

# POLICY BRIEF HUNGARIAN CASE STUDY

### INTEGRATED SOLUTIONS TO ADDRESS HIGH LEVELS OF CLIMATE CHANGE

Region: Central Europe

Scale: Local municipalities

Sectors: Agriculture, Water, Health, Urbanisation

Hungary is one of the more vulnerable countries to climate change in Europe. Extreme events, including droughts, floods, heavy rainfalls and heat waves, have become more frequent and intense over recent decades, and socio-economic and environmental impacts are already having significant consequences for human well-being at the regional and local level. Annual average surface temperatures are increasing, especially during the summer, and there is a trend towards wetter winters and drier summers. Major impacts are anticipated, particularly for water management, human health and well-being, and agriculture, and these could widen existing urban-rural and rich-poor inequalities.

The Hungarian case study worked with local decision-makers to analyse the impacts and risks associated with high levels of climate change (more than a 2°C increase in global mean temperatures above pre-industrial levels) in two medium-sized communities, Szekszárd and Veszprém. Participatory methods were combined with the use of simulation models to test the ability and resilience of present development strategies and adaptation measures to deal with the combined effects of high levels of climate and socio-economic change. The aim was to help stakeholders develop integrated mitigation and adaptation solutions, transformative strategies and transition pathways that lead to a shared vision of a sustainable future.





Left: View of Lake Balaton today. Right: Artist view of a potential future outlook for Lake Balaton in 2100 according to a scenario of high climate and socio-economic change developed with stakeholders during the project.

## **Key Messages**

- Deaths due to heat stress could double in the case study locations and triple across eastern Europe under high levels of climate change. The incidence of exposure to Lyme disease will increase, and water levels in Lake Balaton could oscillate between low and high extremes. There could also be significant impacts on crop yields from heat and water stress, although these are mixed and highly uncertain.
- The challenges posed by climate change vary greatly across scales and by location, even in communities in close proximity. Engaging local stakeholders is crucial, in order to understand the local socio-economic context and increase the ownership and relevance of the adaptation process and its results.
- Combining integrated modelling of different sectors (land-use, urbanisation, water and health) with participatory research has been successful in exploring climate impacts and vulnerabilities in Central Europe and in developing targeted adaptation responses at the local scale.
- Many of the challenges associated with climate change could be at a level that society and current institutions would not be able to handle. Societal and institutional transformation will therefore be needed to strengthen human, social and natural capital, and build resilience in the face of change.



Number of days per decade with heat alerts and heat alarms, and heat-related deaths per year in Szekszárd, Hungary in 2071-2100 for SSP1 and SSP5 vs the baseline in 1981-2010.

### What could a future above 2°C look like?

Four scenarios were developed in order to explore potential future outlooks for Hungary. These were based on the global Shared Socio-economic Pathways (SSPs), adapted to the context of the Hungarian case study during a series of stakeholder workshops, paired with climate scenarios based on the IPCC Representative Concentration Pathways (RCPs). Two fossil-fuel based scenarios (SSP3 and SSP5) were paired with the highest warming scenario (RCP8.5) which is expected without additional mitigation action, and two low-carbon scenarios (SSP1 and SSP4) were paired with a lower warming scenario (RCP4.5).

Socio-economic scenario	Climate scenario <sup>1</sup>	Narrative for Hungary to 2100		
Pink Dream (SSP1)	RCP4.5 Temperature +2.0 to +2.5°C Precipitation -4% to +11%	Commitment to sustainable development leads to a balanced interplay between the health, social, economic and governance sectors. This results in falling inequality, effective governance and less resource intensive lifestyles, which in turn result in gradual improvement of the natural environment. By 2100, Hungary is a fully sustainable, financially healthy and safe country.		
Inequality (SSP4)		Power is concentrated in a small political and corporate elite, paralleled by growing inequality. Society is largely underdeveloped and lives in poverty; health and education services are minimal; the media is controlled; the food system is industrialized; and the state prefers to manage, rather than prevent crises. Eventually, people recognize the potential of self-organization and get by on the periphery of a centralized and elitist regime.		
Pató Pál úr (SSP5)	RCP8.5 Temperature +3.5 to +5.5°C Precipitation +10% to +26%	Growing corruption, technological development, and economic growth, with energy-intensive and isolated lifestyles. Indifference to the environment and non-stop industrialization leads to the unbridled exploitation of fossil energy resources. Greenhouse gas emissions soar, climate change is unabated and a society grossly unprepared to deal with consequences faces total collapse.		
Regional Rivalry (SSP3)		Permanent conflict, the threat of war, economic collapse and the total disintegration of society. Due to climate change and the pillage of natural resources, the environment is in decline and government abandons its responsibilities. People are unable to meet their basic needs and are forced into rural ghettoes. By 2100, there are serious energy shortages, and large-scale agricultural development and urbanisation are halted.		

<sup>1</sup>Annual average change in Hungary in 2071-2100 relative to 1981-2010

# What are the impacts and risks in a future above 2°C?

**Heat stress:** Heat stress will increase as a major public health problem in the region due to the higher frequency and intensity of heat waves, leading to almost continuous heat alerts during summer. Across Central Europe as a whole, heat-related mortality is expected to double for a 2°C warming (~RCP4.5) and triple for a 5°C warming (~RCP8.5).

**Water management:** More intense rainfall events and greater oscillation between extreme dry and extreme wet periods are projected to affect water availability and runoff. As a result, the water level of Lake Balaton, a key national and international asset, may oscillate between extreme low and extreme high levels more frequently, with major implications for the ecological functioning and socio-economic uses of the lake.

**Lyme disease:** Modelling shows that Lyme disease infection rates will increase nation-wide in all scenarios due to higher temperatures, which enhances tick activity, and an increase in the area of forest, which is a major tick habitat. The impacts are worse under the higher climate change scenario (RCP8.5).

Land use and crop production: Urbanization is expected to reverse, and out-migration from the capital and major towns is projected to occur under all scenarios. Projections of the yields of key crops under different scenarios vary greatly and there is significant uncertainty with regards to the scale and direction of the change. Heat stress and water stress, among the many climate and socio-economic factors that affect agricultural land use, will certainly have a major impact on crop production and ultimately will hinder agricultural productivity and food security.

### What do we want our future to look like?

Stakeholders and researchers co-created a common 'Vision for Hungary' in 2100 from the perspective of the two local communities, taking macro-scale framework conditions such as EU-level governance also into account. The vision shows a world of environmental, social and economic sustainability.

#### Health and education

People live long, happy, healthy, active lives, close to nature and connected to their community. Education nurtures traditional knowledge and sustainability skills. The goal of development is well-being, not growth and consumption.

#### Environment

The protection of the environment and climate is a priority. Near-zero industrial emissions and a clean, healthy urban environment.

#### **Food and Water**

Water management builds on the natural functioning of watersheds. Food production is eco-efficient with large-scale organic farming and urban gardening, producing food locally and for export.

Communities and values Cultural and community life is strong and safe, with support for young and old. Money is no longer considered the ultimate measure of success.

### Vision for Hungary 2100

Economy and employment There is a low carbon circular economy with minimal waste. Highly ecoefficient technologies are widespread. Minimal corruption, full employment and a booming tourist industry.

Governance and institutions Decision making is integrated and leaders are accountable. Strong participatory local governance and many local civic initiatives.

Energy, buildings and transport A sustainable, decentralised energy supply provides energy security. Hungary is energy-independent, with energy-efficient buildings, technology and transport.

### How can a sustainable future be achieved?

Local stakeholders worked with researchers to develop transition pathways that move each scenario closer to the 'Vision for Hungary', by identifying additional adaptation and mitigation measures that are appropriate within the constraints and opportunities in each scenario. These measures are most effective for the 'dysfunctional' SSP3 scenario, but have less effect for the optimistic SSP1 scenario where the baseline is already quite close to the vision.

### Pathways to move Hungary towards a common desirable future in 2100

These pathways were generated during stakeholder workshops to match the main priorities and constraints under each scenario. Omission of a pathway for a certain scenario does not necessarily imply that it would not be needed.

Pathway	Scenario			- nen e	Examples of strategies
	SSP1	SSP3	SSP4	SSP5	Examples of strategies
Sustainable and resilient water management	×	~	×	~	Distributed micro-reservoir systems for extreme dry and extreme wet conditions; increase water retention capacity of the soil; incentives for water saving; grey water recycling; revitalization of locally embedded water management institutions.
Inclusive multi- level governance for sustainability	✓ <sup>(1)</sup>	✓	~	~	Strict and enforced environmental standards; zero tolerance of corruption; independent communication channels; devolution of power to organizations with more balanced distribution of legislative, executive and budget powers at the local level; incentives for voting.
Healthy lifestyles and new education systems	✓	~	~	<b>v</b>	Awareness raising activities on resource consumption and health; promotion of traditional, low-consumption lifestyles; education for individual responsibility and sustainability; revitalization of traditional healing methods; society-wide nutrition and fitness program; heat stress management; value system based on well-being.
Green and comfortable cities	~		~	100	Reduced paved surfaces; urban agriculture; natural cooling and shading; increase green space; regulations allowing passive or active houses only; green mobility.
Green energy		~		~	Regulation and incentives for energy efficiency, renewables and electric transport.
Rural development and local economies			~	1	Local markets and co-operatives promote community self- sufficiency and resilience in energy, food and resources; organic and small-scale agriculture; climate resistant crops.



Assessment of the achievement of the 'Vision for Hungary' under the scenario (red line) and pathways (green line) for SSP1 (RCP4.5) and SSP3 (RCP8.5). Achieving 100 (outside of the spider diagram) means that the vision has been achieved.

## What are the transformative solutions?

Transformative solutions are a series of actions that foster the transition to the shared vision of a low-carbon future. All the pathways listed in the table are transformative, but three of them underpin the other pathways across all scenarios:

- The pathway that promotes inclusive and multi-level government and governance for sustainability supports the implementation of all pathways by setting up the framework conditions for actors to move towards sustainability and resilience. For example, it supports setting up integrated and collaborative water management systems by enabling strong governmental regulations and incentives that incorporate the real price of water and other resources into economic activities and by enabling collaboration across scales and sectors. It also underpins local and rural development by strengthening local democracies and local investments in infrastructure and technologies.
- The pathway that promotes shifts to healthy lifestyles underpins changing resource use and demands for sustainable products by educating people about lifestyle choices. It also supports local democracies by building the capacities of people to participate in decisionmaking and fostering political cultures.
- The **sustainable water management** pathway not only succeeds in improving reservoir water storage capacity significantly in all scenarios, but also develops an integrated resource management framework that can promote synergies between water, agriculture and energy.

However, transformative solutions will also need to manage **trade-offs** between climate adaptation and climate mitigation. For example, in some scenarios public cooling centres are set up to reduce heat stress, which could increase emissions unless renewable energy is used. Similarly, there could be a trade-off between the need to set a strong regulatory framework at the national level and the preference for community governance.

# **Policy Recommendations**

- Municipal adaptation and development strategies should not only consider current climate stress and mid-term projections, but also directly address the higher levels of climate change projected further into the future.
- Invest in research to i) reduce uncertainty over the local impacts of climate change (e.g. on crop yields), using high resolution quantitative models, and ii) develop interfaces that can translate complex scientific models into information that can be understood and used by non-scientist audiences at the municipal level.
- Develop platforms to support the engagement of local stakeholders, from all key sectors, in identifying vulnerability issues and risks, developing future visions and constructing transition pathways. Engagement helps to identify place-specific issues, and people involved in developing adaptation solutions are more likely to have ownership and actually implement them.
- Implement practical solutions at the local level, to raise awareness and build capacity for further action, e.g. by expanding green space, constructing water storage, investing in water re-use technologies and encouraging urban agriculture. Diversify crop production to build resilience in the face of uncertain climate impacts.
- Move towards governance for sustainability, with a strong system of regulations, standards and incentives (e.g. for zero-energy housing, renewable energy and organic agriculture) to accelerate a transition towards a climate-resilient society.
- To encourage lifestyle and behaviour change, make maximum use of the media, the education system and the art community to tell stories about how we can transform to address climate change in a way that brings it close to a wide range of audiences.

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#### Find out more:

Clarke et al. (2017) Regional/local scale CCIAV applications, IMPRESSIONS Deliverable D3C.2; Hölscher et al. (2017) Adaptation and mitigation pathways, and synergy mechanisms between them, for the case studies. IMPRESSIONS Deliverable D4.2.

Both available from www.impressions-project.eu.