

CLIMADAM

Development of a
Strategy for adaptation to climate change and
measures to mitigate its negative
consequences for Zakarpatska Oblast

The main purpose

ensuring effective adaptation
of the territory of Zakarpatska Oblast to climate change,
reducing its negative impact on the population,
infrastructure, economy and environment of the region

Key prerequisites

International:

- ▶ United Nations Framework Convention on Climate Change (the year 1992)
- ▶ Paris Agreement (the year 2015)

European:

- ▶ EU Strategy for Adaptation to Climate Change (the year 2021)
- ▶ Adaptation strategy to the consequences of climate change in the Košice region (the year 2020)

National:

- ▶ Strategy of the State Environmental Policy of Ukraine for the period until 2030 (the year 2019)
- ▶ The Concept of Implementation of State Policy in the Field of Climate Change for the period until 2030 (the year 2016)
- ▶ Strategy for Environmental Security and Adaptation to Climate Change for the period until 2030 (the year 2021)
- ▶ Regional Strategy of Development of Zakarpatska Oblast for the period 2021 – 2027

Authors team

- ✓ Agency of geospatial solutions “AGEORA”, including experts on:

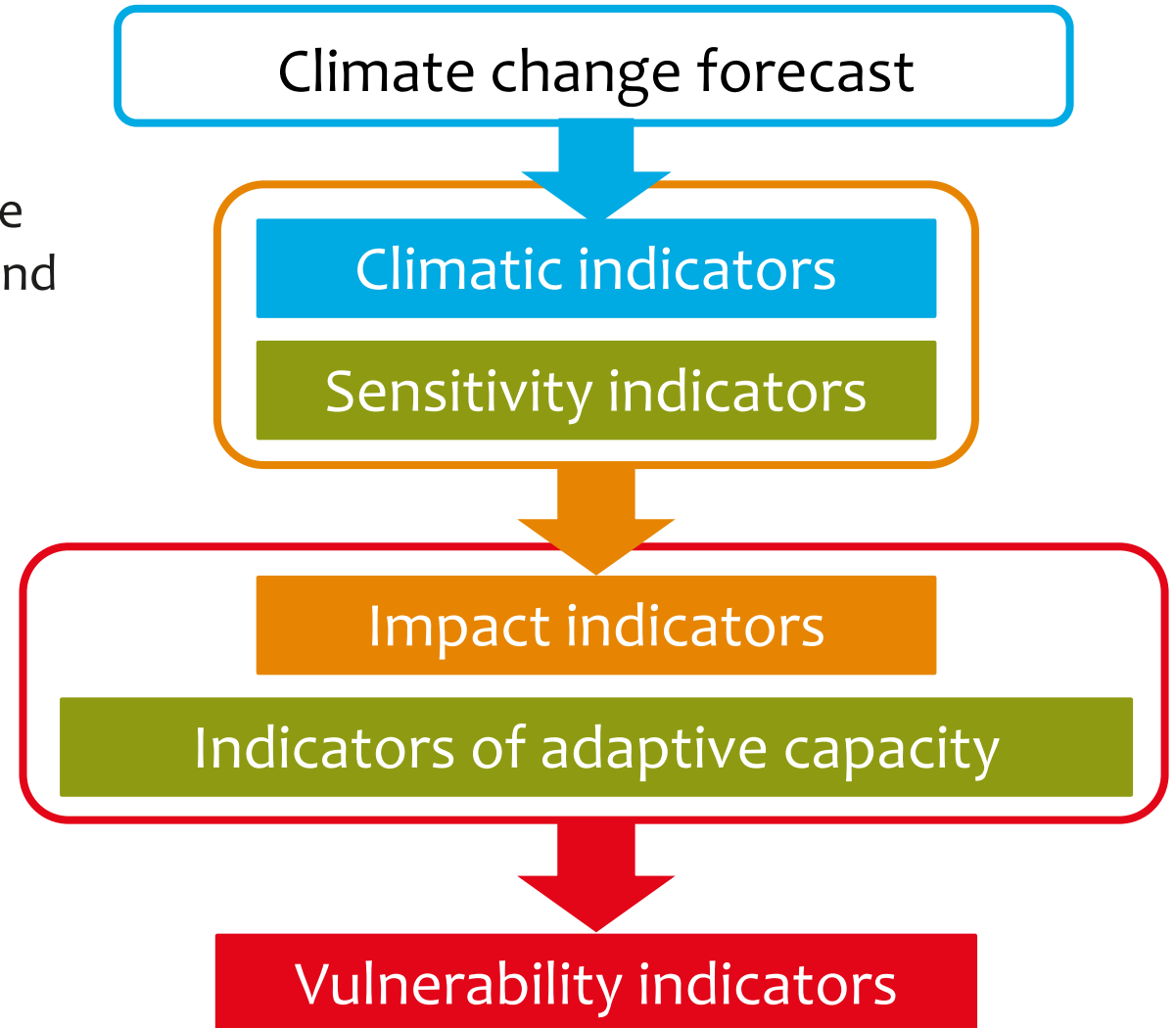
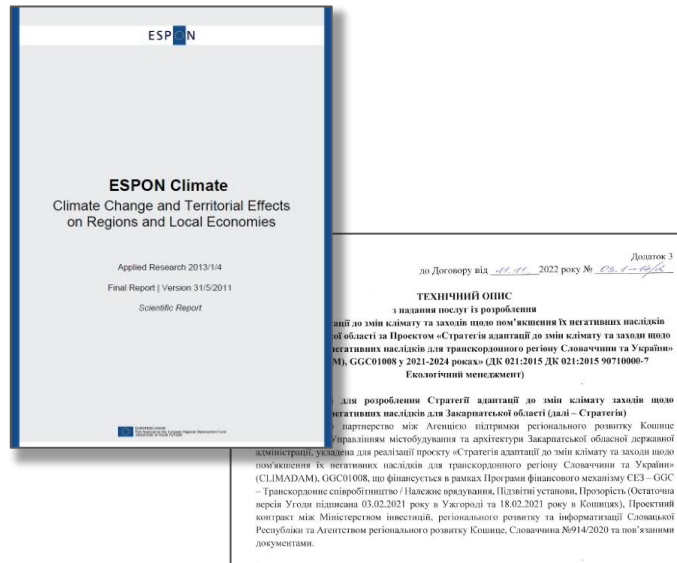
- ✓ climate change
- ✓ geomorphology
- ✓ environment assessment
- ✓ social geography
- ✓ spatial development
- ✓ land resources management
- ✓ GIS technologies

- ✓ Zakarpatska Oblast Center for Hydrometeorology
- ✓ Ukrainian Hydrometeorological Institute



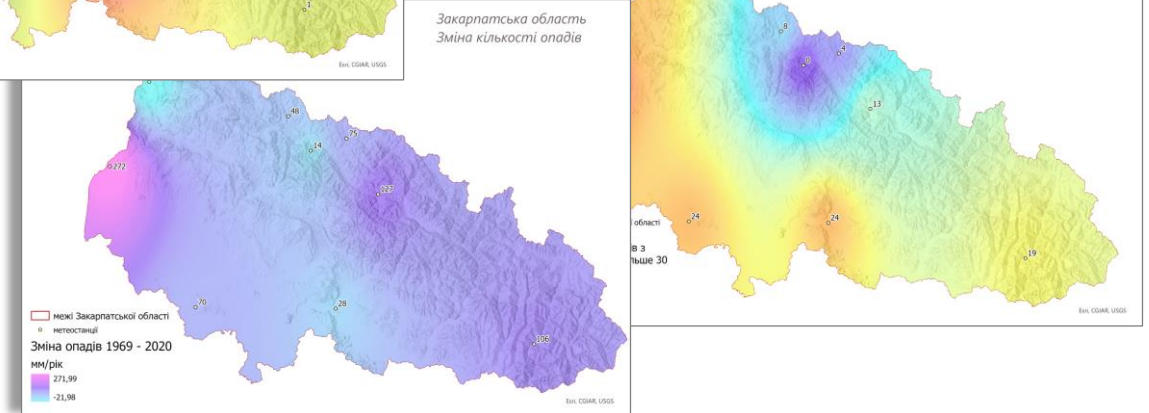
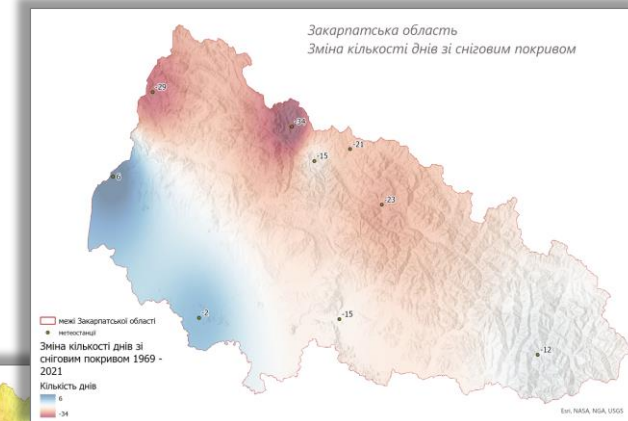
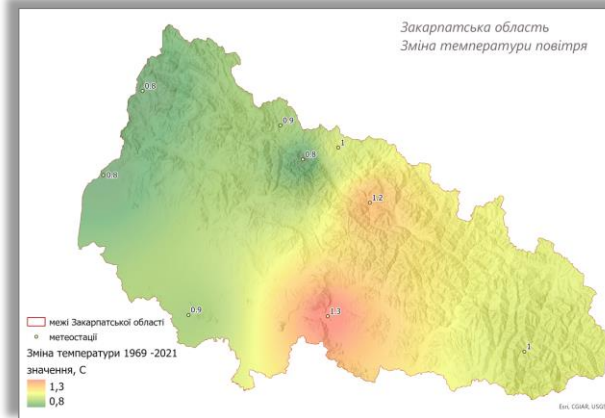
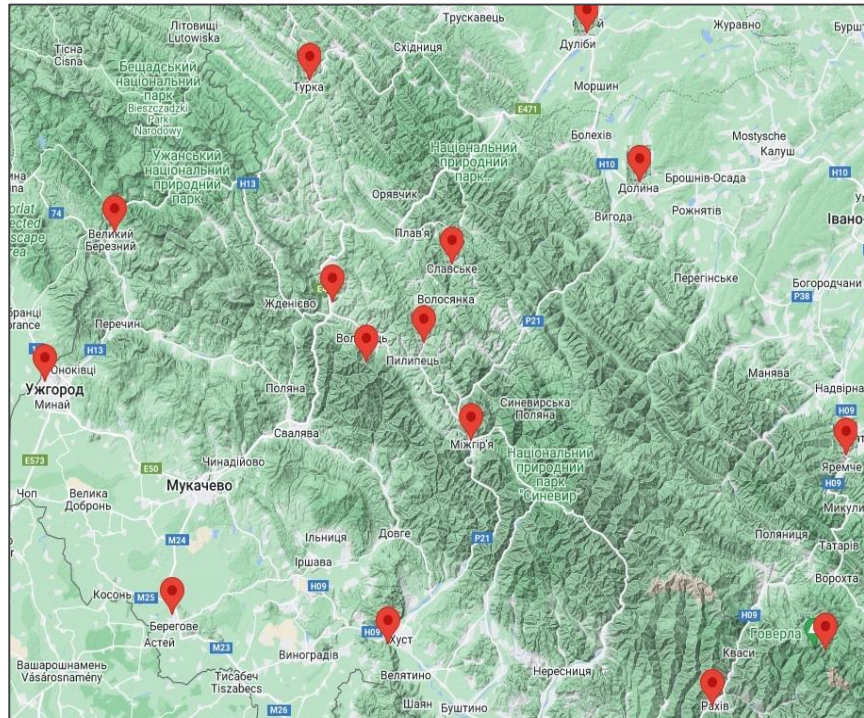
Methodology of the Strategy for **Košický kraj**

specified taking into account the methodology of the ESPON climate project, as well as the conditions and available data for the territory of Zakarpatska Oblast



Climate change forecast

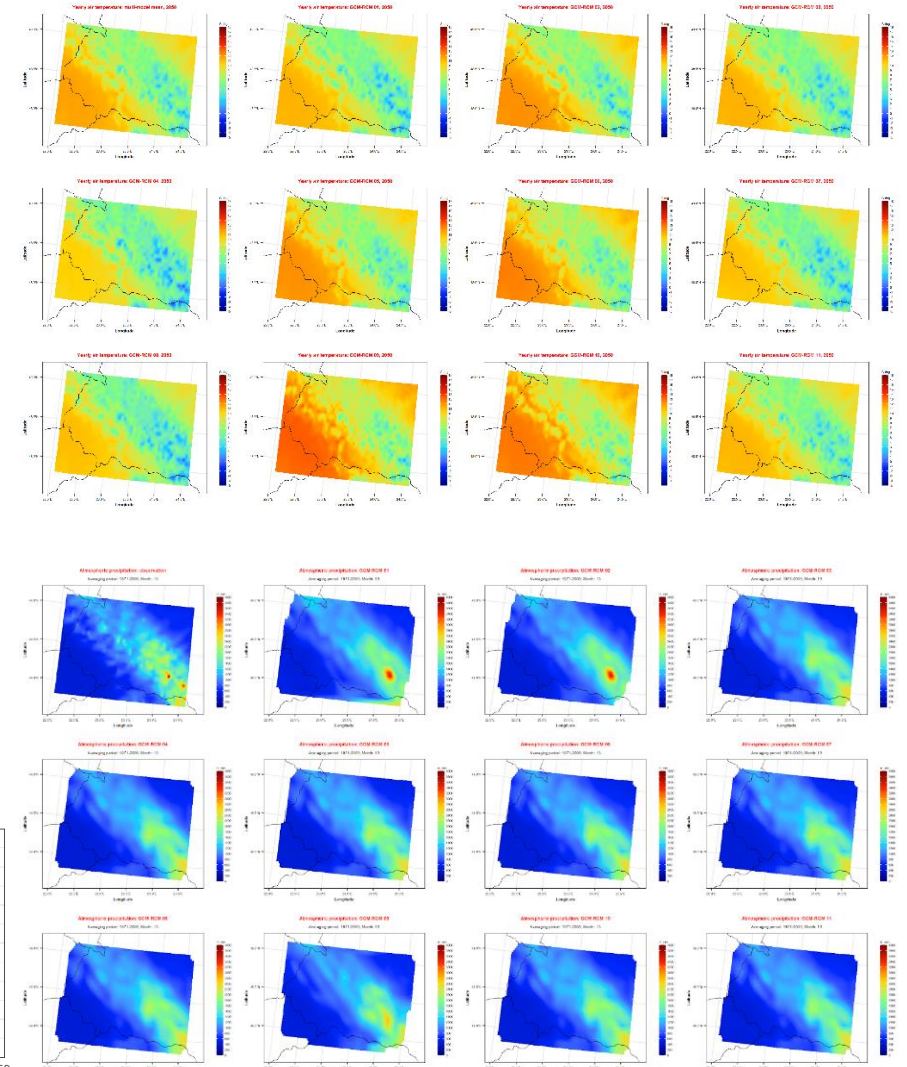
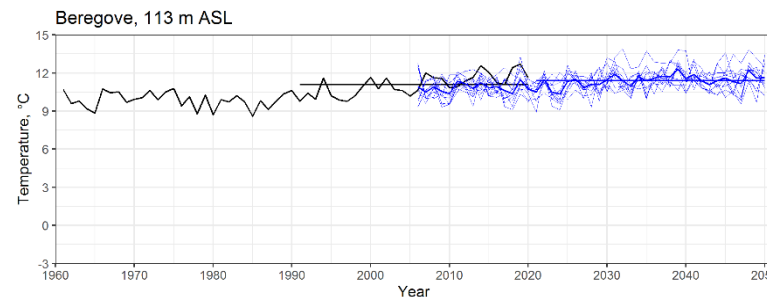
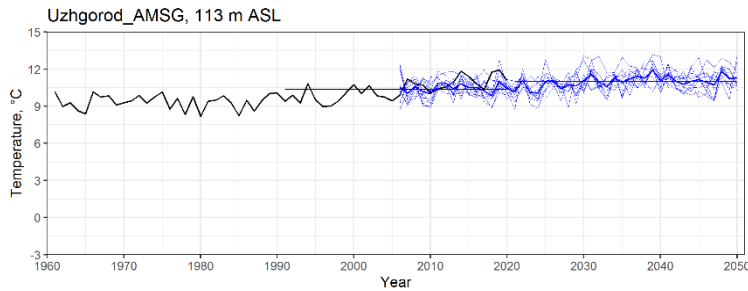
Input data: Data from 9 basic meteorological stations and hydrological posts for the period 1961 – 2022 on the territory of Zakarpatska oblast



The work group on **modeling the forecast** of changes in climatic components in Zakarpatska Oblast **until 2050** on the base **RPC4.5**, **RPC8.5**

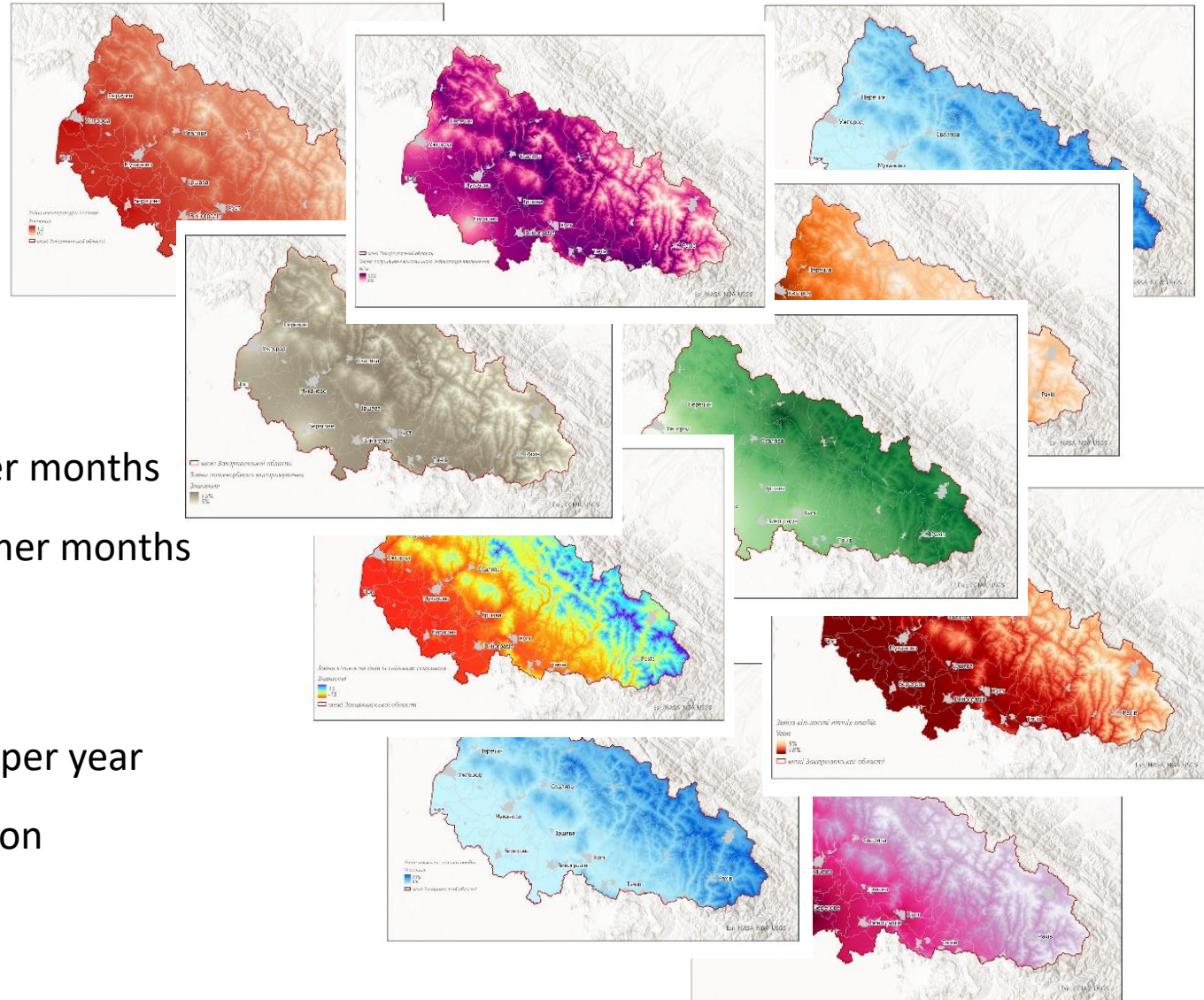
in cooperation with Ukrainian Hydrometeorological

Institute



Climatic indicators:

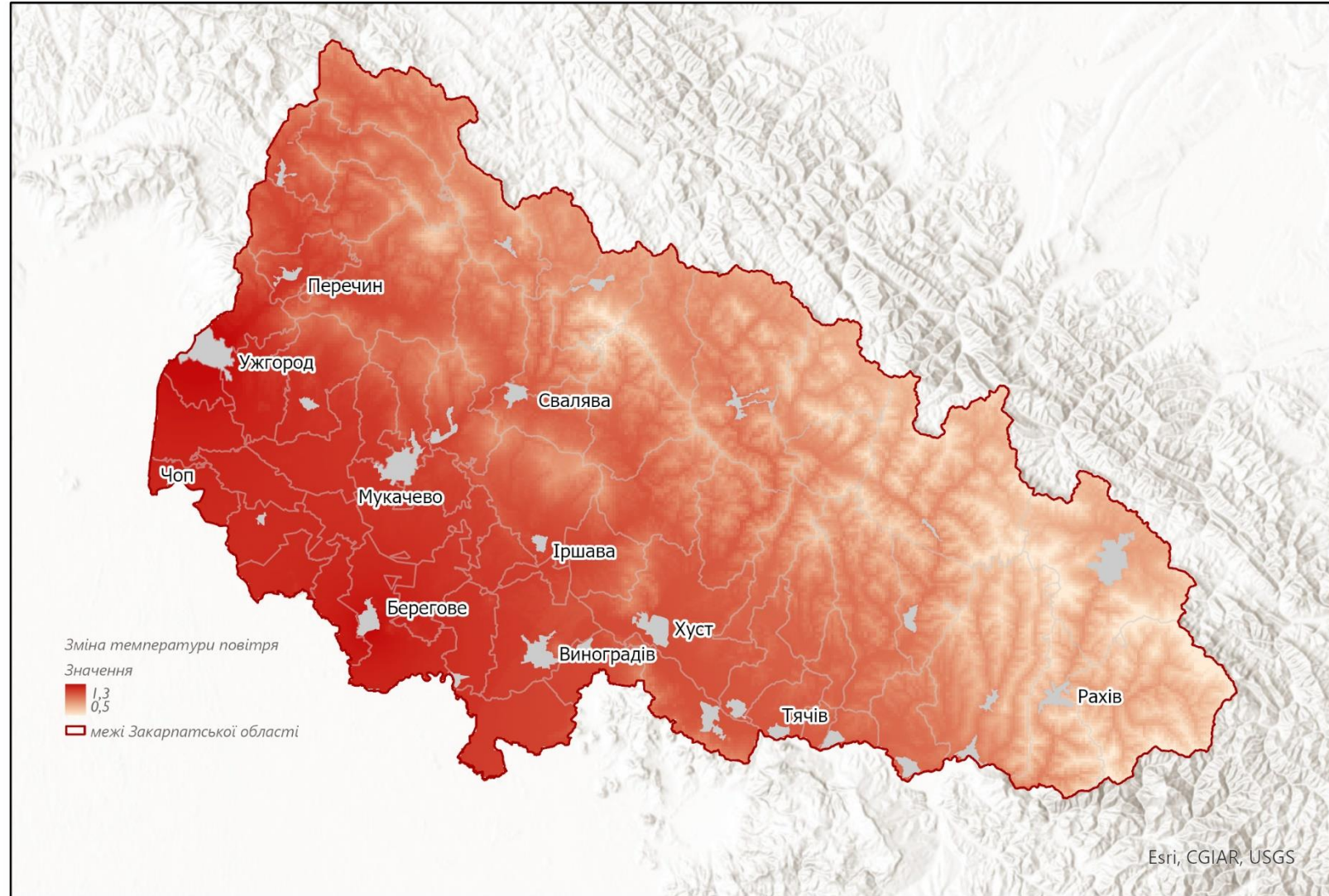
- change in average annual temperature
- change in average annual number of frost days
- change in average annual number of summer days
- change in average annual number of tropical days
- relative change in average precipitation in the winter months
- relative change in average precipitation in the summer months
- change in average number of days with a rainfall of more than 20 mm per year
- change in average number of days with snow cover per year
- relative change in annual potential evapotranspiration
- change in the climatic indicator of drought



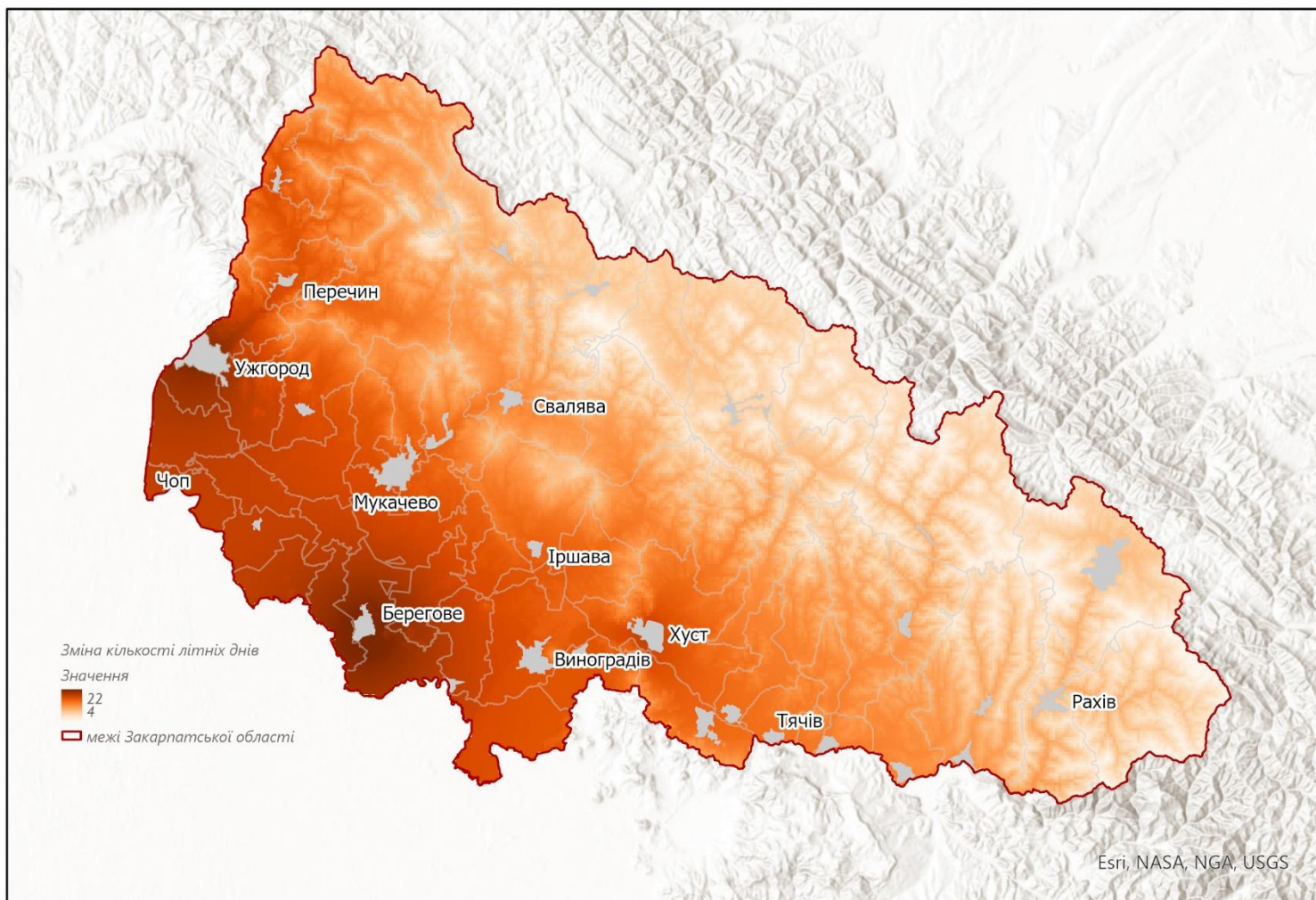
Method of normalization (indicators of exposition)

Normalisation		positive								negative	
#	Indicator / normalised value	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
1.1	Change in annual temperature			increase by 1,15		increase by 1,2		increase by 1,25			
1.2	Change in annual number of frost days				decrease by 12 dní		decrease by 13 dní		decrease by 14 dní		
1.3	Change in annual number of summer days	increase by 8	increase by 9-10	increase by 11-12	increase by 13-14	increase by 15-16	increase by 17-18	increase by 19 - 20			
	Change in annual number of tropical days	increase by 4		increase by 5-6		increase by 7-8		increase by 9-10			
1.4	Relative change in precipitation in the winter months	increase by 6-8%		increase by 9-10%		increase by 11-12%		increase by 13-14			
1.5	Relative change in precipitation in the summer months	increase by 5%		decrease by 1-5%		decrease by 6-10%		decrease by 11-15%			
1.6	Change in number of days with a rainfall of more than 20 mm per year	increase by 0-5%	increase by 5-10%	increase by 10-15%	increase by 15-20%	increase by 20-25%	increase by 25-30%				
1.7	Change in number of days with snow cover per year	increase by 0-5%		decrease by 1-5%		decrease by 6-10%		decrease by 11-15%			
1.8	Relative change in annual potential evapotranspiration		increase by 4-6%	increase by 6-8%	increase by 8-10%	increase by 10-12%	increase nad 12%				
1.9	Change in the climatic indicator of drought	increase by 10%		increase 11-15%		increase 16-20%		increase 20-25%			
1.10	Annual maximums of one-day rainfall totals likely to repeat 1 time in 100 years	0-60	60-80	80-90	90-100	100-120	120-140	140-x			

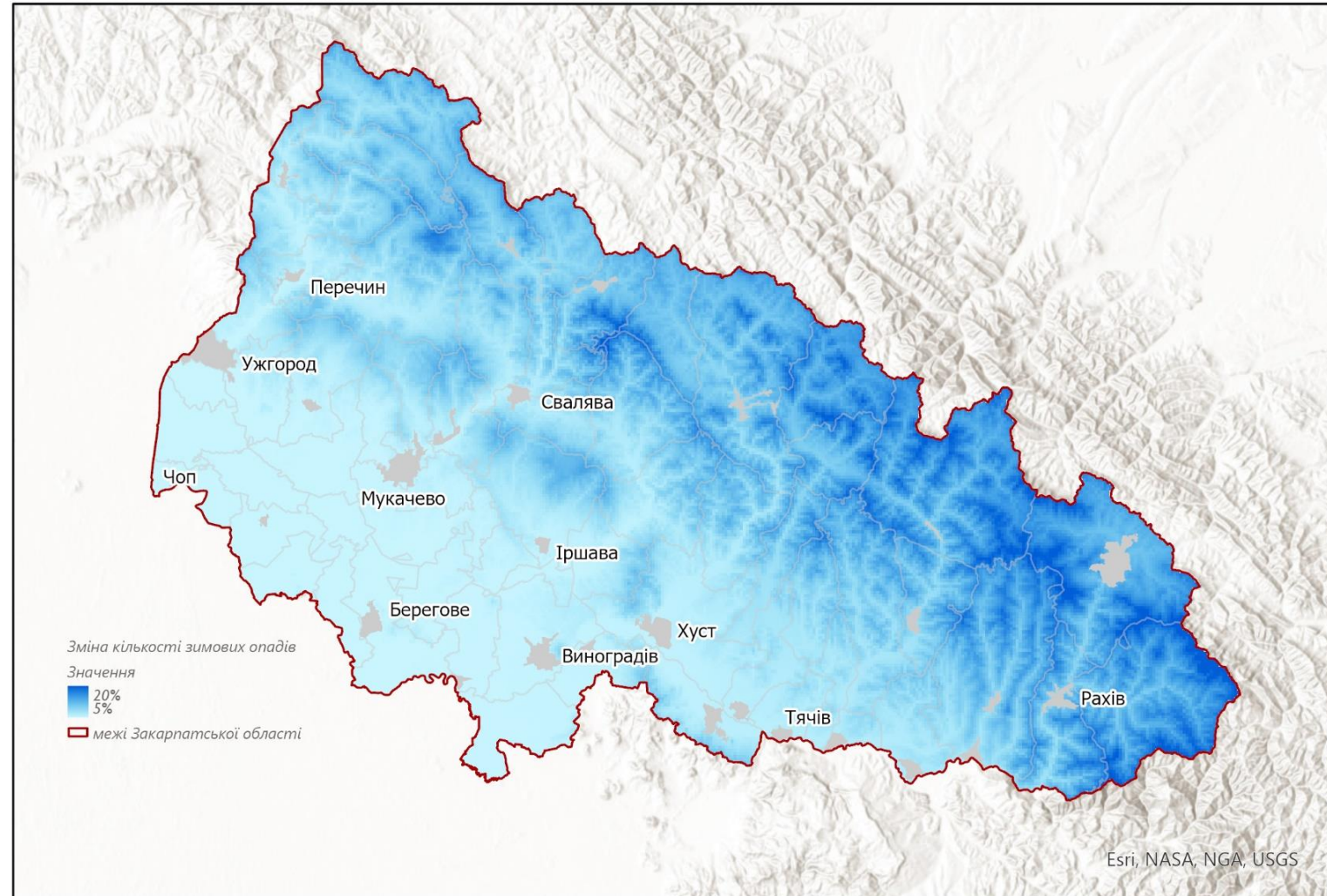
Change in average air temperature 1991-2020 - 2021-2050



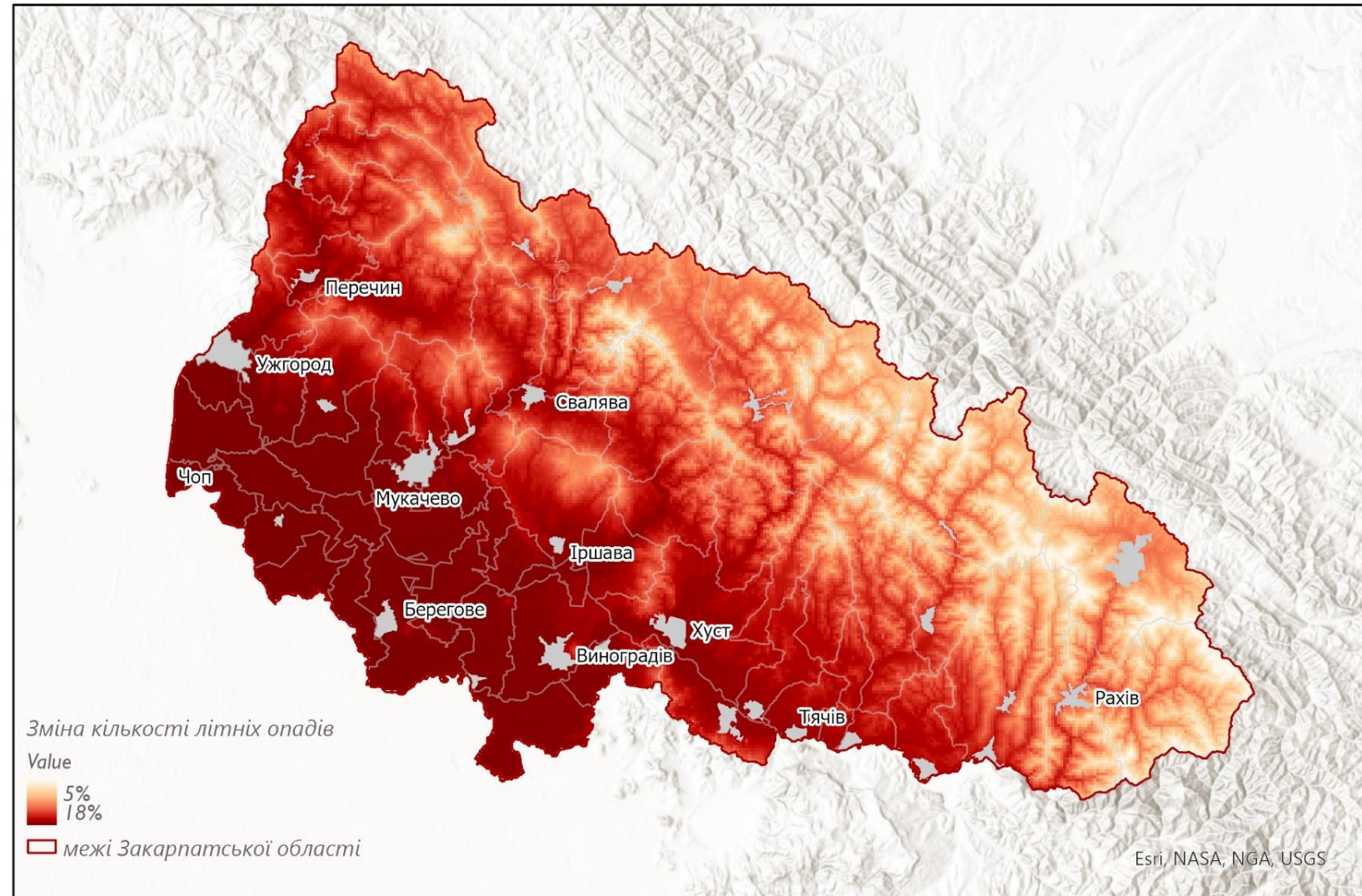
Change in average annual number of summer days 1991-2020 - 2021-2050



Relative change in average precipitation in the winter months 1991-2020 - 2021-2050



Relative change in average precipitation in the summer months 1991-2020 - 2021-2050



Climate change impact assessment

Sensitivity indicators:

- settlements sensitivity to floods / landslides
- roads and railways sensitivity to floods / flashfloods / landslides

- forests sensitivity to fires
- protected areas degree
- soils sensitivity to erosion
- content of organic carbon in the soil
- soils sensitivity to drought
- green areas degree
- built-up areas degree

- population sensitivity to summer heatwaves / floods
- forests sensitivity to drought
- summer tourism sensitivity to summer temperatures
- energy demand sensitivity to summer heatwaves / frost

- cultural heritage objects sensitivity to floods

+ Climatic indicators



Climate change **IMPACT**

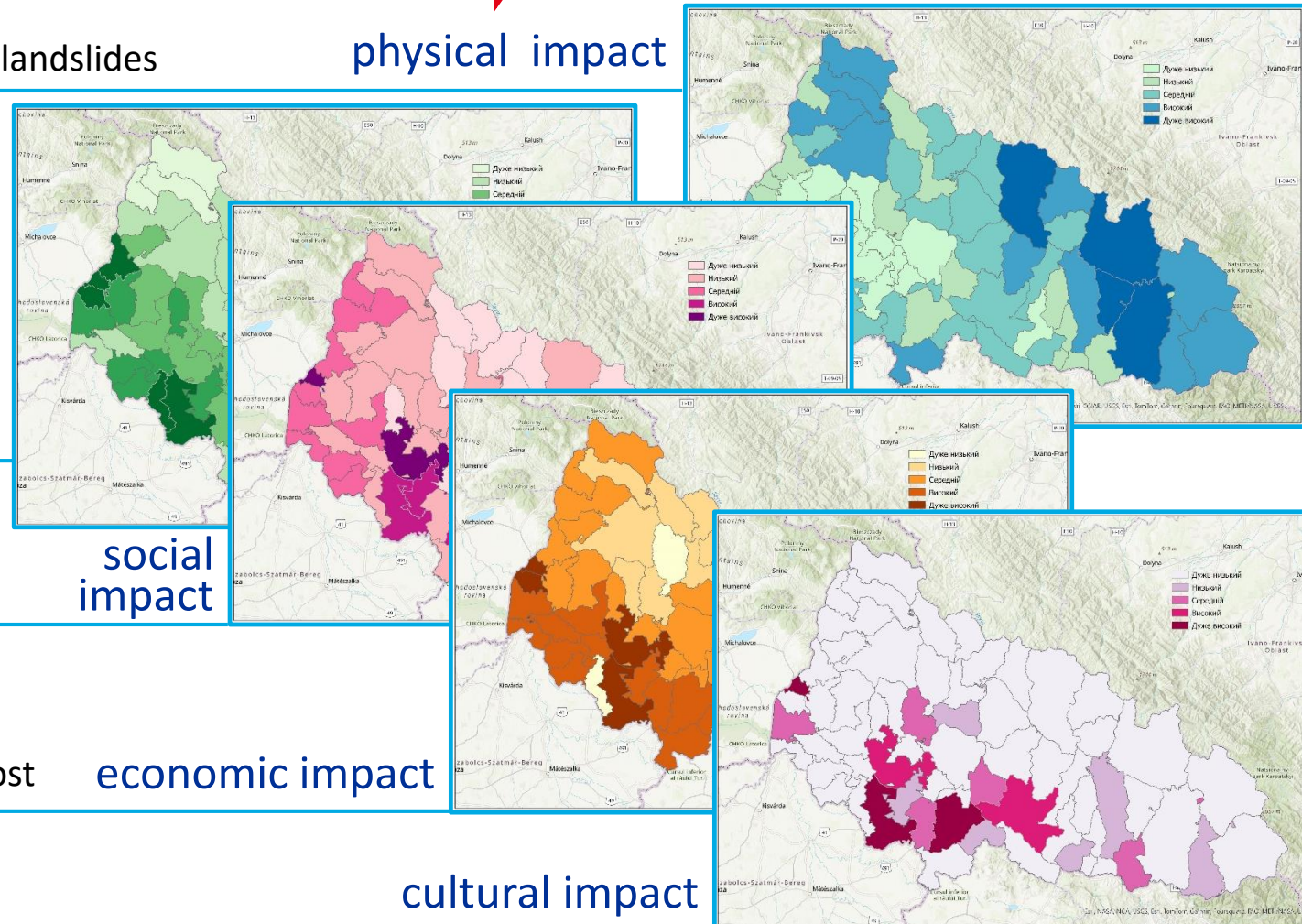
physical impact

environmental
impact

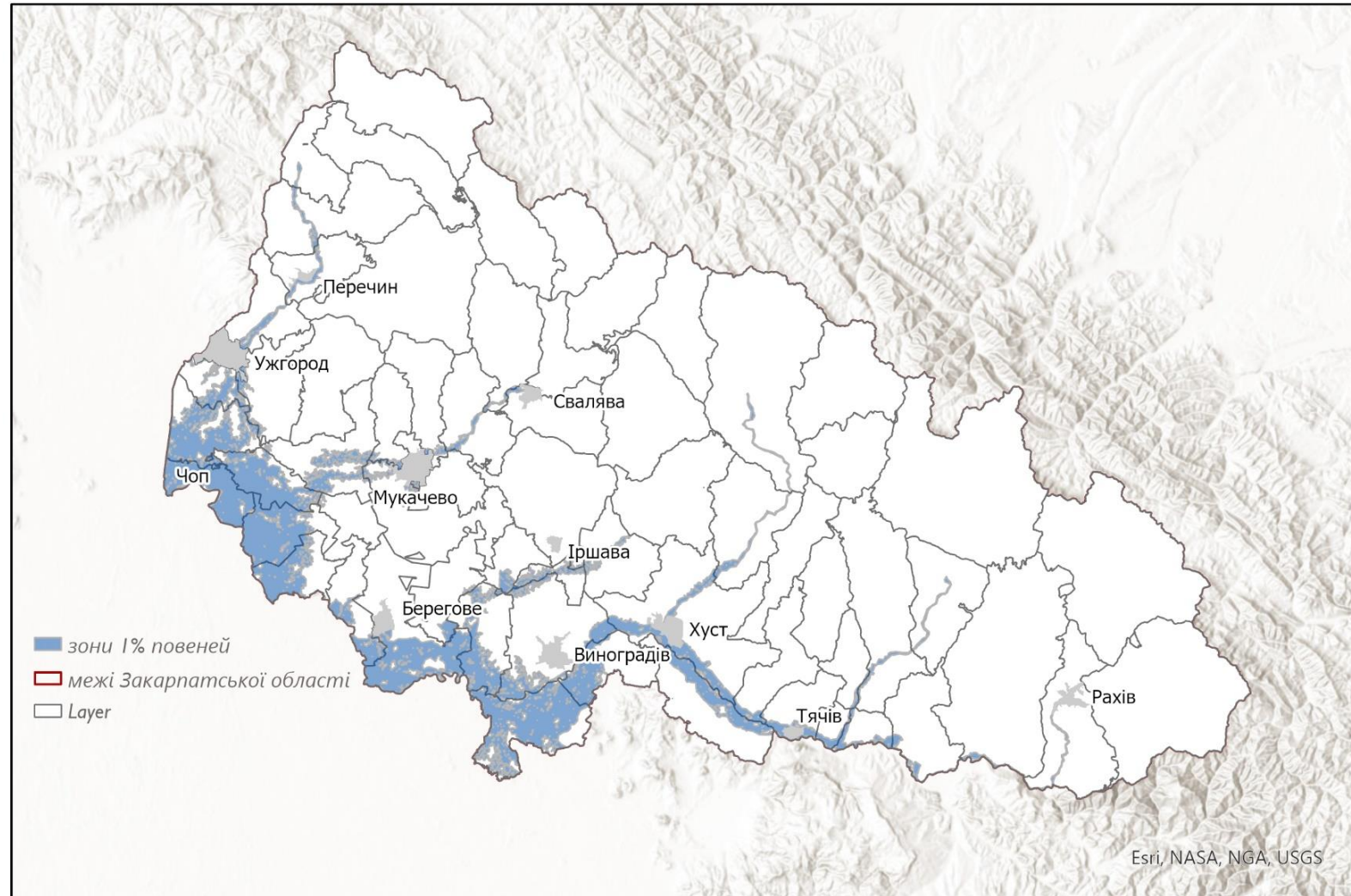
social
impact

economic impact

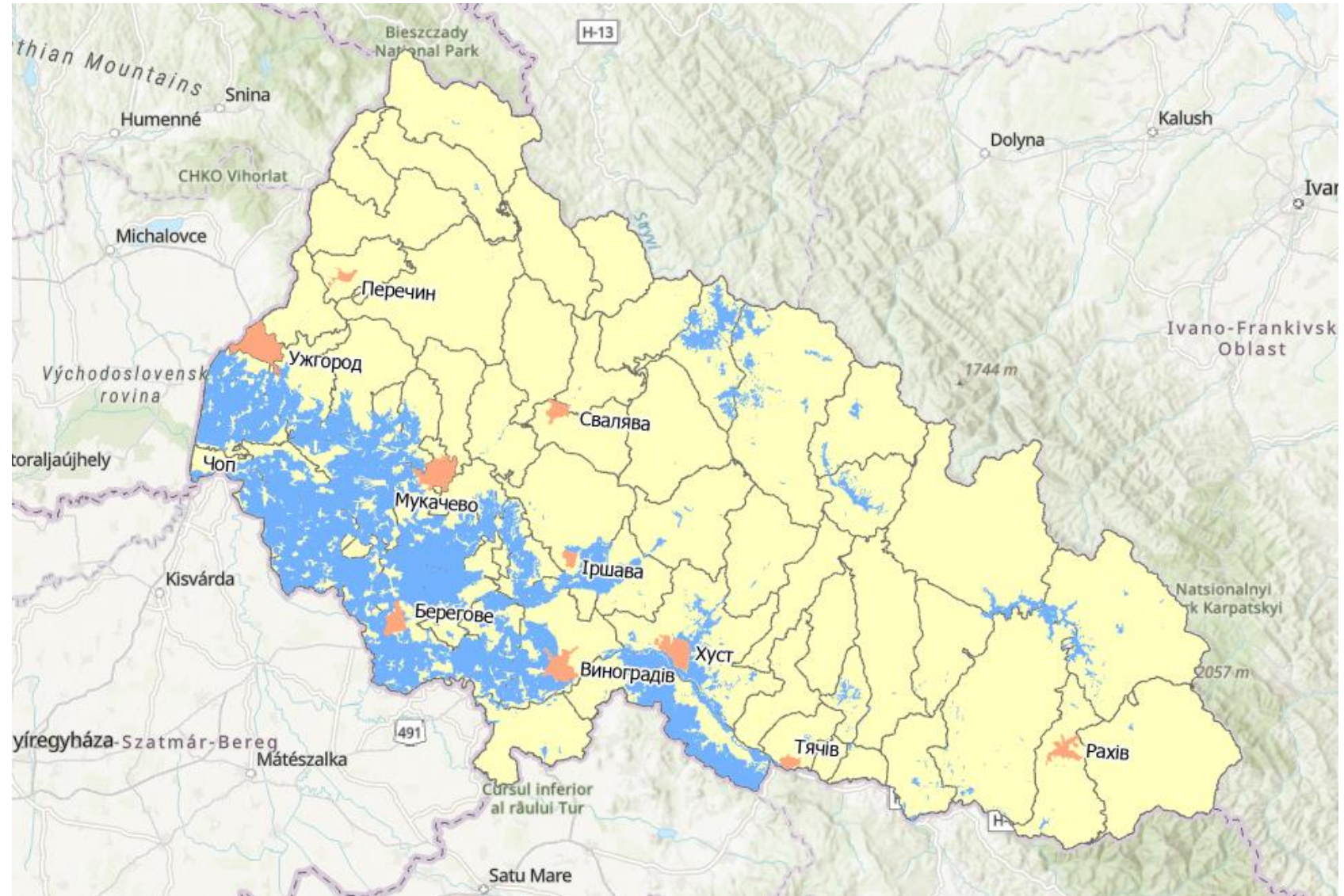
cultural impact



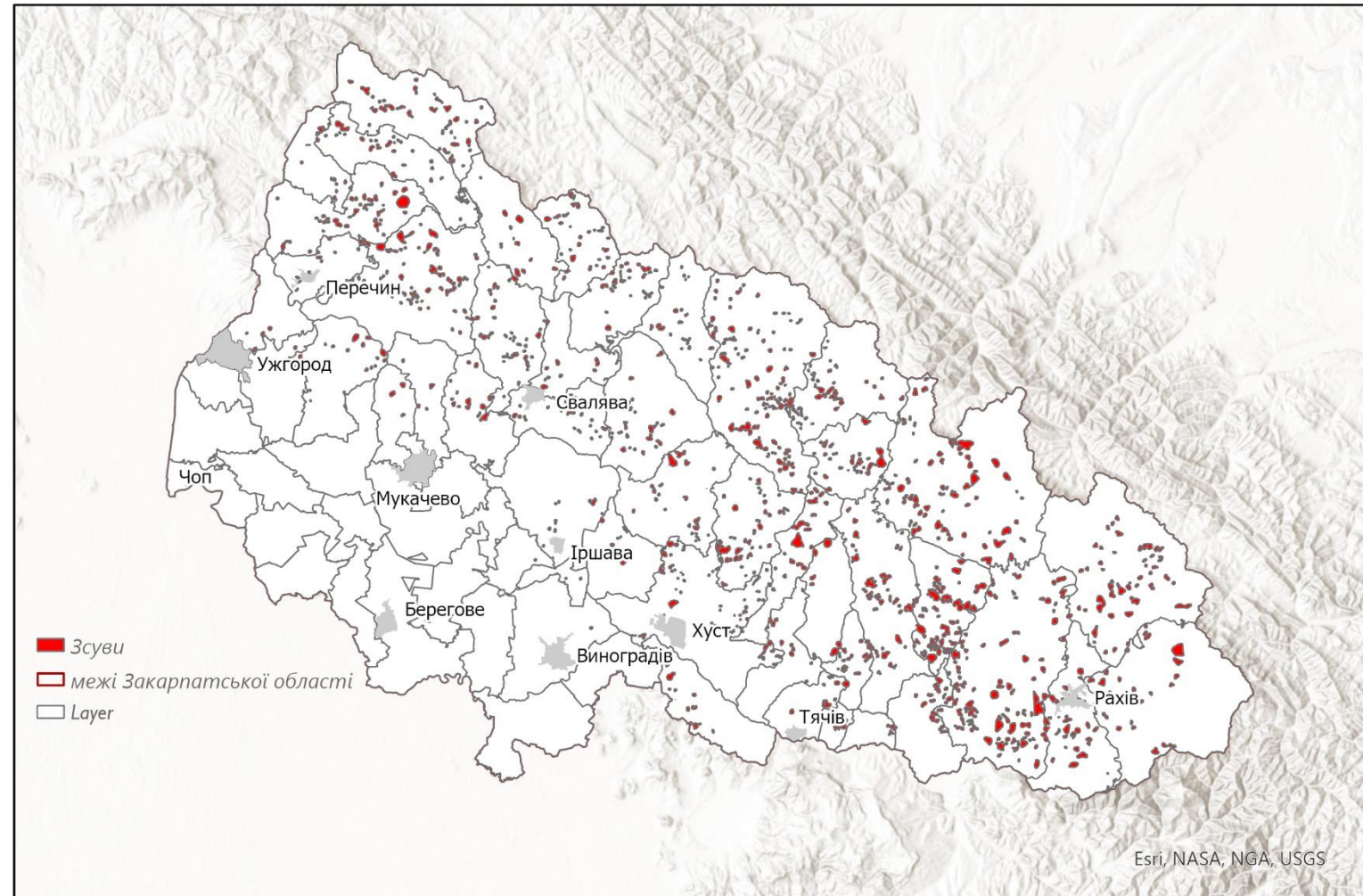
Negative natural phenomena, 1% flood



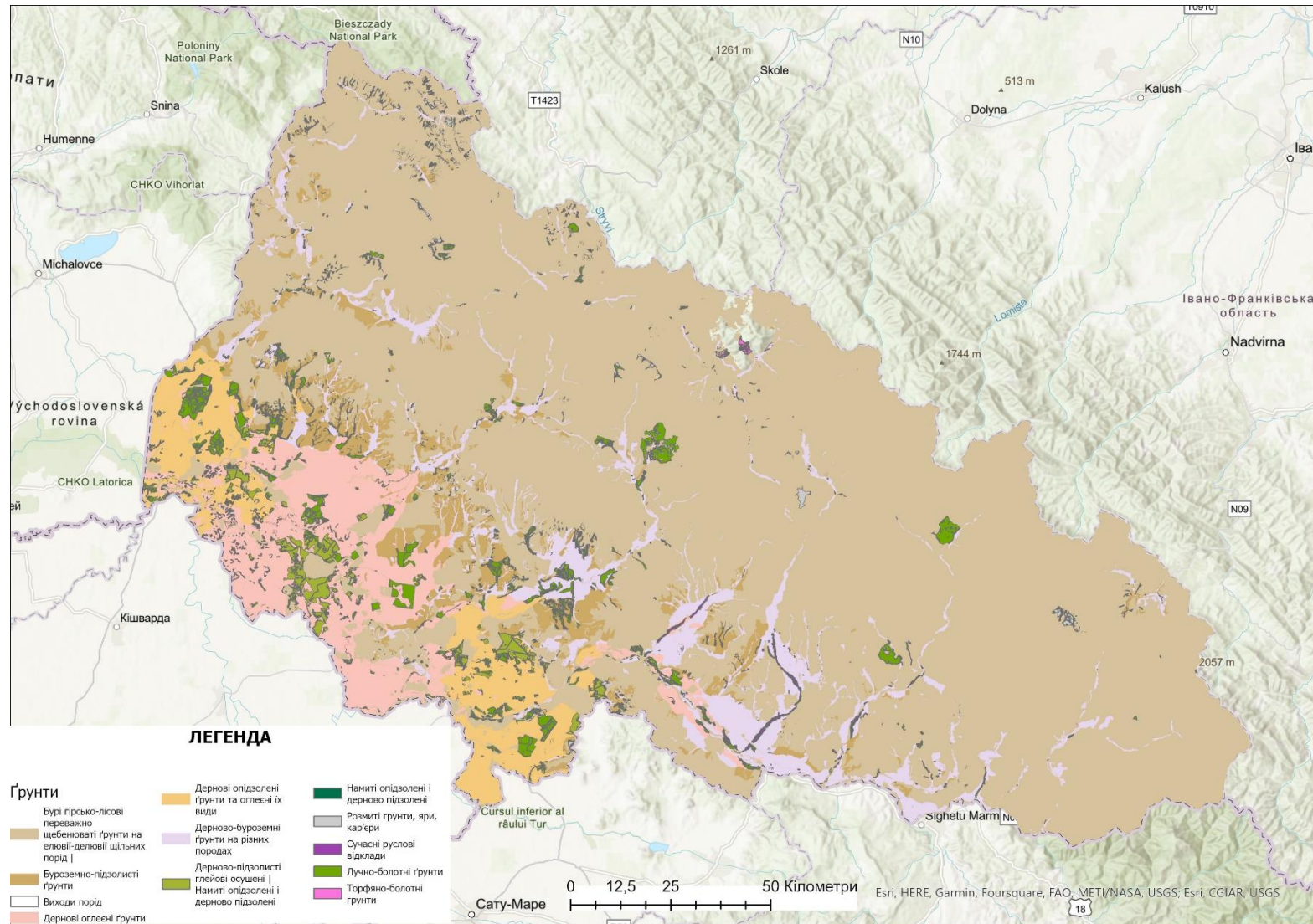
Negative natural phenomena, flash floods



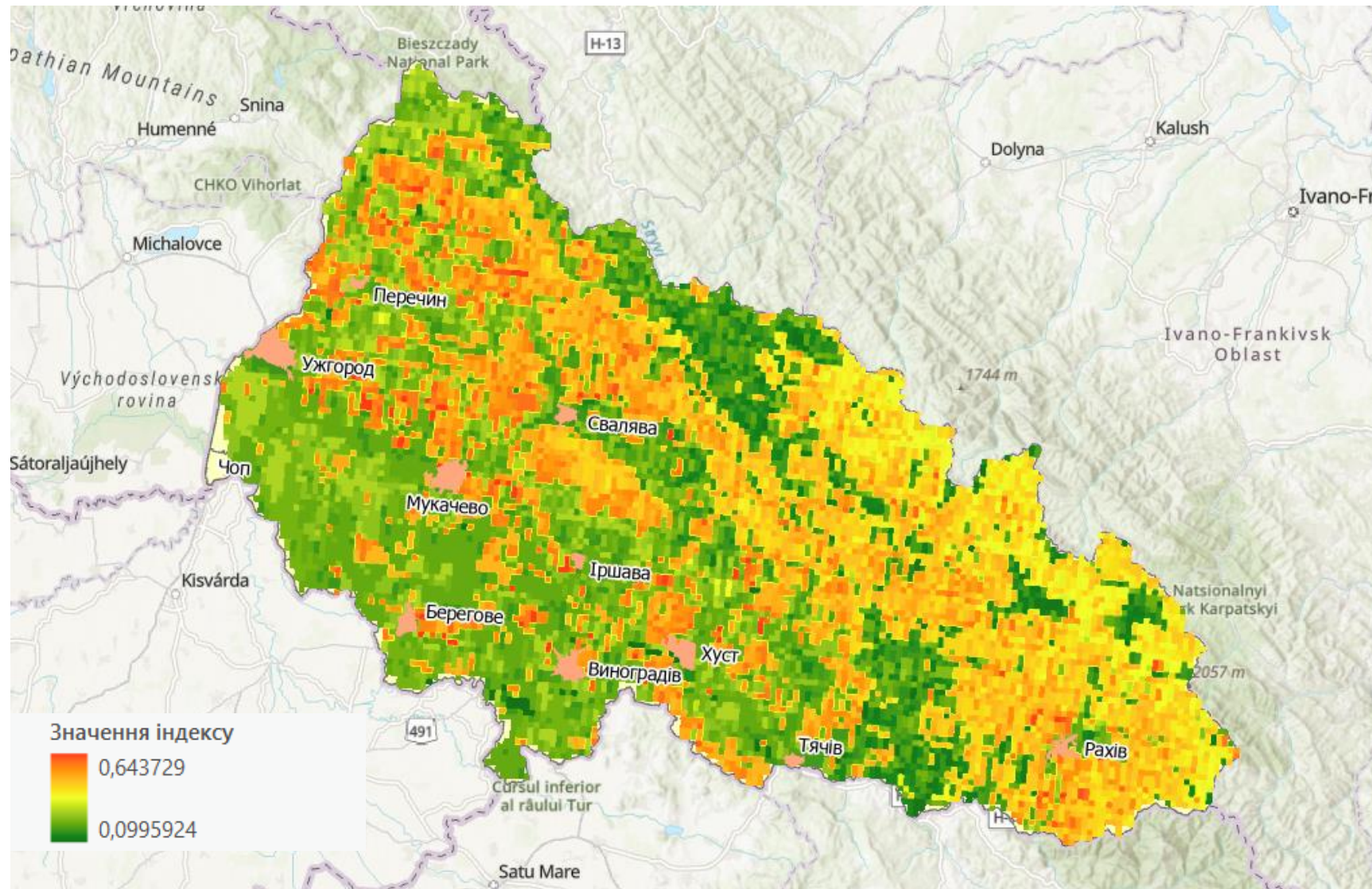
Negative natural phenomena, landslides



Soil properties

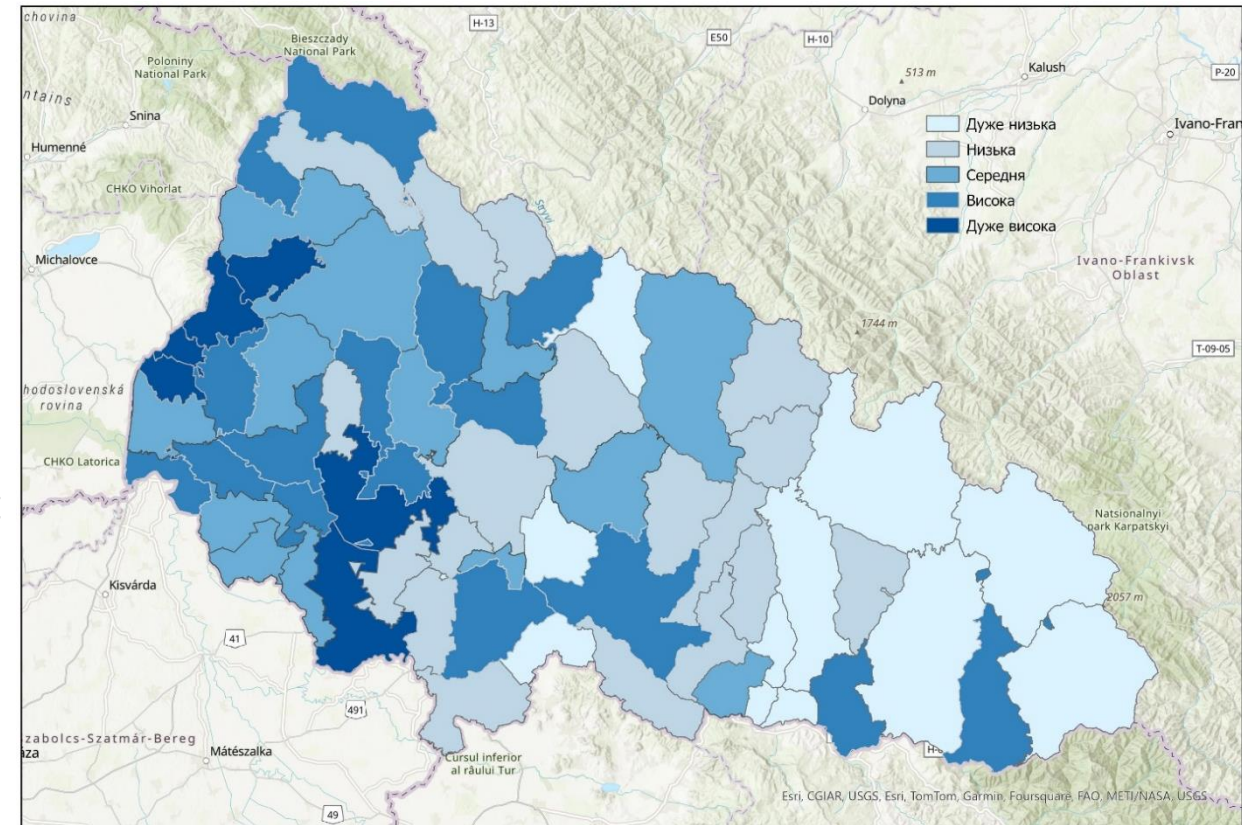


Forest fire danger



Indicators of adaptive capacity:

- the specific weight of spending on development measures in local budgets
- percentage of financed costs for development measures in local budgets
- capacity (surplus) of local budgets
- share of the population with higher education
- the number of places in tourist facilities
- population sensitive to summer heat
- connection to the public water supply
- connection to sewerage with wastewater treatment plant
- high-speed Internet access
- civic participation
- providing services to the population
- age dependency
- transport accessibility



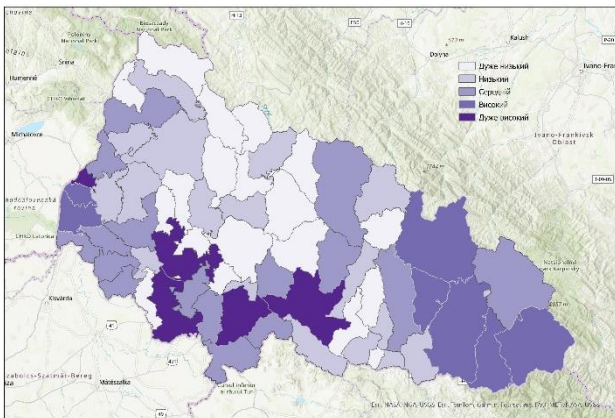
Method of normalization

Indicators of adaptive capacity	positive					negative
normalised value	0	0,1	0,235	0,55	0,775	1
Highest educational attainment		>20%	15 to 20%	10 to 15%	5 to 10%	<5%
Accessibility to the regional centre		0 to 15 min.	15 to 30 min.	30 to 45 min.	45 to 60 min.	>60 min.
Connection to the public water supply	available					not available
Connection to sewerage with wastewater treatment plant	yes					no
Management of local governments		5,5 to 6	5 to 5,5	4,5 to 5	4 to 4,5	<4
Civic participation		>70%	60 to 70	50 to 60	40 to 50	<40%
normalised value	0,1	0,28	0,46	0,64	0,82	1
Age dependency	>40%	35 to 40	30 to 35	25 to 30	20 to 25	<20%

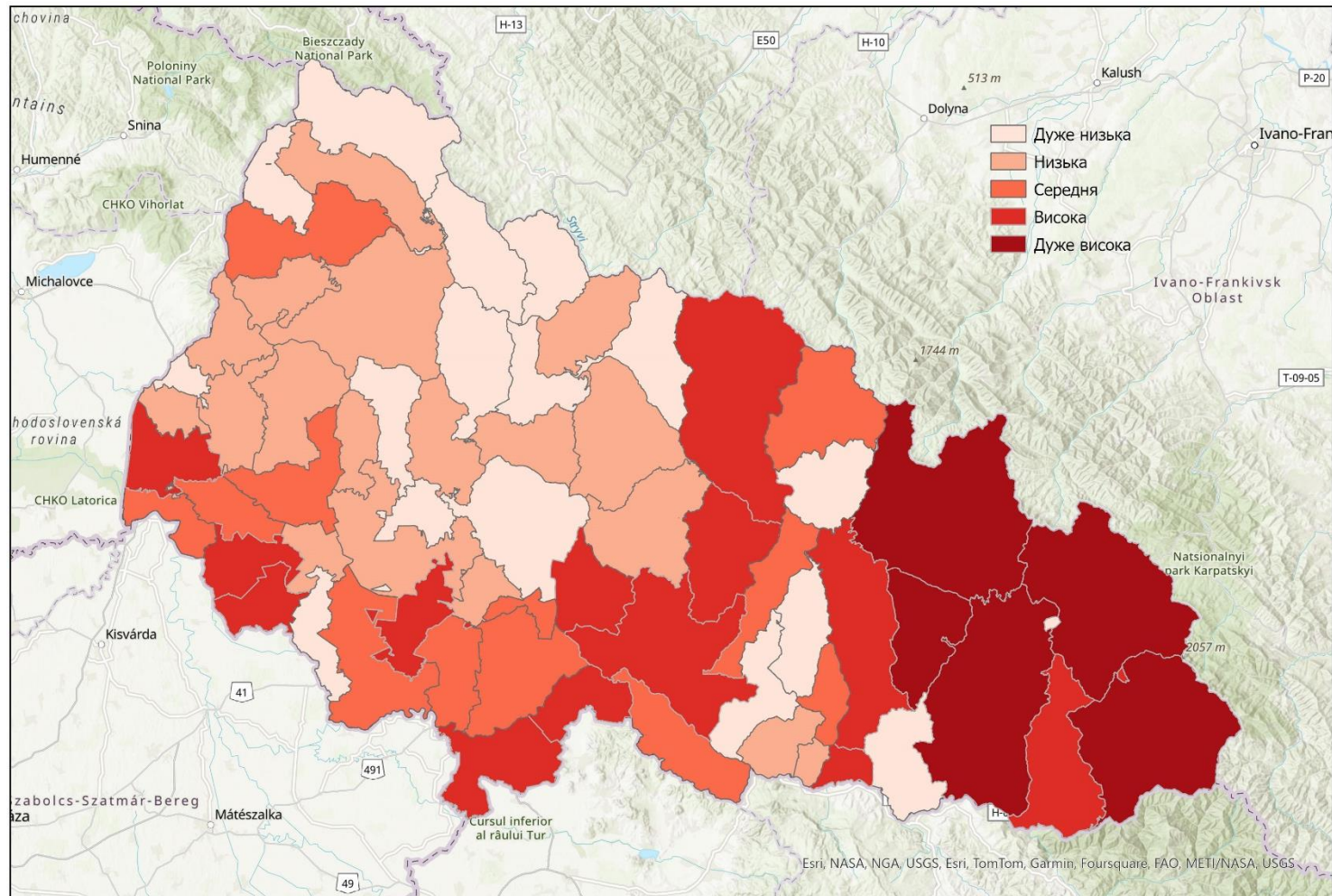
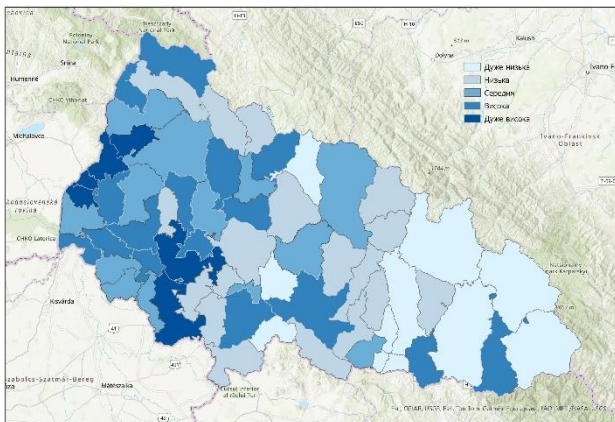
Vulnerability assessment

Vulnerability to climate change

Total impact



Adaptive capacity



Territorial communities with the highest level of vulnerability

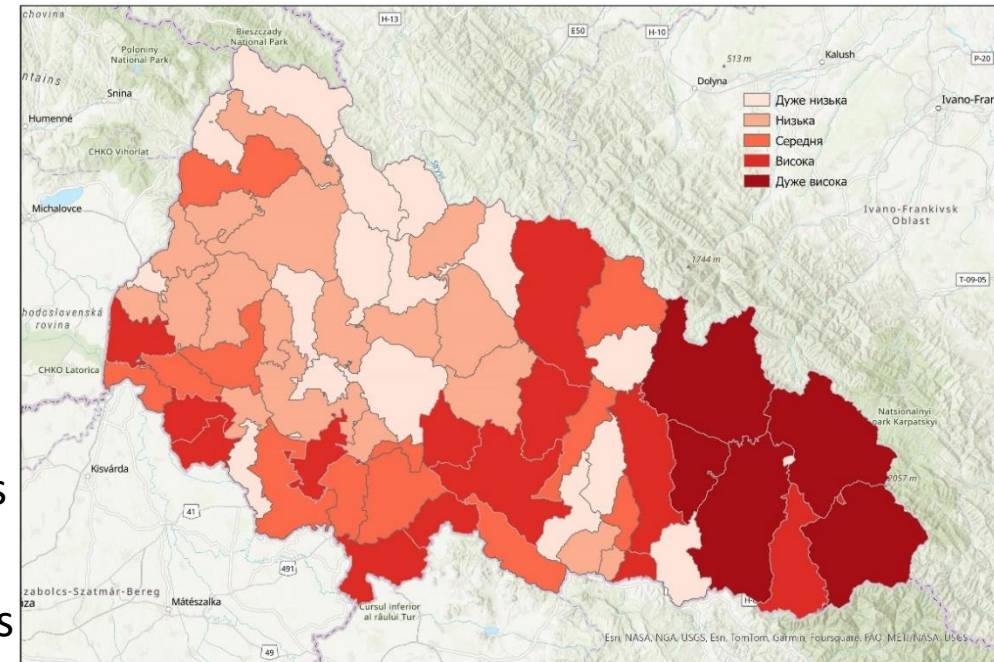
- protection of the territory from the development of hazardous natural processes such as landslides, erosion, mudslides, avalanches
- improving transport accessibility
- optimization of forestry
- diversification of the tourism industry
- provision of water supply to the population

Territorial communities with the medium level of vulnerability

- protection of the territory from flooding and revitalization of river floodplains
- optimization of agriculture and the structure of agricultural lands
- adaptation of urban spaces to climate change
- protection of the population from exposure to high temperatures

Territorial communities with the low level of vulnerability

- protection of the territory from the development of hazardous natural processes, first of all landslides and erosion
- optimization of forestry
- diversification of the tourism industry



Strategic goals / tasks

Strategic goal 1: Strengthening organizational and information support for adaptation to climate change

Task 1.1: Establishing a coordinated management system for adaptation to climate change

Task 1.2: Information provision of climate change adaptation measures

Task 1.3: Implementation of innovative solutions for adaptation to climate change



Strategic goal 2: Preservation of the sustainable state of natural landscapes

Task 2.1: Protection of biodiversity of the region

Task 2.2: Ensuring the spatial connectivity of natural landscapes of Zakarpatska Oblast



Strategic goals / tasks

Strategic goal 3: Prevention of negative consequences of extreme processes in the environment

Task 3.1: Water retention in the landscape taking into account the ecosystem approach

Task 3.2: Revitalization of riverbeds and floodplains in the region

Task 3.3: Development of infrastructure for engineering protection of the territory in areas where ecosystem solutions are not effective or cannot be implemented



Strategic goal 4. Reducing the vulnerability of the population to climate change

Task 4.1: Operational protection of the population against emergency situations

Task 4.2: Formation of the population's ability to adapt



Strategic goal 5. Support of a favorable environment in settlements

Task 5.1: Planning of settlement territories resistant to climate change

Task 5.2: Reduction of the share of artificial coverings in the area of populated areas

Task 5.3: Adaptation of buildings to climate change

Task 5.4: Ensuring sustainable water supply and sewage disposal



Strategic goals / tasks

Strategic goal 6: Formation of an economic complex resistant to climate change

Task 6.1: Diversification of the economic complex of the region

Task 6.2: Ensuring sustainable forestry

Task 6.3: Protection of agriculture from the negative effects of climate change

Task 6.4: Supporting and increasing the competitiveness of tourism

Task 6.5: Ensuring the sustainability of the energy system in the region

Task 6.6: Introduction of mechanisms to stimulate the implementation by local businesses the climate change adaptation measures



Implementation and monitoring

Organizational support, monitoring, coordination of stakeholders:

- ▶ Department on Spatial/Urban Planning and Architecture of Zakarpatska Oblast State Administration

Coordinated involvement of:

- ▶ structural subdivisions of Zakarpatska Oblast State Administration
- ▶ local authorities
- ▶ scientific and educational institutions
- ▶ civil organizations
- ▶ local business

Financing:

- ▶ Oblast budget
- ▶ local budgets
- ▶ state subventions
- ▶ funds of international technical and/or financial assistance and other sources not prohibited by law

Monitoring: annually / data from all stakeholders / report before March, 1 ▶ next activities into the budget

Analysis of the dynamics of changes in climatic indicators: 1 per 5 years ▶ changes into the Strategy





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