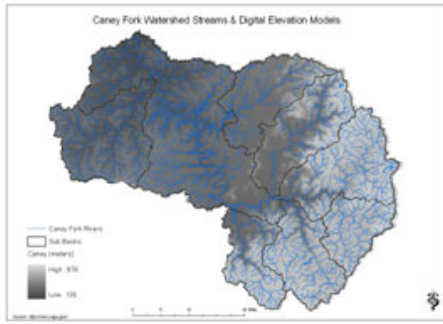
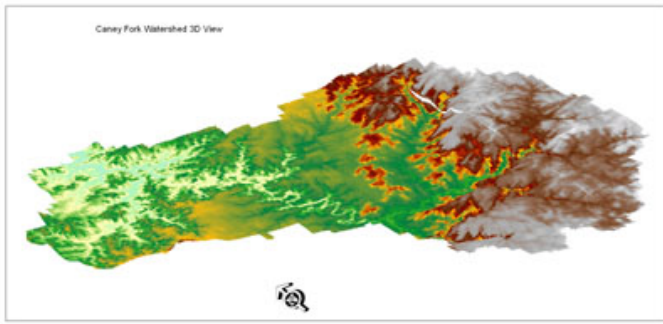
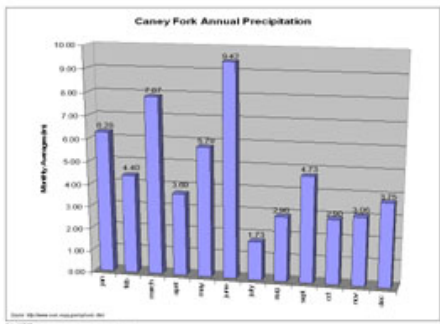
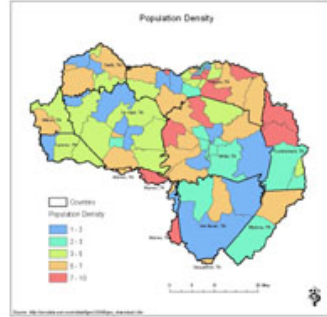
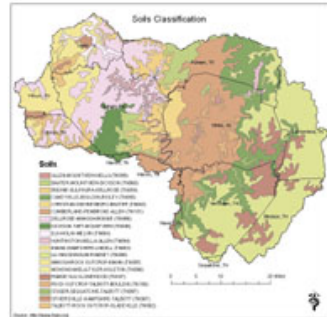
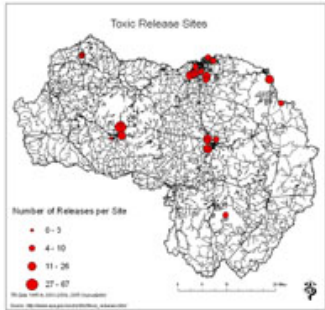
Watershed Area: 1098.8 square miles

Sub-Basins: 9

Major Land Use Percentages:  
 Developed Forest: 45.2%  
 Agricultural/Cropland: 41.2%  
 Barren/Grass: 4.7%  
 Wetlands: 4.6%  
 Open Water: 2.3%

Total Release Sites: 28  
 Total Releases: 108,856,150 lbs

Caney Fork Watershed Total Population: 148,025



## TIGER Products

TIGER = Topologically Integrated Geographic Encoding and Referencing

TIGER products are spatial extracts from the Census Bureau's MAF/TIGER database, containing features such as roads, railroads, rivers, as well as legal and statistical geographic areas. The Census Bureau offers several file types and an online mapping application. Our products are:

- [TIGER/Line Shapefiles - New 2015 Shapefiles](#)
- [TIGER/Line Geodatabases](#)
- [TIGER/Line with Selected Demographic and Economic Data](#)
- [Cartographic Boundary Shapefiles](#)
- [KML - Cartographic Boundary Files](#)
- [TIGERweb](#)

### 25 Years and Counting

- [TIGER Story Map \(Part 1\)](#)
- [Happy 25th Anniversary, TIGER](#)

### [TIGER Data and Product FAQs](#)

#### Which product should I use?

Product	Best For...	File Format	Type of Data	Level of Detail	Descriptive Attributes	Vintages Available
<a href="#">TIGER/Line Shapefiles</a>	Most mapping projects--this is our <i>most comprehensive dataset</i> . Designed for use with GIS (geographic information systems).	Shapefiles (.shp) and database files (.dbf)	Boundaries, roads, address information, water features, and more	Full detail (not generalized)	Extensive	2006 - 2015, CD 113
<a href="#">TIGER Geodatabases</a>	Useful for users needing national datasets or all major boundaries for by state. Designed for use in ArcGIS. Files are extremely large.	Geodatabase (.gdb)	Boundaries, roads, address information, water features, and more	Full detail (not generalized)	Limited	2013-2014
<a href="#">TIGER/Line with Selected Demographic and Economic Data</a>	Data from selected attributes from the 2010 Census, 2006-2010 ACS 5-year estimates, 2007-2011 ACS 5-year estimates, 2008-2012 ACS 5-year estimates and County Business Patterns (CBP) for selected geographies. Designed for use with GIS.	Shapefiles (.shp) and Geodatabases	Boundaries, Population Counts, Housing Unit Counts, 2010 Census Demographic Profile 1 attributes, 2006-2010 ACS 5-year estimates data profiles, 2007-2011 ACS 5-year estimates data profiles, CBP data.	Full detail (not generalized)	Limited	2012 CBP, 2010, 2006-2010 ACS, 2007-2011 ACS, 2008-2012 ACS
<a href="#">Cartographic Boundary Shapefiles</a>	Small scale (limited detail) mapping projects clipped to shoreline. Designed for thematic mapping using GIS.	Shapefiles (.shp)	Selected boundaries	Less detail (generalized)	Limited	2014, 2013, 2010, 2000, 1990
<a href="#">KML - Cartographic Boundary Files</a>	Viewing data or creating maps using Google Earth, Google Maps, or other platforms that use KML.	KML (.kml)	Selected boundaries	Less detail (generalized)	Limited	2014, 2013
<a href="#">TIGERweb</a>	Viewing spatial data online or streaming to your mapping application.	Interactive viewer, HTML data files, plus REST and WMS map services	Boundaries, roads, address information, water features, and more	Detailed	Extensive	2012, 2010, 2012 ACS and 2011 ACS

## Cartographic Boundary Shapefiles

### What Are They?

The cartographic boundary files are simplified representations of selected geographic areas from the Census Bureau's MAF/TIGER geographic database. These boundary files are specifically designed for small scale thematic mapping.

Generalized boundary files are clipped to a simplified version of the U.S. outline. As a result, some off-shore areas may be excluded from the generalized files.

For more details about these files, please see our [Cartographic Boundary File Description page](#).

[Note on Special Characters Not Displaying Correctly](#)

### Download Files

Cartographic Boundary files are available in shapefile format for the 2010 Census, Census 2000, and selected geographies for other years. File-based metadata is included in all files.

- Nation-based Files
  - [American Indian Areas/Alaska Native Areas/Hawaiian Home Lands](#)
  - [Congressional Districts](#)
  - [County](#)
  - [County Within Congressional District](#)



# Generalizacija – reljef (sjenčanje)

## 9. SHADED RELIEF

The representation of shaded relief and its generalization has to be based on the contour image. Angular and rounded forms, steep and flat terrain with transition forms, should be represented in accordance with the contours. The main forms should not be lost, but should be more emphasized as scale becomes smaller.



Fig.142

1:50 000



Fig.143

1:100 000



Fig.144

1:200 000



Fig.145

1:500 000

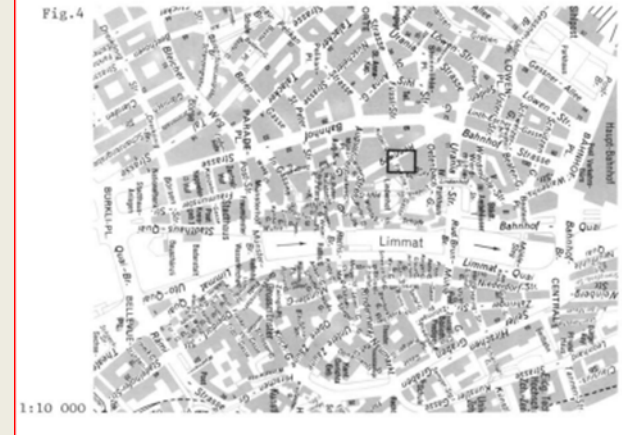
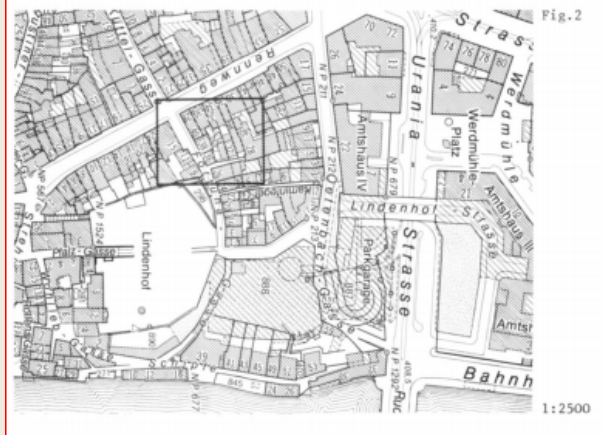


Fig.146

1:1000 000



# Kartografska generalizacija – detaljne topografske karte





Hvala na pozornosti!?

