Guide for the Resilience Assessment of projects funded under the

Interreg VI-A
Hungary-Croatia Programme

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1. Background and purpose of the Guide [1]

Climate change is one of the biggest problems and challenges of our time. Stopping or at least mitigating these processes and preparing for the expected impacts and consequences is a major challenge for humanity. In particular, cooperation between actors at different levels is essential to achieve positive results on climate change, as are meaningful measures and interventions.

Climate change is already having a major impact today, mainly in the form of extreme weather events and increasingly unusual meteorological phenomena. Heat waves and warm spells, cloudbursts and dry spells are becoming more frequent, with direct or indirect effects such as floods, the emergence and spread of new diseases, water shortages and more complex agricultural production, among others. These are occurring with varying frequency and intensity in different parts of the world but are increasingly being felt in our country. It is therefore crucial to ensure that climate change preparedness and adaptation is reflected in as many aspects of life as possible.

This is also a very important aspect to consider when planning and implementing projects. In terms of project types, infrastructure projects with construction and renovation elements are the most affected, not only because of climate change exposure, but also related to emissions of pollutants and greenhouse gases. This is due to both the nature of the construction works and the longer lifetime envisaged. Consideration of climate adaptation aspects is therefore crucial in the design of buildings and other investments, while ignoring them can lead to serious problems and unexpected costs during maintenance. Reducing energy use, using renewable or less polluting energy sources, increasing green spaces and green areas can reduce the long-term costs of an investment, while improving the quality and resilience of the infrastructure. Integrating these aspects at the design stage can contribute to the development of a well-functioning infrastructure system.

In this context, climate change mitigation improvements will be of particular importance in the 2021-2027 programming period, in line with the European Green Deal. At the same time, climate resilience is also a key priority: it is a mandatory requirement for all infrastructural investments planned for a period of at least 5 years to be assessed in terms of climate resilience (see Regulation (EU) 2021/1060 and 2021/1059 of the European Parliament and of the Council).

The mandatory **climate change resilience assessment** aims to identify projects that may have significant greenhouse gas emissions or are highly exposed to climate change. It will also help project planners to design additional measures into their project to ensure that the infrastructure created will continue to operate cost-effectively and fit for purpose in the long term, by taking into account the likely impacts of climate change and the risks they pose.

This "Guide for the Resilience Assessment of projects funded under Interreg VI-A Hungary-Croatia Programme" (hereinafter referred to as the "Guide") is intended to provide basic technical assistance for carrying out the climate change resilience assessment required for projects funded by the European Union that envisage investment in infrastructure(s) with an expected lifespan of at least five years in accordance with Article 22.4 (j) of the Interreg

[1] The 'Guide for the Climate Change Resilience Assessment of Infrastructure Projects 2021-2027', published in February 2022 and forming the background for the present guide is available at:

https://www.palyazat.gov.hu/api/download_document?name=Utmutato%20az%20eghajlatvaltozasi%20rezilienciavizsgalat%20elvegzesehez_21-27-1.pdf&urn=workspace%3ASpacesStore%2Fi%2F7c73a786-6e67-49b0-99da-b6c16d6a863d

Regulation and the Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (2021/C 373/01). The Climate Resilience Guide basically defines two types of resilience assessment to be carried out: Standard and Simplified Resilience Assessments. The Standard Resilience Assessment consists of two sub-assessments (Climate Neutrality and Climate Adaptation), while the Simplified Resilience Assessment consists of one sub-assessment (Climate Adaptation).

The preliminary studies suggest that the developments funded by the Interreg VI-A Hungary-Croatia Programme will not result in significant greenhouse gas emissions, i.e. more than 20 000 tonnes of CO_{2eq} per year. **Project promoters will therefore be required to carry out a Simplified Resilience Assessment prior to the start of the supported projects or the conclusion of the grant contract - however, a Climate Neutrality Sub-Assessment is not required.** At the same time, if the resilience assessment identifies an aspect of the project as high risk, at least one **mitigation activity** from the set of good practices in the Guide must be **included in the** project to address the issue.

2. Structure and methodology of the Guide

A short introduction (Chapter 1) describing the background and purpose of the Guide is followed by Chapter 2, which focuses on the structure and methodology.

Chapter 3 describes the region's exposure to climate change problems.

Chapter 4 presents the Simplified Resilience Assessment, the first step of which is to identify the climate change characteristics that are occurring or are expected to occur in the coming decades at the project's site. The second step is to assess and document the sensitivity of the identified factors that are relevant locally and for the project.

Chapter 5 contains a collection of good practices for risk mitigation actions for projects identified as high risk in any criteria.

Chapter 6, contains a model declaration where the project partner declares the assessment of the potential climate change impacts of the project part to be implemented, the results of the resilience assessment - and, if necessary, the development of mitigation action(s).

3. Climate change vulnerability of the region

A good way to analyse and compare European regions in terms of climate risk and resilience is to use The Climate Risk Typology[2] , a tool to visualise, describe, compare and analyse climate risks for European cities, regions and areas. It groups areas according to their climate risk characteristics, creating a detailed risk profile for each area. This online portal also includes interactive maps, statistical data, and additional information on climate risk typology.

Information on the Hungarian-Croatian border region:

Projected change in mean temperature: 1.8-1.9 °C in the region, broadly in line with European trends. A slightly higher increase is expected in the Croatian part of the region.

Projected change in heat wave days: 6-10 days in the region, which is above the European average. The projected change in the number of heat wave days is higher going south, with the highest value (10 days) in the southernmost Vukovarsko-srijemska.

Projected change in the maximum length of consecutive dry days: 0-1 day in the region, which is below the European average, so it can be said that this indicator is less relevant in the region, but this does not mean that the region is not threatened by drought.

Projected change in the number of days with more than 20 mm of precipitation: 1-2 days in the region, which is close to the European average. The number of days with extreme precipitation will increase in the region, but this is not the main climate risk.

Flood risk: This indicator shows the percentage of the total area of the region that is exposed to a 100-year flood[3]. The border area shows different levels of vulnerability, but the Croatian areas of the region are more affected with the most exposed being the county of Međimurska.

Landslide (geological) hazard[4]: The indicator shows the percentage of the area with moderate (or higher) landslide susceptibility in %. It is also highly differentiated across the border region, Hungarian areas are less affected, however on the other side of the border Varaždinska has a value of 11.7%.

Forest fire risk[5]: This indicator identifies the proportion of the area that has been burnt in the past, which also gives an indication of the extent to which forest fires have been a threat in the past in the area. In the border area, the county of Osječko-baranjska was the most affected by forest fires.

Table 1 gives the exact details of the Interreg VI-A Hungary - Croatia Programme areas according to the aspects presented.

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[2] Carter, J.G, Hincks, S, Vlastaras, V, Connelly, A and Handley, J. 2018. European Climate Risk Typology. [ONLINE] Available at: http://european-crt.org/index.html

[3] The term "100-year flood" is used in an attempt to simplify the definition of a flood that statistically has a 1-percent chance of occurring in any given year. In Hungary, the current legal requirement for the design of flood facilities is to comply with this frequency of flooding.

[4] This indicator draws on NASA's Global Landslide Susceptibility Map, which identifies the potential for landslides across the Earth's surface on a scale from slight to severe.

[5] This indicator identifies the proportion of NUTS 3 territory defined as "burnt area" according to the 2012 Corine classification.

Hungarian and Croatian counties[6]	Climate risk aspects						
	Projected change in mean temperature [7]	Projected change in heat wave days [8]	Projected change in the maximum length of consecutive dry days [9]	Increase in the number of days with more than 20 mm of rainfall[10]	Flood risk	Landslide (geological) hazard	Forest fire risk
Baranya	1,8 °C	8 days	1 day	1 day	10,6%	1,6%	0,1%
Somogy	1,8 °C	6 days	1 day	1 day	3,4%	0,1%	0,1%
Zala	1,8 °C	6 days	0 days	2 days	2,7%	0,9%	0,1%
Bjelovarsko-bilogorska	1,9 °C	7 days	0 days	1 day	1,6%	2,4%	0,0%
Koprivničko-križevačka	1,8 °C	7 days	0 days	2 days	14,8%	1,4%	0,0%
Međimurska	1,8 °C	6 days	0 days	2 days	31,3%	0,0%	0,0%
Osječko-baranjska	1,9 °C	9 days	1 day	1 day	25,4%	0,1%	0,3%
Požeško-slavonska	1,9 °C	7 days	1 day	1 day	0,1%	9,1%	0,0%
Varaždinska	1,9 °C	6 days	0 days	2 days	12,2%	11,7%	0,0%
Virovitičko-podravska	1,9 °C	7 days	1 day	1 day	12,5%	4,8%	0,1%
Vukovarsko-srijemska	1,9 °C	10 days	1 day	1 day	27,2%	0,0%	0,2%

Table 1: Affected NUTS3 areas in the border region

[6] NUTS 3 level.
[7] Reference period of observation: 1981-2010, future forecast period: 2036-2065
[8] A heat wave day is a day when the daily maximum temperature reaches or exceeds 35°C.
[9] Longest period with daily rainfall < 1 mm.
[10] Number of days with daily rainfall ≥ 20 mm.

4. Simplified Resilience Assessment

The assessment aims to determine whether and to what extent the infrastructure elements, networks (project outputs) and their future operation are likely to be vulnerable to the local impacts of climate change.

The analysis should address the project in a comprehensive way, looking at its different components and how it relates to its wider environment - all from a climate change impact perspective. This requires an examination of the following four themes:

- The sensitivity of the project result's technical state to climate change
- Sensitivity of the project operation to an external factor influenced by climate change (e.g. water supply from a vulnerable aquifer, local renewable energy use, condition of the receiving water body)
- The climate change sensitivity of the services provided by the project outcome (e.g. for tourism facilities – number of tourists; transport infrastructure - traffic; etc.)
- Sensitivity of the surrounding area to climate change as a result of the project (e.g., runoff blockage of linear facilities in the event of torrential rains).

The steps for conducting the Simplified Resilience Assessment are as follows:

1. Identify the climate change features that are occurring or are likely to occur in the coming decades at the project site.

2. Determine the project's sensitivity to climate change only for locally relevant climate change impacts.

The expected result of the assessment is the completion of all cells in Table 4 (see below), with a choice of predefined categories.

Step 1: Identify the climate change features that are occurring or are likely to occur in the coming decades at the project site

Table 2 below helps to assess whether the project site is affected by each of the consequences of climate change. The information in the second column of the table provides guidance on how to answer this question.

Consequences of climate change	Hungary-Croatia border region
Expected annual change in average temperature (slow increase)	All NUTS3 regions included in the programme.
Expected change in average temperature (winter)	All NUTS3 regions included in the programme.
Expected change in average temperature (summer)	All NUTS3 regions included in the programme.
Expected change in the number of hot days	All NUTS3 regions included in the programme.
Increase in the number of heatwave days (daily mean temperature > 25 °C)	All NUTS3 regions included in the programme.
Reduction in the number of frosty days in spring (daily min. < 0 °C)	All NUTS3 regions included in the programme.
Increase in the average number of days per year affected by sudden temperature drops (10°C in 3 hours)	All NUTS3 regions included in the programme.
Increase in the average number of days per year affected by windstorms, violent windstorms, hurricanes (gusts over 85 km/h)	All NUTS3 regions included in the programme.
Changes in the seasonal distribution of precipitation	All NUTS3 regions included in the programme.
Increase in maximum length of dry periods (longest period with daily rainfall < 1 mm, day)	Slightly, but all NUTS3 regions included in the programme.
Increase in the number of days with more than 30 mm of precipitation (number of days with daily rainfall ≥ 30 mm)	Slightly, but all NUTS3 regions included in the programme.
Increase in frequency and intensity of floods along rivers	Along rivers.
Increased frequency and intensity of flash floods in mountain and hilly areas	All the hilly and mountain areas included in the programme.
Increase in the frequency and intensity of urban stormwater run-off	All the municipalities in the area could be affected.
Increase in the frequency of waterlogging	All NUTS3 regions included in the programme may be concerned.
Increase in the frequency of forest fires	All NUTS3 regions included in the programme may be concerned.
Expected impact of climate change on the activation of geological hazards based on the frequency of precipitation days exceeding 44 mm	All NUTS3 regions included in the programme, except Međimurska and Vukovarsko-srijemska.

Table 2: Spatial extent of climate change impacts

Considerations and expectations to be taken into account during the assessment:

- The assessment makers (project partners) should also consider the following national strategies/systems/tools:
  Hungary:
  - Nemzeti Éghajlatváltozási Stratégia – National Climate Change Strategy[11]
  - Nemzeti Vízstratégia (Kvassay Jenő Terv) – National Water Strategy Hungary[12]
  - Nemzeti Alkalmazkodási Térinformatikai Rendszer (NATéR) - National Adaptation Geo-information System (NAGiS) [13]

  Croatia:
  - Climate Change Adaptation Strategy in the Republic of Croatia for the Period Until 2040 With a View to 2070[14]
  - Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030[15]

  Other locally available relevant information also can be used (Local environmental data can usually be found in the development strategies, spatial planning instruments, climate and/or environmental programmes, local water damage management plans, SECAP etc. of the municipalities or counties/districts concerned by the development.)
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- Please note that in case of the rows of the table containing the results of the Simplified Resilience Assessment (Table 4), where only the definition "All NUTS3 regions included in the program" is included in column 2 of Table 2, the option "not relevant at the project site" cannot be selected in the individual cells.

In step 1, each row of the table containing the results of the Simplified Resilience Assessment (see Table 4) must be assessed to determine whether it is relevant to the project site. The option 'not relevant at project site' should be indicated in each cell of the rows for climate change impacts that are not considered relevant at project site. For other climate change consequences, step 2 is required.

Step 2: Determine the project's sensitivity to climate change

For each of the climate change impacts identified as locally relevant in the assessment, the criteria in the columns of the table presenting the results of the simplified resilience assessment (see Table 4) should be considered and all of the following questions should be answered:

- To what extent is the technical condition of the infrastructure vulnerable to the climate change impact?
- Is the operation of the resulting infrastructure dependent, and if so, to what extent, on a factor influenced by the consequence of climate change (e.g. water supply from a vulnerable aquifer; local renewable energy use; characteristics of the receiving water body; thermal comfort of the occupants of the facility)?

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11 https://nakfo.mbfsz.gov.hu/hu/node/517
12 https://www.vizugy.hu/vizstrategia/documents/997966DE-9F6F-4624-91C5-3336153778D9/Nemzeti-Vizstrategia.pdf
13 https://map.mbfsz.gov.hu/nater/
14 https://mingor.gov.hr/UserDocsImages/KLIMA/Climate%20change%20adaptation%20strategy.pdf
15 https://mingor.gov.hr/UserDocsImages/UPRAVA%20ZA%20ENERGETIKU/Strategije,%20planovi%20i%20programi/hr%20necp/Integrated%20Nacional%20Energy%20and%20Climate%20Plan%20for%20the%20Republic%20of_Croatia.pdf

- Is the demand for the services provided by the infrastructure sensitive - and if so, to what extent - to the climate change consequence (e.g. for tourism facilities – number of tourists; for transport infrastructure - traffic; etc.)?
- Will the infrastructure make the surrounding area vulnerable to a local climate change effect, and if so, to what extent (e.g. the run-off blocking effect of linear facilities in the event of torrential rainfall)?

Questions have to be answered on the basis of precise knowledge of the project characteristics (e.g. the extent of the expected transport needs as a result of the development, the type of products produced, the technology used, etc.) **and,** where appropriate, **expert opinions.** Of course, depending on the type of the project, different expert opinions may be required, but typically the technical designer of the project, or, depending on the nature of the development, the utility company experts involved, as well as local planning experts with local knowledge, will have sufficient knowledge to answer the questions. In addition to those listed above, other experts (e.g. water, transport, tourism, nature conservation, etc.) may need to be involved where appropriate, but formal written expert advice is not required. It is also possible to exchange opinions orally in bilateral or multilateral discussions. However, it is essential that the answers to the questions reflect, as far as possible, the views of all professionals involved in the preparation of the project.

For all climate change impacts and sensitivity aspects, there are several options to choose from. The choice between them is based on qualitative methods and is to some extent subjective. The following table provides guidance for the choice:

Optional option	Selection criteria
not sensitive	Due to the nature of the project, the climate change consequence is not relevant at all from the sensitivity point of view (e.g. a reduction in the number of frosty days does not play a role in the development and expected traffic of a summer tourist facility).
low sensitivity	The climate change consequence only indirectly affects the implementation and maintenance of the project to a small extent.
medium sensitivity	Although the climate change consequence may have a direct impact on the project, it should not prevent the implementation and maintenance of the project, either from a technical or economic point of view.
high sensitivity	The given consequence of climate change may have a significant impact on the infrastructure, equipment, inputs and products created, potentially jeopardising the technical or economic sustainability of the project.

Table 3: Criteria for determining the climate change sensitivity of projects

<u>As a result of the assessment carried out, one of the following categories should be selected in each cell of Table 4 below</u>:

- not relevant at the project site
- not sensitive
- low sensitivity
- medium sensitivity
- high sensitivity.

Consequences of climate change	To what extent is the technical condition of the infrastructure vulnerable to the climate change impact?	Is the operation of the resulting infrastructure dependent, and if so, to what extent, on a factor influenced by the consequence of climate change (e.g. water supply from a vulnerable aquifer; local renewable energy use; characteristics of the receiving water body; thermal comfort of the occupants of the facility)?	Is the demand for the services provided by the infrastructure sensitive - and if so, to what extent - to the climate change consequence (e.g. for tourism facilities – number of tourists; for transport infrastructure - traffic; etc.)?	Will the infrastructure make the surrounding area vulnerable to a local climate change effect, and if so, to what extent (e.g. the run-off blocking effect of linear facilities in the event of torrential rainfall)?
Expected annual change in average temperature (slow increase)				
Expected change in average temperature (winter)				
Expected change in average temperature (summer)				
Expected change in the number of hot days				
Increase in the number of heatwave days (daily mean temperature > 25 °C)				
Reduction in the number of frosty days in spring				

(daily min. < 0 °C)				
Increase in the average number of days per year affected by sudden temperature drops (10°C in 3 hours)				
Increase in the average number of days per year affected by windstorms, violent windstorms, hurricanes (gusts over 85 km/h)				
Changes in the seasonal distribution of precipitation				
Increase in maximum length of dry periods (longest period with daily rainfall < 1 mm, day)				
Increase in the number of days with more than 30 mm of precipitation (number of days with daily rainfall ≥ 30 mm)				
Increase in frequency and intensity of floods along rivers				
Increased frequency and intensity of flash floods in mountain and hilly areas				
Increase in the frequency and intensity of urban				

stormwater run-off				
Increase in the frequency of waterlogging				
Increase in the frequency of forest fires				
Expected impact of climate change on the activation of geological hazards based on the frequency of precipitation days exceeding 44 mm				

Table 4: Summary table of the results of the simplified climate change resilience assessment

Options for moving forward

The outcome of the Simplified Resilience Assessment will determine whether further climate change assessments are required as part of the project. The following options are available:

A) If the activities planned to be implemented under the project do not show a high level of sensitivity to any of the expected climate change impacts in any of the aspects assessed (i.e. no cell in Table 4 above is defined as "high sensitivity"), no further assessment is warranted. In this case, the applicant makes a Declaration (see Chapter 6).

B) If the activities planned to be implemented under the project are highly sensitive to at least one of the locally foreseeable impacts of climate change in at least one of the aspects assessed, the project receiving support is required to include at least one of the good practices from Chapter 5 in the project.
Risk mitigation actions need to be selected until contracting and implementation needs to take place by the end of the project.

If the project already contains an element that is included in the collection (Chapter 5)**, please indicate the relevant mitigation action in the declaration**.

In case the declared mitigating action will not be implemented by the end of the project, eventual correction/mitigation can be applied.

5. Collection of risk mitigation actions

Nature-based solutions should be the first line of action to reduce the risks and impacts of climate change. There are several overlapping definitions of nature-based solutions. As defined by the International Union for Conservation of Nature (IUCN)[16] and the United Nations[17] :

Nature-based solutions are actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well- being and biodiversity benefits.

Nature-based solutions can have a positive impact in the following areas:

- adapting to climate change.
- the resilience of the natural and built environment and society.
- mitigate the progress of climate change by capturing, storing and reducing greenhouse gas emissions in the atmosphere.
- conserving and restoring biodiversity.
- improving the overall quality of the environment.
- sustainable use of natural resources and water.
- maintaining food and water security.
- implementing energy and resource efficient infrastructure interventions.
- other socio-economic benefits.

Good practices are categorised below (in Table 5) according to the climate change implications in Table 4.

Collection of risk mitigation actions

A: Green roofs and green facades for public buildings (e.g. community centre, museum, church, information point, sports centre) - Greening can be achieved by planting plant species in the ground or in plant pots, by using support panels and container elements fixed to the façade or in front of the façade, by vertical root zone systems or by integrated modular structures. In addition to cooling and shading, green roofs and facades improve air quality, reduce the energy demand of the building, are suitable for CO_2 capture, but also for cleaning and retaining rainwater.

B: Green roofs and green facades for the building(s) covered by the project - The proposed possible interventions are the same as in A above.

C: Increasing green spaces (e.g. outdoor cultural, community, sports and recreational spaces; urban parks; community gardens, courtyards, parks of public buildings, wildflower meadows) - Green spaces are less likely to heat up, can retain water in the area and are also beneficial for biodiversity.

D: Shading (shading provided by any vegetation) - In general, traditional tree and plant planting will provide adequate shading for buildings and other paved surfaces. For tree planting in densely built-up urban environments more exposed to thermal insulation effects, the Stockholm Tree Pits solution is recommended. This serves the dual purpose of providing a

[16] Source: https://www.iucn.org
[17] Source: https://wedocs.unep.org/bitstream/handle/20.500.11822/39752/K2200677%20-%20UNEP-EA.5-Res.5%20-%20Advance.pdf?sequence=1&isAllowed=y

structural soil with good load-bearing capacity for public functions and also ensures healthier growth and a longer lifespan for the trees. In the case of this Swedish solution, all paved surfaces (except roads) are designed with open pores. This allows surface water to penetrate into the root zone of the trees where it can be stored. All utility lines for inspection and maintenance are accessible via an accessible utility tunnel. Each tree is provided with at least 30 m^3 of space for its root zone, which can store about 5 000 litres of water per year.

E: Permeable pavement surfaces - These surfaces can be made of porous materials that allow rainwater to permeate through the pavement, or non-porous blocks that allow water to flow between the voids and be absorbed into the soil. In addition to reducing runoff, permeable pavement systems can also trap suspended solids, thereby filtering contaminants from stormwater. These solutions can be used for roads, car parks and pedestrian walkways, for example, in a similar way to conventional technologies. Today, permeable concrete, asphalt and compacted materials are available to ensure natural absorption of moisture between paving stones or around trees. Permeable pavements can also have the advantage of significantly reducing the need for road salt by up to three quarters and can reduce construction costs in residential and commercial developments by reducing the need for traditional drainage elements. Finally, this technology is also useful in reducing the urban heat island effect, as water retained in the ground cools its surroundings through evaporation.

F: Rain gardens - A rain garden is a shallow, natural depression decorated with deep-rooted native flowers, shrubs and grasses. It is designed to collect and retain stormwater runoff from drains, driveways and sidewalks, allowing water to slowly evaporate and infiltrate back into the ground. Rain gardens can reduce stormwater runoff by 75-80% after a major rainfall event. A unique and important feature of rain gardens is that they effectively remove up to 90% of chemicals and up to 80% of sediment from rainwater. Compared to traditional lawns, rain gardens release up to 30% more water into the soil. In densely built-up urban environments, their installation can be combined with the Stockholm Tree Pits.

G: Miyawaki Forest - Named after Japanese ecologist Akira Miyawaki, the method is designed to restore and self-sustain native flora in up to 20-30 years - as opposed to centuries of natural regeneration. The very small Miyawaki forest requires only 10-20 m^2 land and direct sunlight for at least 8 hours a day. The selected urban/suburban area will be planted with as many native shrubs and trees as possible. Seedlings tend to grow towards the sun and therefore compete, so they grow at a much faster rate. By greening urban spaces, providing shade and reducing air pollution, the mini forest can be a useful tool in the fight against the ecological crisis and climate change, but it also helps insect and bird populations and has aesthetic value.

H: Planting a buffer zone - Systematically planted forests at the edge of a settlement can protect it from strong winds, dust and other pollutants in the incoming air mass. When selecting trees for planting, it is important to consider soil conditions, other natural factors (climate, prevailing winds, temperature, rainfall, etc.) and to avoid invasive species.

I: Designing swales and filter strips – These are the cheapest and most natural methods. Plant-covered surfaces are not only aesthetically pleasing, but the web of soil particles and roots also filter water thoroughly. Therefore, a slow spread over a large area, percolation through a closed plant cover is the most beneficial. Where lacking space or where permeability of the soil is poor, the percolation surface may need to be combined with or replaced by an underground percolator.[18]

[18] https://vizmegtartomegoldasok.bm.hu/hu/tudastranszfer/innovativ_megoldasok

J: Rainwater collection, greywater recycling - Rainwater from any building can be easily collected in collection tanks and used for irrigation or as greywater for flushing.

K: Tree planting, development of forest management in mountain and hill areas - By limiting logging, stopping felling, stopping earthworks that change the shape of the slope or create new/greater loads, potential negative geological events can be prevented.

L: Leaky log dams - The idea is to allow small stream flows to pass through the gaps below. In flash floods, however, they hold back the sudden influx of large volumes of water and the sediment and debris that comes with it. The water is released slowly and in a controlled manner through the gap between the logs, thus flattening the flood peak. This relieves and protects low-lying defences, residential or commercial areas. They also have the added advantage of requiring very little material input, especially when constructed using locally harvested timber.[19]

M: Establishment of a reservoir - The sample project settlement is located in a hilly area, highly vulnerable to flash floods, and there are frequent droughts in summer. Flash floods and drought cause serious damage to the municipality, and the project aims to address both problems through nature-based solutions. In this method, a lateral reservoir provides a significant part of the water retention. To operate the lateral reservoir, an intake ditch and a discharge ditch with a gate are connected. At the inflow points of the reservoir, easily cleanable sediment traps have been installed to prevent the reservoir from silting up.[20]

N: Mulching - Mulching is a layer of material applied to the soil surface. The purpose of mulching is to conserve soil moisture, improve soil fertility and health, prevent weed growth and improve the appearance of the area. Bark, wood shavings, vine pulp, nut shells, garden green waste, crop residues, compost, manure, straw, dry grasses, leaves are commonly used to cover the soil surface. When applied correctly, it can significantly improve the water-holding capacity of the soil.

O: Coarse woody debris in streams, canals - Coarse woody debris in stream channels has several ecological and hydrological benefits. Coarse woody debris consists of large tree limbs or trunks that either fall into streams or are deposited in the stream channel by human intervention. Coarse woody debris can be planted with varying degrees of naturalness. They can be used to create barriers that effectively restrict the flow of water. In general, coarse woody debris slows down the flow rate of water and reduces the peak flood stage.

P: Fire risk database - Geographers at the University of Szeged have developed a method that can improve the efficiency of fire prevention and forecasting. The method is based on the creation of an up-to-date and large-scale database, refined by field measurements, which is a kind of geo-spatial information application containing the land cover, topography, natural and planted forest conditions, road network, water intakes, etc. of a given area, which can help to control fires. In cooperation with the disaster management, a geo-database and a mapping application have been developed as a pilot project for an area. Where satellite data are used to pinpoint the fire risk of a given forest area, it is much easier to react to spontaneous as well as expected events. Firefighters can also use navigation to help them determine the shortest route, speed, and accessibility.

Q: Creating map databases - For most climate risks, it can be useful to create a map database to assess and identify the exposure and extent of risk in the affected areas.

[19] https://networknature.eu/casestudy/26186
[20] https://networknature.eu/casestudy/26186

Soft actions - Local initiatives, community building, awareness raising and knowledge sharing

Some small-scale, "soft" local community initiatives can also generate change. These are typically not very resource-intensive: they require determination, broad communication, and credible, enthusiastic initiators.
Climate awareness can also be promoted through the creation/support of small local communities for related purposes, or by expanding the activities of well-established, cohesive local communities in other areas. Activities to promote a more sustainable future and social well-being often do not require large-scale action and strong commitment. It is also essential to offer attractive opportunities for different age groups (from pre-school to pensioners) to get involved - even if not at the same time.

R: Information, awareness-raising - The main task is to inform the population concerned about the behaviour to be followed and the prohibited activities, by informing them about the risks they face. Awareness-raising lectures, interactive discussions, clubs, workshops, thematic courses, camps can be organised - depending on local possibilities. It is important to strengthen local communication, e.g. by forming groups on social media platforms, expanding the network of contacts, and strengthening opportunities for sharing information and knowledge and exchanging experiences.

S: Community brainstorming - The aim is to gather ideas from the public on where and how to implement measures to increase sustainability. An interactive map can be linked to the community brainstorming session where anyone can make suggestions based on the problems they see in their everyday life.

T: Climate Partnership - The climate partnership aims at personal involvement of the population and raising awareness of the expected negative impacts of climate change in the region, with a special focus on the immediate risks in the region. Such a partnership can also be a way of gaining the support of residents for the adaptation actions needed at individual and community level.

U: Community and home composting - The method involves the treatment and use of organic materials of plant origin through local composting. This avoids organic material becoming waste and saves the costs of transporting and landfilling it. In the case of community composting, it is very important to appoint a responsible person, the "compost master", who is skilled in composting and who supervises the operation of the community composter. Composting can prevent the burning of green and organic waste, thereby preventing fire hazards and air quality deterioration.

Consequences of climate change	Risk mitigation activity letter
Expected annual change in average temperature (slow increase)	A, B, C, D, R, S, T
Expected change in average temperature (winter)	A, B, C, D, R, S, T
Expected change in average temperature (summer)	A, B, C, D, N, R, S, T
Expected change in the number of hot days	A, B, C, D, N, R, S, T
Increase in the number of heatwave days (daily mean temperature > 25 °C)	A, B, C, D, N, R, S, T
Reduction in the number of frosty days in spring (daily min. < 0 °C)	A, B, C, R, S, T
Increase in the average number of days per year affected by sudden temperature drops (10°C in 3 hours)	A, B, C, R, S, T

Increase in the average number of days per year affected by windstorms, violent windstorms, hurricanes (gusts over 85 km/h)	**H, Q, R, S, T**
Changes in the seasonal distribution of precipitation	**I, J, R, S, T**
Increase in maximum length of dry periods (longest period with daily rainfall < 1 mm, day)	**A, B, C, D, F, G, I, J, N, R, S, T**
Increase in the number of days with more than 30 mm of precipitation (number of days with daily rainfall ≥ 30 mm)	**F, J , K, L, M, R, S, T**
Increase in frequency and intensity of floods along rivers	**L, M, O, Q, R, S, T**
Increased frequency and intensity of flash floods in mountain and hilly areas	**K, L, M, O, Q, R, S, T**
Increase in the frequency and intensity of urban stormwater run-off	**F, I, J, Q, R, S, T**
Increase in the frequency of waterlogging	**F, J, Q, R, S, T**
Increase in the frequency of forest fires	**P, Q, U, R, S, T**
Expected impact of climate change on the activation of geological hazards based on the frequency of precipitation days exceeding 44 mm	**K, Q, R, S, T**

Table 5: Matching potential mitigation solutions to the problems

6. Declaration of completion of the Resilience Test

DECLARATION

INTERREG PROGRAMME NAME: Interreg VI-A Hungary-Croatia 2021-2027 CALL FOR PROPOSALS CODE NUMBER: .... NAME OF PROJECT PARTNER ORGANISATION: .... ADDRESS OF THE PROJECT PARTNER ORGANISATION: .... PROJECT TITLE: .... ACRONYM OF PROJECT: .... PROJECT (PLANNED) DURATION: ....

I, the undersigned, as representative of the project partner organisation, declare that a simplified resilience assessment has been carried out for the project to be implemented, potential climate change impacts have been assessed, relevant risks have been identified and categorised according to their sensitivity.

The results of the Simplified Resilience Assessment for our project are:

(Please underline which of A) or B) below is relevant!)

A) The activities planned to be carried out under our project do not show a high sensitivity to any of the expected climate change impacts in any of the aspects assessed, and therefore no further assessment is warranted.

or:

B) The activities we plan to implement in our project are highly sensitive to at least one of the locally foreseeable impacts of climate change in at least one of the aspects assessed. Accordingly, I declare that[21]:

b1) we already have the following mitigating action(s) planned in the project[22]: …..

b2) we do not have any mitigating action(s) planned in the project, therefore we are committed to implement the following mitigating action(s)[23]: …..

[21] If you have selected option B) please fill in b1) or b2.
[22] Please insert the corresponding letter(s) of the planned action(s) from Chapter 5 of the present guide.
[23] Please insert the corresponding letter(s) of the planned action(s) from Chapter 5 of the present guide.

Date: ....

Name of the official representative of the project partner organisation (signature, stamp):

....

Name of the project partner organisation:

....