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**NaTour4CChange**



## *ZADAR REGION*

Identification and assessment of the  
main coastal tourism-related issues  
concerning climate change mitigation  
and adaptation



| Project Information |  |
|---------------------|--|
| Project Acronym     | NaTour4CChange   |
| Project Full Title  | Governing sustainable tourism in territories with high environmental value: reconnecting tourism and nature for addressing the climate crisis with an ecosystem-based approach |
| Project Priority    | #2: A Greener Med  |
| Project Mission     | #4 Enhancing Sustainable Tourism   |
| Specific Objective  | #2.4 Promoting climate change adaptation and disaster risk prevention, resilience, taking into account ecosystem-based approaches  |
| Type of Project     | Thematic Project   |
| Contract No         |  |
| Start date          | 1 January 2024   |
| Duration            | 33 months  |

| Deliverable Information      |   |
|------------------------------|---|
| Deliverable no               | 2.4.1.  |
| Deliverable title            | Report on identification and assessment of the main coastal tourism related issues concerning climate change mitigation and adaptation of each regional territory |
| Contractual date of delivery | 31.12.2024.   |
| Actual date of delivery      |   |
| Type of deliverable          | External  |
| Nature of deliverable        | Report  |
| Work Package                 | WP2   |
| Activities                   | 2.4.  |
| Partner responsible          | IFT   |



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#### Acknowledgements:

*We would like to thank the project collaborators who were members of the Regional Coordination Unit (RCU): Ms. Marta Hordov, head of Tourism Department, Zadar County; Mr. Zvonimir Dorkin, head of Administrative Department for Physical Planning, Environmental Protection and Municipal Affairs, Zadar County; Ms. Ina Sikirić Ivčić, Tourist Board of Zadar County; Nives Rogoznica, Public Institution NATURA Jadera; prof. Božena Krce Miočić, associate professor Tomislav Klarin, prof. Robert Lončarić, assistant professor Gabrijela Vidić from University of Zadar, including the employees of the Pakoštane Tourist Board and residents who voluntarily participated in the climate risk assessment.*



## Project Overview

The Mediterranean region is one of the most vulnerable hotspots in the current biodiversity and climate crises, warming 20% faster than the global average and being the second biodiversity hotspot in the world. The increase of severe climate events is also likely to influence the choice of destinations and time to travel for its over 510 million inhabitants. The effects of climate change will put additional pressure on already strained ecosystems and vulnerable economies and societies, with Tourism being one of the most affected economic sectors.

The recent Transition Pathway for Tourism and the Glasgow Declaration are building a global momentum for Climate Action in Tourism, but policymakers and destinations need support to better develop efficient climate mitigation and adaptation policies using ecosystem-based approaches and improved multi-level governance structures, including robust planning and ensure the long-term engagement of the private sector and citizens. Indeed, ecosystem-based management is considered a good practice to effectively deal with these threats as it considers the different stakeholders and factors affecting ecosystems and the mechanisms involved, in order to find solutions.

**NaTour4CChange** builds on and capitalizes on successful experiences at the Mediterranean and global level to test solutions for increasing the resilience of coastal destinations in the Mediterranean. The project will aim to set common methods to allow participating regions to assess their tourism-related climate adaptation and mitigation priorities, and take climate action via plans and strategies, supported by cooperative governance.

In coastal destinations, cross-sector teams will deliver specific tourism climate Action Plans, focusing on climate adaptation, where Nature-based Solutions (NbS) will be tested to ensure their feasibility. At the same time, innovative destination marketing and communication approaches will engage private stakeholders, visitors, and residents in climate action.

The project will also ensure cross-fertilization among participating regions and destinations, to achieve common methods and to compare the different tested plans and solutions, leading to lessons, best practices, and policy.



## Glossary

**The Intergovernmental Panel on Climate Change (IPCC)** is a body of the United Nations responsible for assessing science related to climate change. The IPCC was created to provide policymakers with regular scientific assessments of climate change, its implications, and potential future risks, as well as to suggest options for adaptation and mitigation.

**Climate Change Adaptation (CCA)** refers to predicting the adverse effects of climate change and taking appropriate actions to prevent or reduce the damage they may cause or to exploit opportunities that may arise.

**Ecosystem-based Approaches (EbA)** focus on managing biodiversity and ecosystems in a holistic way to maintain and enhance the benefits and functions of ecosystem services.

**Climate Risk Assessment (CRA)** is a structured analysis of climate variables (or hazards) and their impacts in the present and future climate, providing information for decision-making.

**Representative Concentration Pathways (RCPs)** are climate change scenarios up to 2100 for projecting future greenhouse gas concentrations (not emissions). They describe future concentrations of greenhouse gases and have been officially adopted by the IPCC.

**Nature-Based Solutions (NbS)** encompass all actions that rely on ecosystems and the services they provide to address various societal challenges, such as climate change, food security, resource management, or disaster risk.

**Climate Change Mitigation (CCM)** refers to reducing the impacts of climate change by decreasing the emission of greenhouse gases (GHGs) into the atmosphere or enhancing the storage of these gases.

**Ecosystem Services (ES)** are the benefits that ecosystems provide to society, improving health, the economy, and quality of life for humans.

**Shared Socioeconomic Pathways (SSPs)** are climate change scenarios based on predicting global socioeconomic changes up to 2100, as defined in the IPCC's Sixth Assessment Report (AR6). They are used to derive greenhouse gas emission scenarios with different climate policies and provide narratives that qualitatively describe alternative socioeconomic developments (including future changes in demographics, human development, economy, lifestyle, policies and institutions, technology, and the environment and natural resources).

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## 1. INTRODUCTION

The European Commission's Transition Pathway for Tourism<sup>1</sup> and the Glasgow Declaration (UN Tourism)<sup>2</sup> are currently driving climate action in tourism, while national authorities are complementing these efforts by adopting legal frameworks. In Croatia, the **Tourism Act** (NN 156/23<sup>3</sup>) has been enacted, aligning with the Climate Change Adaptation Strategy of the Republic of Croatia and the Low-Carbon Development Strategy of the Republic of Croatia (NN 63/21)<sup>4</sup>. This Act represents concrete support for destinations and tourism stakeholders, focusing on the development and implementation of effective climate change adaptation and mitigation monitoring and relevant measures.

The relationship between tourism and climate change has been incorporated into the Sustainable Tourism Development Strategy and the National Action Plan until 2027 (Ministry of Tourism and Sport<sup>5</sup>). The Tourism Act defines elements necessary for sustainability and enhancing climate resilience of destinations. Additionally, public bodies dealing with environmental protection<sup>6</sup> support, encourage and co-finance the implementation of nature-based solutions to decarbonize and to adapt destinations to climate change.

This document entitled "Identification and assessment of key issues related to coastal tourism in relation to climate change mitigation and adaptation" is an analytical document developed for the purpose of drafting the Regional Strategy for Climate Change Mitigation and Adaptation in Coastal Tourism of Zadar County.

### 1.1. Structure and Content of the Document

This document consists of two parts. The first part presents an **Analysis** of the State of Climate Change Mitigation and Adaptation in Tourism in Zadar County with a Climate Risk Assessment (CRA). The second part of the document focuses on strategic and operational measures for enhancing **climate resilience** of Zadar County as a coastal Mediterranean tourist destination. The final goal is to develop the **Strategy** for Climate Change Adaptation with Climate Resilience **Action Plan for Zadar County**.

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<sup>1</sup> [https://mint.gov.hr/UserDocsImages/2022\\_dokumenti/Transition\\_Pathway\\_For\\_Tourism\\_2\\_22.pdf](https://mint.gov.hr/UserDocsImages/2022_dokumenti/Transition_Pathway_For_Tourism_2_22.pdf)

<sup>2</sup> <https://www.unwto.org/the-glasgow-declaration-on-climate-action-in-tourism>

<sup>3</sup> [https://narodne-novine.nn.hr/clanci/sluzbeni/2023\\_12\\_156\\_2382.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2023_12_156_2382.html)

<sup>4</sup> [https://narodne-novine.nn.hr/clanci/sluzbeni/full/2021\\_06\\_63\\_1205.html](https://narodne-novine.nn.hr/clanci/sluzbeni/full/2021_06_63_1205.html)

<sup>5</sup> Ministry of tourism and sport - MINTS:

[https://mint.gov.hr/UserDocsImages/2023\\_dokumenti/Nacionalni%20plan%20razvoja%20odr%C5%BEivog%20turizma%20do%202027.%20godine%20i%20Akcijski%20plan%20do%202025.%20godine.pdf](https://mint.gov.hr/UserDocsImages/2023_dokumenti/Nacionalni%20plan%20razvoja%20odr%C5%BEivog%20turizma%20do%202027.%20godine%20i%20Akcijski%20plan%20do%202025.%20godine.pdf)

<sup>6</sup> The system includes the Ministry of Environmental Protection and Green Transition (MZOJT) as well as public institutions (JU), such as JU Natura Jadera, which manages the protected natural areas of Zadar County.

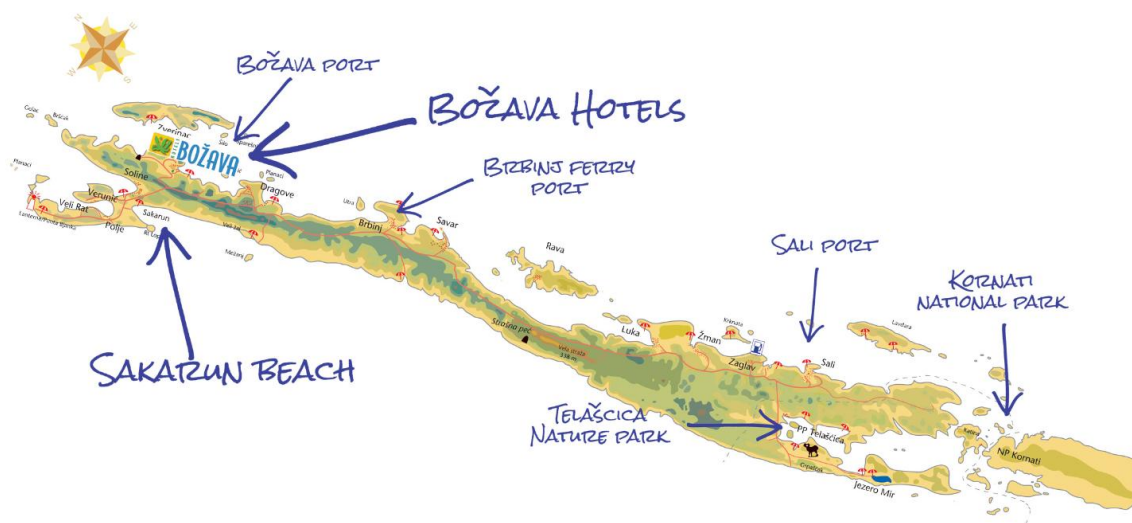


The development of this document is based on strategic planning procedures, EU and Croatian legislation, as well as collaboration with stakeholders and local community of Zadar County. The analyses and assessment are conducted through participatory approaches and expert analysis. They follow the methodological guidelines of the **Intergovernmental Panel on Climate Change** (IPCC<sup>7</sup>), the knowledge base of the **Euro-MED Interreg project NaTour4CChange**, and relevant literature and data bases.

## 1.2. Purpose and Expected Outcomes of the Document

The purpose of this document is to provide coastal Mediterranean destinations with a knowledge base and examples of best practices for combating climate change and to preserve natural areas, especially ones that are under touristic pressures.

Specifically, the selected pilot site of Zadar County is the Sakarun Beach located on the Island of Dugi Otok (Figure 1.). According to national protection framework this beach is declared as a protected landscape and it is also Natura 2000 site (POVS HR3000069). It is managed by 'Public institution for nature protection Natura Jadra'. Within the framework of this project NbS will be implemented on this pilot site to enhance the climatic, environmental, economic, and social sustainability of tourism.



**Figure 1.** The touristic pressure on Sakarun Beach (Source: Natura Jadra)

This concept of the NbS<sup>8</sup> is applied by the International Union for Conservation of Nature (IUCN)<sup>9</sup> and other organizations, such as the European Commission<sup>10</sup>.

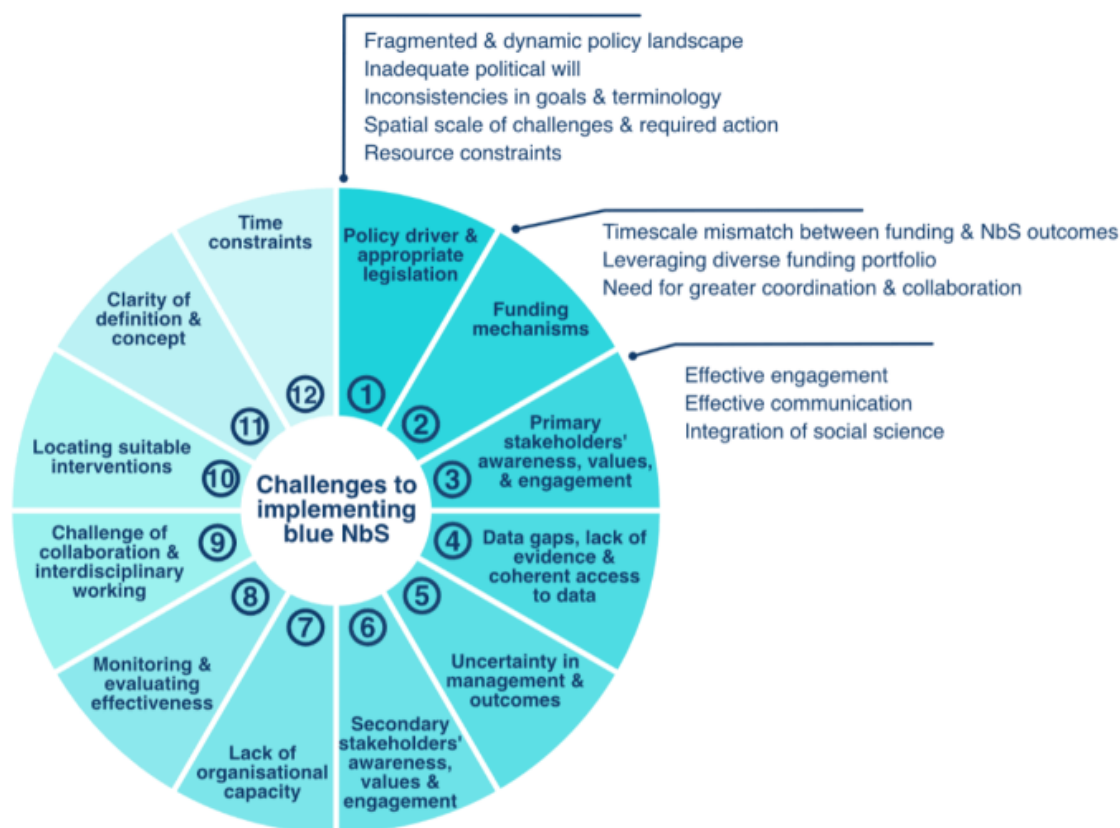
<sup>7</sup> The Intergovernmental Panel on Climate Change; <https://www.ipcc.ch/>

<sup>8</sup> Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. Gland, Switzerland: IUCN. xiii + 97pp. DOI: <http://dx.doi.org/10.2305/IUCN.CH.2016.13.en>

<sup>9</sup> The International Union for Conservation of Nature; <https://iucn.org/>

<sup>10</sup> [https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions\\_en](https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en)

The key role of NbS in climate change mitigation and adaptation is enhancing societal and economic sector resilience by ensuring long-term protection of public health, people, and property, as well as environmental protection and biodiversity enhancement. The challenges and concepts that can be applied (and are discussed in this document) are illustrated in Figure 2.



**Figure 2.** Challenges and applicable Nature-based Solutions concepts (Source: <https://macobios.eu/>)

Zadar County already has a number of practice examples, which will be further improved through this project<sup>11</sup>. The expected outcome is a synergistic enhancement of tourism sustainability, integrating the broader concepts of climate resilience and climate neutrality of the destination.

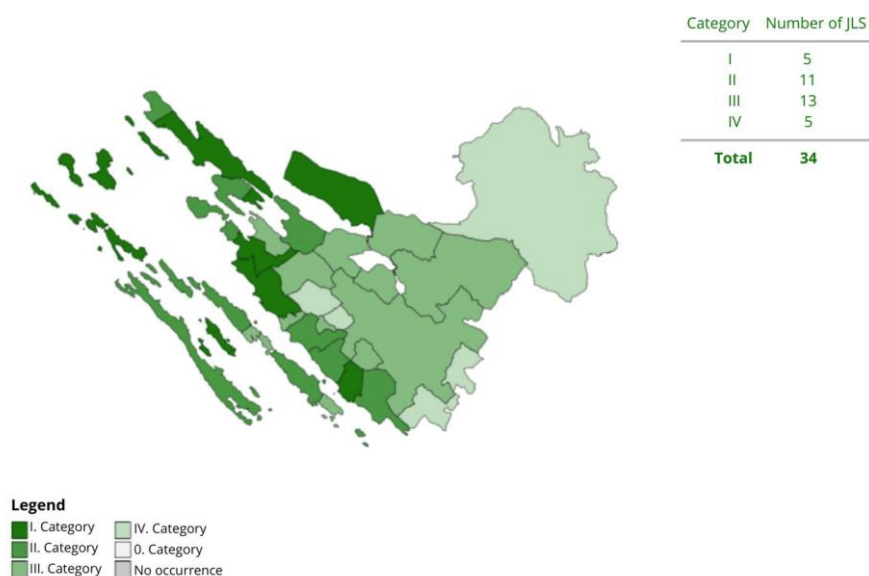
## 2. ANALYSIS OF THE CURRENT STATE AND CLIMATE RISK ASSESSMENT

### 2.1. Destination Characteristics

**The territorial organization** of Zadar County consists of 34 local self-government units, including 28 municipalities and 6 cities (Zadar, Benkovac,

<sup>11</sup> <https://www.grad-zadar.hr/repos/doc/Nacrt%20Strategije%20primjene%20prirodnih%20rjesenja%20u%20prilagodbi%20na%20klimatske%20promjene%20za%20Grad%20Zadar.pdf>

Biograd na Moru, Obrovac, Pag, and Nin). The county covers a total area of 7,276.23 km<sup>2</sup>, accounting for 8.3% of Croatia's total area (making it the fifth largest county in the country). It plays a key role in connecting northern and southern Croatia, both via road and rail transport. The road network includes state roads and the A1 highway (the so-called Dalmatina), while Zadar Airport provides connections to international destinations. The county's economy is based on trade, manufacturing, tourism, maritime transport, construction, fisheries, and agriculture. According to the Tourism Development Index<sup>12</sup>, most municipalities in Zadar County fall into Category II (16 municipalities), followed by Category III (11 municipalities), Category IV (2 municipalities), and Category I (1 municipality – Starigrad) and 4 cities (Nin, Biograd, Zadar, and Pag).



**Figure 3.** Tourism Development Index in Zadar County (Source: IZT, Zagreb)

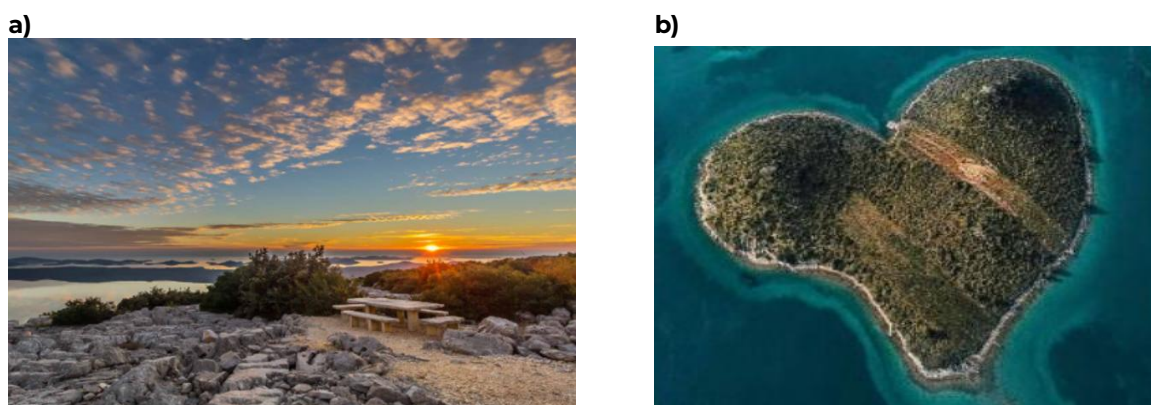
Zadar County is **geographically located** in the central part of the Croatian Adriatic coast. However, most of its territory is within Southern Croatia (Dalmatia), with a smaller portion extending into the Mountainous Croatia region. The county is surrounded by the Dinaric Mountain range and the North Dalmatian plateau. The Ravni Kotari region, a plateau, hosts a significant portion of the county's arable land, making it suitable for agricultural production. The county is rich in water resources, with reserves from the Zrmanja River, Lake Vrana, and smaller watercourses. According to the Spatial Plan<sup>13</sup> almost three-quarters (70%) of Zadar County's area is continental, while the remaining 30% are islands and coastal regions. The island region of Zadar County includes the following island groups: Kornati archipelago, Žut-Sit Island group, Murter island group and Cres-Lošinj Island group. Zadar County has the longest coastline in Croatia, with a total of approximately 1,300 km of seashore, which represents a significant comparative advantage in tourism.

<sup>12</sup> <https://www.iztg.hr/hr/itr/>

<sup>13</sup> Prostorni plan Zadarske županije, Izmjene i dopune, Zadarska županija, Zadar, 2015.

**The climate subtypes** of moderately warm rainy climate<sup>14</sup> are present in most of Zadar County. In the coastal area of the county, summers are mostly dry and hot, while winter periods are generally mild and rainy, which are characteristics of the Mediterranean climate. The characteristic of the sub-Mediterranean climate zone is harsher winters in the areas of Bukovica and Ravni Kotari, as well as somewhat higher precipitation in the summer months compared to the coastal areas and islands. In higher mountainous areas, the prevailing climate is snow-forest, characterized by cold and snowy winters, and pleasant summers with cool nights. Temperature extremes increase as one moves away from the coast, primarily due to the weakening of the sea's influence and the simultaneous strengthening of continental characteristics. The general air circulation is marked by strong windiness. The typical winds in the county are the bora (*bura*), which is particularly strong in the area of Pag Island and the Velebit Channel, as well as the *jugo*<sup>15</sup> (the southeast wind) and *maestra*<sup>16</sup>. The bora is the most prominent, leaving significant traces on vegetation, agricultural land, landscapes, and affecting the location of settlements and ports, as well as the type and position of buildings.

**In the field of nature protection**, the management structure is divided. National Parks and Nature Parks are managed by public institutions established by the Croatian Government. Thus, in Zadar County, there are the public institutions that manages the National Park Paklenica, the Nature Park Telašćica, and the Nature Park Vransko Jezero. Other forms of protected areas in Zadar County are managed by the Public institution for nature protection Natura Jadra established by Zadar County. This institution manages 13 protected natural areas of Zadar County, including areas of the European ecological network Natura 2000 (except areas within the boundaries of National Park Paklenica, Nature Park Telašćica, Vransko Jezero, and Velebit).



**Figure 4 a).** Nature Park Vransko lake and **b)** Galešnjak island<sup>17</sup> (Source: Zadar County Tourist Board)

<sup>14</sup> [https://meteo.hr/klima.php?section=klima\\_hrvatska&param=k1](https://meteo.hr/klima.php?section=klima_hrvatska&param=k1)

<sup>15</sup> a humid and warmer wind accompanied by large waves along the coastal area, carrying clouds and rain






<sup>16</sup> moderate humid summer wind

<sup>17</sup> <https://www.zadar.hr/hr>

Zadar County has a **key geopolitical location** in connecting the continental and coastal areas of Croatia, thanks to the A1 highway (Zagreb - Zadar - Split - Dubrovnik), which is also part of the future Adriatic-Ionian European transport route. Through modern highway connections, the county is conveniently positioned on an important transport route: Baltic - Pannonian Basin - Zadar - Ancona - Central and Southern Italy.

**The population** is mostly located in the coastal areas of the county (143,063 inhabitants). The Zadar County has 159,766 inhabitants.

**The economy** of the county relies on the following economic sectors: tourism, agriculture, and fishing, as well as maritime traffic (so-called blue economy sectors). Since data for Zadar County is not available, Figure 5. shows recent data collected for 7 Croatian counties, including Zadar County. Data and information for individual coastal Croatian counties are not available.

| Maritime Sectors in Croatia  |  |
|--|--|
| Maritime Tourism   | Maritime Transport   |
| <ul style="list-style-type: none"> <li>19.5% of GDP in 2022.</li> <li>€9,121.8 million of revenue in 2022, but in a slight decline.</li> </ul>   | <ul style="list-style-type: none"> <li>Ferry services are high growth due to link with tourism.</li> <li>Geographical position in the Adriatic Sea provides high economic potential for shipping.</li> </ul>                                     |
| Shipbuilding   | Oil and Gas  |
| <ul style="list-style-type: none"> <li>In decline, but key national sector.</li> <li>Includes new ships, repair, conversion, and offshore construction.</li> <li>Uncertain future due to financial severe financial distress.</li> </ul>                                  | <ul style="list-style-type: none"> <li>Occurs in the Northern Adriatic.</li> <li>20 operative gas platforms, and 230km of gas pipeline at sea bottom.</li> <li>Future plans: New LNG terminal and 28 hydrocarbon exploration areas.</li> </ul>  |
| Fisheries and Aquaculture  |  |
| <ul style="list-style-type: none"> <li>Estimated employment of 20.000 widespread across Croatia.</li> <li>Direct production and related services exceed 1% of GDP.</li> <li>Share of fishery production in aquaculture only 20%, but high growth potential.</li> </ul>  |  |

**Figure 5.** Maritime sectors in Croatian Adriatic Counties, 2023. (Source: World Bank, 2024<sup>18</sup>)

<sup>18</sup> Charting Croatia's the Blue Economy Pathways; [Open Knowledge Repository](#)





**Tourist traffic** primarily takes place in the coastal area and on the islands of Zadar County. In recent years, Zadar County has demonstrated a consistent upward trend in tourism. In 2021, the county recorded 12.7 million overnight stays. This number rose to 14.9 million in 2022, positioning Zadar County fourth among Croatian counties in terms of overnight stays. The growth continued in 2023 with 15.2 million overnight stays. By 2024, the county achieved **15.4 million overnight stays**. Notably, in May 2024, the city of Zadar experienced a 24% increase in overnight tourist stays compared to the same period in the previous year (Source: CBS). Additionally, in 2023, Zadar County's **nautical ports** reported a 15.6% increase in total income compared to 2022. These statistics underscore Zadar County's growing appeal as a tourist destination in Croatia.

The average length of stay for tourists in Zadar County is **6.1 days**. According to the data from the Zadar County Tourist Board, in 2022 there were **149,299 commercial beds** in the county (an increase of 58% compared to 2011). More than half of the commercial tourist traffic is generated in private accommodation, followed by camps with about 20% share. Hotels and nautical tourism, as types of accommodation that attract visitors with higher purchasing power, account for about one-fifth of the total revenue. Tourist traffic also takes place in non-commercial accommodation facilities<sup>19</sup>, where 4.2 million tourists stayed in Zadar County in 2024. This represents 38.8% of the total overnight stays in Croatia (the highest proportion compared to the rest of Croatia). Considering the data and trends, it can be concluded that in most coastal local government units of Zadar County, repositioning the **'sun and sea'** product towards higher quality is challenging. It is precisely this type of tourist activity that is most attractive to the largest number of visitors.

The main reason for traveling is **leisure** (95.8%), while the primary motive for visiting Zadar County is the sea (95.1% of respondents), followed by **nature** (53.3%) and **manifestations** (23%), such as concerts, marathons, parties etc.

Most visitors arrive by car (79.1%), 17.3% travel by car by car with a camper, and 15.5% arrive by plane. As many visitors to the County **arrive by road**, that indicates a future problem for introducing more environmentally friendly modes of transport. For example, electric vehicles (or boats) need additional energy supported by e-infrastructure and services.

The estimated daily water consumption in summer peak season exceeds **120 million liters per day**, and the needs increase by 30-40 million liters due to nautical tourism (at full capacity).

Nautical traffic is constantly growing, so monitoring the **behavior of boaters and tourists** on vessels represents a significant challenge. The state of the drainage system, combined with the **intensity of construction** and the continuous increase in the number of tourists, represents the greatest risk to

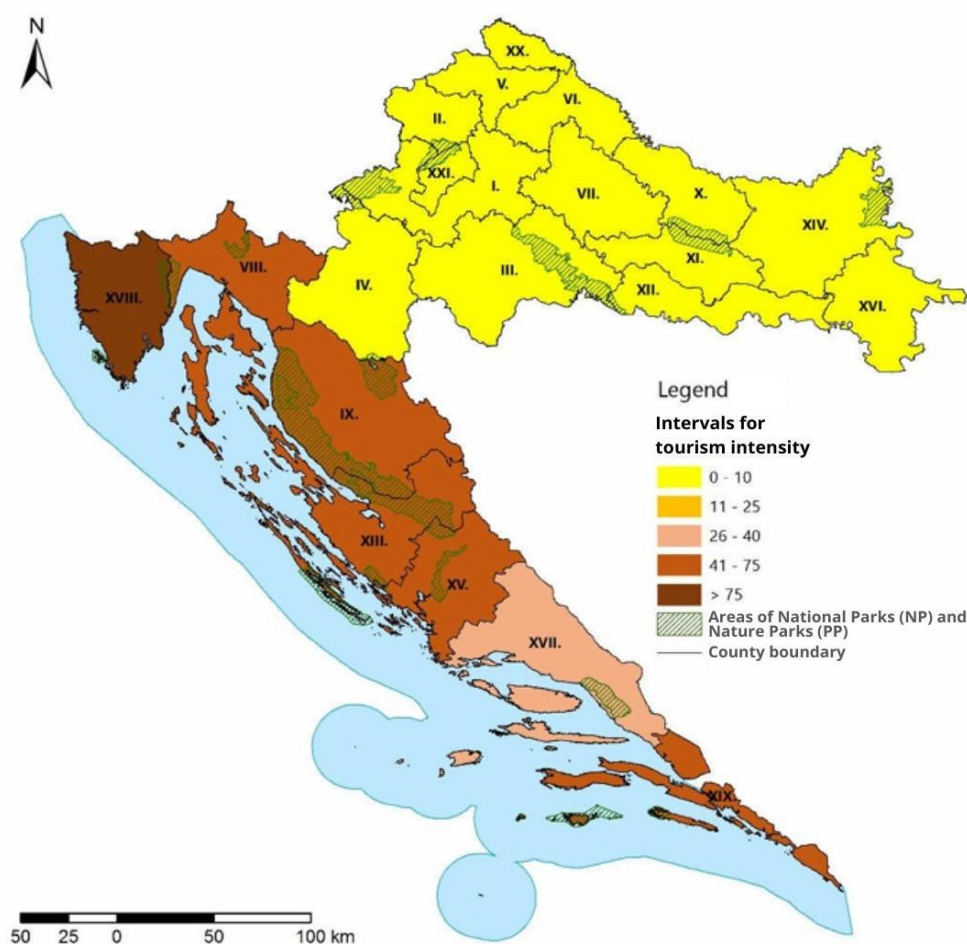
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<sup>19</sup> The stay of owners, their family members, other relatives, and friends in holiday homes and apartments, as well as the stay of tourists in other accommodations where lodging services are not charged, such as with residents of a tourist city/municipality

the existing model of tourism development in the county. The **waste** management system is burdened during the summer tourist season, but improvements are continuous and satisfactory.

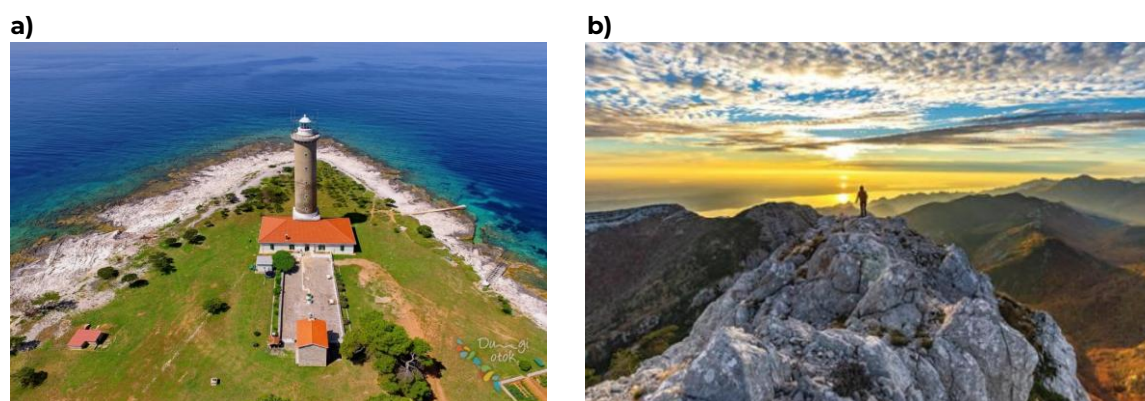
During the peak tourist season in 2022, the county had **316,655 daily beach users** (an average of 4.3 m<sup>2</sup> per bather). The National Park Paklenica was visited by 129,532 visitors in 2023.

An overview of the burden that tourists pose on all the resources and systems of Zadar County can be considered through the **tourist intensity** expressed either per km<sup>2</sup> or per capita. In any case, the tourist intensity calculated per capita of Zadar County (marked with XIV) provides a more precise insight into the pressures that tourism brings to a specific area in the short time of the summer tourist season (Figure 6.).



**Figure 6.** Tourism intensity in Croatia (expressed per county resident) in 2016 (Source: Ministry of Environmental Protection and Green Transition of Republic of Croatia)

Guests are extremely satisfied with their overall stay at the destination, with as many as **95.2% expressing satisfaction**.



**Figure 7a)** Lighthouse on Dugi Otok and **b)** view from Paklenica National Park (Source: website Dugi otok<sup>20</sup>, and Zadar County Tourist Board)

According to the TOMAS 2023 survey<sup>21</sup> conducted during 2022 and 2023 on a sample of 800 respondents, the key characteristics of visitors are as follows: 53% of tourists travel with family, 25% with a partner, 21% with friends, and 1% travel alone.

## 2.2. Mitigation of Climate Change in Zadar County

### 2.2.1. Greenhouse Gas Emissions

According to the National Greenhouse Gas Inventory of the Republic of Croatia (2023)<sup>22</sup>, CO<sub>2eq</sub> emissions (excluding removals from the Land Use, Land-Use Change, and Forestry - LULUCF<sup>23</sup>) amounted to **17,410.6 ktCO<sub>2eq</sub>** for Croatia in 2021 (compared to 19,660.0 ktCO<sub>2eq</sub> in 2000). According to EUROSTAT data<sup>24</sup>, the Accommodation and Food Service Activities sector, as well as Travel Agencies, Tour Operators, and Other Reservation Services, emitted **8.4 ktCO<sub>2eq</sub>** in 2022.

Emission data for the NUTS 2 and NUTS 3 statistical regions are currently unavailable, except for isolated studies and sporadic monitoring of emissions in specific sectors. According to the Development Plan of Zadar County until 2027<sup>25</sup>, a key regional development challenge is the high level of greenhouse gas emissions (CO<sub>2eq</sub>). Emissions mainly originate from **transportation**, particularly during the summer months when energy consumption for cooling increases. It is notable that diesel-powered vehicles (50.1%) and gasoline-powered vehicles (47.8%) predominantly operate within the Zadar County.

<sup>20</sup> <https://www.dugiotok.hr/en>

<sup>21</sup> <https://www.itzg.hr/en/main-projects/tomas-surveys/>

<sup>22</sup> file:///C:/Users/M/AppData/Local/Temp/9772bb76-90a1-4471-ad8b-17ea206ed4a7\_hrv-2023-nir-13apr23.zip.4a7/Croatian%20NIR%202023.pdf

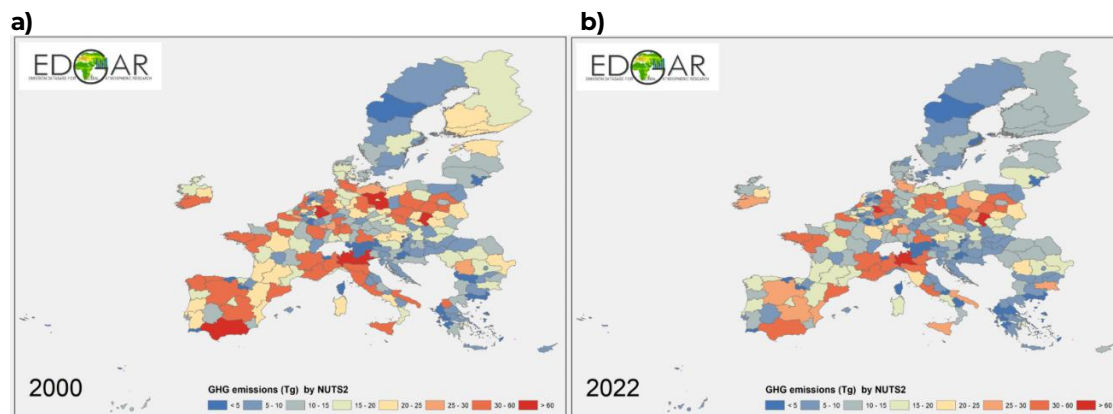
<sup>23</sup> Land Use, Land-Use Change and Forestry

<sup>24</sup> Carbon dioxide emission footprints (FIGARO application) [env\_ac\_co2fp\_\_custom\_14792774], EUROSTAT

<sup>25</sup> [Dodatak 2. Osnovna analiza stanja.pdf](#)



For an approximate assessment of Zadar County's CO<sub>2eq</sub> (NUTS 3) the European Commission's EDGAR system<sup>26</sup> was used as a data source, which presents CO<sub>2eq</sub> emissions at the NUTS 2 level (Figure 8a and b). Emissions at NUTS 2 level have not significantly changed in the past 20 years, remaining around **5–10 Tg per year**<sup>27</sup>.



**Figure 8a and b.** Greenhouse gas emissions at the NUTS 2 level<sup>28</sup> (source: EC)

### 2.2.2. Climate Action 1: Decarbonization

National authorities have established a legal framework<sup>29</sup> and **the National Energy Efficiency Action Plan** with specific measures for decarbonization and climate change mitigation. These measures aim to reduce CO<sub>2eq</sub> emissions and are continuously implemented at the level of local (regional) self-government units, depending on the area's specific characteristics and the applicability of each measure.

In general, a list of mitigation measures with an indication of the timeframe and responsibilities, sources of financing and performance indicators is an integral part of the **Climate Change Mitigation, Climate Change Adaptation and Ozone Layer Protection Program**. Each regional unit (county), the capital city of Zagreb and a large city are required to develop and adopt this document<sup>30</sup>. Measures aimed at the decarbonization of Zadar County are presented in Table 1.

On the national level, an **Energy Management information System - ISGE**<sup>31</sup> has been established<sup>32</sup>.

<sup>26</sup> The Emissions Database for Global Atmospheric Research; <https://edgar.jrc.ec.europa.eu/>

<sup>27</sup> 1 Tg = 1 000 000 tones = 1 million tones.

<sup>28</sup> [https://edgar.jrc.ec.europa.eu/dataset\\_ghg70\\_nuts2](https://edgar.jrc.ec.europa.eu/dataset_ghg70_nuts2)

<sup>29</sup> Zakon o klimatskim promjenama i zaštiti ozonskog sloja (eng. *The Climate Change and Ozone Layer Protection Act*) (NN 127/19)

<sup>30</sup> <https://mingo.gov.hr/pristup-informacijama-4924/zakoni-i-propisi/zakoni-i-propisi-iz-djelokruga-uprave-za-klimatske-aktivnosti/propisi-iz-podrucja-zastite-zraka/7746>

<sup>31</sup> <https://www.isge.hr/login.xhtml>

<sup>32</sup> It is a software application for monitoring and analyzing energy and water consumption, serving as an essential tool for systematic energy management in the public sector.

**Table 1.** Climate change mitigation measures in Zadar County

| Sector                    | Measure   | Measure Description   | Performance Indicators and Implementation Period   |
|---------------------------|---|---|--|
| CROSS-SECTORAL MITIGATION | Promotion of Energy Efficiency for Citizens   | Designing and implementing public information and education programs on energy efficiency related to housing, vehicle use, and other segments.                    | Number of conducted programs, produced informational materials, and web publications; 2023-2026. |
| MITIGATION                | Promotional, Informational, and Educational Measures and Activities for Traffic Improvement and CO <sub>2</sub> Reduction | Designing and implementing public information and education programs on greenhouse gas emissions and their potential negative consequences.                       | Number of conducted programs, produced informational materials, and web publications; 2023-2026. |
| TRANSPORT                 | Establishment of Alternative Fuel Infrastructure System   | Construction of electric charging stations.   | Number of installed electric charging stations; 2023-2026.                                       |
| TRANSPORT                 | Procurement of Zero-Emission Vehicles Owned by the County   | Procurement of electric vehicles.   | Number of procured electric vehicles; 2023-2026.   |
| ENERGY EFFICIENCY         | Improvement of Systematic Energy Monitoring and Management in County Administration and Institutions/Companies Buildings  | Use of innovative information and communication technologies (ICT) to reduce GHG emissions.   | Developed application; 2023-2026.  |
| CONSTRUCTION              | Integrated Energy Renovation of County Administration and County Institutions/Companies Buildings                         | After establishing an energy monitoring and management system in County Administration and County Institutions/Companies buildings, an analysis will be conducted | Number of renovated buildings; 2023-2026.  |
| CONSTRUCTION              | Installation of Photovoltaic Systems on the Roofs of County Institutions/Companies Buildings                              | Installation of photovoltaic systems on County buildings that meet the criteria for using photovoltaic systems.   | Number of buildings with installed photovoltaic systems; 2023-2026.                              |

Based on the previously described measures, Zadar County, as well as the local self-government units within its area, are implementing a range of decarbonization activities.

The key document for decarbonization of Zadar County is the **Energy Efficiency Action Plan for Zadar County for the period 2024–2026**<sup>33</sup>. One of the main examples of good practice in decarbonization in Zadar County is the procurement of **25 new buses** for urban and suburban transport (2019), which meet the EURO VI standard and therefore have low CO<sub>2eq</sub> emissions. In addition to energy efficiency in transport, Zadar County plans to co-finance energy renovation measures for family homes and schools. It also organizes "Plug in and Save" events and carries out promotional and informational<sup>34</sup>.

**Example of good practice:** City of Zadar is an example of a local self-government unit that has developed an **Energy Efficiency Action Plan – SECAP**<sup>35</sup> as a signatory the Covenant of Mayors<sup>36</sup>. This Action Plan contains information on projects, such as: promotion of energy efficiency in buildings, savings in public lighting, installation of solar systems in schools, energy efficiency in urban transport, expansion of cycling infrastructure, awareness raising and education, etc.. Furthermore, this document provides an assessment of the current situation and needs regarding energy consumption and long-term goals, including the overall energy savings target, measures, and indicators for improving energy efficiency and sectoral decarbonization. It also specifies the project leaders and implementation deadlines, measures to improve energy efficiency in line with the **Energy Development Strategy**<sup>37</sup> and other strategic documents of the Government of the Republic of Croatia. There are, as well, methods of calculating energy savings in accordance with regulations<sup>38</sup> with the financing, monitoring, and reporting mechanisms. I

A notable advantage of Zadar County is its total **forested area**, which amounts to **222,022.41 ha** (194,963.28 ha are state-owned). To preserve this resource, which has ecological value in terms of reducing CO<sub>2</sub> emissions, the public institutions for nature protection, as well as Hrvatske Šume Ltd. (Croatian Forests), the State Administration for Protection and Rescue, and local and regional Civil Protection continuously implement measures for its preservation and protection.

<sup>33</sup> Public Announcement: <https://www.zadarska-zupanija.hr/novosti-arhiva/item/2228-donesen-akcijski-plan-energetske-ucinkovitosti-zadarske-zupanije#:~:text=Rije%C4%8D%20je%20o%20planskom%20dokumentu%20koji%20se%20donosi,pobolj%C5%A1anje%20energetske%20u%C4%8Dinkovitosti%20u%20jedinici%20podru%C4%8Dne%20%28regionalne%29%20samouprave.>

<sup>34</sup> [https://glasnik.zadarska-zupanija.hr/images/glasnici/2020/22/2/\\_PRILOG\\_Godi%C5%A1nji\\_plan\\_energetske\\_u%C4%8Dinkovitosti\\_Z%C5%BD\\_za\\_2020.\\_godinu.pdf](https://glasnik.zadarska-zupanija.hr/images/glasnici/2020/22/2/_PRILOG_Godi%C5%A1nji_plan_energetske_u%C4%8Dinkovitosti_Z%C5%BD_za_2020._godinu.pdf)

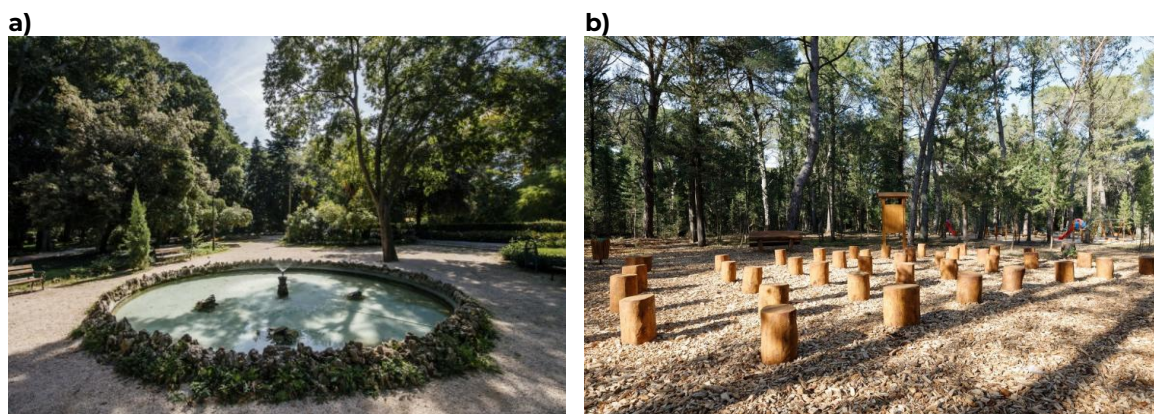
<sup>35</sup> <https://krsevan.grad-zadar.hr/GradskoVijece/SAZIV%2021%20-%2025/GV%2016%20-%2022.12.22/26%20-%20Akcijski%20plan.pdf>

<sup>36</sup> <https://www.grad-zadar.hr/dokumenti-1051/>

<sup>37</sup> In addition to energy efficiency in transport, Zadar County plans to co-finance energy renovation measures for family homes and schools. It also organizes "Plug in and Save" events and carries out promotional and information activities.

<sup>38</sup> [https://narodne-novine.nn.hr/clanci/sluzbeni/full/2021\\_09\\_98\\_1772.html](https://narodne-novine.nn.hr/clanci/sluzbeni/full/2021_09_98_1772.html); NN 28/20, 30/22, 96/23

**Example of good practice:** An example of good practice in the LULUCF sector (which manages green areas) is the adoption of the Strategy for the Implementation of Natural Solutions for Climate Change Adaptation by the Governing Body of the City of Zadar (NBSS)<sup>39</sup>. This document has climate adaptation measures that are successfully implemented, as well as measures that encourage emission reductions.



**Figure 9 a) and b).** Nature-based Solutions in Zadar County – City Park ‘Vladimir Nazor’ - monument of parc architecture and ‘Musapstan’ - forest park near City of Zadar (Source: Zadar Tourism Board)

Figure 9a shows the City Park ‘Vladimir Nazor’ which has been a monument of parc architecture since 1971. It was created by repurposing the fortress, Zadar’s first line of defense. Figure 8b depicts the children’s playground in ‘Musapstan’ near the City of Zadar in the ‘Musapstan Forest’. Besides their significant tourism and aesthetic value, these sites serve as examples of NbS applied both in climate change mitigation and adaptation.

### 2.2.3. Recommendations for Decarbonization in Zadar County

To gain a better insight into the overall direct energy consumption and the composition of energy sources, it is recommended that Zadar County initiate the development of a new **Energy balance and statistics** (the previous one was created for the year 2012). This is particularly important due to new circumstances and changes in the structure and volume of energy consumption in the Zadar County. Consequently, this serves as a tool for stronger and accelerated management of the decarbonization of all economic sectors in the region, including tourism.

It is recommended to continue **coordinated decarbonization activities** with the relevant ministries (tourism, construction, transport, agriculture, economy), the Environmental Protection and Energy Efficiency Fund (EPEEF) and local government units within the county. These stakeholders should systematically

<sup>39</sup> Natural Based Solutions Strategy : <https://www.grad-zadar.hr/repos/doc/Nacrt%20Strategije%20primjene%20prirodnih%20rjesenja%20u%20prilagodbi%20na%20klimatske%20promjene%20za%20Grad%20Zadar.pdf>



plan and implement energy efficiency measures across all sectors (households, transport, public administration) and integrate renewable energy sources (RES) and energy more efficient business practices. The goal is to reduce CO<sub>2eq</sub> emissions at the level of all local government units since some of them are highly tourism-dependent, and therefore energy-intensive. Besides, it is important to achieve both energy and financial savings. This kind of effort is aligned with the Paris Agreement and EU target - reducing emissions by 55% by 2030 compared to 1990 levels and achieving climate neutrality by 2050.

**Nature-based Solutions**, green and blue infrastructure in urban areas of Zadar County, as well as the **protection of forests and forest land** in rural parts, along with overall environmental protection and **sustainable land management** play a crucial role in increasing greenhouse gas absorption (carbon sinks). These measures are key to achieving the decarbonization goals of both the Republic of Croatia and Zadar County.

For comprehensive and evidence-based management, it is essential to establish a **data flow system** not only for energy consumption and the outcomes of energy efficiency and RES projects but also to track the carbon sink outcomes (sustainable forests and land management).

In this context, it is imperative that **Zadar County acts as a coordinator** of cooperation among all levels and types of governance structures, economic entities, local communities, civil society organizations with a particular emphasis on **tourism stakeholders** and the scientific community.

**Awareness and educational activities** for accelerated regional decarbonization have yielded positive results. However, it is recommended to **expand the scope of targeted groups**. Those actions include stakeholders from the **tourism industry** - owners of commercial accommodation and hospitality establishments, travel agencies, private renters, tourists, and day visitors, as well as designers, builders and managers of tourism infrastructure and services, along with other interested parties.



## 2.3. Adaptation to Climate Change in Zadar County

### 2.3.1. Adaptation Status Analysis

Given the fact that Zadar County encompasses various highly sensitive terrestrial and marine ecosystems where numerous tourism activities take place, it has been essential to take an integrated approach to assessing the impacts of climate change on the region's tourism offerings and natural assets.

This kind of action is particularly important for inland and coastal areas, as well as on islands, which are characterized by the natural phenomenon of karst. Karst represents a unique mechanism for protecting groundwater and underground fauna. Besides the pressures arising from economic activities (primarily tourism), climate change is placing an additional burden on all **terrestrial and marine ecosystems**, which are main tourist assets.



**Figure 10.** National Park Paklenica<sup>40</sup> (Source: TBZC)

The **National Disaster Risk Assessment of the Republic of Croatia** has established guidelines for identifying and evaluating disaster risks, including those caused by climate hazards. In line with this document, **Zadar County** adopted the **Risk Assessment of Major Disasters for Zadar County (2022)**, which identified the following region's key climate risks.

- Extreme temperatures
- Droughts
- Wildfires
- Floods
- Storms, hurricanes, and strong winds

The measures outlined in the Risk Assessment of Major Disasters for Zadar County (2022) are being implemented, thereby increasing the destination's resilience to climate change (Table 2.).

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<sup>40</sup> <https://www.zadar.hr/hr>

**Table 2.** Climate change adaptation measures in Zadar County.

| Sector                    | Measure Name   | Implementation |
|---------------------------|--|----------------|
| CROSS-SECTORAL ADAPTATION | Promotion, informative, and educational measures to raise awareness about climate change events in the local community   | 2023.-2026.    |
| CROSS-SECTORAL ADAPTATION | Preparation, promotion, and implementation of workshops for stakeholders in education  | 2023.-2026.    |
| SPATIAL PLANNING          | Analysis and preparation for the implementation of the coastal zone protection plan from the effects of the sea and water  | 2023.-2026.    |
| URBAN DEVELOPMENT         | Preparation for improving the concept of green infrastructure  | 2023.-2026.    |
| URBAN DEVELOPMENT         | Implementation of the green infrastructure concept   | 2023.-2026.    |
| URBAN DEVELOPMENT         | Landscape/horticultural arrangement of institutions founded by Zadar County  | 2023.-2026.    |
| WATER RESOURCES           | Investigation of groundwater quality for multi-purpose use depending on composition  | 2023.-2026.    |
| HEALTH                    | Strengthening resilience to the pressures of climate change  | 2023.-2026.    |
| HEALTH                    | Strengthening the monitoring system of allergenic species  | 2023.-2026.    |
| HEALTH                    | Upgrading the system for monitoring climate indicators   | 2023.-2026.    |
| BIODIVERSITY              | Raising awareness about ecosystems, habitats, wild species, protected areas, and ecological network areas, and the importance of preserving ecosystem services and their impact on all aspects of life and the economy | 2023.-2026.    |
| BIODIVERSITY              | Incorporating climate change adaptation measures into key management documents for protected areas and ecological network areas, including implementation indicators   | 2023.-2026.    |
| BIODIVERSITY              | Defining measures to reduce the spread and limit the populations of invasive alien species   | 2023.-2026.    |
| BIODIVERSITY              | Strengthening the capacity of relevant authorities for nature conservation   | 2023.-2026.    |
| AGRICULTURE               | Analysis of possibilities for building innovative irrigation systems   | 2023.-2026.    |
| AGRICULTURE               | Education of farmers for the construction of irrigation reservoirs   | 2023.-2026.    |
| AGRICULTURE               | Co-financing of irrigation equipment for family farms  | 2023.-2026.    |
| AGRICULTURE               | Education of farmers on growing species and varieties of agricultural crops and breeds of domestic animals that are more resistant to climate change   | 2023.-2026.    |
| AGRICULTURE               | Support for farmer education   | 2023.-2026.    |

### 2.3.2. Climate Action 2: Analysis of Climate Resilience and Development of Climate Risk Assessment

An analysis of publicly available data from secondary sources was conducted to review climate hazards and their impacts in Zadar County. Based on this analysis and the results of the Survey, the Climate Risk Assessment of Zadar County (hereinafter referred to as CRA) was developed. The analysis used IPCC scenarios. The results of the CRA are presented in Table 3.

Methodological explanations for the development of CRA are presented in **Annex 1. of the Regional Strategy for Mitigation and Adaptation to Climate Change in Coastal Tourism of Zadar County**. Climate adaptation (and resilience) measures and indicators is also developed in accordance to the Guidelines of the IPC community<sup>41</sup>.

#### 2.3.2.1. Introduction to Climate Risk Assessment

An analysis of publicly available data from secondary sources, such as the Croatian Meteorological and Hydrological Service (CMHS), Ministry of Environment and Green Transition (MEGT), Croatian Firefighters Association and others, was conducted to review climate variables and hazards to assess the level of climate risks that are poses as a threat to Zadar County.

Additionally, the Survey was also carried out using the Questionnaire presented in **Annex 2. Of the Regional Strategy for Mitigation and Adaptation to Climate Change in Coastal Tourism of Zadar County**. Based on the Analysis and primary data collected by the Survey, the **CRA for Zadar County** was developed.

The analysis used RCP<sup>42</sup> (4.5, 8.5) and consulted SSPS<sup>43</sup> scenarios. The results of the CRA are presented in **Chapter 2.3.3. (Table 3)**.

Methodological explanations for the development of CRA could be found in **Annex 1.** Of this document. Climate adaptation measures and indicators for monitoring its implementation are an integral part of the Action Plan for Adapting Coastal Tourism to Climate Change (chapter 3.).

<sup>41</sup> <https://www.ipcc.ch/report/ar6/wg2/>

<sup>42</sup> <https://worldoceanreview.com/en/wor-5/climate-change-threats-and-natural-hazards/climate-change-and-the-coasts/the-ipcc-scenarios/>

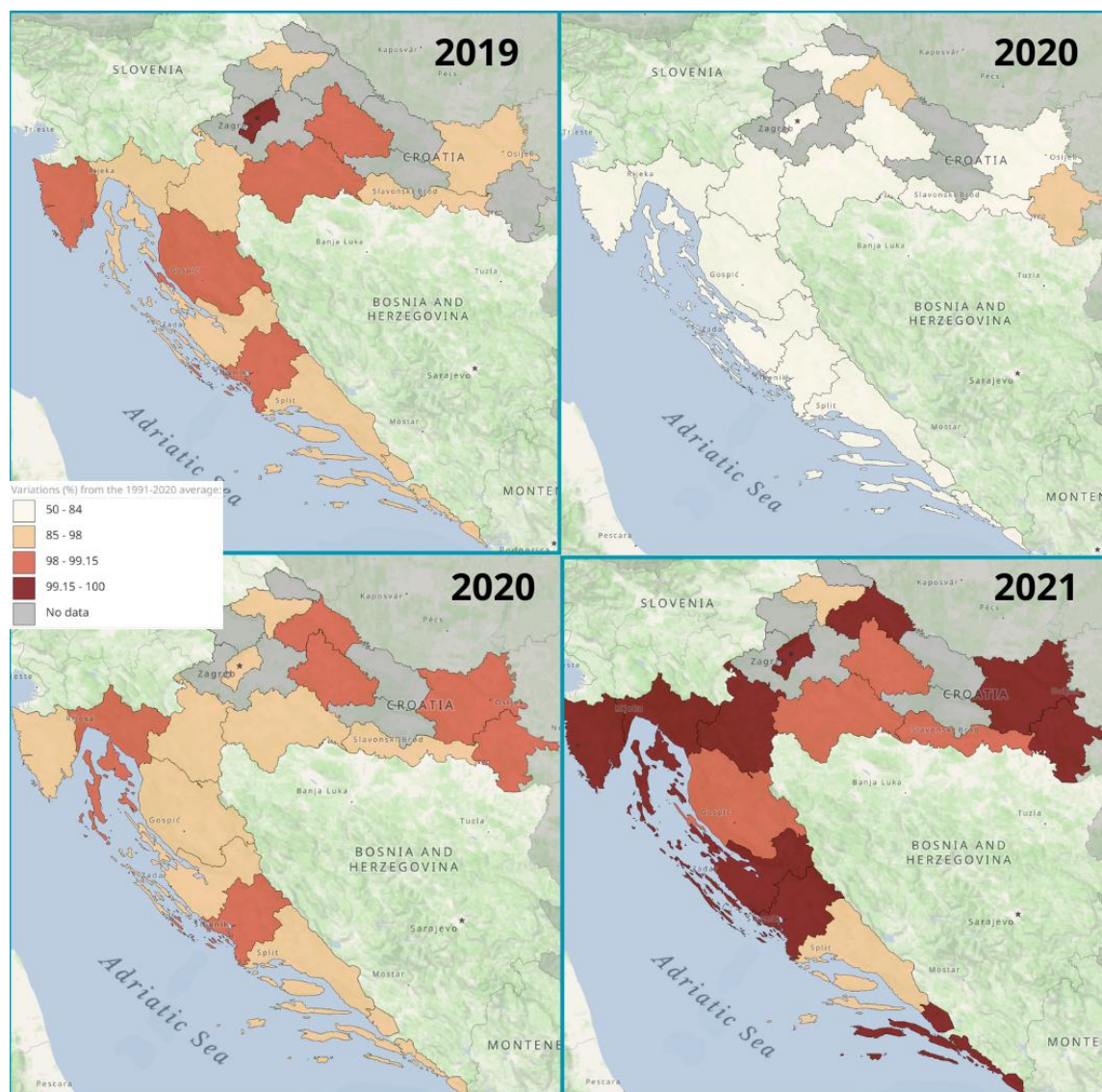
<sup>43</sup> <https://www.ipcc.ch/report/ar6/syr/figures/csb-2-figure-1>



### 2.3.2.2. Analysis of Climate Variables and Hazard

#### Extreme Temperatures

Extreme temperatures in Zadar County occur during the summer months (Figure 11). Besides adverse effects to infrastructure and the environment (high level of UV index, droughts), there is a significant impact on the health during the summer season, especially due to heatwaves. Extreme temperatures can be a trigger for the occurrence of fires, directly endangering human lives, the environment and property.



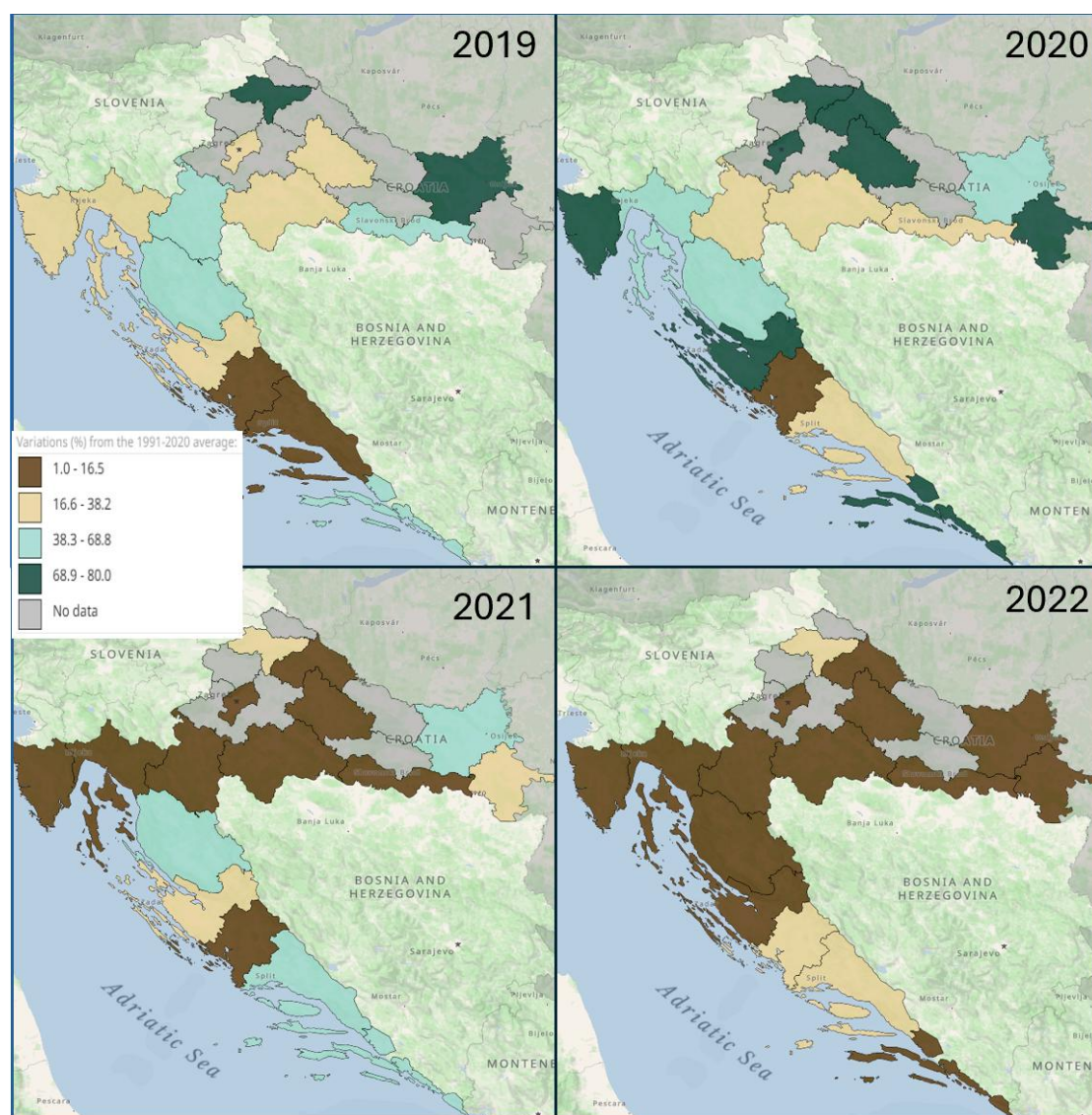
**Figure 11.** Deviations of the average air temperature for the summers 2019 to 2022 compared to the 1981–2010 average (map construction: Plan Bleu Observatory; data source: CHMS<sup>44</sup>).

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[https://meteo.hr/klima.php?section=klima\\_pracenje&param=ocjena&el=msg\\_ocjena&MjesecSezona=lj\\_eto&Godina=2022](https://meteo.hr/klima.php?section=klima_pracenje&param=ocjena&el=msg_ocjena&MjesecSezona=lj_eto&Godina=2022)

## Drought and Reduced Water Availability

The consequences of climate change are manifested in increasing deviations of annual precipitation (Figure 12). It induces frequent dry periods during the summer months, especially in the Ravni Kotari and coastal areas. The average number of dry days remains mostly unchanged, but the number of dry days is increasing on the islands. In Zadar County, there are approximately 263 days without precipitation annually. The highest number of dry days occurs in July and August (26 days per month), while in November the number of dry days is around 19 days). Extreme droughts during the summer months affect a large part of Zadar County. In 2008, 2012, and 2015, drought caused exceptionally large damage to agricultural crops.



**Figure 12.** Deviations of annual precipitation in Croatian Counties from 2019 to 2022 (maps construction: Plan Bleu Observatory<sup>45</sup>; data source: CMHS)<sup>46</sup>

<sup>45</sup> [https://app.mapx.org/?theme=color\\_light&project=MX-R2F-467-2PL-J9H-CCR&language=en](https://app.mapx.org/?theme=color_light&project=MX-R2F-467-2PL-J9H-CCR&language=en)

<sup>46</sup> [https://meteo.hr/klima.php?section=klima\\_pracenje&param=ocjena](https://meteo.hr/klima.php?section=klima_pracenje&param=ocjena)



## Fires

Due to long dry periods during the four hottest months, the geographic location, and the coverage of forests and other vegetation, Zadar County consistently has a significant fire risk potential. Most fires are classified as wildland fires (83.8%), followed by building fires (12.7%) and vehicle fires (3.5%). The meteorological forest fire danger index during the four hottest months shows a high and very high potential danger for June and September, and an extreme danger for July and August (Figure 10). The county is divided into 47 fire areas and 43 fire zones.

The connectivity of settlements, road accessibility, and the availability of forest and agricultural land in most parts of the county are adequate, allowing firefighters to respond quickly. The exceptions are the islands and the less accessible or inaccessible parts of Velebit, where the road infrastructure is insufficiently developed to ensure smooth passage for fire trucks (reliance on air forces – firefighting Canadairs, intervention units, and helicopters is necessary).

**Table 3.** Number of vegetation fires, burned areas (ha) and air force deployed by coastal counties of the Republic of Croatia in 2023<sup>47</sup> (source of data: CFA)

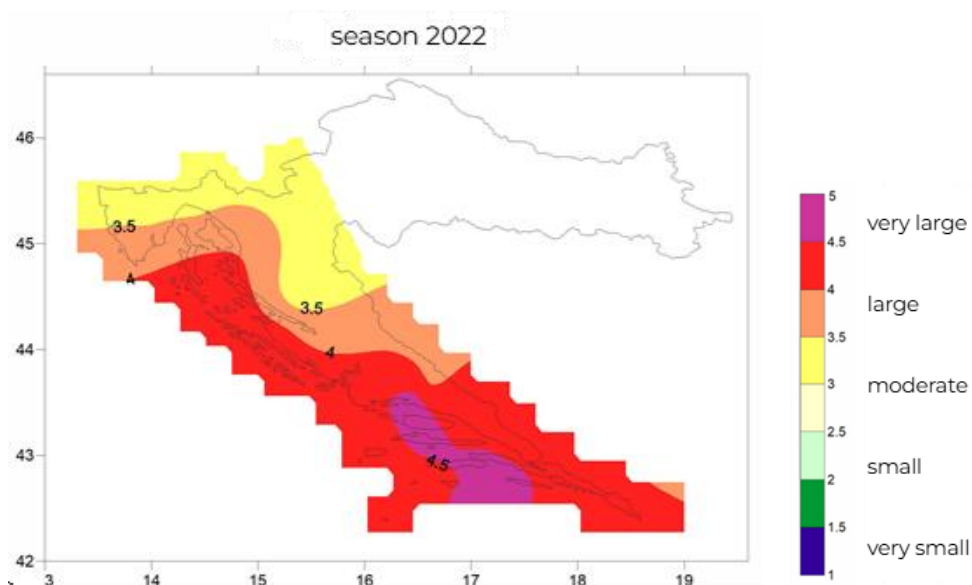
| COUNTY                 | NUMBER OF<br>VEGETATION<br>FIRES | AREA (ha) | AIR FORCES<br>cumulative total |
|------------------------|----------------------------------|-----------|--------------------------------|
| SPLITSKO-DALMATINSKA   | 716                              | 922       | 34                             |
| ZADARSKA               | 426                              | 507       | 14                             |
| ŠIBENSKO-KNINSKA       | 242                              | 1.253     | 34                             |
| ISTARSKA               | 210                              | 42        | 0                              |
| PRIMORSKO-GORANSKA     | 122                              | 36        | 0                              |
| DUBROVAČKO-NERETVANSKA | 118                              | 664       | 18                             |
| LIČKO-SENJSKA          | 117                              | 127       | 0                              |

Table 3 shows the number of fires in Zadar County, and Figure 13a and b average monthly hazard class for the occurrence and spread of vegetation fires, collected by Croatian Firefighters Association.

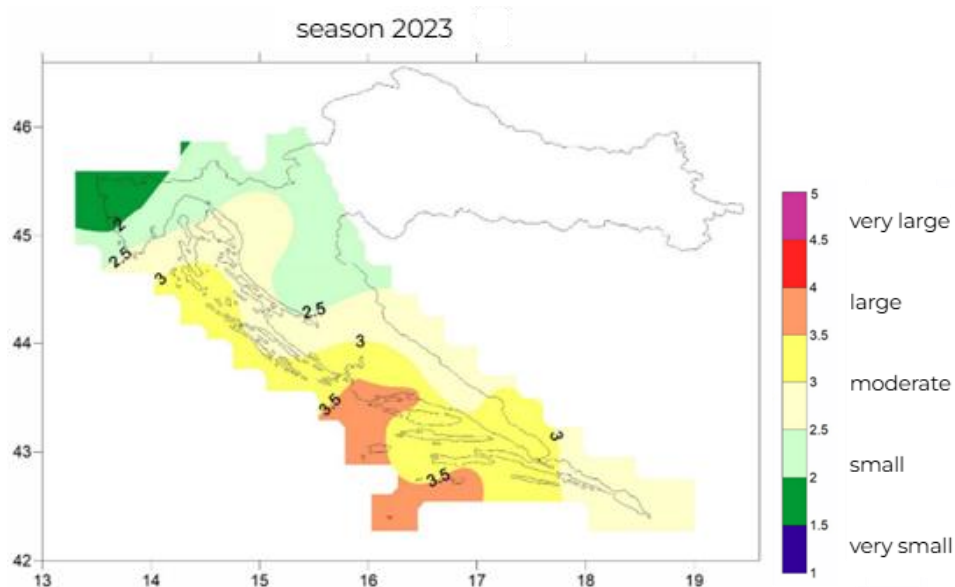
According to the same source, Figures 14 and 15 show the increase in the number of fires for the entire Croatia in the period from 2006 to 2017.

<sup>47</sup> Report on the implementation of the program of activities in the implementation of special fire protection measures for the Republic of Croatia 2023 (the latest report available at: <https://hvv.gov.hr/izdvojeno-11/program-aktivnosti-2025/izvjesca-programa-aktivnosti/2828>)

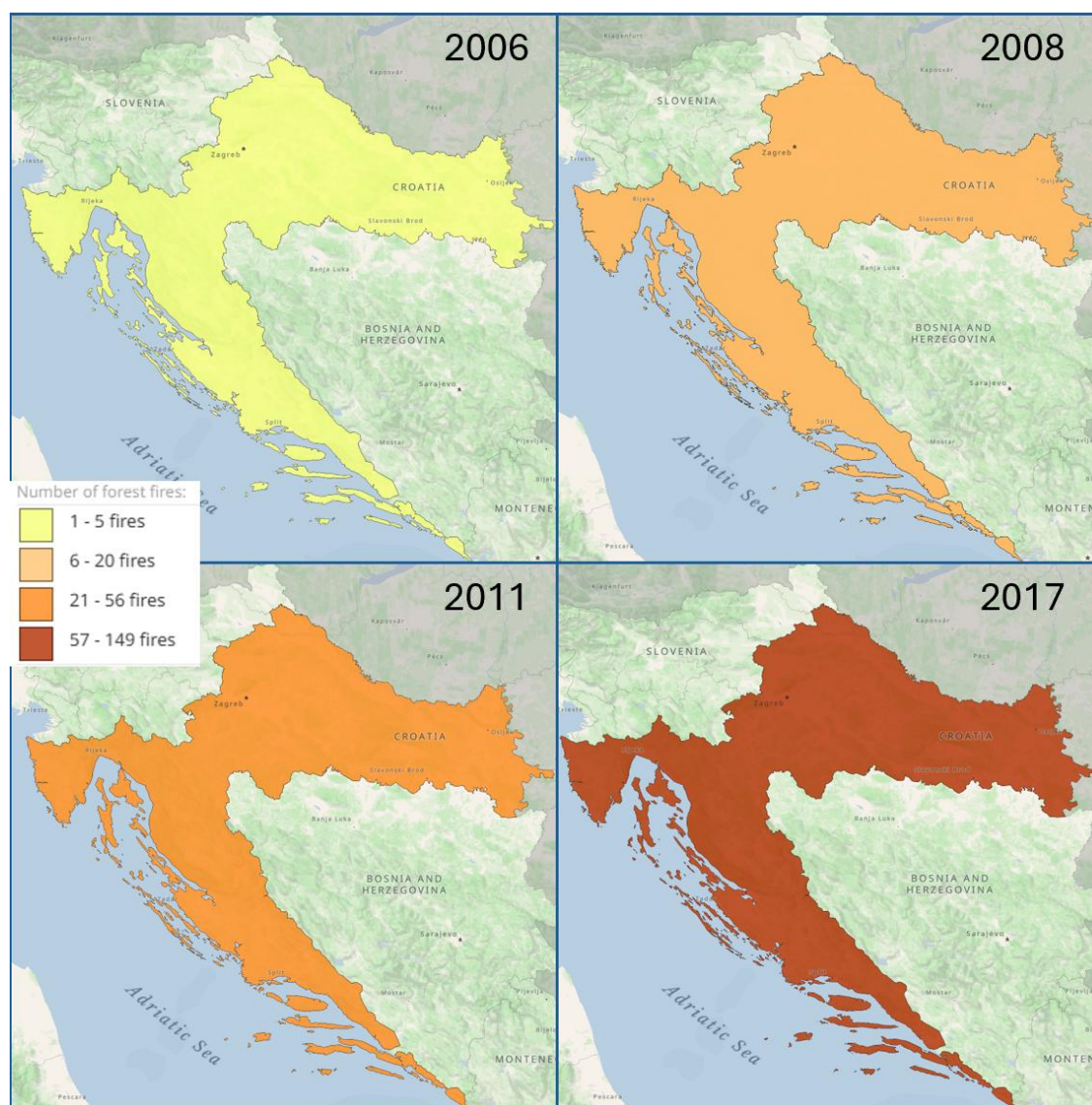
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b)

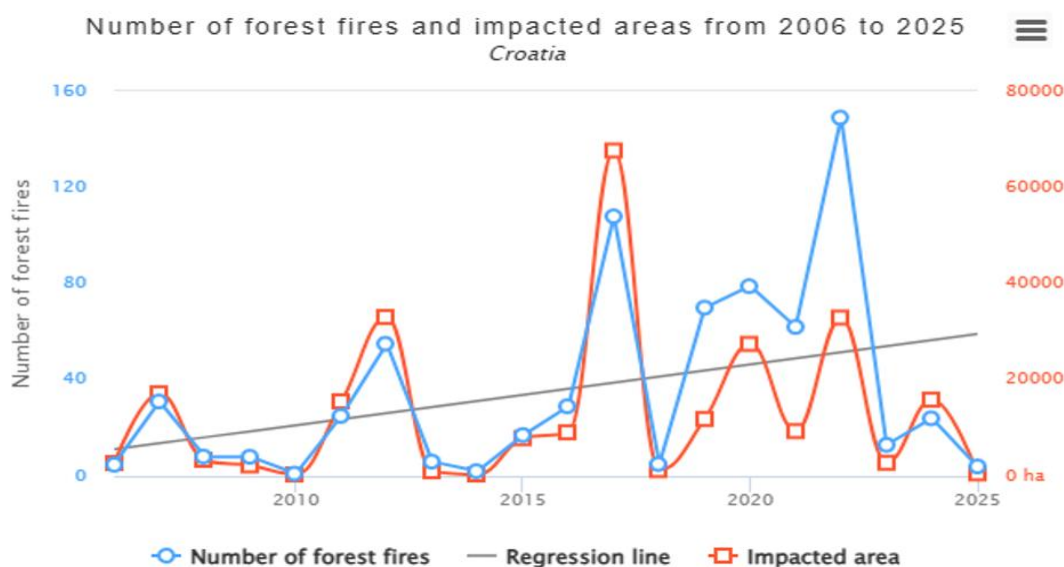


**Figure 13 a)** Average monthly hazard class for the occurrence and spread of vegetation fires for the summer season (June, July and August) 2022 and **b)** summer season (June, July and August) 2023 (source: CFA)



**Figure 14.** Fire risk assessment in Croatia for 2006, 2008, 2011 and 2017 (maps construction: Plan Bleu Observatory, data source: CHMS<sup>48</sup>)

<sup>48</sup> "[https://civilna-zastita.gov.hr/UserDocImages/CIVILNA%20ZA%C5%A0TITA/PDF\\_ZA%20WEB/Procjena\\_rizika%20o d%20katastrofa\\_2019.pdf](https://civilna-zastita.gov.hr/UserDocImages/CIVILNA%20ZA%C5%A0TITA/PDF_ZA%20WEB/Procjena_rizika%20o d%20katastrofa_2019.pdf)"



**Figure 15.** Number of forest fires and impacted areas associated (ha) in Croatia, from 2006 to 2025 (graphic design: Plan Bleu Observatory; data source: Copernicus. EFFIS database, 2025<sup>49</sup>).

### Floods and Coastal Flooding<sup>50</sup>

The area of Zadar County includes the small catchment area of the "Zrmanja – Zadar hinterland" – Protected Area 26, excluding the northeastern part of the Municipality of Gračac, which belongs to the Una River catchment (Figure 16). The catchment area is primarily characterized by significant fluctuations in river flow and the short time span for flood wave propagation. The Vlačine and Grabovac dams are used for irrigation and flood defense, and they are managed by Croatian Waters. The main cause of floods is large amounts of precipitation.

The highest rainfall occurs in the autumn, somewhat less in winter and spring, while rainfall decreases significantly in the summer. The area most at risk of flooding include: the city of Biograd na Moru, the city of Benkovac, the city of Obrovac, the municipality of Jasenice, the municipality of Pakoštane, the municipality of Polača, the municipality of Posedarje, and the municipality of Gračac. The declaration of a natural disaster due to flooding in September 2017 affected much of Croatia, including Zadar County (459.6 mm of precipitation fell, while the annual average for the observed period was 151.2 mm). A natural disaster was declared due to flooding in the coastal areas of the county, specifically for the cities of Zadar and Nin, and the municipalities of Preko, Sv.

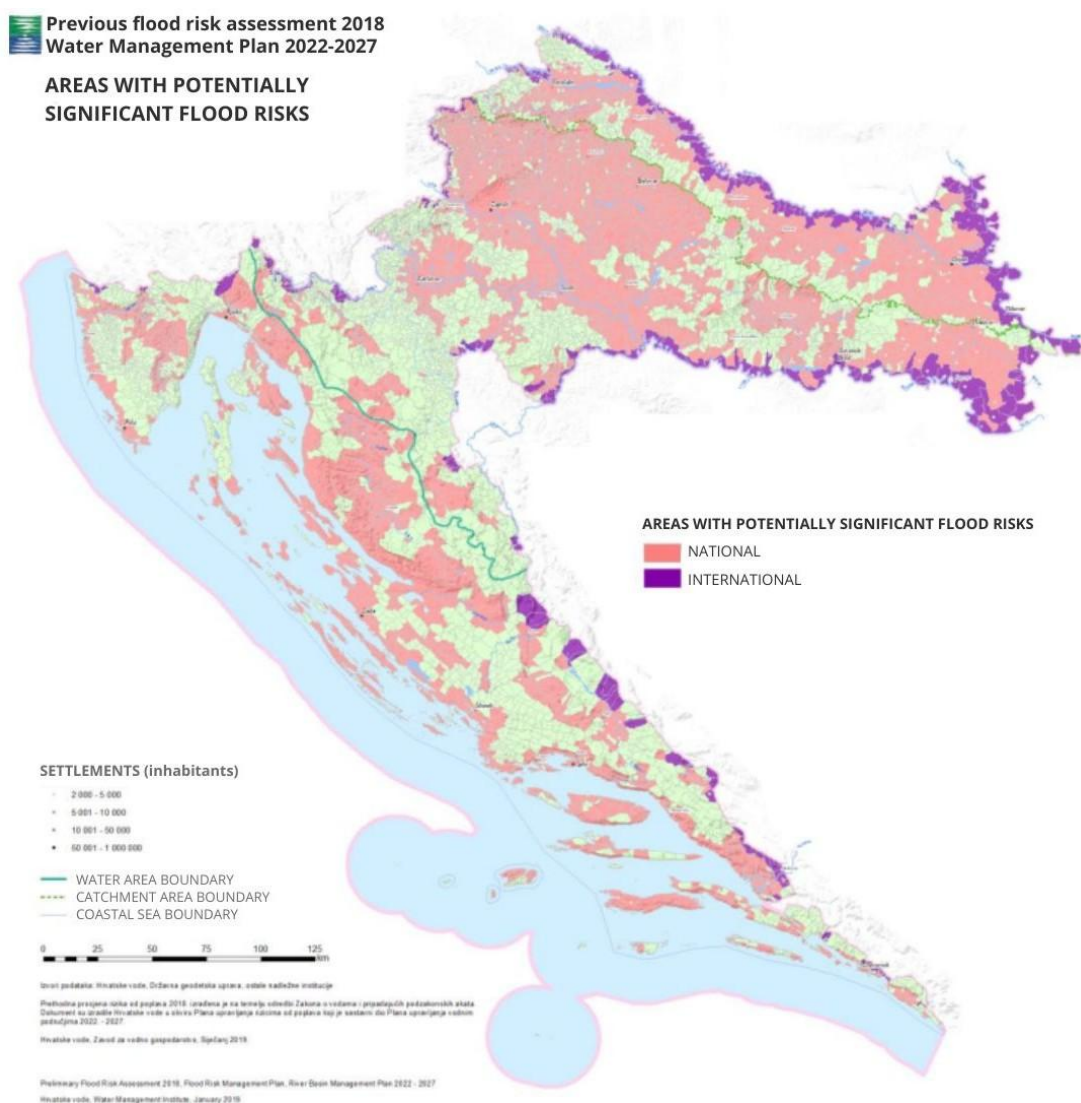
<sup>49</sup> <https://forest-fire.emergency.copernicus.eu/apps/effis.statistics/seasonaltrend>

<sup>50</sup> The rise in sea level, with a maximum predicted increase of 0.6 m by the end of the 21st century, is not significantly large, but the risk will gradually increase over time as exposure changes. Additionally, the uncertainties in the assessment of sea level rise are related to tectonic movements, changes in the rate of global sea level rise, and the lack of model projections for the Adriatic with finer spatial distribution, considering the processes at the coast-sea boundary.



Filip i Jakov, Poličnik, Kukljica, Ražanac, Pakoštane, Bibinje, Sukošan, Zemunik Donji, Pašman, Starigrad, Sali, Vrsi, Privlaka, and Kali.

There was also significant damage to residential, commercial, and public buildings (schools, healthcare institutions), municipal and transport infrastructure, and agriculture. Coastal flooding is another climate hazard that sporadically occurs in the county, especially in urban coastal areas. It is common for these areas (e.g., the city of Zadar) to have several smaller sub-catchments, and the stormwater drainage system (often a mixed sewer system) needs to be improved as soon as possible.



**Figure 16.** Areas with Potentially Significant Flood Risks (Source: Hrvatske vode)<sup>51</sup>

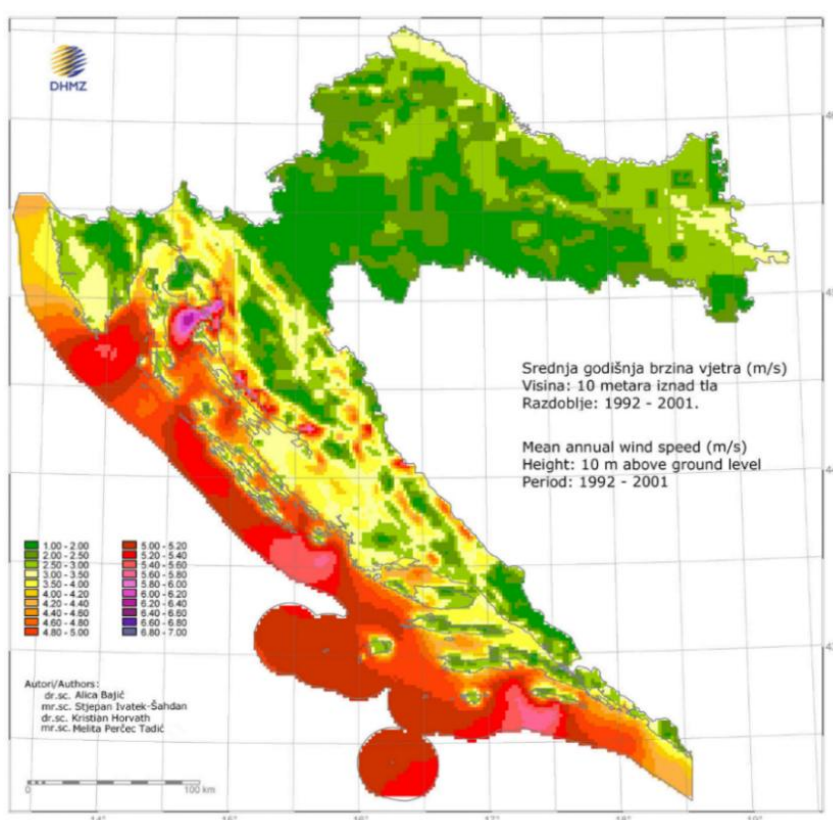
<sup>51</sup> <https://www.voda.hr/hr/karte-opasnosti-od-poplava-i-karte-rizika-od-poplava-2019>

## Storm or Hurricane-Force Weather and Strong Winds

The area around the Pag Bridge and the Maslenica region is the most vulnerable to strong wind gusts, including storm and hurricane-force weather (Figure 17). In this area, the electricity distribution network is particularly at risk, which may cause local power supply disruptions.

The effects of storm/hurricane-force and strong winds can lead to difficulties in road and maritime traffic, as well as interruptions in economic activities (e.g., tourism) due to restricted maritime transport between the mainland and the islands. Accidents in maritime traffic, damage to vessels, or sinkings are not uncommon, posing risks to human lives and the environment (e.g., spills of hazardous substances into the sea). Agricultural crops in Zadar County are also at risk from strong and stormy winds, especially when accompanied by hailstorms.

At the Zadar hydrometeorological station (CMHS), over the last 20 years, strong winds have been recorded on an average of 39 days per year, while storm-force winds have occurred only one day per year. The highest number of such days occurs in the colder part of the year. The county is not expected to experience storms, hurricanes, or strong winds with catastrophic consequences.

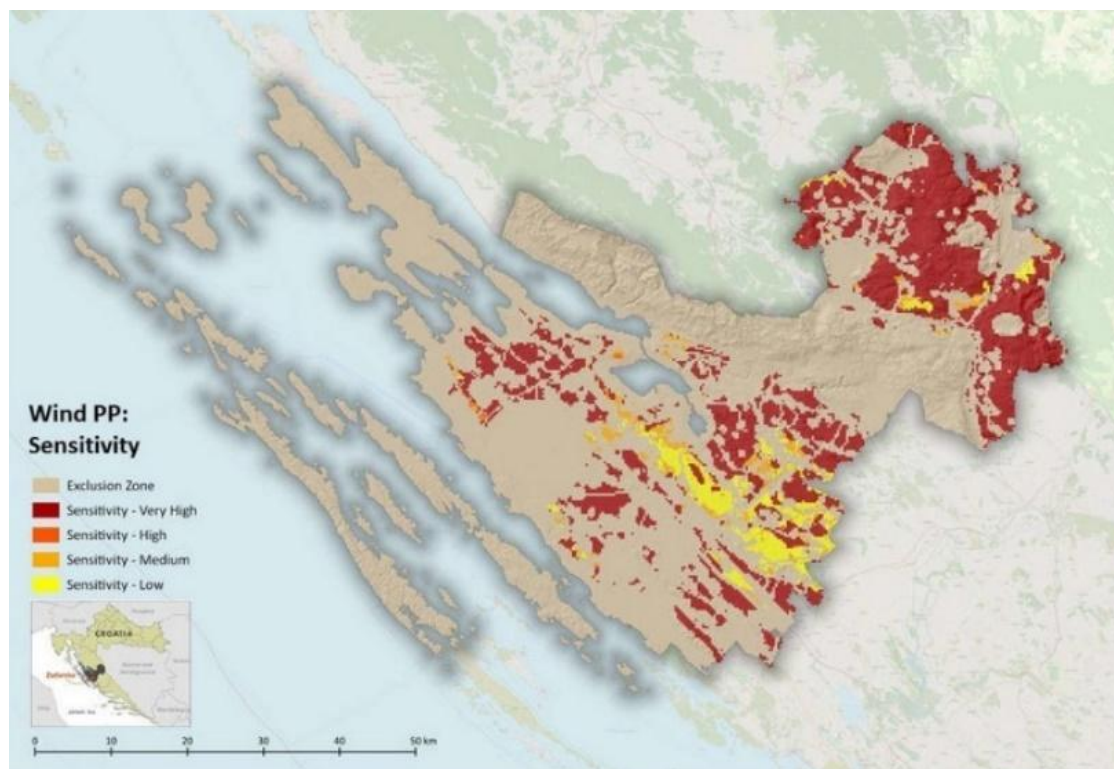


**Figure 17.** Average Annual Wind Speed in Croatia (data source: CMHS<sup>52</sup>)

<sup>52</sup> [https://klima.hr/k1/k1\\_4/obvY9201p50\\_komob.gif](https://klima.hr/k1/k1_4/obvY9201p50_komob.gif)



When planning and constructing various types of infrastructure (tourism, energy, transport, etc.), it is essential to consider not only the current climate but also future climate projections and the inherent uncertainty that characterizes them. A good practice example of planning the construction of renewable energy infrastructure in Zadar County is shown in Figure 18.



**Figure 18.** Sensitivity map of wind farms in Zadar County based on wind intensity (data source: Vorkapić et al. 2021)<sup>53</sup>)

### 2.3.3. Climate Risk Assessment

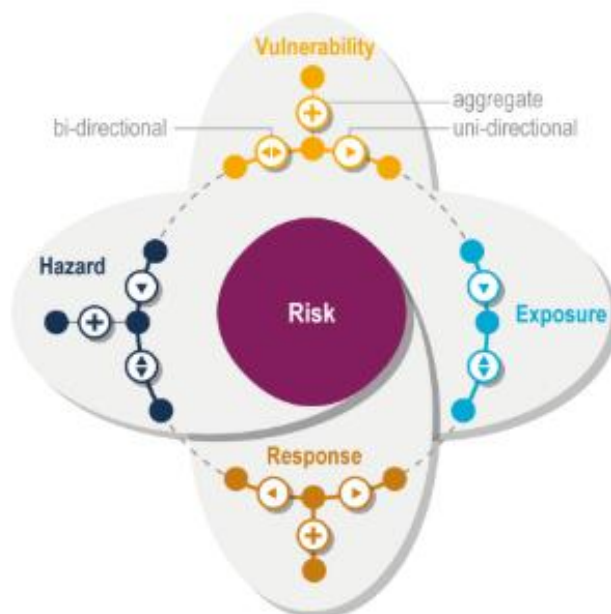
This CRA is based on the IPCC methodology (Figure 19), CMHS data and data collected by the Survey. This methodology synthesizes expert assessment and participatory approach (relevant stakeholders and citizens). It is based on relevant documents, scientific and professional publications, as well as the Interreg NaTour4CChange project knowledge base.

The assessment was carried out by the **Institute for Tourism** as a key delivery of the aforementioned project. Based on this assessment, an Action Plan for Nature-Based Solutions will be developed for the pilot area of Dugi Otok to support climate change adaptation and enhance climate resilience. Unlike the pilot destination's Action Plan, the regional CRA for Zadar County encompasses a broader range of climate adaptation measures and activities.

<sup>53</sup>

[https://www.researchgate.net/publication/350942353\\_Integrated\\_Renewable\\_Energy\\_Planning\\_in\\_Southeast\\_Europe\\_-\\_Pilot\\_project\\_Integrated\\_Wind\\_and\\_Solar\\_Planning\\_in\\_Zadar\\_County](https://www.researchgate.net/publication/350942353_Integrated_Renewable_Energy_Planning_in_Southeast_Europe_-_Pilot_project_Integrated_Wind_and_Solar_Planning_in_Zadar_County)

The probability analysis, impact analysis, and final CRA together provide the foundation for identifying, evaluating, selecting, and implementing adaptation measures for coastal tourism in Zadar County.



**Figure 19.** Concept of Climate Risk Assessment (CRA) according to IPCC AR5/AR6.

The CRA methodology is detailed in [Annex 1 of the Regional Strategy for Mitigation and Adaptation to Climate Change in Coastal Tourism of Zadar County](#). It is based on the latest IPCC guidelines, internationally recognized agreements, EU and national legislation, and expert scientific literature.

**Table 4.** Results of the Climate Risk Assessment (CRA) for the coastal part of Zadar County

| CLIMATE VARIABLES /HAZARDS           | THEMATIC AREAS         | RISK LEVEL      |                |
|--------------------------------------|------------------------|-----------------|----------------|
|                                      |                        | Current climate | Future climate |
| Extreme Air Temperatures             | Tourist Infrastructure | 2               | 3              |
|                                      | Tourist Offer          | 1               | 3              |
|                                      | Natural Areas          | 2               | 4              |
| Heatwaves (Land)                     | Tourist Infrastructure | 3               | 3              |
|                                      | Tourist Offer          | 2               | 3              |
|                                      | Natural Areas          | 2               | 4              |
| Drought (Reduced Water Availability) | Tourist Infrastructure | 2               | 3              |
|                                      | Tourist Offer          | 1               | 2              |
|                                      | Natural Areas          | 2               | 4              |
| Wildfires                            | Tourist Infrastructure | 3               | 4              |
|                                      | Tourist Offer          | 2               | 3              |
|                                      | Natural Areas          | 4               | 4              |
| Floods                               | Tourist Infrastructure | 2               | 3              |
|                                      | Tourist Offer          | 1               | 2              |
|                                      | Natural Areas          | 1               | 3              |
| Sea floods                           | Tourist Infrastructure | 3               | 4              |
|                                      | Tourist Offer          | 3               | 3              |
|                                      | Natural Areas          | 1               | 3              |
| Strong Winds and Storm Gusts         | Tourist Infrastructure | 2               | 4              |
|                                      | Tourist Offer          | 1               | 3              |
|                                      | Natural Areas          | 2               | 3              |

Legend:

|       |                      |
|-------|----------------------|
| 0     | No risk / Negligible |
| 1 – 2 | Low risk level       |
| 3 – 4 | Medium risk level    |
| 5     | High risk level      |

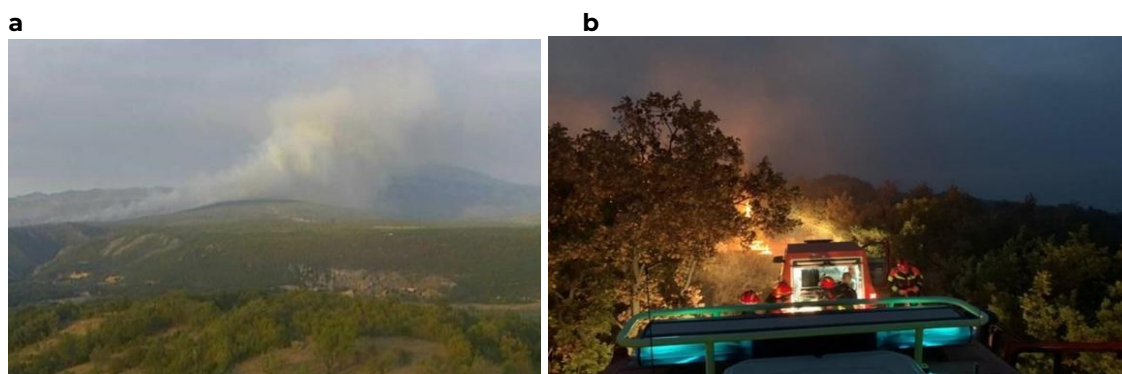
**Note:** A broader set of climate variables/hazards was analyzed, but only those with significant risk levels (1-5) are presented.

**Risk** is a combination of the probability of an event occurring and the impact of that event. Probability indicates how likely the identified climate hazards will occur within a certain period (over the duration of the project), while impacts consider the consequences of the occurrence of the identified climate hazards.

**The Climate Risk Assessment (CRA)** was carried out for a total of 18 primary climate variables or secondary hazards for the impact of climate change on the coastal area of the Zadar County, for 3 thematic areas: Tourist Infrastructure (TI), Tourist Offer (TO), and Natural Areas (NA). It should be noted that only those hazards for which an increase in the risk level was detected are shown in Table 3. For example, for TI, each of the detected key hazards (except for flooding) showed a higher risk level compared to the current climate CRA results. It should be noted that none of the 18 analyzed hazards showed a high-risk level (5) for either the current or future climate.

The **CRA** indicated that the risk of wildfires reached a medium level with a score of 4 (out of 5), but the situation changes significantly in the future climate. For the coastal areas and areas of island it is observed that most of the detected climate variables/hazards are associated with **atmospheric warming**. Variations and increases in average annual/seasonal/monthly air temperatures, as well as the seasonal occurrence of extreme air temperatures, are a driving force of heatwaves, droughts, wildfires, and strong winds and storms in the future climate.

The CRA suggests that future climate change will lead to an increase in risks for coastal tourism in the region. It also emphasized the vulnerability of natural areas in the county, as high-risk levels (4) were observed for four (out of seven) climate variables/hazards. Effective climate adaptation should consider objectives of **different sectors** (and thus various thematic areas) and its integration.



**Figure 20 a) and b).** Fire events in Zadar County (Source: Croatian Firefighting Association)<sup>54</sup>

<sup>54</sup> <https://hvz.gov.hr/vijesti/pozari-otvorenog-prostora-na-podrucju-priobalja/4659>

### 2.3.4. Challenges and Recommendations for Increasing Climate Resilience in Zadar County

**The main feature of all climate projections is the uncertainty of the scale of changes.**

The climate results from a complex interplay of natural and anthropogenic factors, which makes it difficult to predict with precision how it will change, both globally and locally. Additionally, the climate system itself has intrinsic variability. Seemingly small changes can lead to strong and sudden impacts, including cascading reactions.

In the conducted Climate Risk Assessment (CRA), the future climate was simulated according to the so-called medium (moderate) scenarios/paths:

- a) Scenarios of greenhouse gas concentrations **RCP4.5 and RCP8.5**, used in the CRA process for analyzing exposure in both the current and future climate.
- b) The greenhouse gas emissions scenario **SSP2**, used for providing a qualitative description of alternative socio-economic development.

Through the CRA (Chapter 2.3.2.), climate risks with significant potential to threaten tourism and other economic activities in Zadar County were ranked. According to the results presented in Table 3, these include:

- a) **For the current climate:** wildfires, with natural areas being the most vulnerable, and sea flooding, which poses the greatest threat to tourism infrastructure.
- b) **For the future climate:** extreme air temperatures, heatwaves, drought with reduced water availability, wildfires, floods, sea flooding, strong winds and storm surges, and the effects of solar radiation on property, people, and nature.

Based on the results, it can be concluded that adaptation measures for tourism in the coastal area of Zadar County have become a necessity for all three thematic areas (TAs). At present, only the trend of changes is reliably known, making it crucial to adequately prepare and manage climate risks in the destination. Therefore, to increase climate resilience against these risks and for the TAs, it is generally **recommended that potential adaptation solutions be phased and feasible for all climate change scenarios.**

Individually, for each TA, this implies that:

**Tourist infrastructure** should be designed, planned, implemented, and maintained in a way that makes it resilient to identify climate risks.

**Tourist offerings** should be adaptive, focused on sustainable forms of tourism that provide visitors with safety, comfort, and preserved attractions throughout the entire year.



**Natural areas** are particularly under potential pressure from climate risks, compared to other considered TAs. Therefore, they should be in a special focus not only from the aspect of nature protection and conservation but also for those who use ecosystem services – from tourism companies to visitors, including the local population.



**Figure 21.** Green Belt and around old City of Zadar (city peninsula) (Source: Zadar Tourism Board)

The implementation of **Nature-Based Solutions** (NBS) has proven to be a key solution. It implies the need to strengthen both the public and private sectors in terms of increasing knowledge and skills, financial resources, and coordination among decision-makers.

In addition to the already implemented structural and non-structural adaptation measures, a strong recommendation is to foster NBS in all considered TPs (and beyond), which some parts of the coastal destination are already doing.

*NOTE: Decarbonization and adaptation measures are not part of this assessment but are elaborated in the Regional Strategy for Mitigation and Adaptation to Climate Change in Coastal Tourism of Zadar County (will be available in the next phase of the project).*