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# APPLICATION OF GIS DATA MODELLING FOR STONE AGGREGATE POTENTIAL IN DALMATIA

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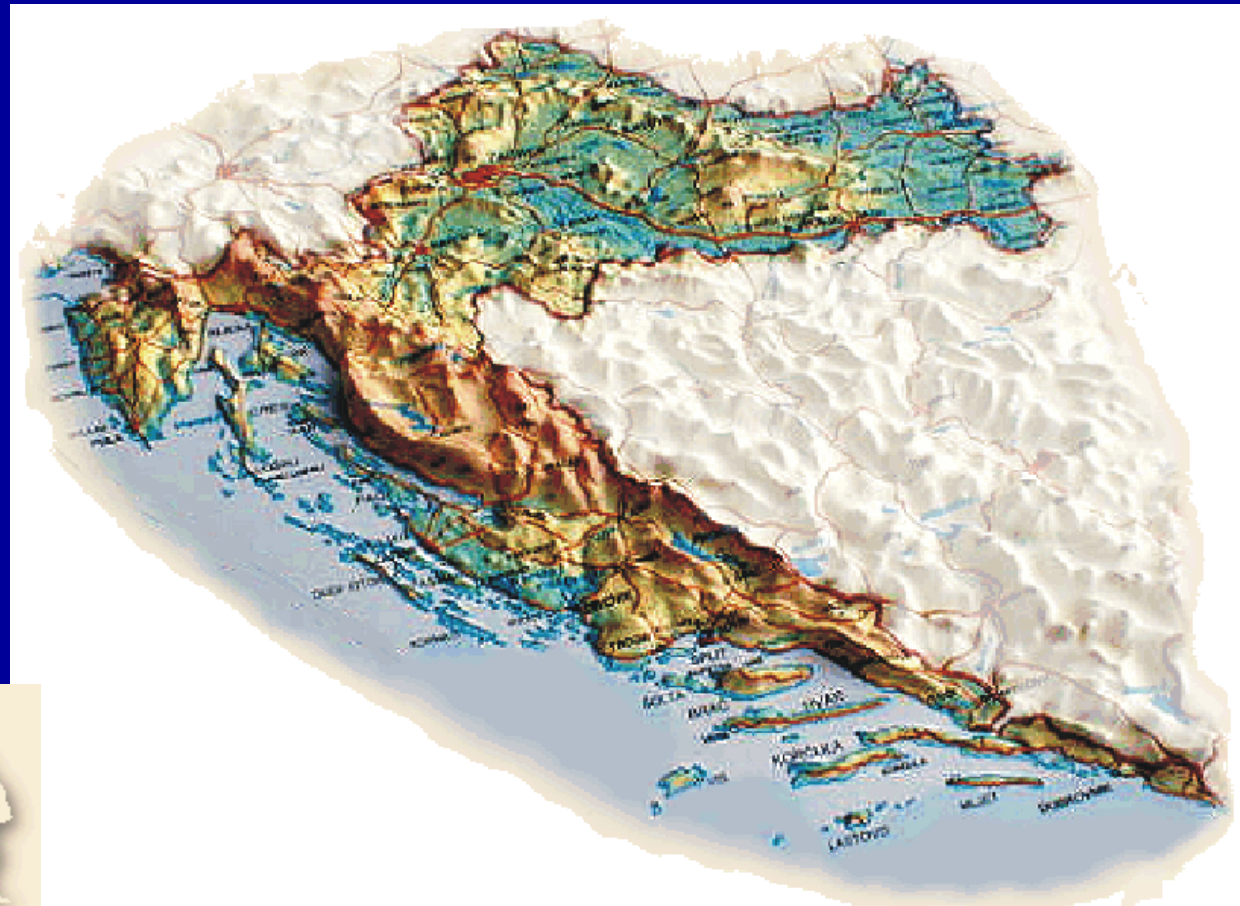
# Scope

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- GIS based modelling for stone aggregate potential
- Geology of Croatia
- Mineral resources of Croatia and Dalmatia
- Extraction sites in Dalmatia and aggregate production (study area)
- Method: Weights of evidence (WofE)
- Results: areas suitable for aggregate stone quarries in Dalmatia
- Future prospects of mineral aggregate extraction and land use conflicts

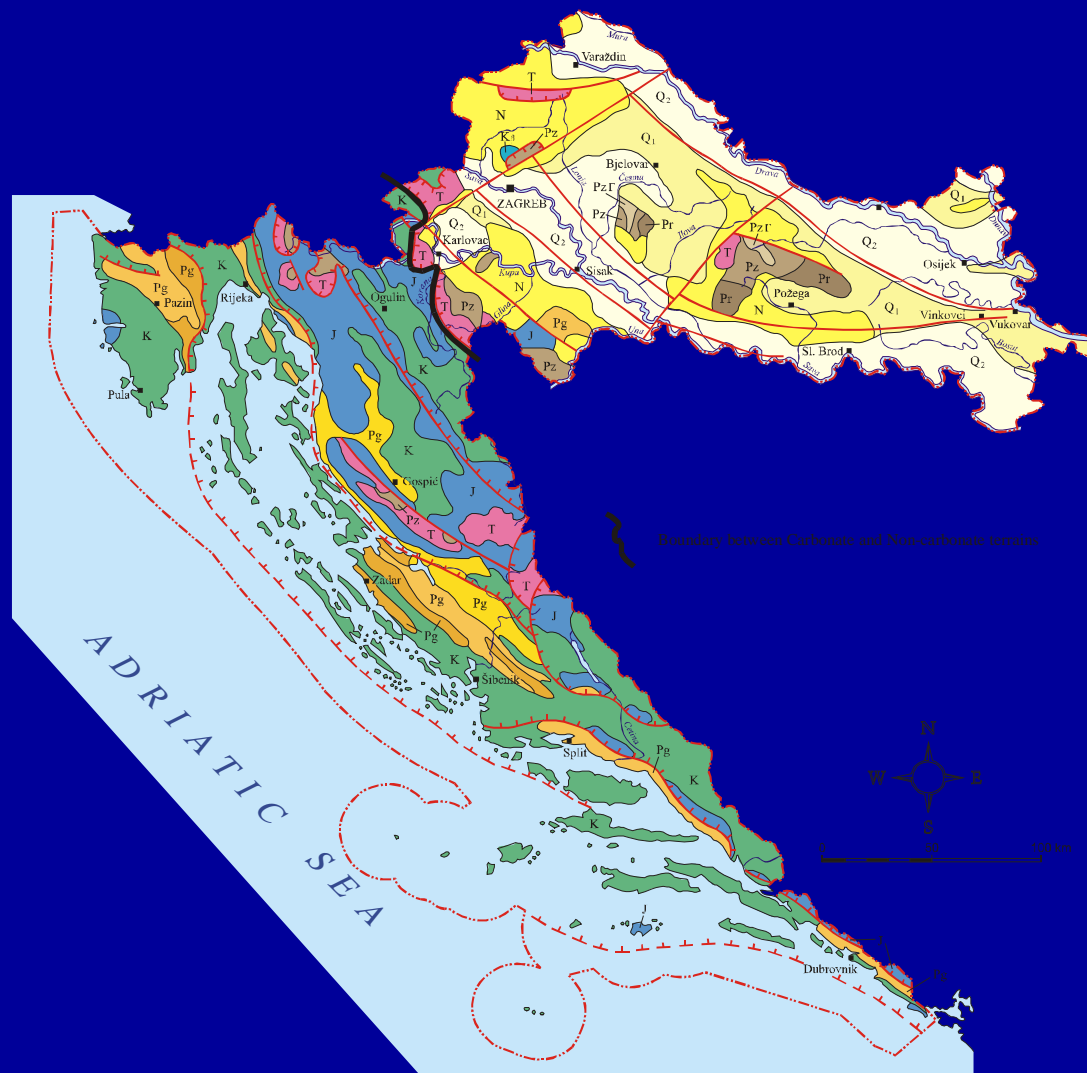
# Geography

- Area: 58,540 sq km
- Population 4.8 million



# Geology of Croatia

- >50% carbonate rock  
(limestone and dolomite mainly of the Mesozoic Adriatic Carbonate Platform)
- 40 % thick unconsolidated Quaternary sedimentary deposits
- <5% eruptive and metamorphic rocks



# Mineral resources of Croatia

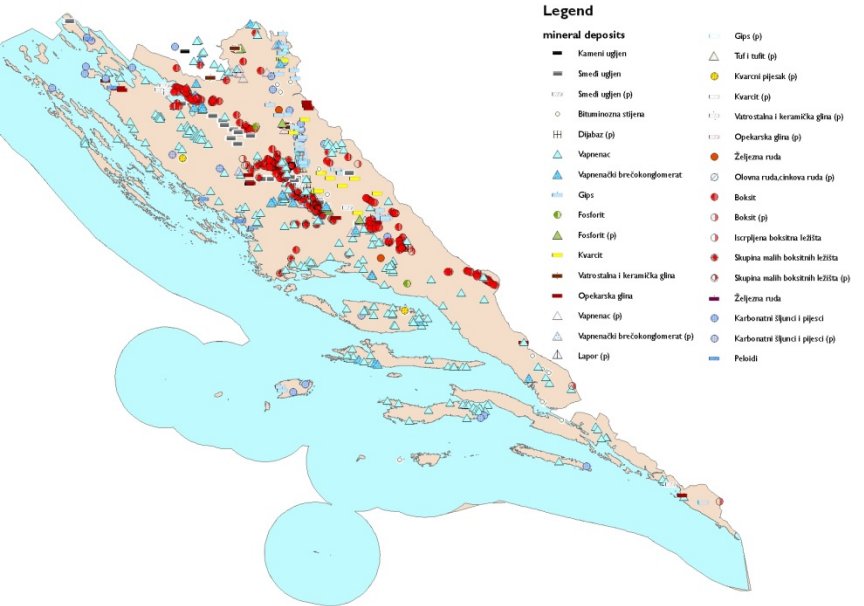
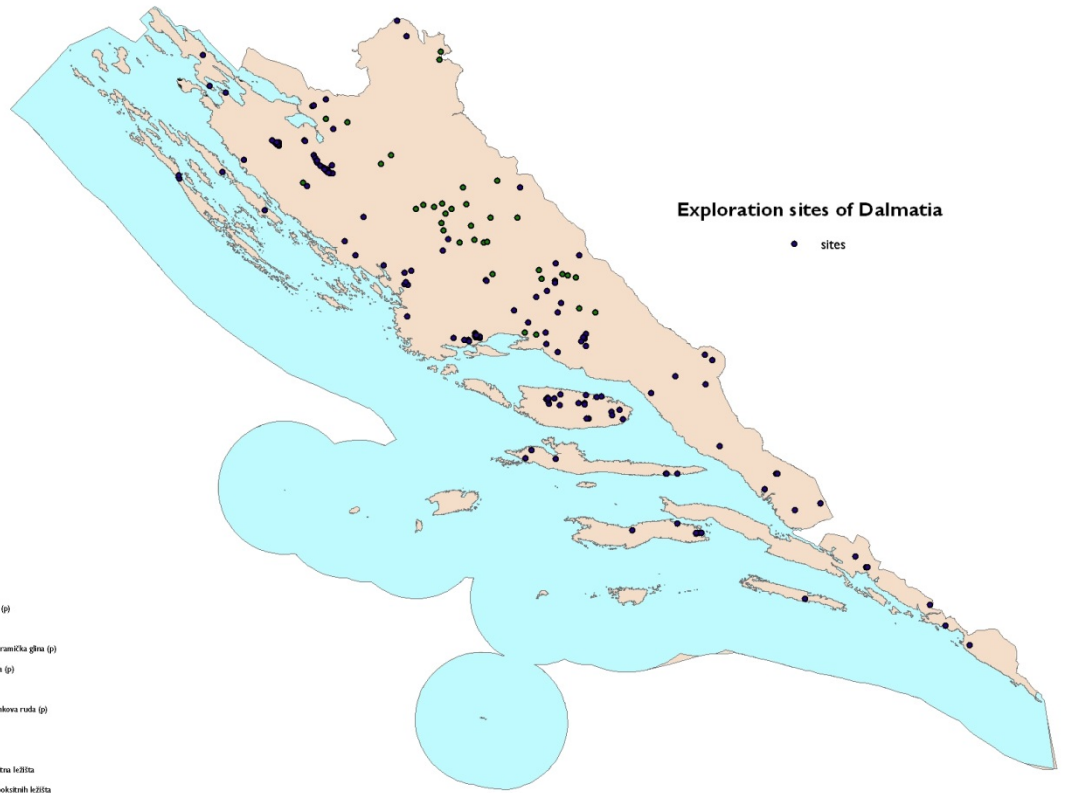
## Mineral commodity:

- crushed stone aggregate; 253 sites
  - dimension stone aggregate; 103 sites
  - sand and gravel; 82 sites
  - clay; 49 sites
  - bauxite ; 15 sites
  - gypsum; 9 sites
  - other non metal deposits
  - coal in the past
- 
- 626 TOTAL NUMBER OF EXPLOATION SITES IN CROATIA (378 km<sup>2</sup>)



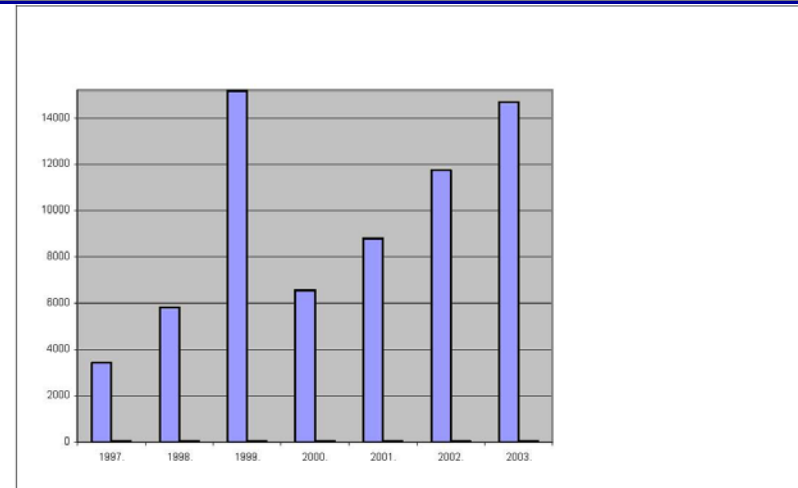
# Quarrying in Dalmatia

- 68 active crushed stone aggregate quarries or 25 % in Dalmatia
- 82 active dimension stone aggregate quarries or 80 % in Dalmatia

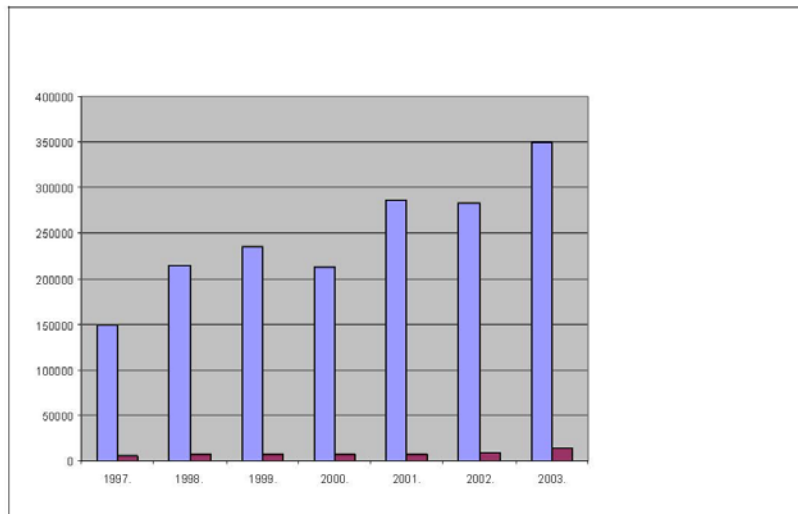


# Quarrying in Dalmatia

- exploitative reserves of dimension stone aggregate 13.5 mill. m<sup>3</sup> in the study area
- exploitative reserves of crushed stone aggregate 350 mill. m<sup>3</sup> in Croatia ( 25% in Dalmatia)
- increasing demand for aggregate in EU, as well in Croatia



dimension stone aggregate



crushed stone aggregate

# Quarrying in Dalmatia

Traces of old Roman quarries can be found along the coast, together with ruins of public buildings, basilicas and temples.

Today export destinations include Italy, Germany, Austria, Belgium, the Netherlands, Slovenia, Bosnia - Herzegovina, Czech Republic, UK, South Korea and Australia.

Limestones exclusive to the Dalmatia include Veselje, Adria Grigio, San Giorgio, Rasotica, Dracevica and Zecevo.



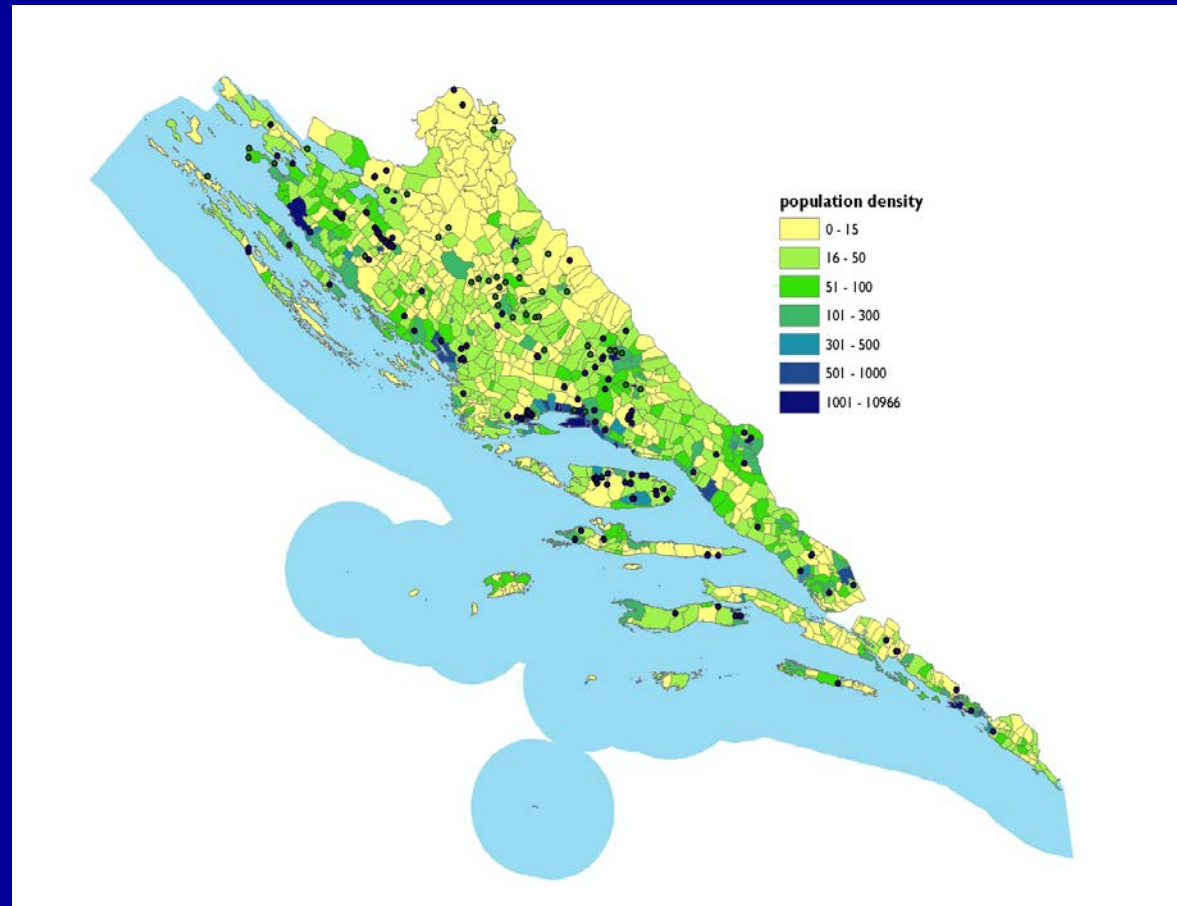


# Weights of evidence (WofE)

- quantitative method
- for mineral-potential mapping by Bonham-Carter, Agterberg, and Wright (1988)
- response variable (training points)
- predictor variable (evidential theme)
- analyze spatial associations between variable
- reclassification the evidence categories
- define optimal prediction
- three evidential theme layers were used:
  - bedrock maps with appropriate quality attributes
  - proximity to principal highways and road lines
  - categorical groups define by census tract population density
- all evidential theme layers were prepared in grid format using Arcview 9.1. and ArcSDM extension

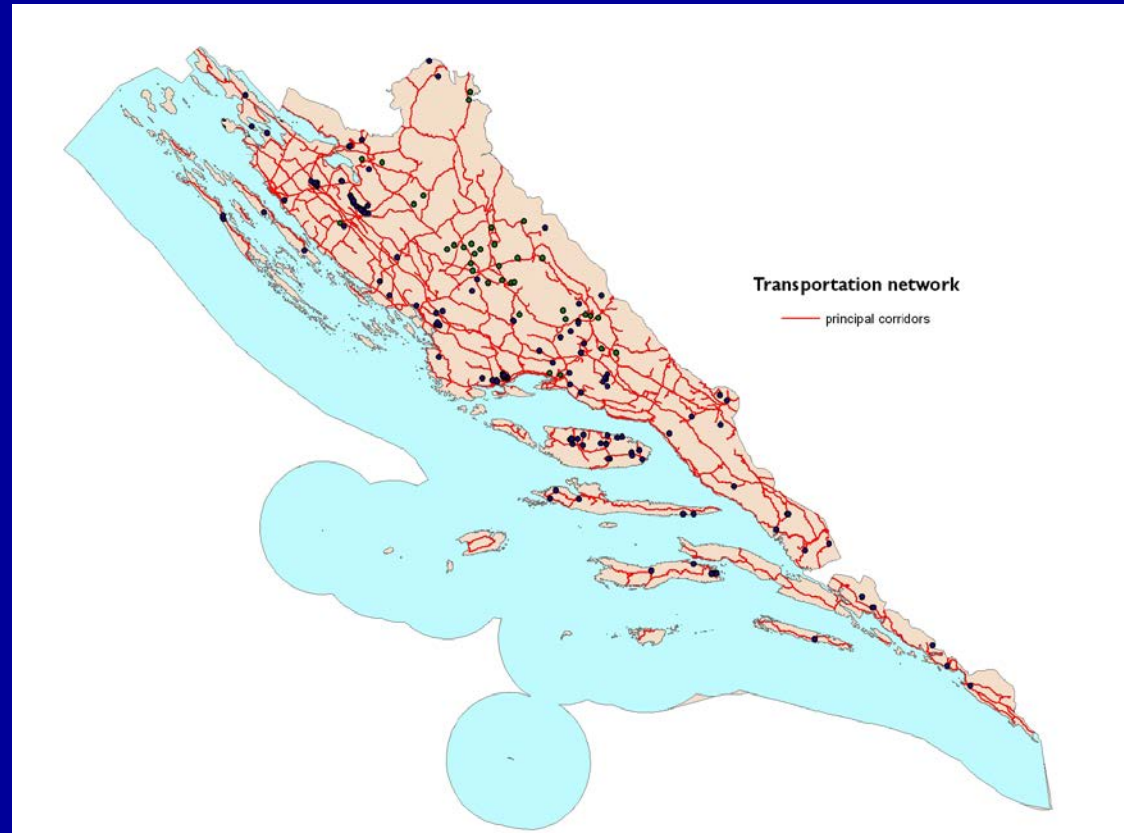
# Weights of evidence (WofE)

- predictive evidence
- population density  
(people per square km)



# Weights of evidence (WofE)

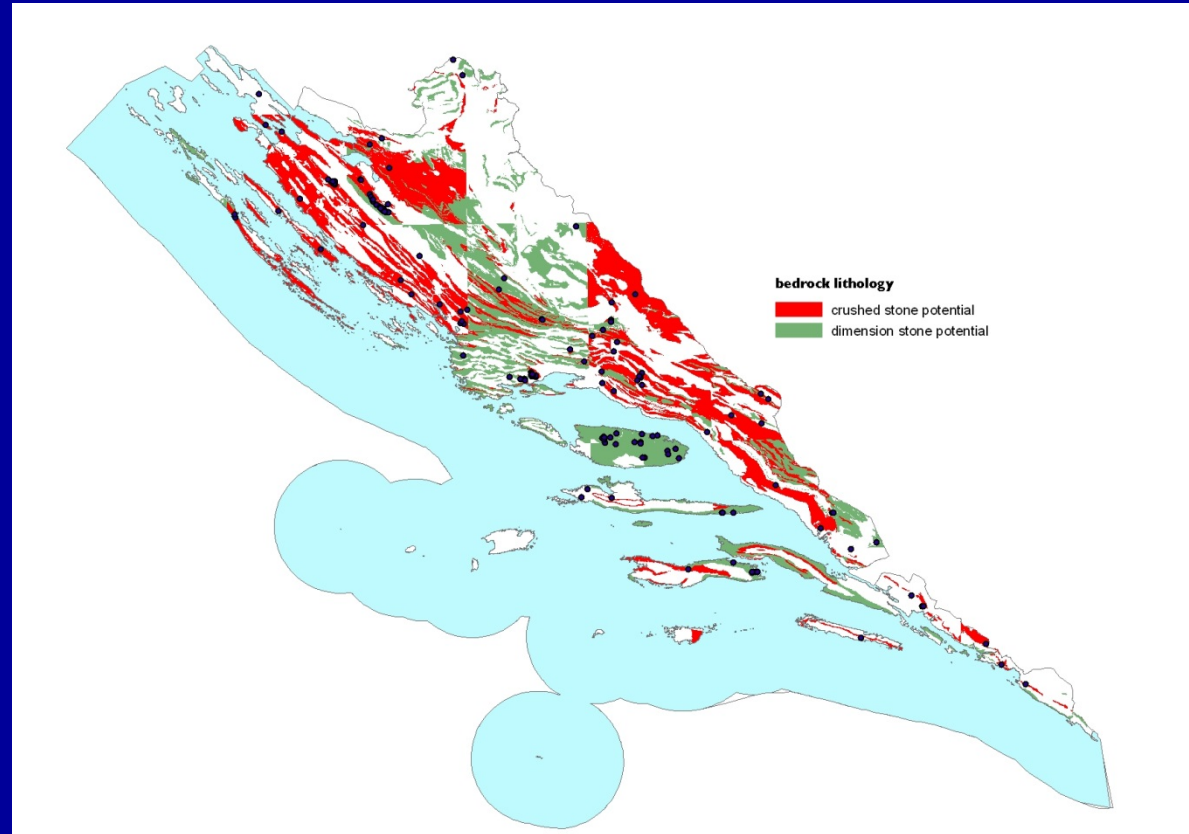
- predictive evidence
- transportation network
- distance from transportation corridors within 2 and 4 km
- 90% crushed stone aggregate quarries are within 2 km of principal roads
- the importance of proximity to transportation roads for the industry



# Weights of evidence (WofE)

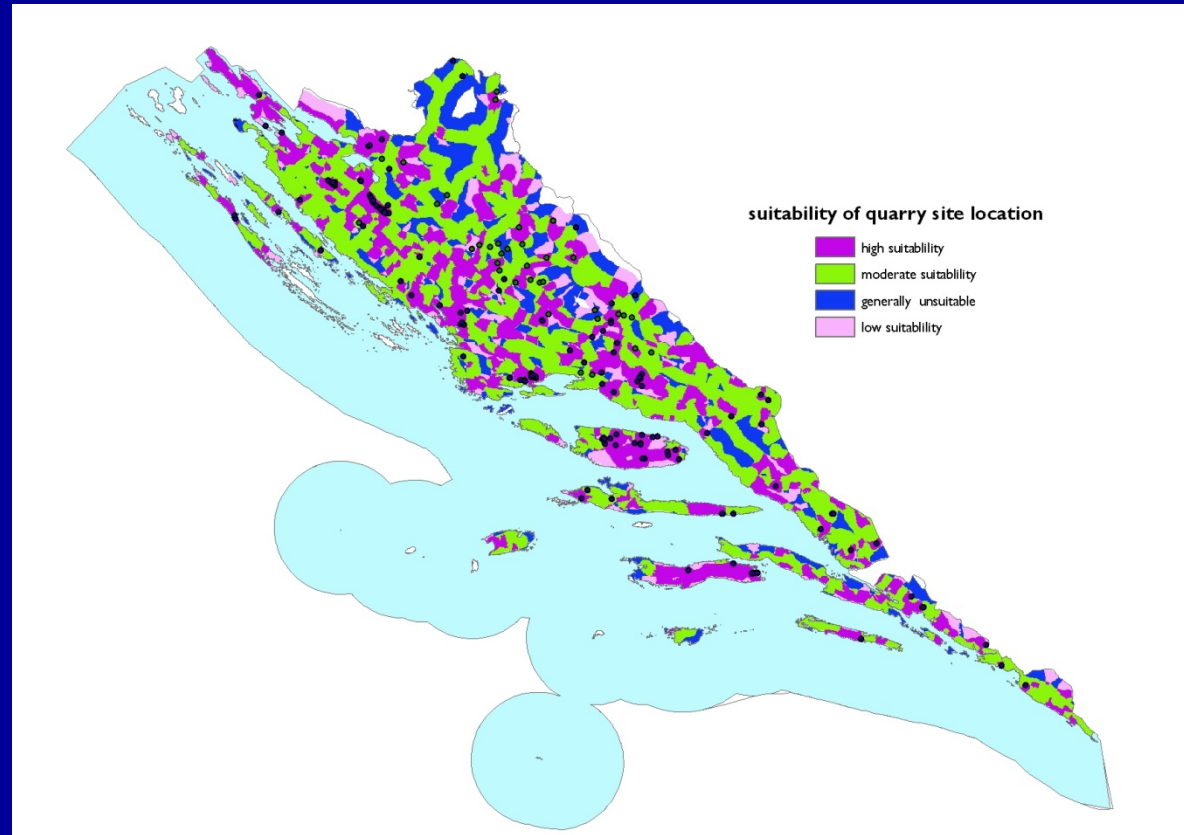
## bedrock lithology

- predictive evidence
- compilation of 1:100 000 scale basic geological maps of Republic of Croatia
- 20 maps sheets in digital format
- potential maps for stone aggregate in the study area



# Results

Method demonstrates a technique to define suitable areas for aggregate production using geological map, transportation network and population density spatial data for evidence



# Future prospects

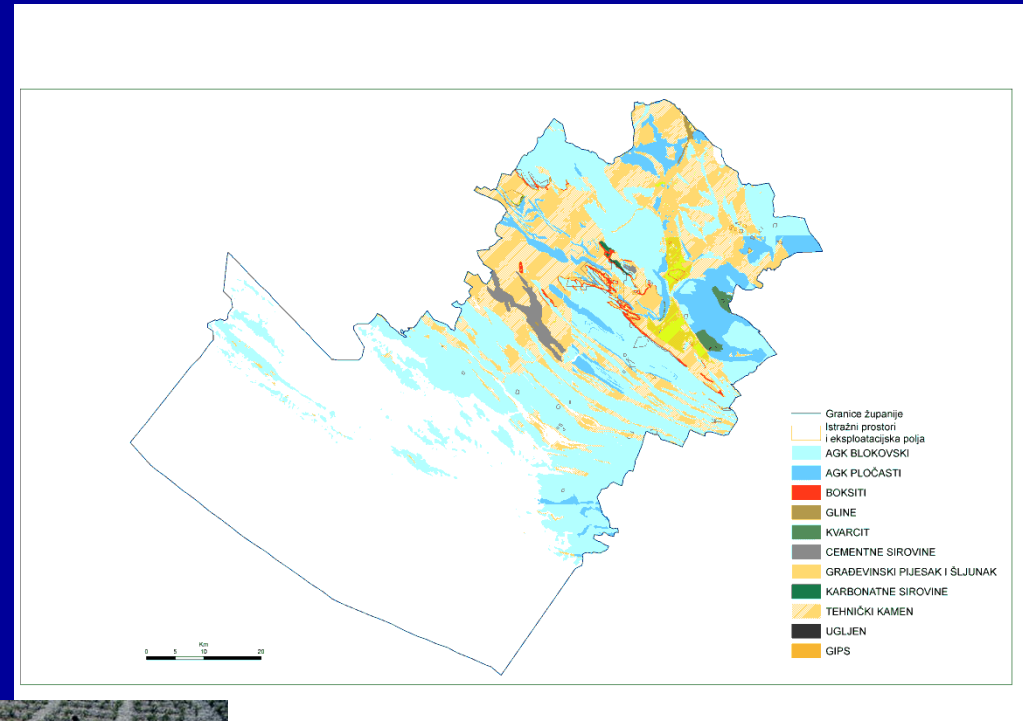
To rise awareness to various mining problems and impacts on karst and to help manage better the use of mineral resources in Dalmatia based on identification of more suitable areas for stone production taking in account both environmental and marketplace restrictions and to help local environmental policy makers to correctly manage the fragile karst environment and to preserve the natural landscape.



# Future prospects: Mineral resource potential and land use restrictions

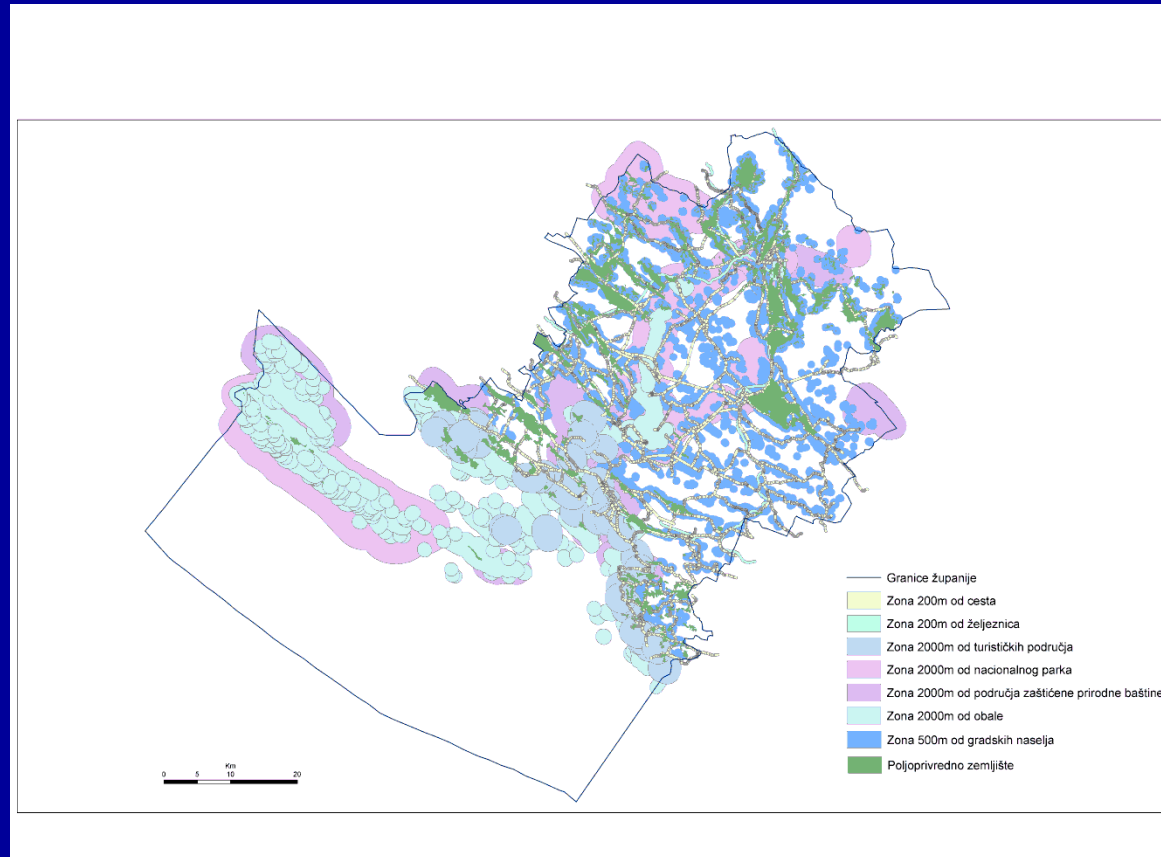
## Case study: Šibensko-kninska county - Dalmatia

- geological potential for mineral resources



# Future prospects: Mineral resource potential and land use restrictions

- Šibensko-kninska county -  
Dalmatia-administrative  
restrictions in context of  
mineral exploitation  
(central and local  
government agencies)
- road infrastructure
  - protected areas
  - valuable land
  - 1 km distance from the coast
  - tourist resorts
  - settlements

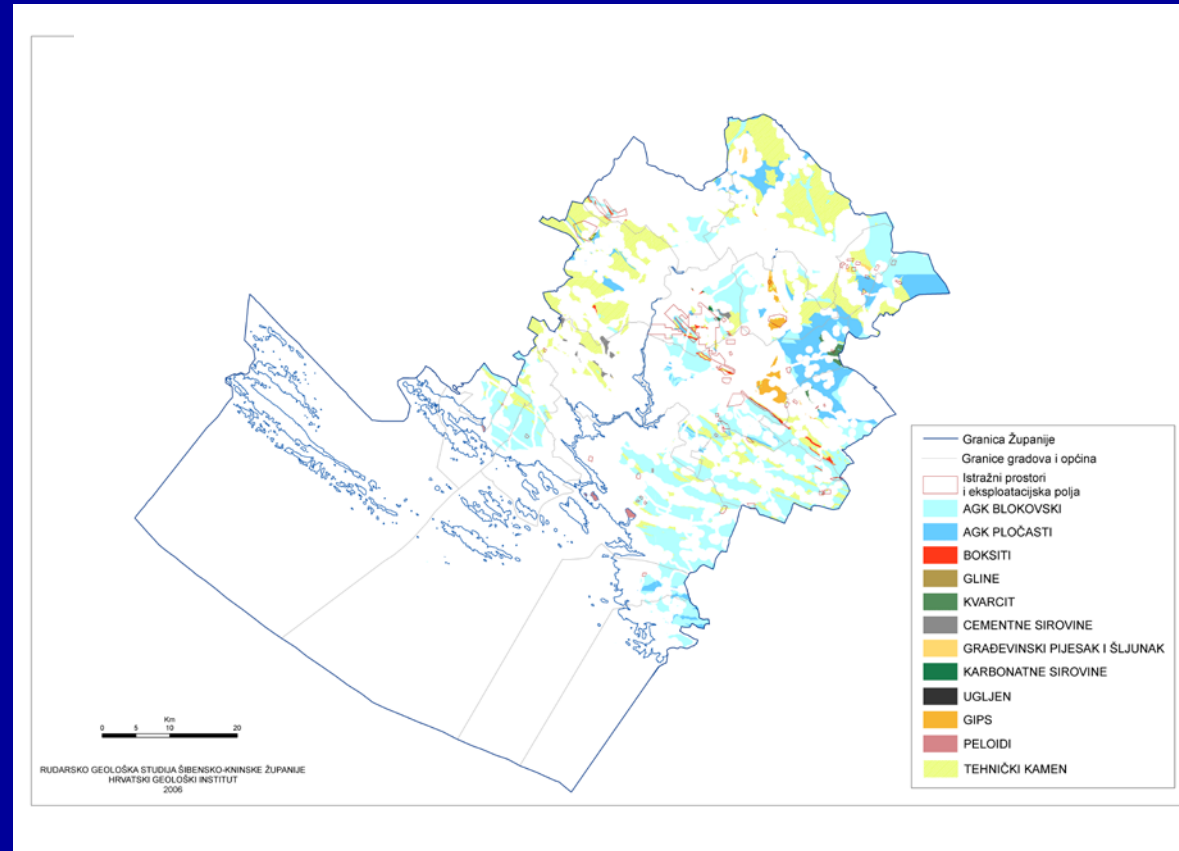




# Future prospects: Restricted mineral potential and spatial planning

## Šibensko-kninska county - Dalmatia

- road infrastructure
- protected areas
- valuable land
- 1 km distance from the coast
- tourist resorts
- settlements (500 m distance buffer)
- visual impacts on the landscape (viewshed)



## Future goals are to:

**Apply GIS-WofE modeling to determine most favorable areas for quarrying in terms of geology, environmental protection and county master planning and derive a model procedure applicable to spatial planners for the whole territory of Croatia**



**Thank you !**