



SCERIN-7 Capacity Building Workshop

24-27 June 2019, Novi Sad, Serbia

NATURAL RISKS AND ANTROPOGENIC IMPACTS ON THE BULGARIAN BLACK SEA REGION

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NATIONAL INSTITUTE OF GEOPHYSICS, GEODESY AND GEOGRAPHY – BAS

Thematic focus of SCERIN

- LCLUC and implications to climate & society
- Forest function, disturbances, fires
- Ecosystem carbon storage and flux dynamics
- Water ecosystems management

PRESENTATION OUTLINES

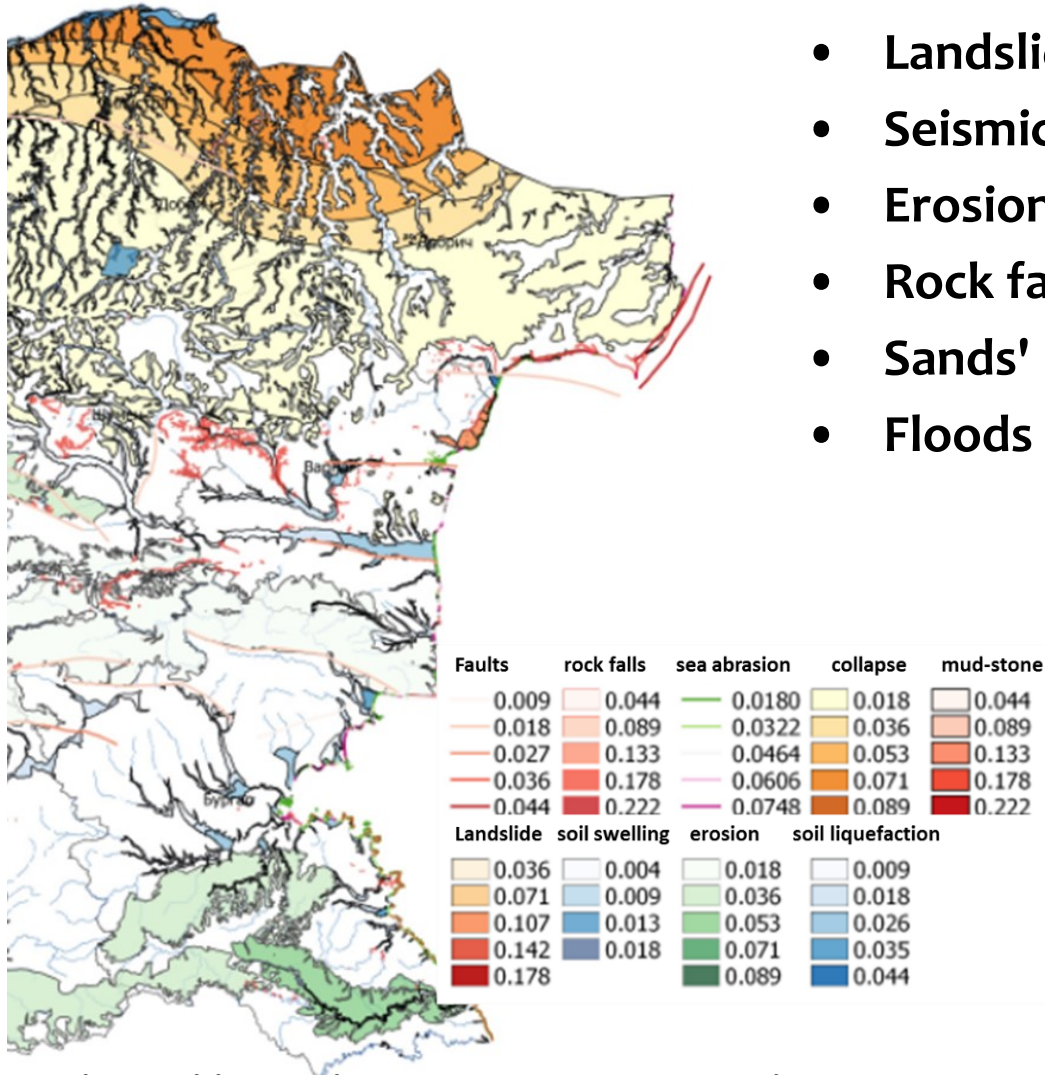
Area of Interest: **Bulgarian Black Sea coastal zone**

- Hazard and risk processes in the coastal zone – results from research studies
- Monitoring of LC dynamics by remote sensing and *in situ* observations – urban expansion

Hazard and risk processes in the coastal zone

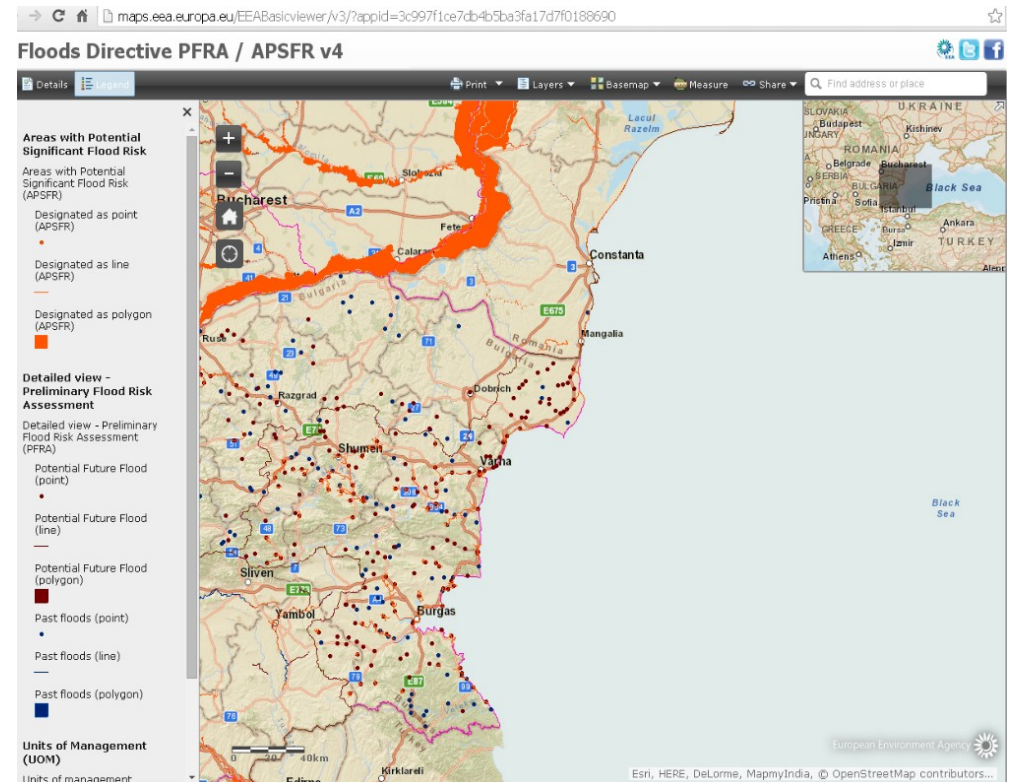
Main geohazards in Bulgarian coastal zone

- Landslides – more than 380 landslides
- Seismic activity
- Erosion & Sea abrasion ~70% of the BG coastline
- Rock falls
- Sands' liquefaction
- Floods



Geological hazardous processes; Appendix 2.1

<http://gis.mrrb.government.bg/KGR/>.



Flood events in Bulgaria

Natural disasters do not affect evenly the Bulgarian territory

- Increased frequency of heavy rains causing severe floods /1997, 2001, 2002, 2005, 2006, 2014, 2016, 2017/;
- **STORM SURGES** along the BG BS coast
 - 1976, 1977, 1979, 1981, 1996,1998, 2006, 2010, 2012, 2013, 2014
- **FLOODS /2014: 360; 177,604K BGN/**
- ✓ **Coastal floods: missing data in EM-DAT&NSI**



Flood hazard and risk maps of Bulgaria

according to Directive 2007/60/EC

https://www.bsbd.org/uk/FR_mplans.html

•FIRST PHASE

- ✓ **2010** - EU FRD was transposed into Bulgarian national legislation.
- ✓ **2011** – 4 common criteria for risk assessment at the national level are agreed: **human health, the environment, cultural heritage and economic activity** (PFRS, 2012).

•SECOND PHASE

- ✓ **2013** - NATIONAL METHODOLOGY developed by the NIMH-BAS, approved by MEW for preparing hazard and risk maps of flooding
- ✓ **2014** – updated list of ASPRF
- ✓ **2015** - Compiling hazard and risk maps for all ASPRFs

•THIRD PHASE

- ✓ **2015** - Flood Risk Management Plan (2016-2021)
- ✓ **2015** - River Basin Management Plan (2016 - 2021)

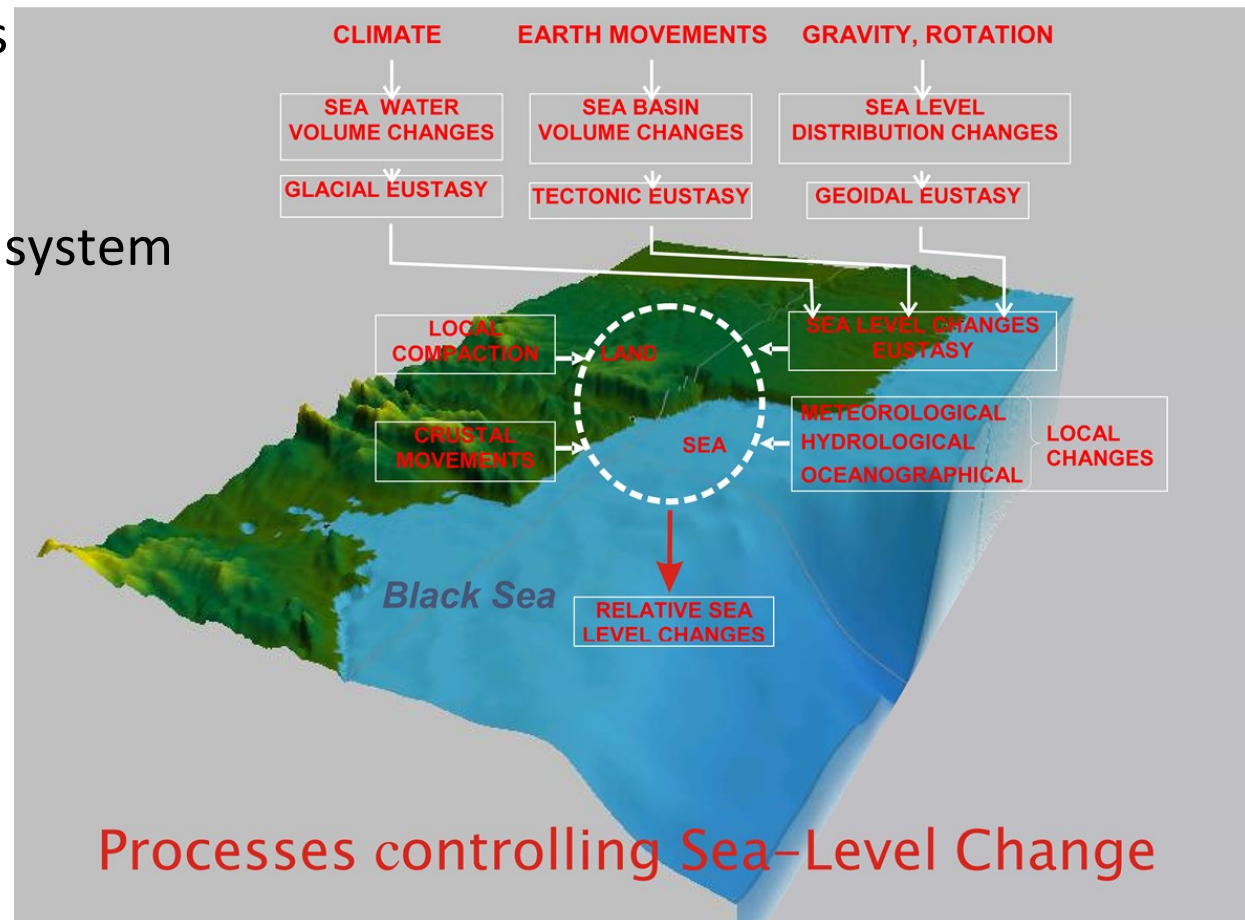
2nd & 3rd Phase - subjected to revision and updating every 6 years

- ✓ **2019** - Revision of flood hazard and flood risk maps

Black Sea level variations and climate change

Different temporal and spatial scale

- Short-term (from minutes to several days)
- Long-term (from several months to centuries)
- Synoptic, seasonal, multiannual and long-term periodic oscillations
- Extreme values of sea level in storm surge events
- Mesoscale sea level oscillations
- Tsunami waves
- Effect of the Bosphorus Strait
- Black - Marmara - Aegean seas system



Coastal flooding in the Bulgarian Black Sea coast



Sea flooding in the resort "Golden Sands" on March 10, 2010



Varna



Burgas

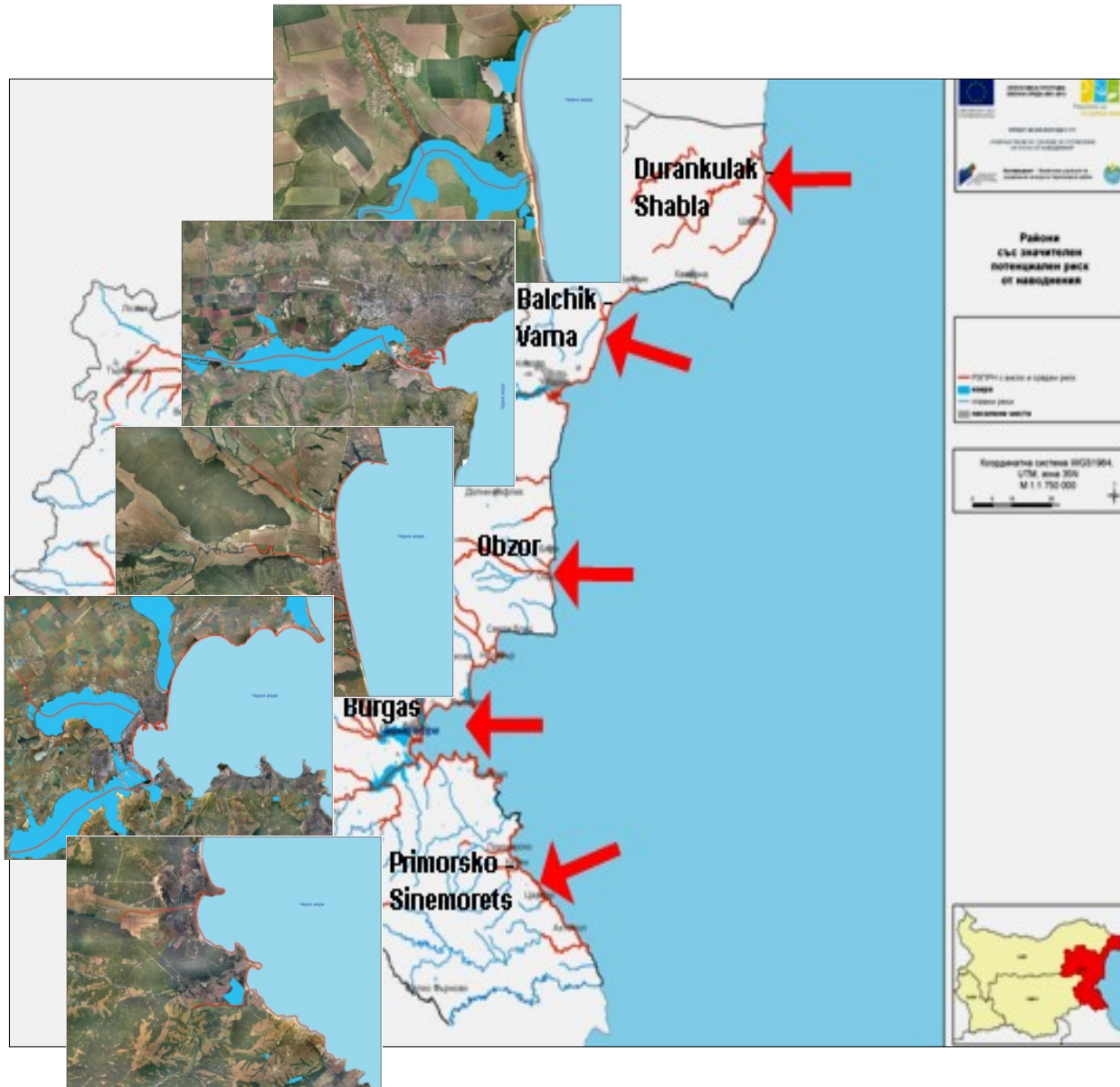


Varna



High waves and flood along the Bulgarian Black Sea coast on 8-9 February 2012

ASPRF in the Black Sea basin water management of Bulgaria



Basin water management

<http://www.bsbd.org/>

✓ **14.7** % of the country

✓ **100%** of the territorial sea.

BG Black Sea coast line is **378** km

Total number ASPRF - 34

✓ **River – 29**

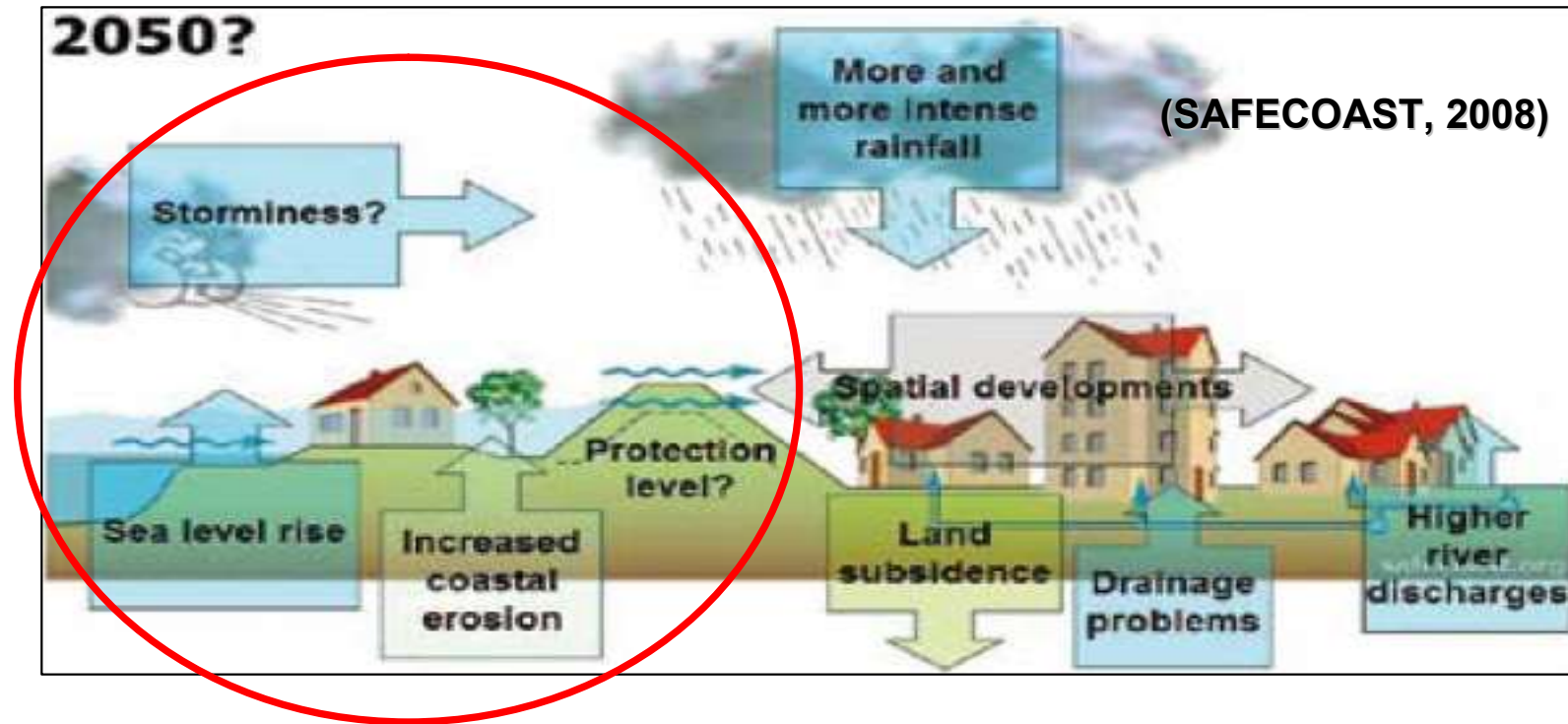
✓ **COASTAL – 5**

Total length – **1 385.580** km

<http://eea.government.bg/wp/purn/bsbd/>

<http://www.bsbd.org/UserFiles/File/knijka%20BG.pdf>

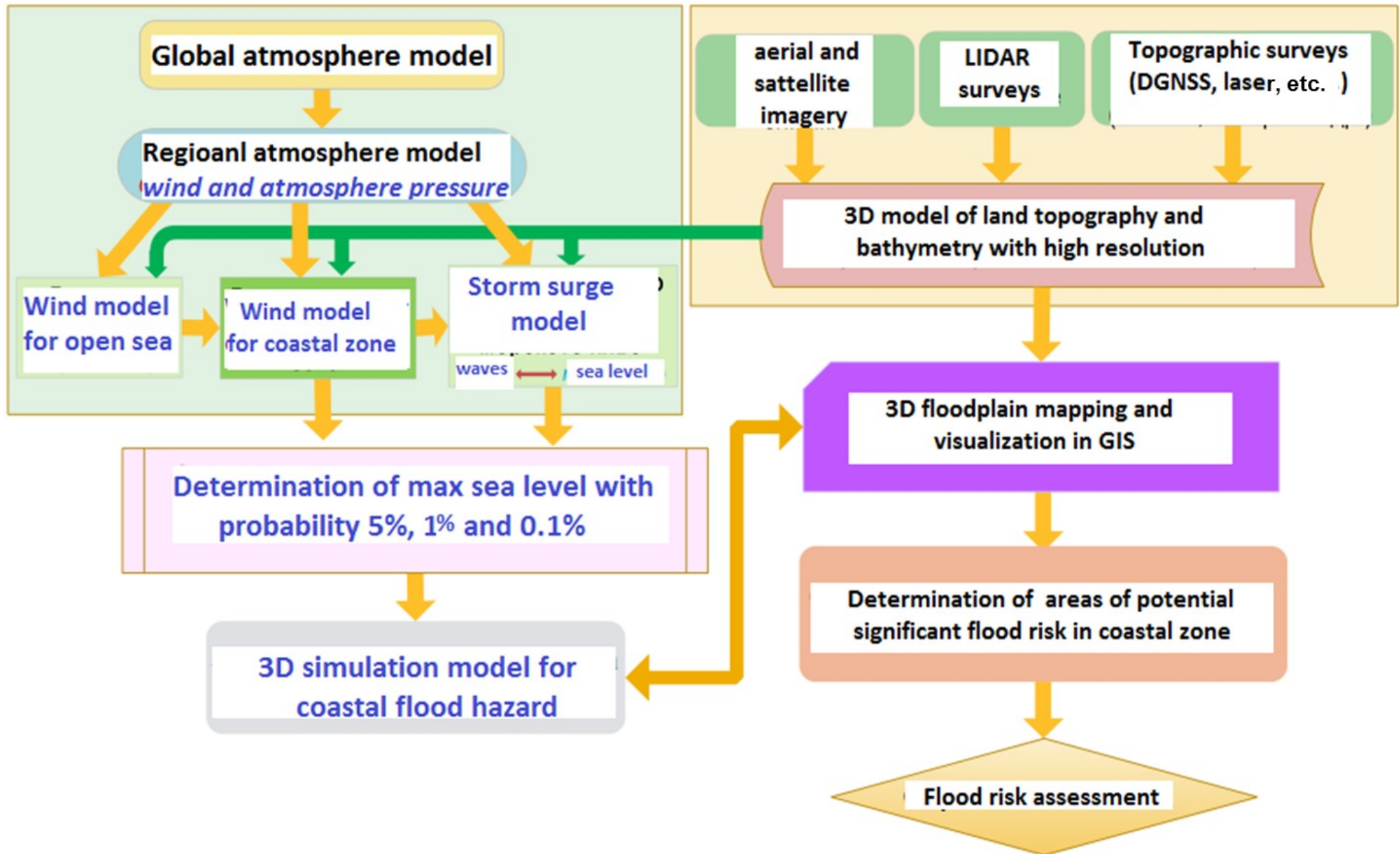
Major factors that influence future coastal flood risk



Varying risks posed by relative sea level and climate change

- Frequency of extreme weather events (torrential rain, storm surge, droughts)
- Coastal erosion and abrasion
- Navigation hazards
- Impacts on coastal infrastructure
- LC/LUC
- Habitat change, etc.

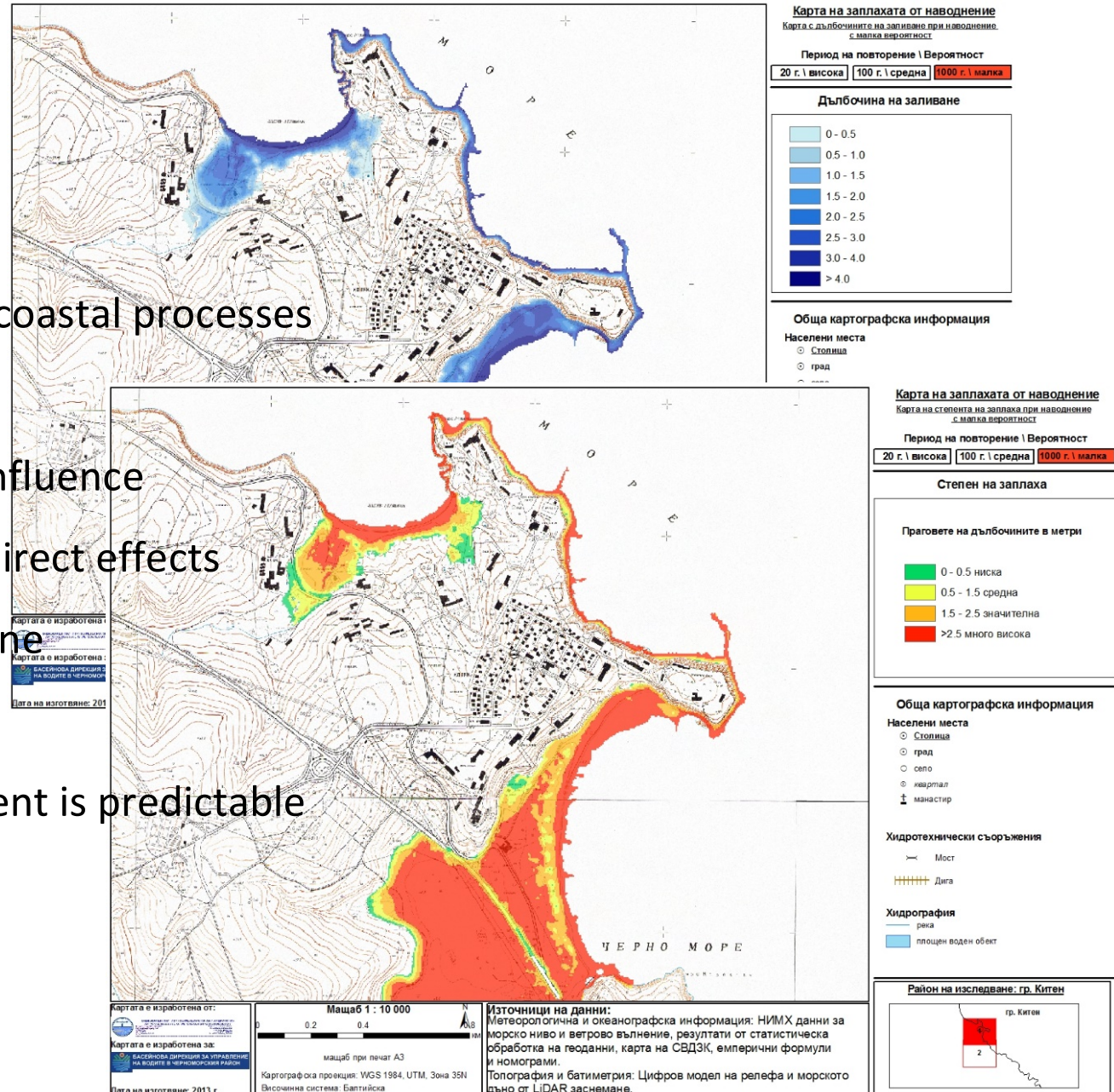
General scheme for assessing the coastal flood risk in /Methodological guidance, 2013/



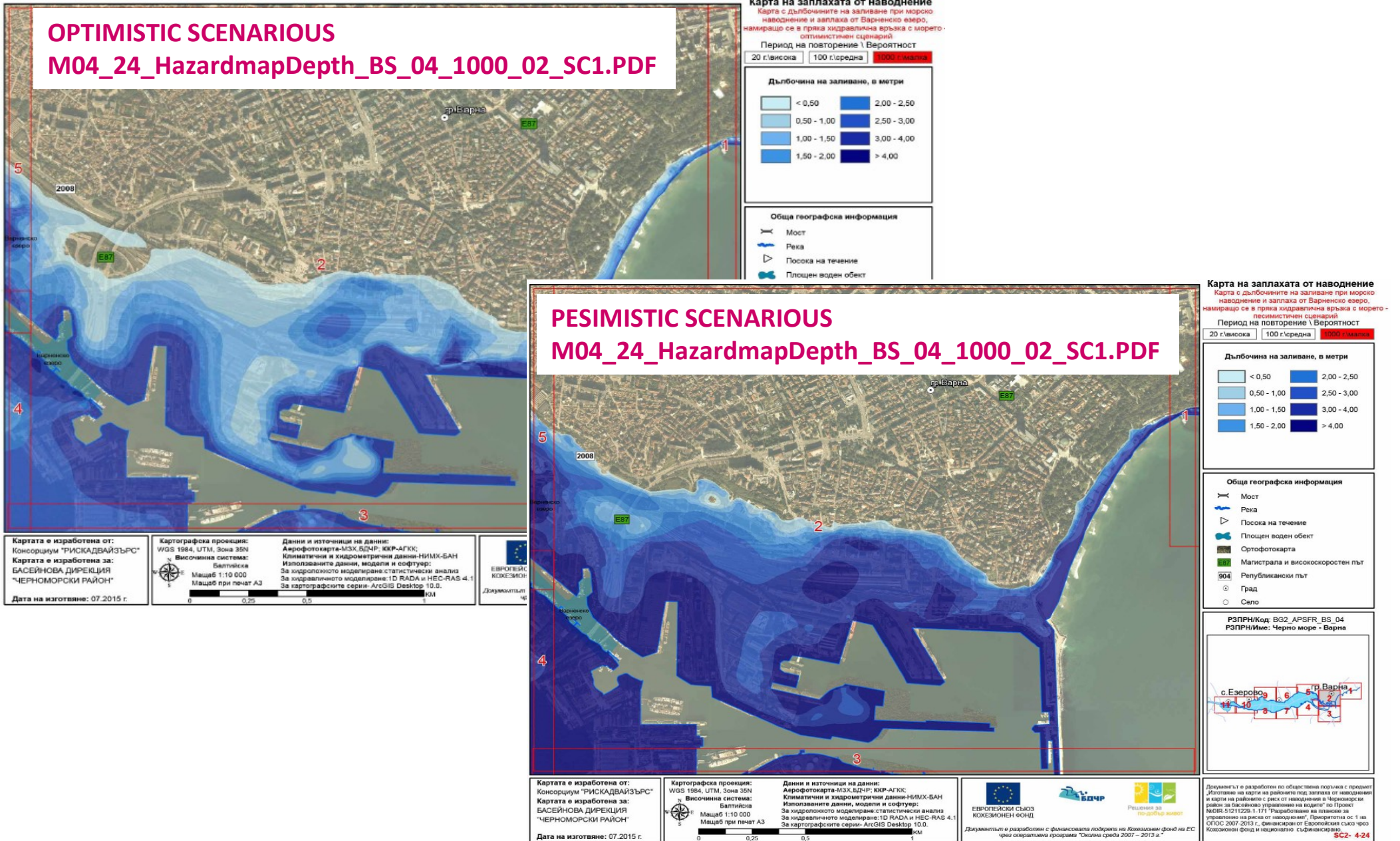
Coastal hazard flood map (Methodology, NIMH, 2013)

KEY FACTORS INTO ACCOUNT:

- Trend of SLR
- Spatial & temporal dynamics of coastal processes
- **Anthropogenic impact**
- Space in which the threat may influence
- Extreme phenomenon cause indirect effects
- Intensity of impact in coastal zone
- Duration of the process/event
- Extent to which the process/event is predictable
- Many others...



Some examples of flood hazard maps – Varna region



Improvement of coastal hazard and flood risk maps

- **Scientific and technological issues**

- Improvement of research infrastructure
- Hydrodynamic and wave modeling
- National Spatial Data Infrastructures
- Developing emergency management system
- Applying novel methods & IT technologies

- **Social-economical issues**

- User-oriented map products
- Efficiently spreading of flood hazard and flood risk information
- Improve greatly awareness of flood risks
- Consultation and collaboration with all “Interested party”



Anthropogenic impacts - LU/LCC

- Environmental issues related to global environmental changes
- Urbanization of coastal zones
- Problems with protection and preservation of coastal landscapes
- Remote sensing and GIS for environmental monitoring

Anthropogenic impacts in the coastal zone

Urban expansion

Land use/Land cover changes – urban expansion

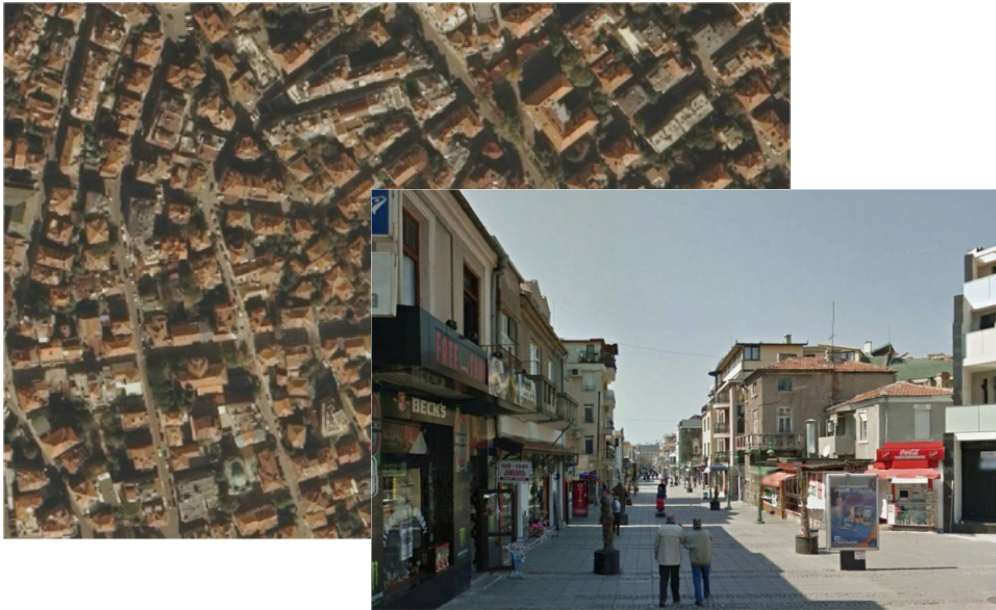
The objective:

- Mapping and analysis of dynamics of urban areas of the Black Sea Coastal Zone in Bulgaria for the period 1977-2016 based on remote sensing data and ecological indicators

Methodology

- Satellite and orthophoto images
- ✓ time series: 1977, 1990, 2000, 2006, 2011, 2016
- Mapping – two levels
 - **Regional** - at scale **1:50 000** (the entire coastal zone)
 - LCLU: min mapping unit **4 ha**, min width **50 m**
 - LCLU change: min mapping unit **1 ha**, min width **50 m**
 - **Local** - at scale 1:10 000 (Burgas town)
 - LCLU: min mapping unit **0.25 ha**, min width **10 m**
 - LCLU change: min mapping unit **0.05 ha**, min width **10 m**
- Developing an enhanced classification of urban territories compatible with CORINE Land Cover – **47 classes** at scale **1:10 000**
- Application of **key ecological indicators** related to LCLU that reveal the dynamics and trends in urban areas development

City Centre (class 11112)



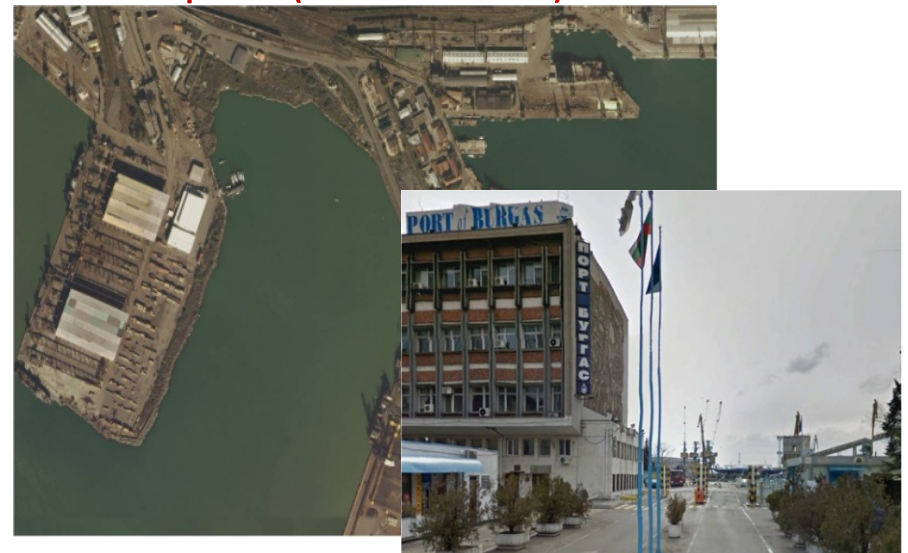
Family houses (class 11221)



Block of flats (class 11212)



Sea port (class 12311)



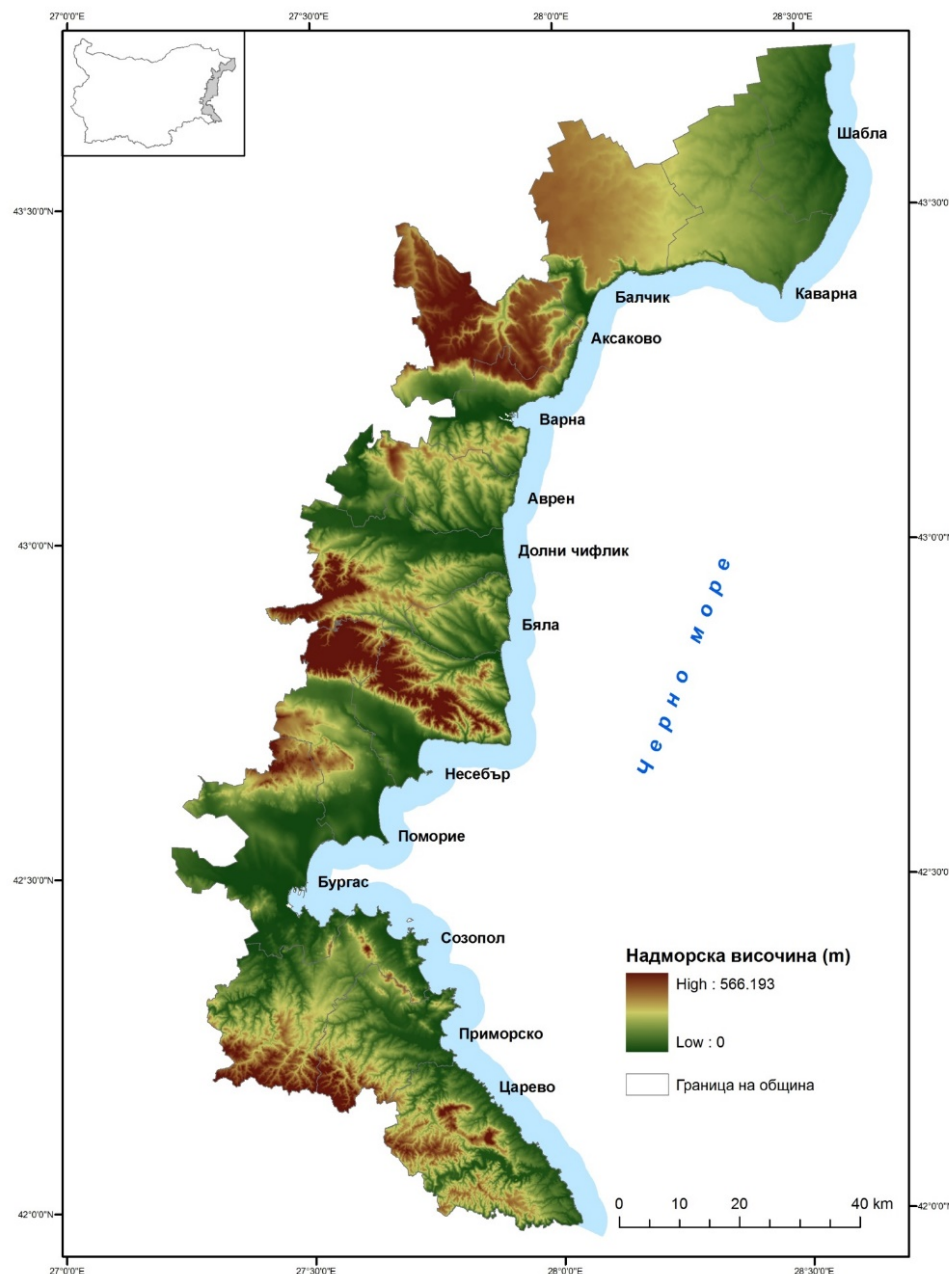
Dynamics of Urban Areas of the Black Sea Coastal Zone

Bulgarian Black Sea Coastal Zone

- (41.56°N - 43.44°N; 27.17°E - 28.36°E),
- Area: **5 767 km²** (576719,53 ha)
- Width: **7 – 40 km**
- Length: **378 km**

The region includes:

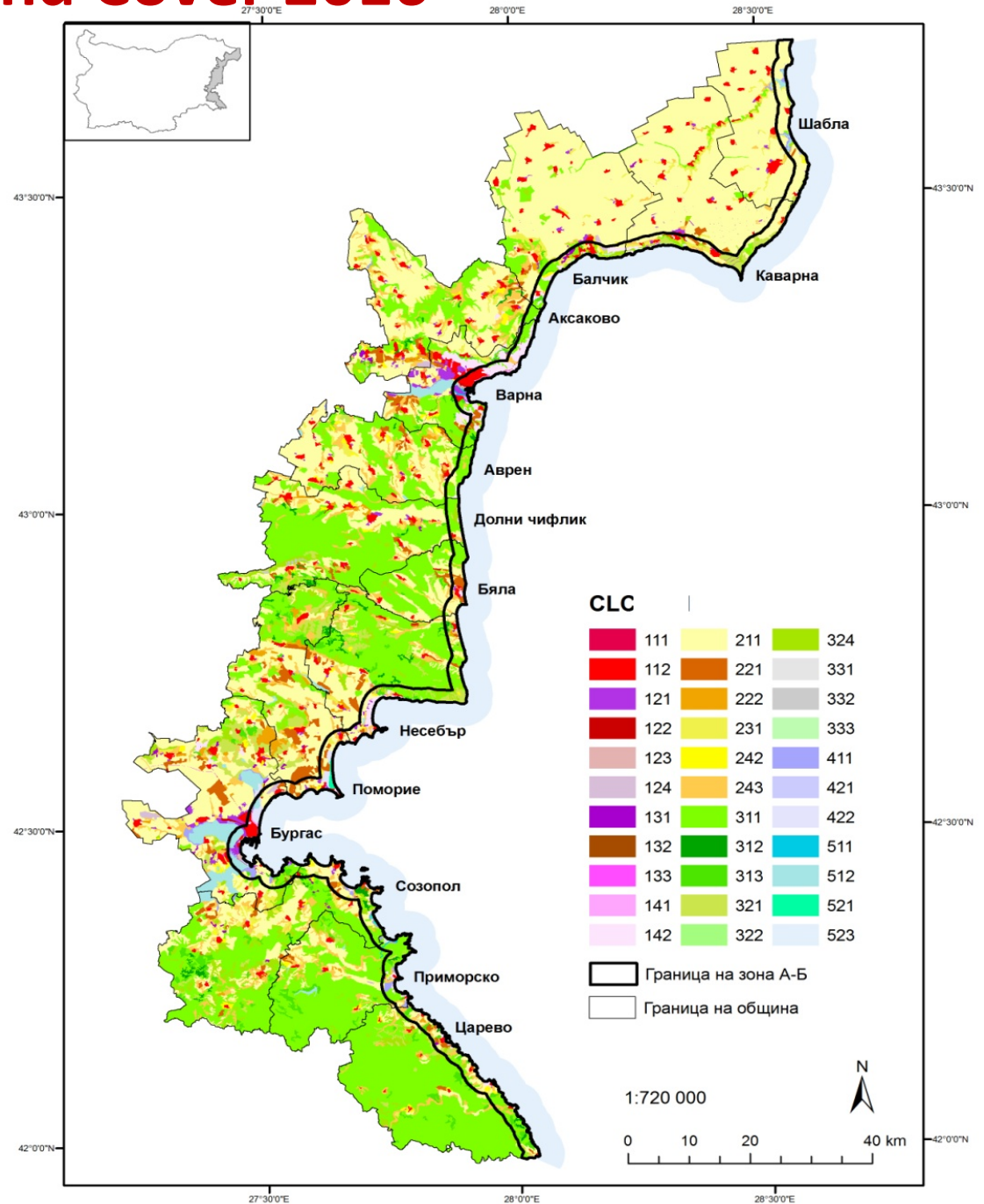
- **14** municipalities
- **204** settlements
- Population **718 089** (2016)



CORINE Land Cover 2016

Zone A – B

- width 100 m
- width 2 км from zon

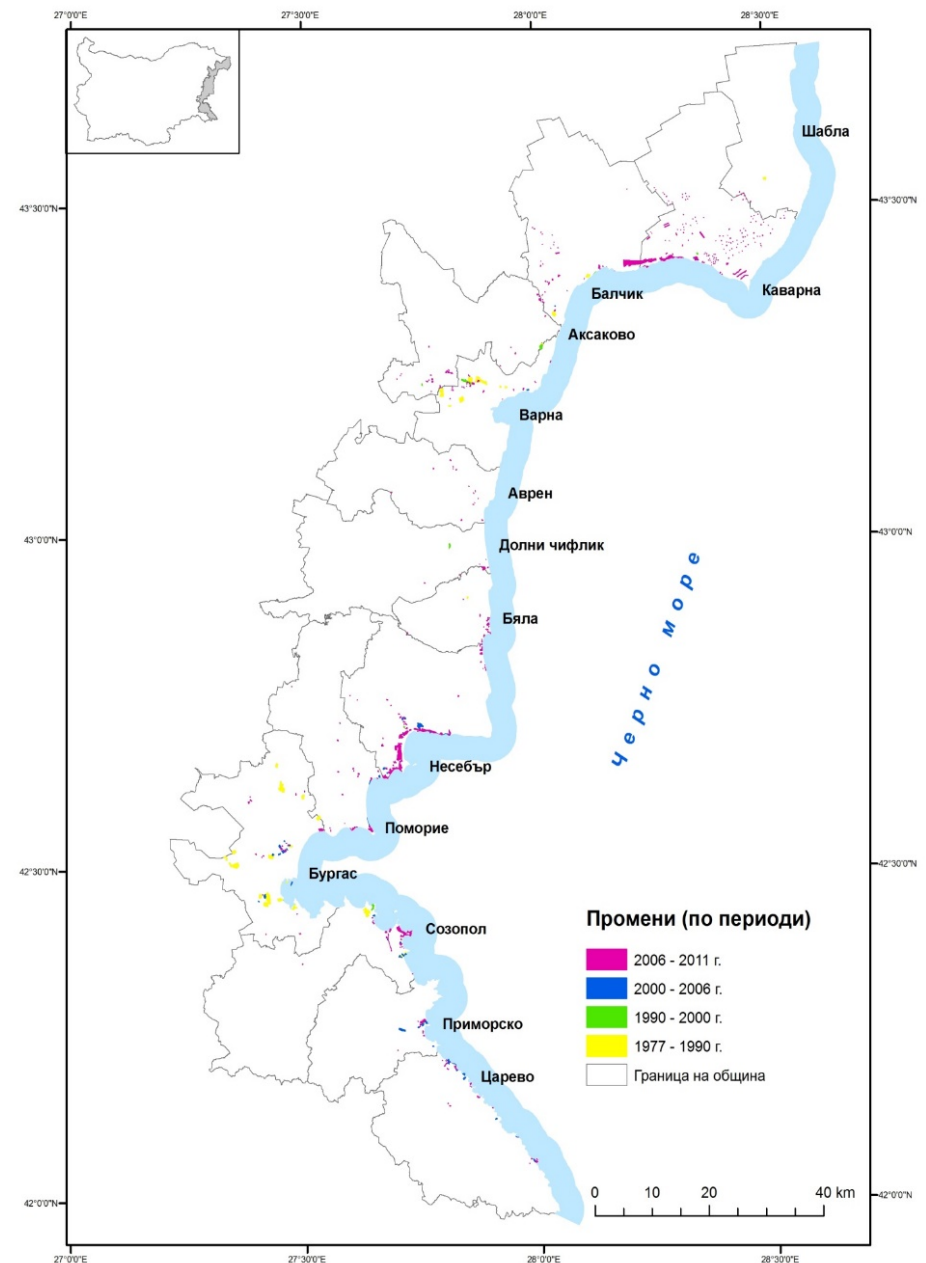


Land Cover and Land Use Change /1977-2016/

1977 – 1990 within internal part of the coastal zone and around the larger towns Varna and Burgas

2000-2016 in 4 municipalities: Nesebar, Kavarna-Balchik and Sozopol

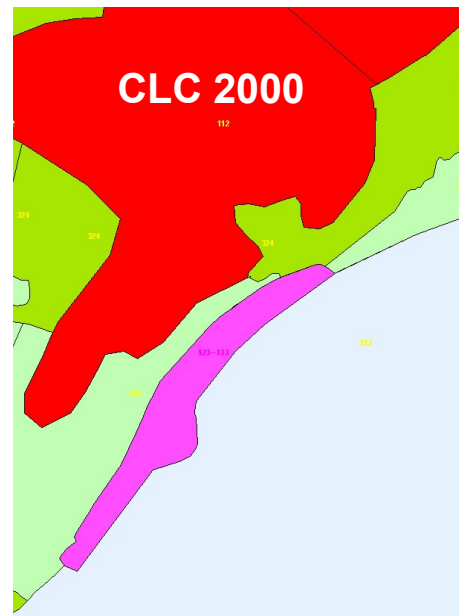
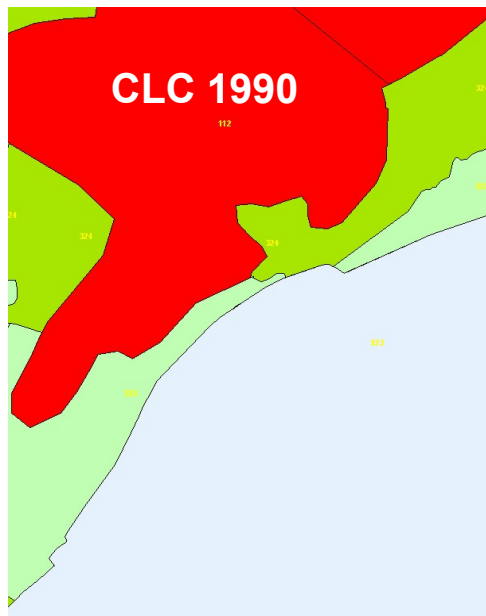
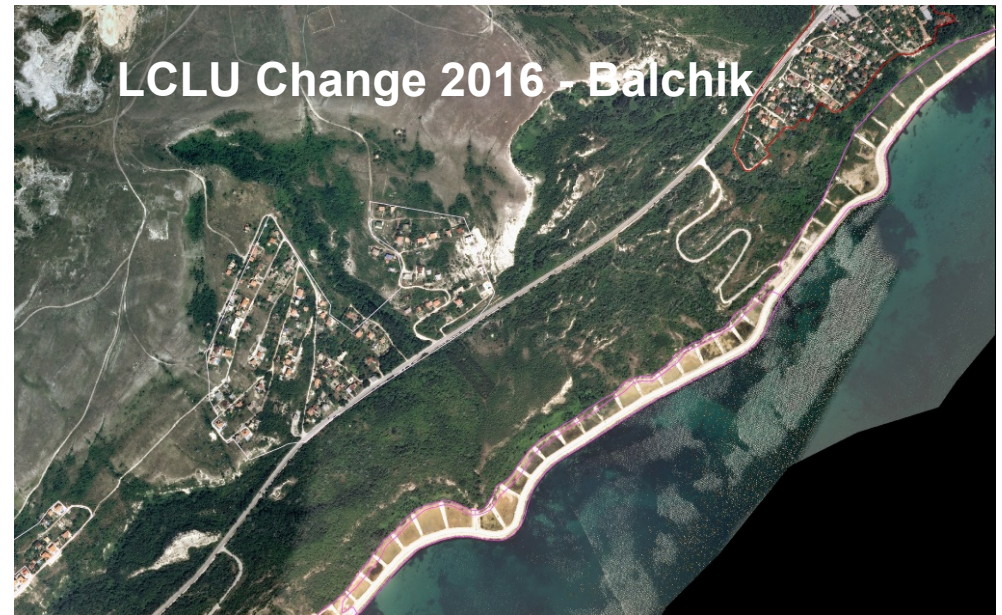
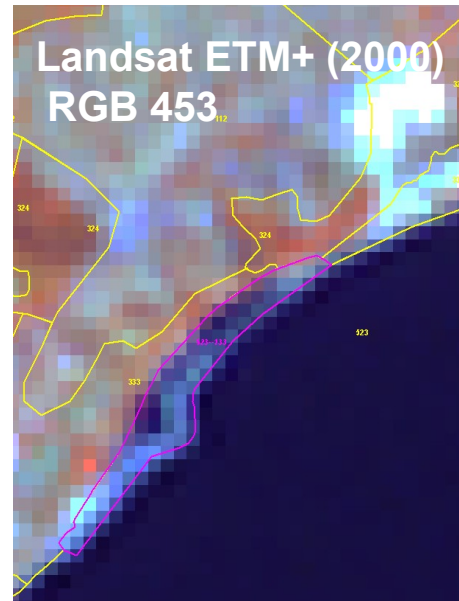
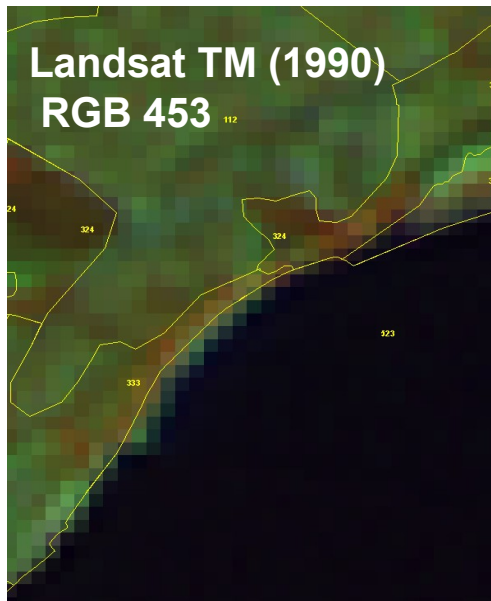
2006-2016 in zone A-B



Land Cover and Land Use Change 1977-2016

Municipality	LCLU changes (ha)			
	1977-1990	1990-2000	2000-2006	2006-2016
Shabla	15,76	0	0	2,22
Kavarna	0	11,87	157,92	380,76
Balchik	51,91	4,95	231,20	262,45
Aksakovo	0,61	8,79	0	38,15
Varna	265,41	59,32	12,98	37,54
Avren	0	0	0	8,20
Dolni Chiflik	0	11,31	17,96	24,42
Byala	4,51	0	7,08	24,90
Nesebar	0	9,21	614,25	623,13
Pomorie	7,83	0	85,72	89,52
Burgas	558,00	0	102,13	41,38
Sozopol	95,65	23,95	204,73	203,12
Primorsko	0	8,88	92,57	35,36
Tsarevo	0	0	126,05	47,98
Total	999,68	138,28	1 652,58	1 819,13

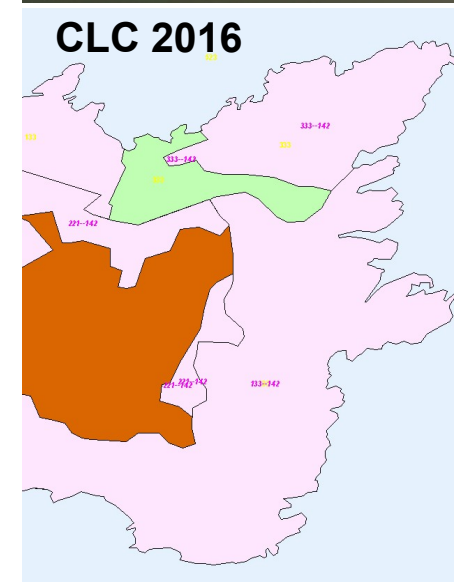
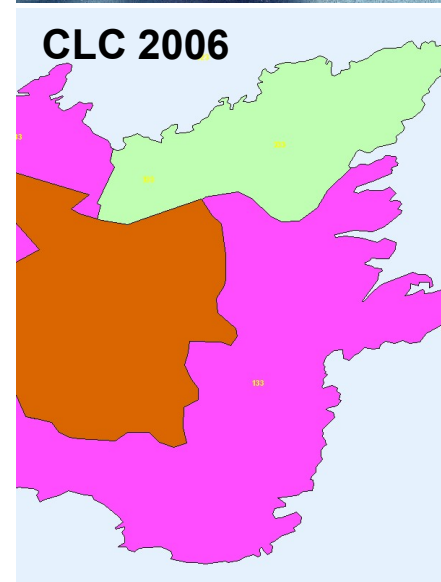
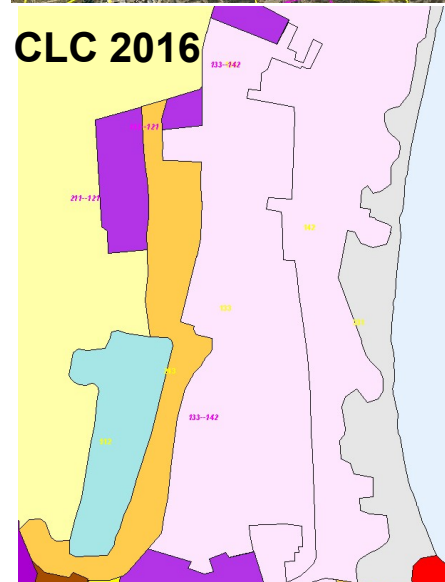
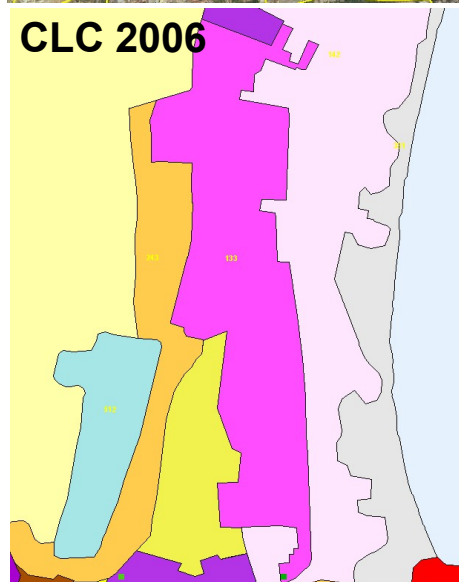
LCLU Change 1990-2000 (Balchik&Kavarna)



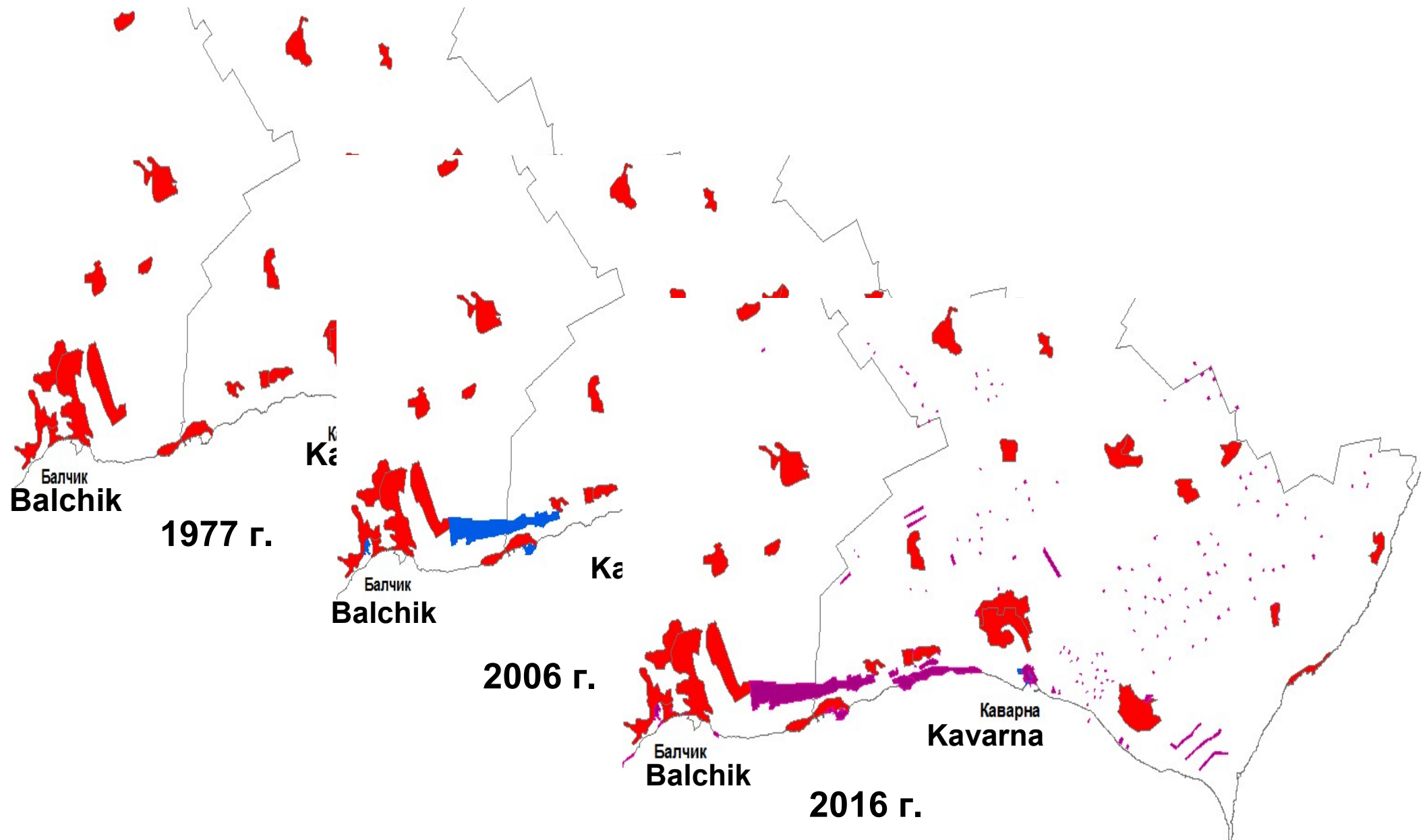
LCLU Change 2006-2016

Sunny Beach

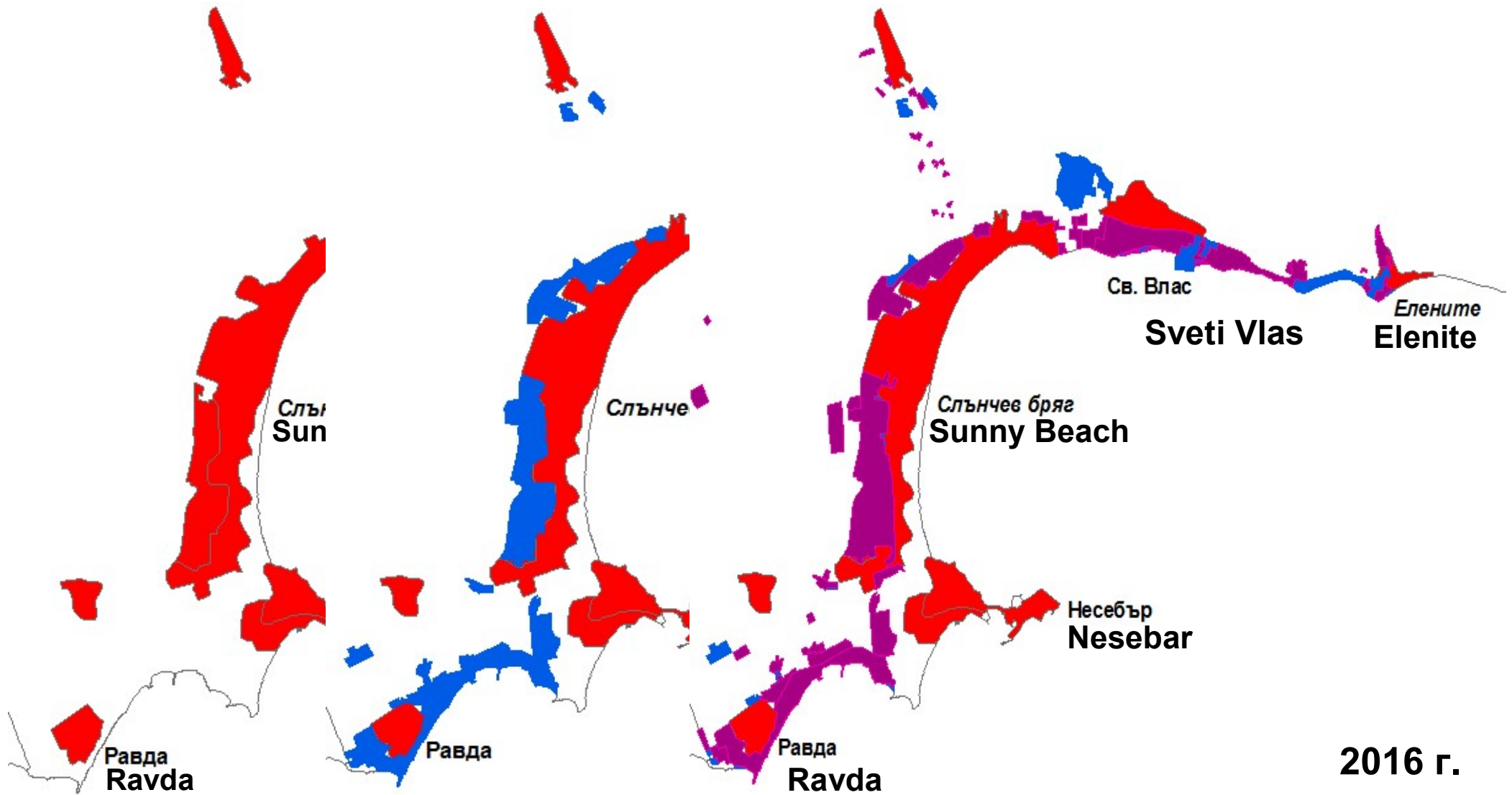
Sozopol



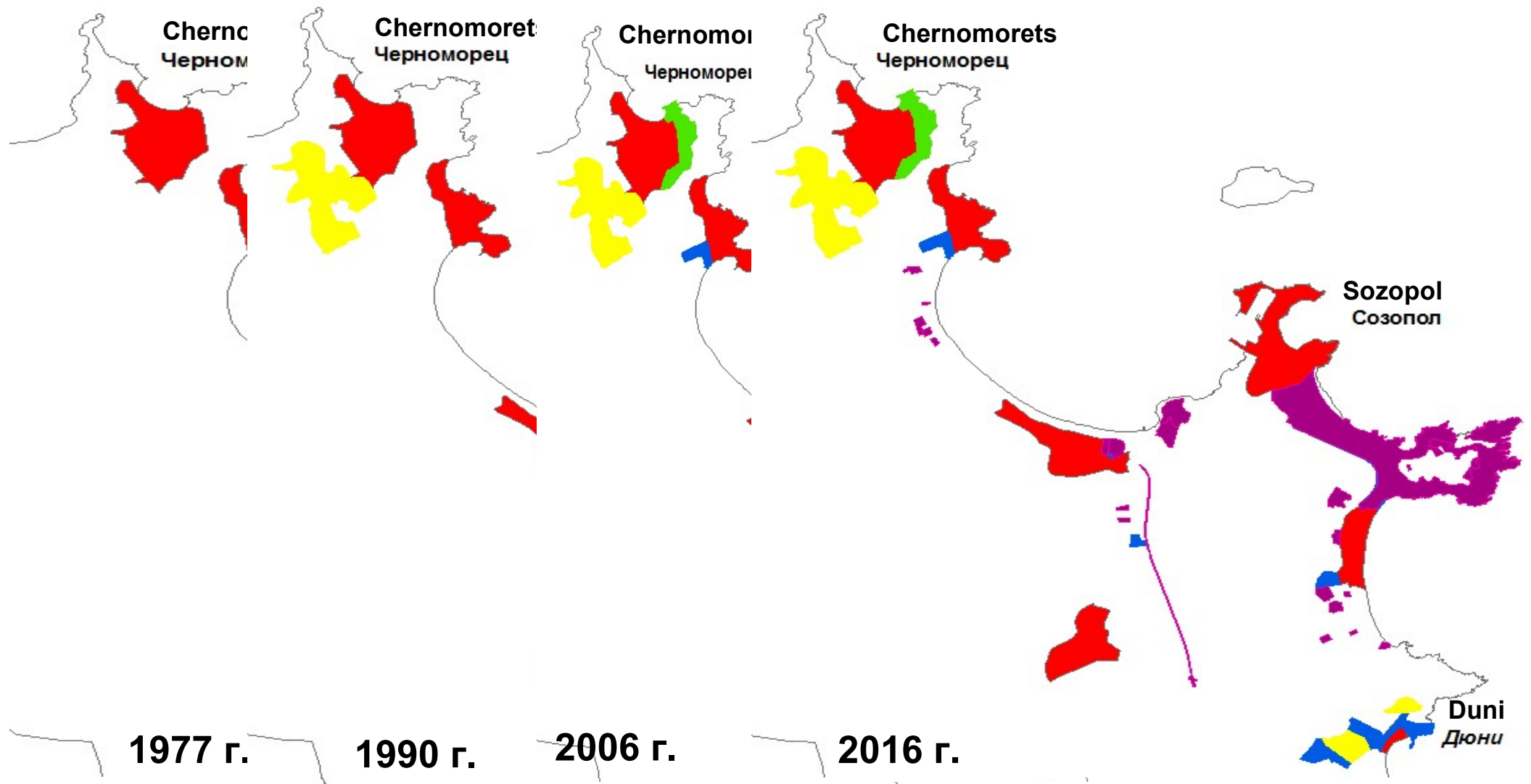
LCC (1977, 2006, 2016)



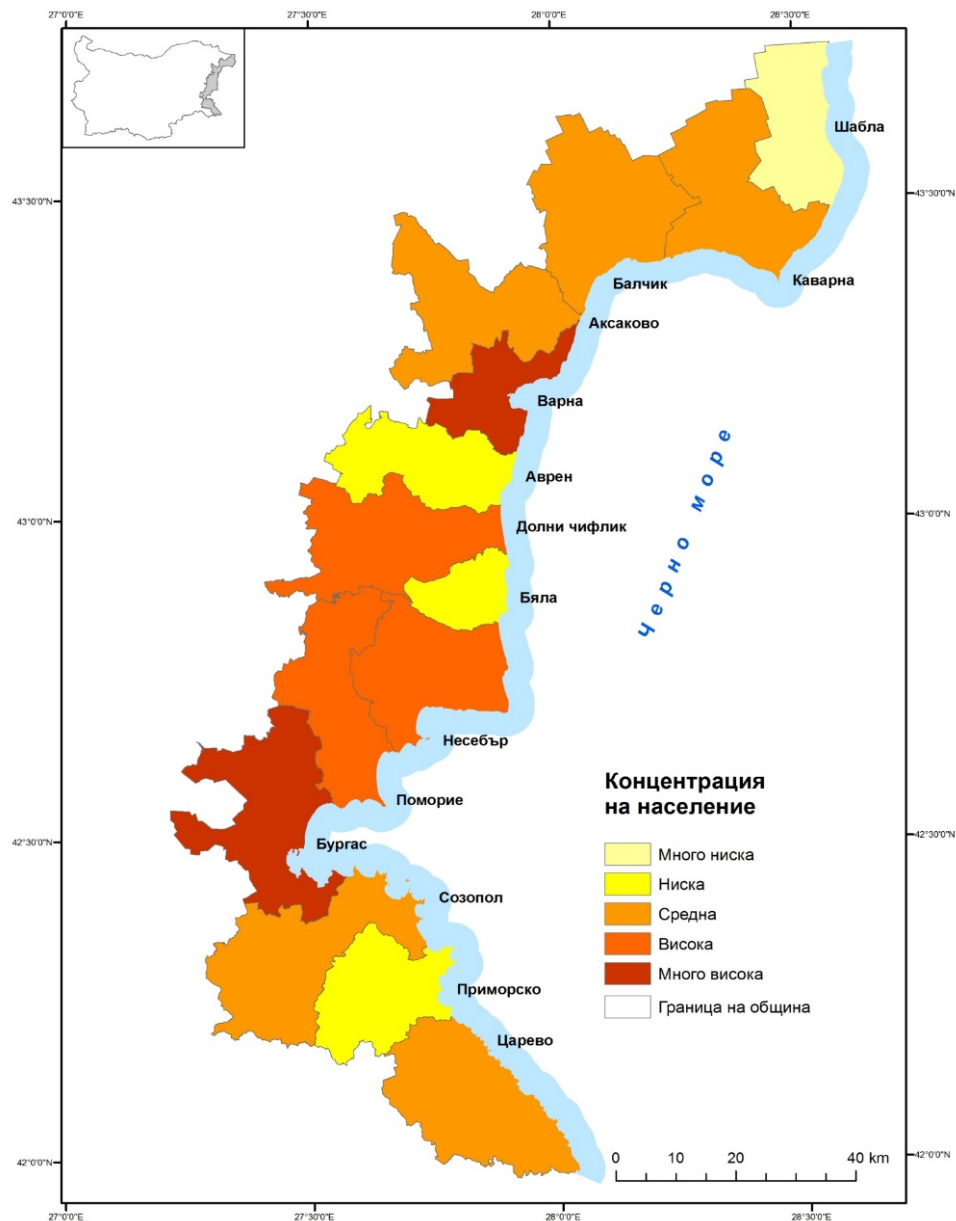
LCC (1977, 2006, 2016)



LCC (1977, 1990, 2006, 2016)



Ecological Indicator- Concentration of population



2016:

Very high: Varna, Burgas

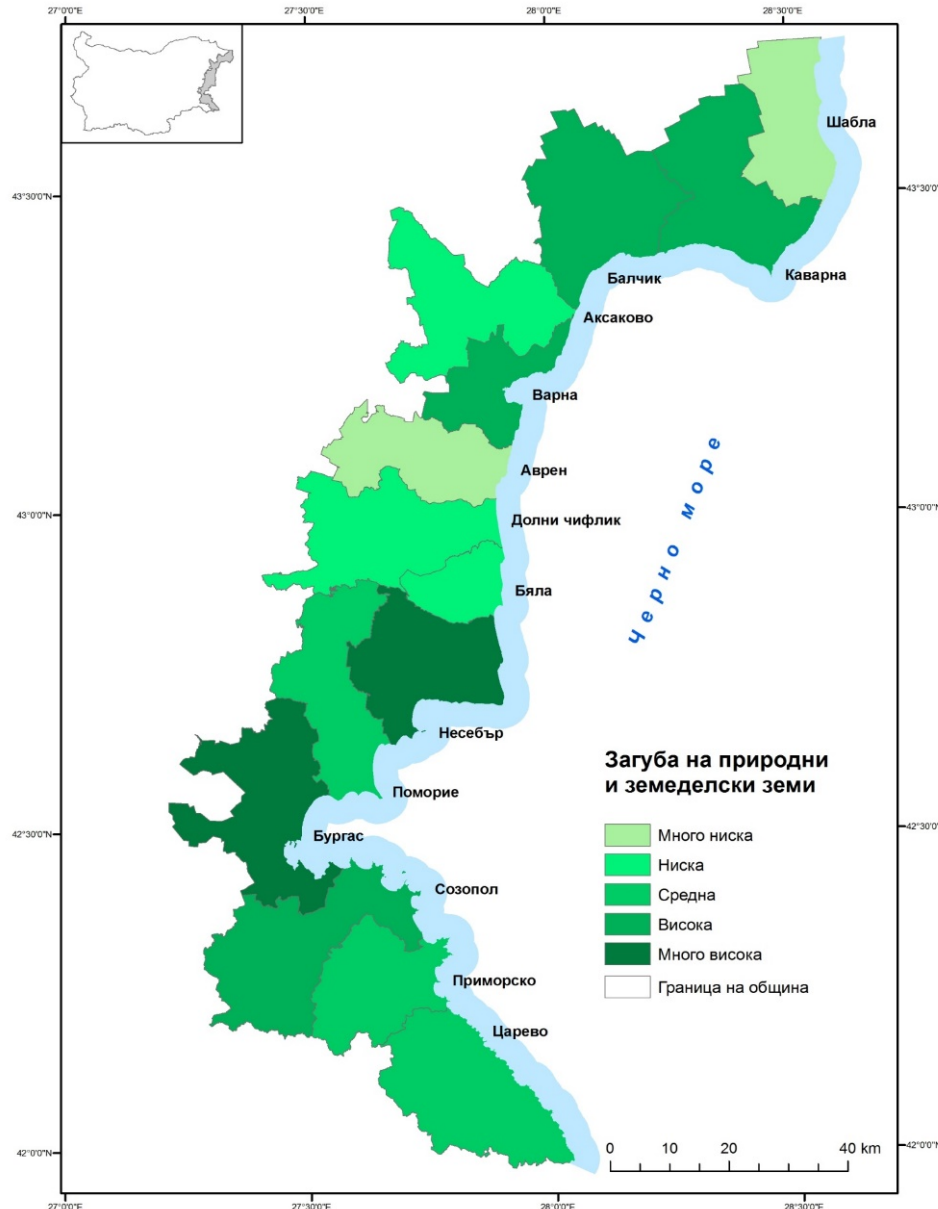
High: Pomorie, Dolni Chiflik, Nesebar

Medium: Sozopol, Kavarna, Balchik, Tsarevo, Aksakovo

Low: Primorsko, Byala, Avren

Very low: Shabla

Ecological Indicator - Loss of natural and agricultural land



2016 г.:

Very high: Burgas, Nesebar

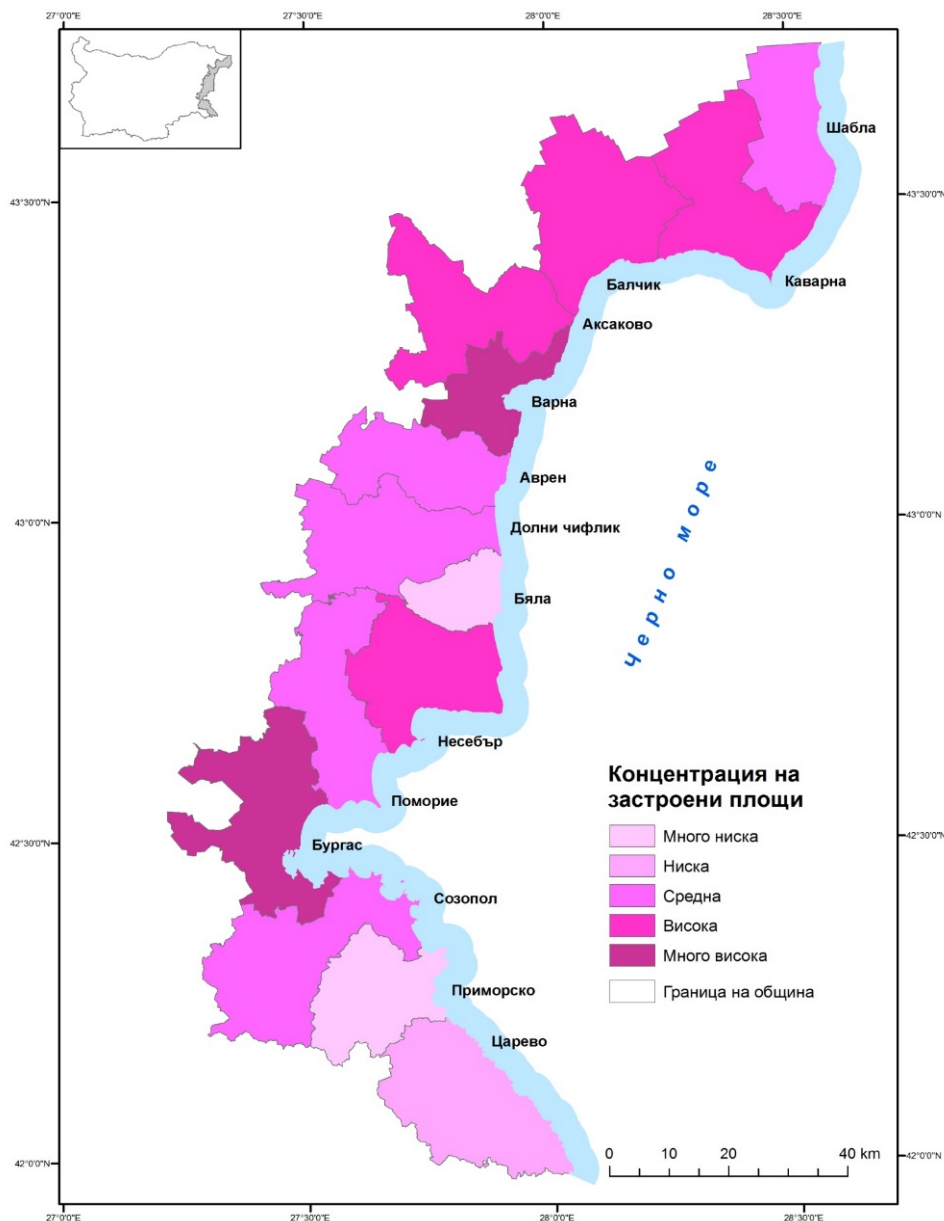
High: Kavarna, Sozopol, Varna, Balchik

Medium: Tsarevo, Pomorie, Primorsko

Low: Aksakovo, Dolni Chiflik, Byala

Very low: Shabla, Avren

Ecological Indicator - Built-up areas



2016:

Very high: Varna, Burgas

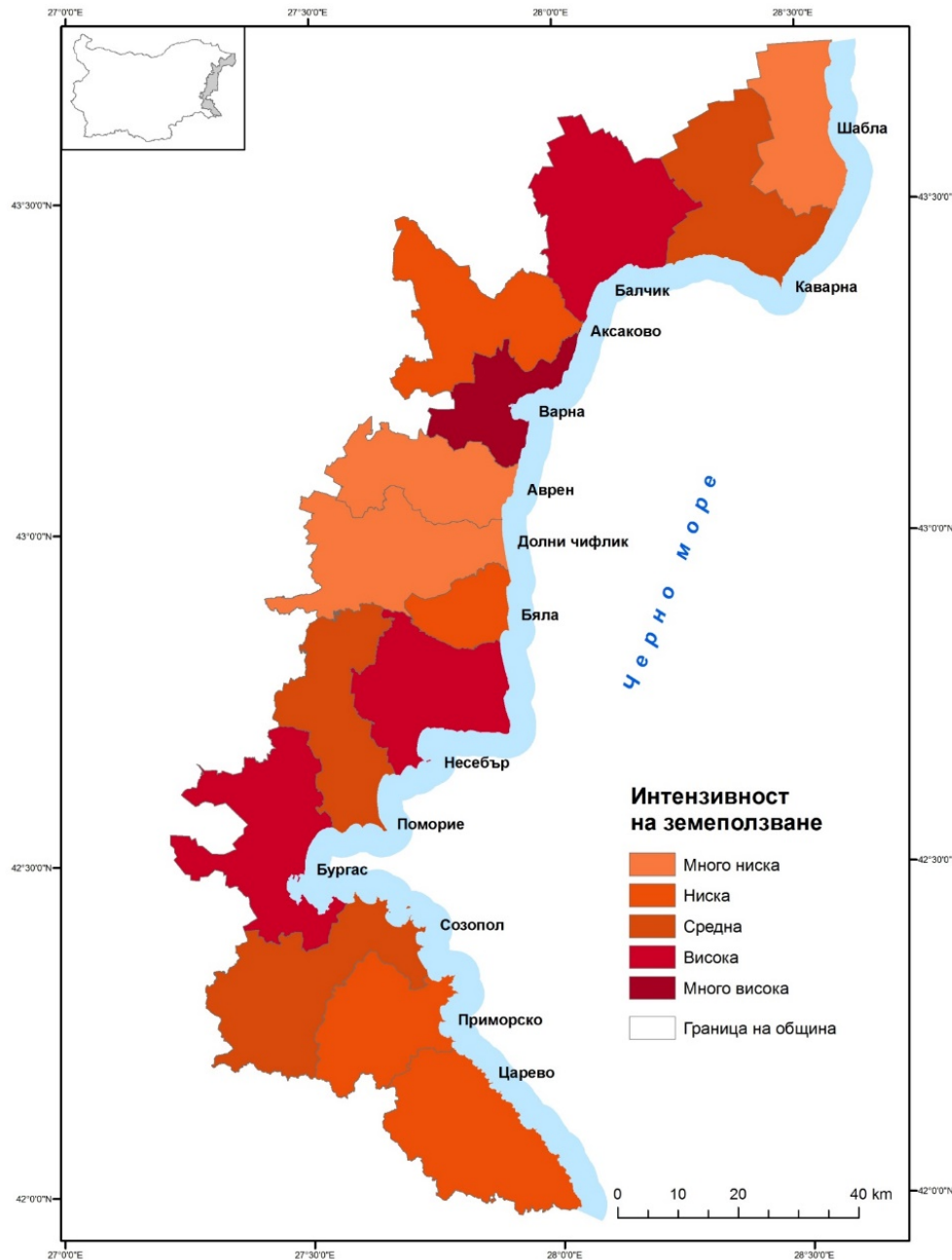
High: Balchik, Aksakovo, Kavarna, Nesebar

Medium: Pomorie, Shabla, Dolni Chiflik, Avren, Sozopol

Low: Tsarevo

Very low: Primorsko, Byala

Ecological Indicator - Land Use Intensity



Zone A-B in 2016:

Very high: Varna

High: Balchik, Burgas, Nesebar

Medium: Sozopol, Pomorie, Kavarna

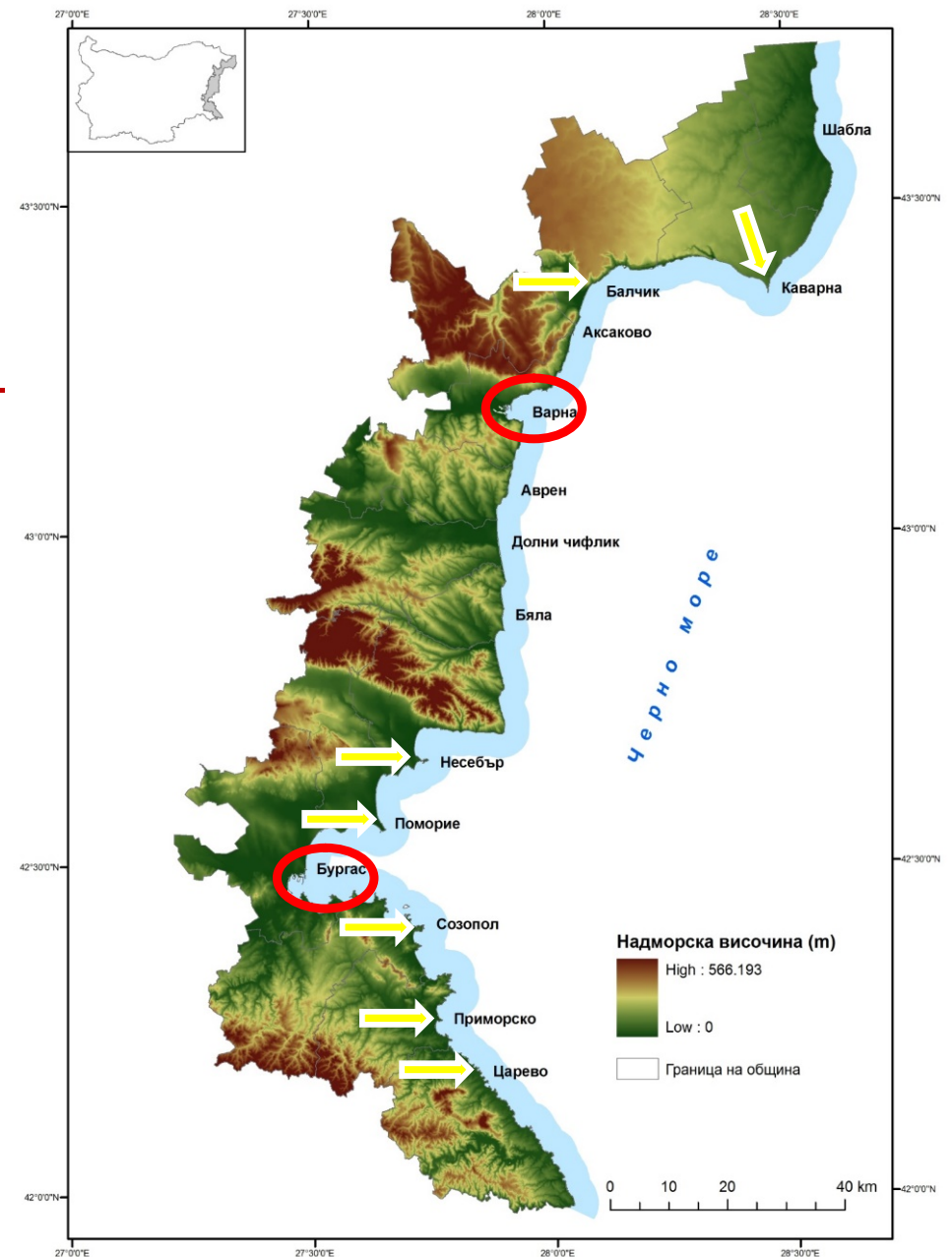
Low: Aksakovo, Byala, Primorsko, Tsarevo

Very low: Dolni Chiflik, Avren, Shabla

Mid-term trends of urbanized areas' development

2010 – 2020

1. **Growth Centers** - Varna and Burgas
2. **Agglomeration formations of tourist type** - Balchik, Kavarna, Nessebar, Pomorie, Sozopol, Primorsko and Tsarevo
3. **Development axes** - major national and international transport corridors, green (Via Pontica) and cultural corridors
4. **Hot spots:**
 - Nessebar - Sunny Beach - Sveti Vlas
 - Sozopol
 - Kavarna - Balchik



Problems to be resolved

- Updating and standardization of all heterogeneous data bases
- Estimates of parameters depend on weather patterns, recent geodynamic and climate processes, and anthropogenic influence
- Development of new methods and technologies to improve management of the natural and human-induced hazards in coastal zones
- Effective communication and cooperation between all stakeholders at local, national and international level
- Climate change to be considered when developing national strategies, programs, plans and other documents for the sustainable development of coastal areas
- Implementation of EU and national regulations and agreement with the active participation of the public



Thank you for your attention!

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