Climate-Ready İzmir: Enhancing Resilience Strategies (CRIZ-ERS)

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İzmir Metropolitan Municipality, Türkiye

Barcelona, 11 June 2025

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CLIMAAX
climate ready regions

İzmir

- The 3rd biggest city in Türkiye.
- Coastal city with a gulf and harbor.
- İzmir has 630 km shoreline.
- A key hub for **industry**, **agriculture** and **tourism**.
- Population: 4.49 million
- Area: 12,000 km²
- Number of districts: 30
- Mediterranean climate with **hot, dry summers and mild, wet winters**. (*Köppen climate classification: Csa*)







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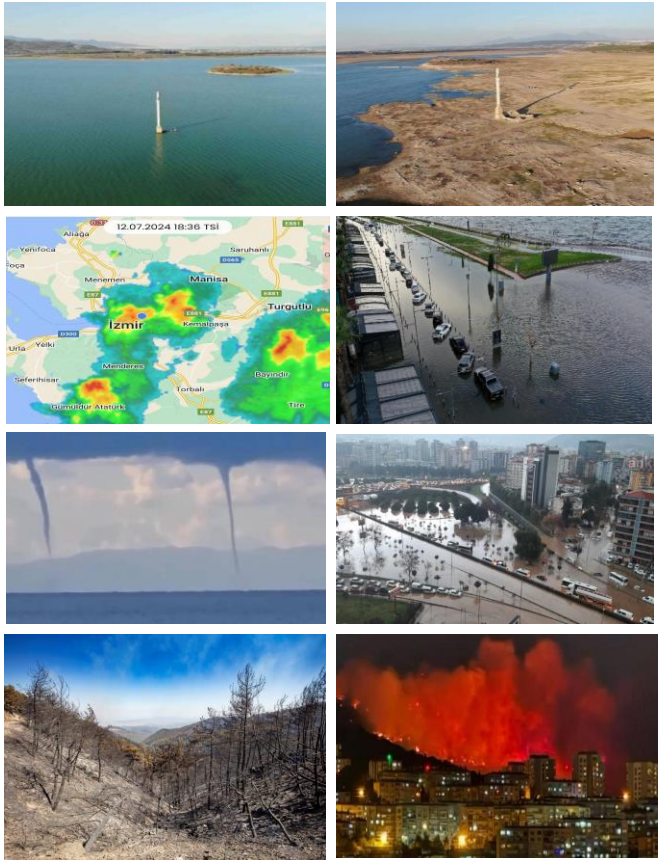
Impacts of Climate Change:

Climate Hazards:

- Citywide **droughts** in 2019 and 2024.
- **Intense rainfall** and **flooding** 2021 and 2024,
- A severe **storm** and **tornado** 2021.
- **Coastal flooding** in 2023.
- Frequent summer **heatwaves**
- Record-breaking **wildfires** in 2019 and 2024.

Existing Climate Action Plan:

- İzmir has developed a Sustainable Energy and Climate Action Plan (SECAP) that identifies climate-related hazards, risks, and vulnerabilities.
- While this plan provides a good foundation, **it lacks detailed and location-specific** data that are essential for effective local actions.
- Currently, there is **limited information at the neighborhood level**, which makes it difficult to fully understand local vulnerabilities.
- **The CLIMAAX framework and tools** help close these gaps by providing more detailed and location-specific climate risk and vulnerability assessments.



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İzmir's CRIZ-ERS Project:

Phase 1: RVA for İzmir

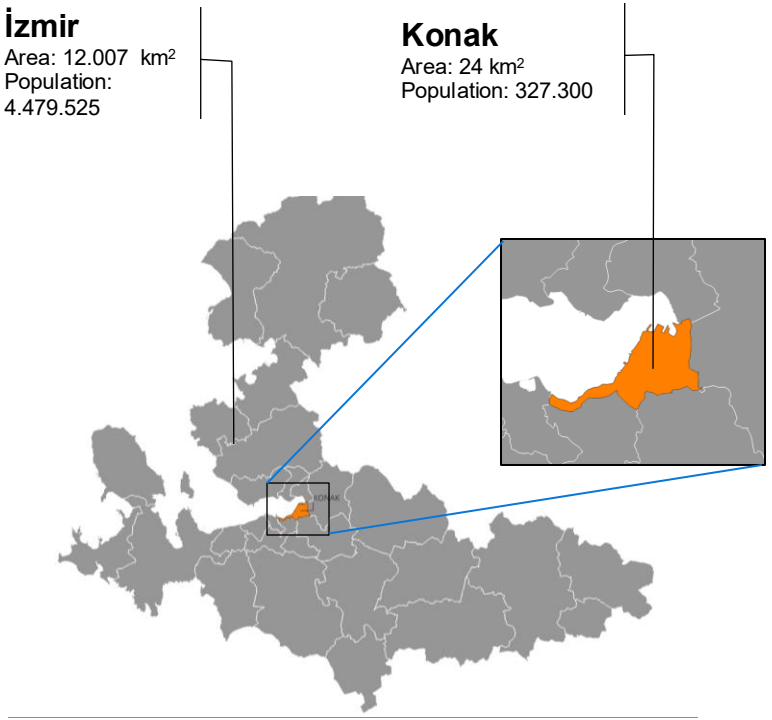
- The initial phase focus on a city-wide Risk and Vulnerability Assesment (RVA) for the entire İzmir province to refine and improve the existing climate RVA.
- We aim to focus four hazard (**Extreme Precipitation, Heatwaves, Droughts and Flooding**) in Phase 1.

Phase 2: RVA for Konak

- More detailed, neighborhood-level RVA for the Konak district (24 km2) with its dense population and lack of green spaces, is particularly vulnerable to urban flooding.
- We aim to focus two hazard (**Floods** and **Heatwaves**) in Phase 2.

Phase 3: Enhanced Climate Adaptation Plans

- **İzmir Province**: Update the city-wide climate adaptation plan with improved, science-based insights from RVA findings.
- **Konak District**: Develop a detailed adaptation plan tailored to Konak's specific risks and vulnerabilities.



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CRIZ-ERS Project Team:

Project Coordinator:
İzmir Metropolitan Municipality (IMM)

Directorate of Climate Change and Clean Energy

- Yiğit Beydağ
- Çağlar Tükel
- Akın Küçükyılmaz
- Eylem Demircioğlu
- Seçil Uysal
- Mehmet Göktuğ Öztürk
- Seray Şengül

Stakeholders:

- Municipal departments, universities, NGOs, chamber of professionals, related public institutions and citizens.

Subcontracting:
Technical subcontract consulting services

- M. Kemal Demirkol: Technical Advisor (Climate Adaptation, Risk Assessment)
- Prof. Dr. Osman Balaban: Technical Advisor (City Planning and Climate Adaptation)
- Assoc. Prof. Dr. Meltem Şenol Balaban: Technical Advisor (Disaster Risk Management)
- Assoc. Prof. Dr. Selda Tuncer: Technical Advisor (Social Policies and Gender Equality)
- Assist. Prof. Dr. Banu Gökmen: Technical Advisor (Urban Conservation/Cultural Heritage)
- Dr. Çağrı Karaman: Technical Advisor (International Climate Analysis and Model Development Expert)
- Dr. Emrah Alkaya: Technical Advisor (Environment and Urban Infrastructure)
- Engin Koç: Technical Advisor (Ecosystem and Biodiversity)
- Elif İrem Köse Kiper: Technical Advisor

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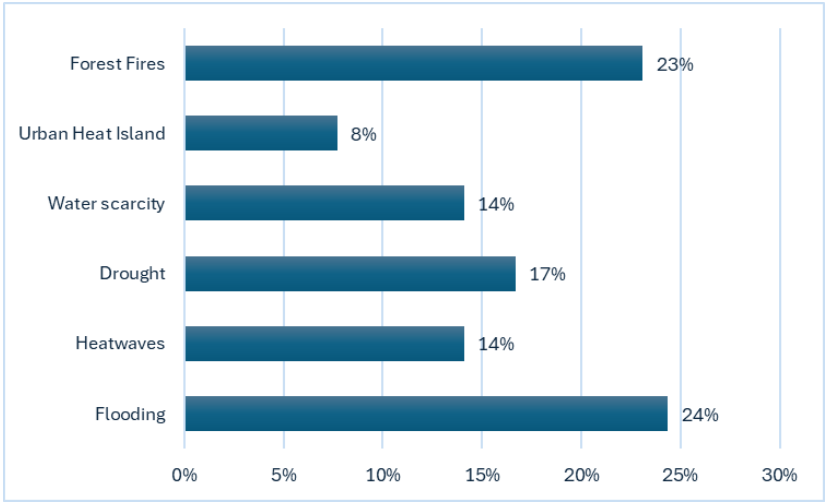
Phase 1: RVA for İzmir

Relevant studies have been examined:

- Sustainable Energy and Climate Change Action Plan (2019),
- Green City Action Plan (2020),
- Provincial Disaster Risk Reduction Plan (2021),
- The Urban Heat Island and Social Vulnerability Assessment Report (Karşıyaka Municipality, 2024),
- The Urban GreenUP Project (2024) and
- Historical records regarding heat waves, wildfires, drought and agricultural droughts, sea level rise (Turkish State Meteorological Service)

Main Hazards Highlighted by Stakeholders:



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Data Overview Used For Hazard and Risk Assessment

Data Overview	Hazard data	Vulnerability data	Exposure data	Risk output
Workflow 1: Extreme Precipitation	Projected increase in heavy rainfall events (e.g., 100 mm/24h return period changes)	*Infrastructure vulnerability: Schools, hospitals, and critical infrastructure are in areas with a ≥10% decrease in the return period of 100 mm/24hr event*	*Population & Infrastructure - Schools and hospitals*	*The risk map of Projected Changes in Return Period (Frequency) of 100mm/24hr event*
Workflow 2: Heatwaves	Heatwave metrics such as frequency, average length, and total yearly heatwave days for the historical, and projected periods under RCP 4.5 and RCP 8.5. and Land surface temperature (LST) data from Landsat 8 Satellite	*Vulnerable population data (0-5 years and > 65 years)*	*Land Surface Temperature - areas that heat up most (UHI)*	*The heatwave risk map based on the exposure (LST - areas that heat up most) x vulnerability (density of vulnerable population).*
Workflow 3: Agricultural Drought	Precipitation deficit leading to yield loss in maize, wheat, sorghum, and barley. Daily mean precipitation, temperature, relative humidity, solar radiation, wind speed. Soil available water capacity, elevation, and thermal climate zone	*Share of cropland with irrigation systems.*	*Crop distribution and economic value data Global Agro-Ecological Zones (GAEZ).*	*Revenue losses from irrigation deficit expressed as 'lost opportunity cost' in thousand euros.*
Workflow 4: Coastal Flooding	Statistical indicators derived from water level time series for different return periods (10, 50, 100, 200, 500 years) and NASA Sea Level Projection tool for future periods	Global flood depth-damage functions (vulnerability curves) from JRC (Huizinga et al., 2017).	Land use/land cover map from JRC (LUISA Base Map 2018) for urban areas, agricultural fields, infrastructure, and water bodies.	Flood Risks to build infrastructure, flood and associated damages maps for extreme event in (5, 10, 50 and 100 years)

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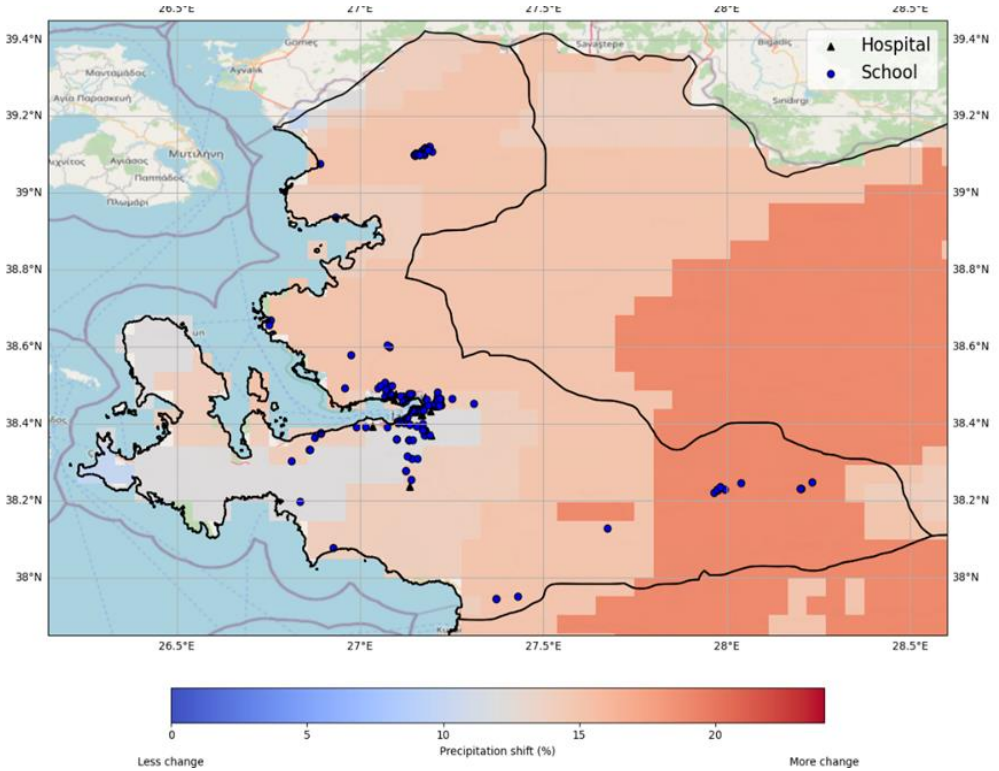
Risk Assessment: Extreme Precipitation

- Under the **RCP8.5 scenario**, the return period for a **100 mm/24h rainfall event** is projected to **decrease across the İzmir region**, meaning such extreme events will become more frequent in the future.
- In **coastal areas**, this decrease is around **10%**, while in **inland parts**, it can reach up to **20%**. This suggests that **İzmir is likely to experience more frequent and intense heavy rainfall events**.
- Many **schools and hospitals** are located in zones where the return period for a 100 mm/24h event is projected to **decrease by 10% or more**.
- This poses a risk of **disruptions to education and healthcare services**, and may result in **potential damage to buildings and infrastructure**.



Projected Shift in Return Period Frequency (%) for 100mm/24h Rainfall Events – İzmir (2041–2070 vs. 1976–2005, RCP8.5)

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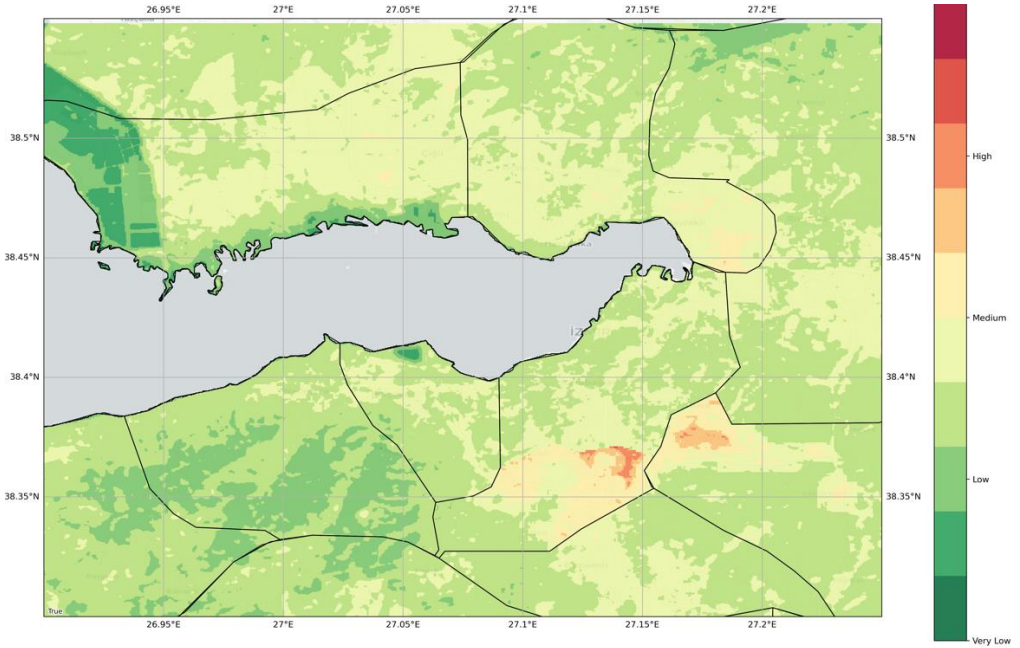
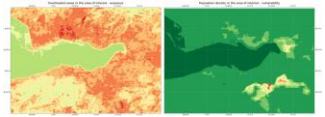
Risk Assessment: Heatwaves

- The western and coastal regions of İzmir experience **lower heat risk**.
- In contrast, **inland areas**, particularly the southern and southeastern parts of the city, face **significantly higher heat risk**.
  These areas have **high population and urbanization densities**, **limited vegetation cover**, and a greater share of **vulnerable groups** — such as young children, the elderly, and people with **pre-existing health conditions**.
- İzmir is also affected by the **Urban Heat Island (UHI) effect**, which further increases surface temperatures in densely built-up areas.
- As the city continues to urbanize, the **expansion of impervious surfaces** without adequate measures — such as increased **tree cover** — will amplify heat risks. This will be especially critical as **temperatures continue to rise due to climate change**.



Possible Heat Risk to Vulnerable Population
(Land Surface Temperature × Population Vulnerability)



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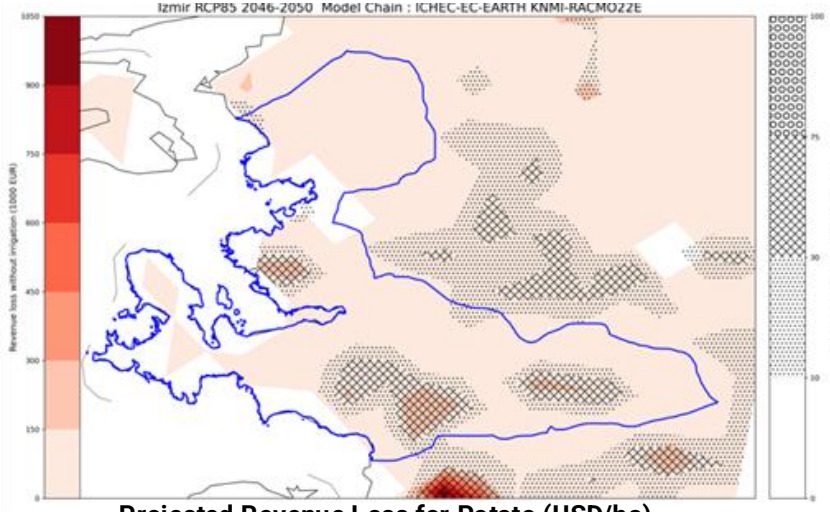
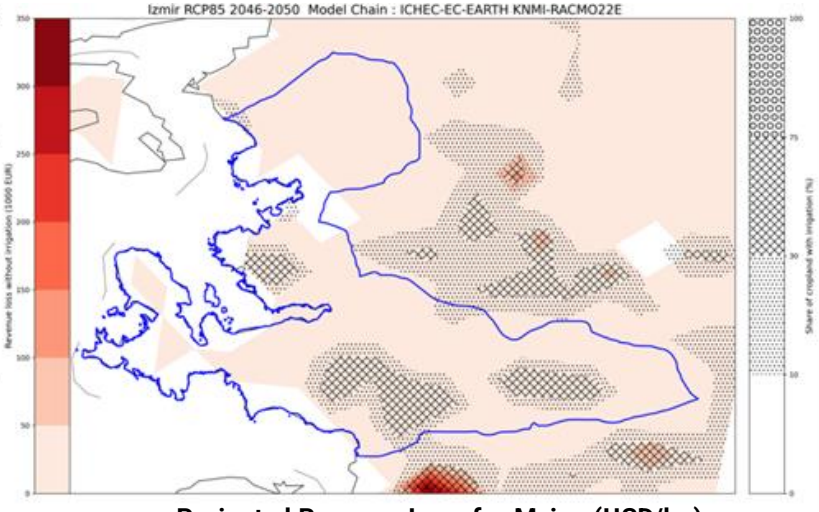
Risk Assessment: Agricultural Drought

- The most severe economic losses from drought are expected in the **southern and southeastern parts** of İzmir. **Northern and coastal areas** are projected to face **lower revenue impacts**.
- The maps show that **precipitation deficits** will result in **significant agricultural losses**, especially for **potato and maize** production.
- These losses are calculated as **'lost opportunity cost'**, representing the income loss in **non-irrigated areas**.



Projected Revenue Loss for Potato (USD/ha)
(2046–2050, RCP8.5)



Projected Revenue Loss for Maize (USD/ha)
(2046–2050, RCP8.5)

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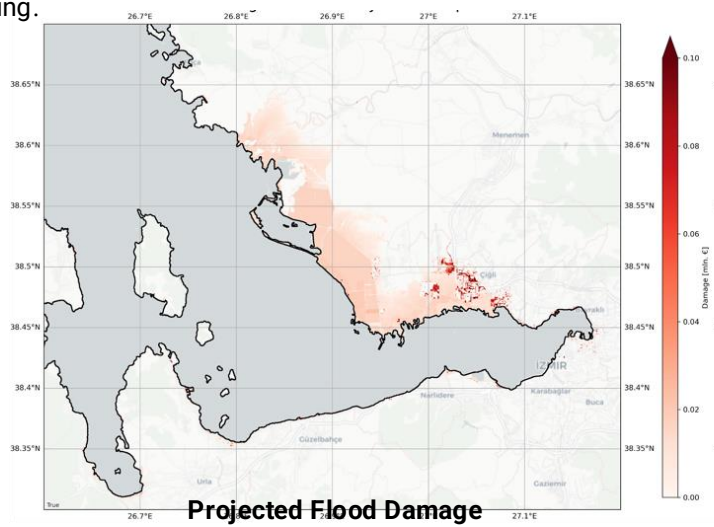
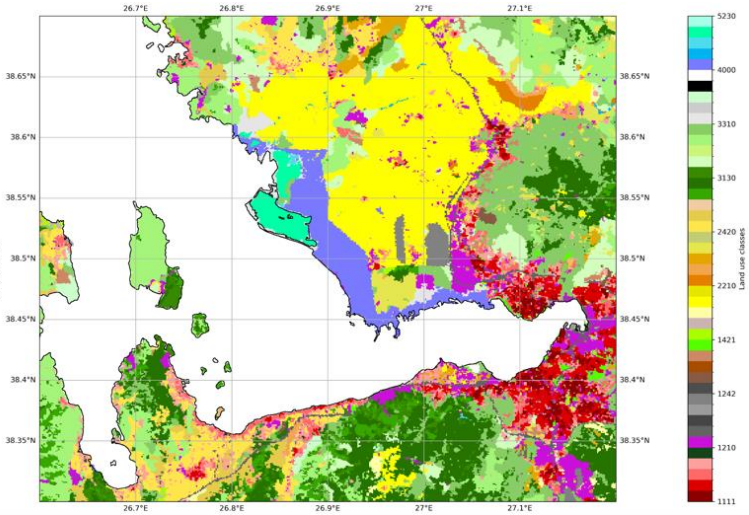
Risk Assessment: Coastal Flooding

- Coastal areas in İzmir face **significant flood risks**, especially in **low-lying zones**.
- The areas most exposed to flooding and economic damage are located around the **northern coastal districts**, where urban development and infrastructure are dense.
- **Critical infrastructure** — including **roads, ports, and industrial zones** in the **North** — could be heavily affected by coastal flooding.
- **Coastal districts** such as **Karşıyaka** and the **city center** are also impacted, but to a **lesser extent**.
- **Densely populated** and **industrialized areas** are more vulnerable to **financial losses** from coastal floods.
- In addition to historical flood risks, **sea level rise** is expected to **amplify flooding impacts** by 2100, especially during **extreme events** like storm surges.



Projected Flood Damage (1-in-100-Year Event, SSP5-8.5, 2100)



Land Use and Exposure – LUISA Base Map (JRC, 2018)

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Conclusion & Next Steps :

Conclusions:

- The results highlighted **spatial inequalities** in risk exposure, especially in **densely populated, low-lying, and inland areas**.
- Each hazard presents **different challenges** to infrastructure, public health, agriculture, and the economy.
- The assessment confirmed the importance of **localized data**, multi-stakeholder collaboration, and science-based planning.

Next Steps:

- We will conduct a more detailed assessment at the **neighborhood level**, starting with **Konak district**, focusing on **flood and heatwave risks**.
- The outcomes will be used to update İzmir's climate adaptation strategy and to design **targeted, actionable adaptation plans**.
- We will also address gaps identified in Phase 1 — such as **data on forest fire risks** — by collecting new data in the upcoming stages.
- Stakeholder engagement and data integration will remain key components in strengthening İzmir's long-term **urban climate resilience**.

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