MERLIN

Regional Scalability Plan
Case Study 9 – Tisza

Developing sustainable water management and landscapes in the Tisza Plain

Roadmap to 2050

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Imprint

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Content

1 For the reader

Goal of the document

This is the Regional Scalability Plan (RSP) of the activities initiated along the River Tisza in Hungary within the MERLIN project. It is a vision and a roadmap by 2050 to **develop sustainable water management and landscapes in the Tisza Plain**. The RSP may help ensure that sustainable development processes applied in the pilot areas can be applied throughout the river basin. It contains proposals on how to implement nature based water retention (NWRM), sustainable land use and water-efficiency. This is also a tool for climate resilience: preparing for increasingly extreme weather events, responding to declining surface and groundwater resources and biodiversity degradation. Climate-resilient economic and social development can be a breakthrough for Hungary's hard-hit eastern micro-regions.

The content

This document briefly describes the ecological, economic and social **situation and future trends** in the focus area. Current problems of water management and land use are explored, and how these may be made worse by climate change. We present a **vision of sustainability** for the Great Plain of Tisza, the key to which is water retention, reconnecting floodplains to the river and land use that leaves sufficient space to retain water. We outline how economic and social development could be built on this and the policy frameworks needed. We explain how interventions can help achieve the **EU Green Deal targets.** We list **the actions** that need to be taken to move towards the 2050 long-term goals.

Inputs used

While writing the RSP, we drew on the experience gained during the fieldwork of the MERLIN project, the suggestions and inspiration given by the **Case Study Board**, local farmers at pilot sites, representatives of the Upper Tisza Regional Water Directorate, the Network of Village Advisers, the National Chamber of Agriculture and the Hortobágy National Park Directorate in the Bereg Pilot Site.

In 2024, we held **a series of workshops on the planning of a Tisza Valley Strategy**, with key leaders, planners and researchers in the Hungarian water sector, representatives of major NGOs working on sustainability, experts of outstanding importance in agri-environmental research. Representatives participated these meetings from the General Directorate of Water Management, VIZITERV Environ, Budapest University of Technology and Economics Department of Sanitary and Environmental Engineering, National Environmental Council, National Society of Conservationists, Association for Hungarians in the Carpathian Basin, Alliance for the Living Tisza. We have incorporated the conclusions of this high-level, multi-sectoral series of discussions into the RSP. The description of most of the planned actions is a product of this discussion.

In addition, to prepare the RSP, we have used the situation analysis and recommendations of the **Tisza 21 Concept prepared by WWF Hungary** with the involvement of key experts in the field.

Potential users

This RSP can be used by different target groups and can be a roadmap for cooperation.

Local and regional NGOs that are open to plan, implement and disseminate environmentally sound agricultural and sustainable rural development models in the Tisza River Basin in Hungary. Our partner NGOs (Association for Hungarians in the Carpathian Basin [KMME], Upper Tisza Valley Rural Development Association, Foundation for Nagykörű, E-Misszió Association, Alliance for the Living Tisza) focus on Nature Based Water Retention Measures (NWRM) and biodiversity enhancement in their areas of operation.

National-level NGOs or networks, such as National Society of Conservationists – Friends of the Earth Hungary [MTVSZ–FOE] or the Choose the Water Network may also strengthen cooperation for NWRM in the Tisza Basin. A network of local, regional, national organisations could be able to start replicating the development model in other areas along the Tisza, with regard to ecological, social and economic sustainability, and the active involvement of local societies.

Research workshops and companies investigating the possibilities, benefits and feasibility of NWRM on a theoretical or practical level (Budapest University of Technology and Economics Department of Sanitary and Environmental Engineering, VIZITERV Environ [the largest state-owned water planning company], Institute of Agricultural Economics, Regional Centre for Energy Policy Research and other institutions) should be involved in

strategic planning too. To support the justification of NWRM and to measure its impact, citizen-science provides a good opportunity, of which there are good examples in Hungary (e.g. Vadonleső – Wilderness Spotters).

Farmers, organisations representing farmers' interests, are key actors in the implementation of the RSP. A key factor in the transition to NWRM-based land use in the Tisza River Basin is the change in farming practices, which is a profound change of direction, a process that has been going on for decades. In this, knowledge co-creation with stakeholders and motivation of participants is a key success factor. The large farmers who cultivate most of the catchment and the small farmers who work on tens of thousands of plots may have different interests in the process.

Public organisations, authorities, local governments are key actors in water, ecological, social and economic development based on NWRM at the territorial level. These include water directorates in the Tisza region, national park directorates, municipal and county governments, and local departments of the National Chamber of Agriculture in the Tisza River Basin in Hungary.

National decision-makers are the top-level partners in strategic planning and implementation, particularly the General Directorate of Water Management, National Chamber of Agriculture and the ministries responsible for water, agriculture, energy, climate change adaptation and mitigation. The National Council for Sustainable Development of the Parliament are key partners too. It is essential, however, that it is clear to the government that the sustainable development of the Tisza River Basin and Eastern Hungary is a whole-of-government responsibility and not a matter for individual ministries.

This RSP may be used as an input for the planning of the **Tisza Valley Strategy** being prepared for the government.

2 Focus of the RSP

2.1 Regional characteristics

The Tisza River Basin (157,186 km²) is the largest sub-basin of the Danube catchment and connects five countries: Romania, Ukraine, Slovakia, Hungary and Serbia. Hungary has the second largest area of the Tisza Basin that covers almost 30% of the catchment. Most of the Tisza River Basin in Hungary (46,380 km²) is typically low-lying, flat area dominated by intensive agriculture production.

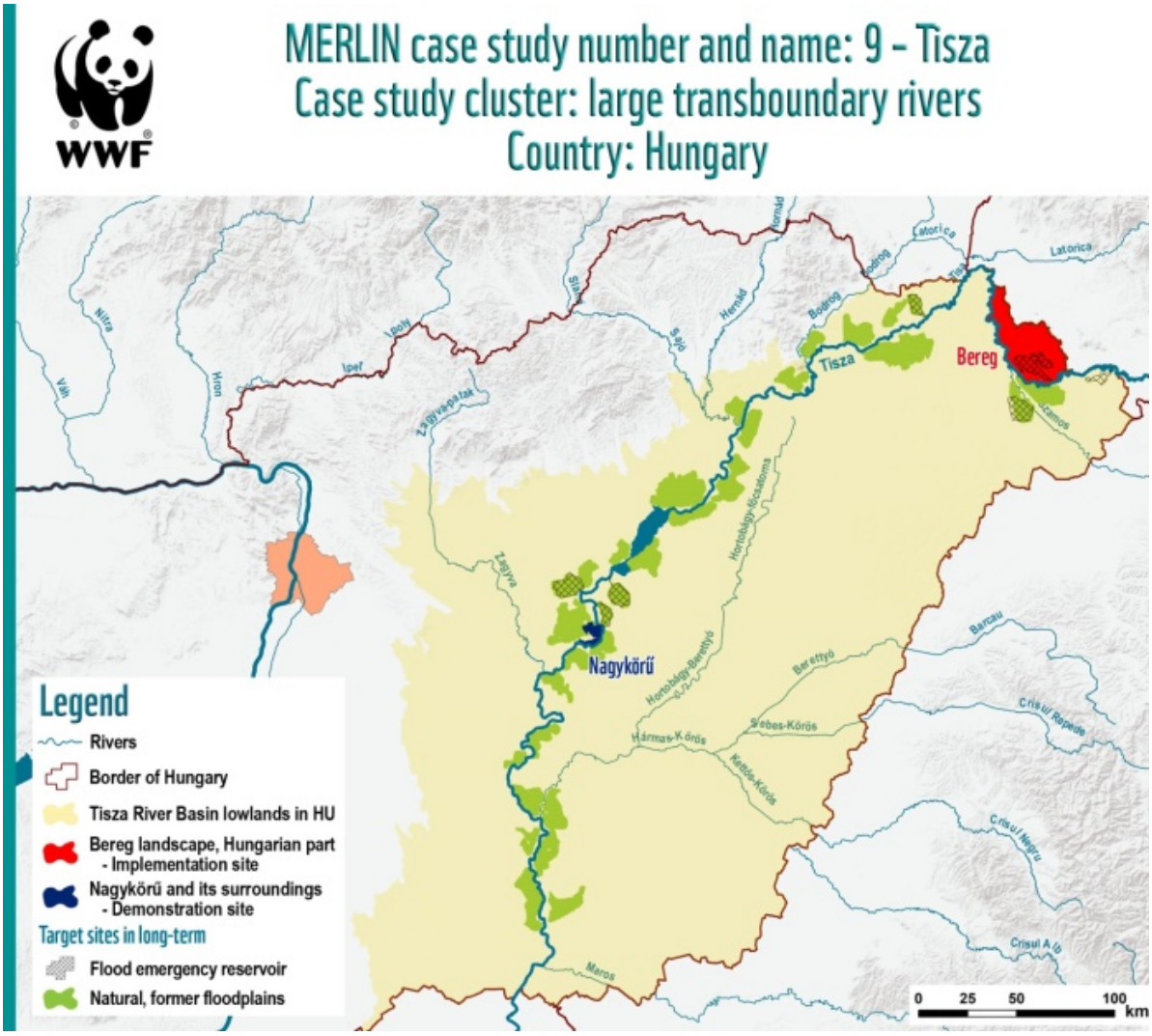

Figure 1: Map of the planning area - the Tisza Plain (Source: Authors' elaboration)

This RSP focuses on the Hungarian part of the Tisza catchment area, the Great Plain and the Sand Ridge areas, which is referred to as the Tisza Plain. The total area of the planning area is 40,418 km², of which 31,307 km² are lowland and 9,111 km² are lowland steppe. The Tisza Plain region, comprising 83 districts, has 4 million inhabitants, 42% of the Hungary's population in almost 45% of the country's territory. The Eastern part of Hungary, including the Tisza Region has a relatively weak economy and a lot of social problems. Some parts of the basin have rich biodiversity with unique species, like mayfly. There are 305 protected areas, covering 19,000 km² in the Hungarian part of the Tisza River Basin. Within this, however, there are different categories of nature conservation. Most areas fall into the category of relatively low conservation status. The weakened state nature conservation institutions alone cannot guarantee the good or improving condition of protected areas. The Natura 2000 country reports for Hungary show a deteriorating state of biodiversity. To achieve long-term improvement, it is essential that land users are made interested in the protection of natural values.

Before the river regulation and draining works in the 19th – 20th centuries, two thirds of the Pannonian Plain was a floodplain, periodically inundated by the Tisza and its tributaries. People used this opportunity in much of

the Tisza Plain by floodplain farming. They cleaned natural “side-channels” of the river so that the river could flood deeper lying areas of the floodplain. People helped the main river to connect the parts of the floodplain (tributaries, streamlets, lakes, inundated areas) into one single system. Lakes and other wetlands were used for fishing, reed management and the collection of other aquatic plants and animals. The inundation of pastures, meadows and orchards meant natural irrigation for them, increasing the yields. Arable farming was possible in the higher-lying areas, which were rarely or never covered by water. Flooding of a larger area has made the watercourse of the rivers more even, reducing the maximum water level of floods. Floods compensated the Pannonian Plain for the lack of rainfall, improved the local climate of the area and made it possible to sustainably use the floodplain.

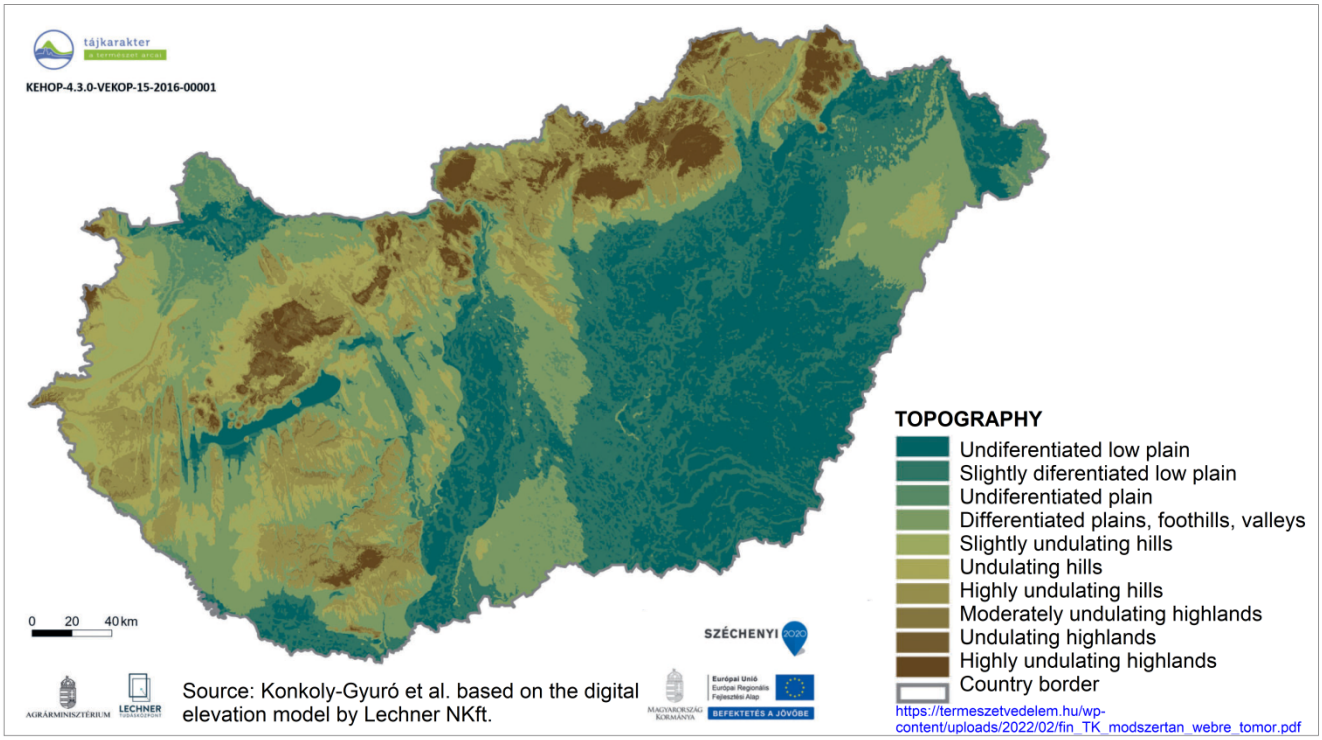

Figure 2: Topography of Hungary (Source: Konkoly-Gyuró et al. based on the digital elevation model by Lechner NKFt. https://bit.ly/45wm0J9)

River regulation in the 19th and 20th century changed profoundly the life of Tisza. The total length of the river was shortened by approximately 30%, from 1400 km to 966 km. Now the river runs between flood protection dikes and lost the connection with most of its former floodplains. The narrowing of the floodplain brought increasing levels and higher risks of floods, which is becoming worse as the floodplain between the dykes is being filled up with sedimentation. The biodiversity has radically decreased, including a radical decline of the fish population. Key habitats – like marshes, wet meadows, floodplains and gallery forests – lost more than 90% of their area since 1780. Inland excess water outside the dikes causes damages to agriculture. Despite the outstanding natural value of some areas, the biodiversity of the Tisza River Basin is generally highly degraded, with much of the land being ploughed or artificially created since the river was regulated.

2.2 Justification for the region

The Pannonian Plain is particularly affected by droughts. The central part of it, the Danube-Tisza Interfluve has already become a semi-desert. Nevertheless, irrigation is neither a response for most of the farmers, as only 2 per cents of croplands can be irrigated throughout Hungary. For most of the farmers this solution is just not economical. Biodiversity is threatened mostly by the lack of water, intensive agriculture, invasive species and harmful management practices (e.g. clear cutting forests in the floodplains). Biodiversity loss and the growing presence of invasive species mean serious problems. Although, the Tisza could provide the lowlands with water transported here from the mountains, this opportunity is not used now. The water management system focuses on draining the waters away as quickly as possible.

Seven large flood risk reduction reservoirs were built in the Further Development of Vásárhelyi’s Programme (FDVP) started by the Hungarian Government in 2001. These are so-called 'dry reservoirs', which can be used to

let in sudden surges of water if an extreme flood threatens to cause a disaster. Their main purpose is therefore to reduce the peak level of extreme floods, which is only done in special cases, estimated by engineers to occur once every 40 years. They are not currently used to protect against drought or to store water in the landscape. However, three of the reservoirs are suitable for NWRM, one of which is our Bereg pilot site.

Hungary is affected by three different climatic influences: the oceanic climate in the west, the dry continental climate in the northeast and the Mediterranean climate in the south of the country. This makes modelling the expected impacts of climate change a very difficult task. **Research suggests that climate change will exacerbate the damage caused by drought, heatwaves and other extreme weather events.** The distribution of precipitation is shifting from the spring and early summer precipitation maxima to a wetter winter. Due to climate change and river regulation, water levels and quantities in the river Tisza decrease. As the rivers have been straightened and shortened, their water level fluctuations have increased and the incision of the riverbed has increased to an extreme. In this context, the Upper Tisza has only a very short period during which flood waves can be gravitationally discharged into the floodplain and the length of these periods is reduced in the Central Tisza too. The frequency and severity of weather extremes will increase in the Pannonian Plain. Longer and more intense droughts, heatwaves and more extreme floods are projected for the area. Hungary is thus considered one of the most vulnerable countries to climate change in Europe. In case no change is made to land use and water management practices, biodiversity will further decrease, the social and economic situation will become worse in the project area.

2.3 Linkages and synergies with other initiatives

This RSP builds on previous documents for the Tisza river basin and links to ongoing or incipient strategic planning processes. The main inputs used or related for the preparation:

- **Further Development of Vásárhelyi's Plan** – A government programme launched in 2001 to increase flood safety along the Tisza. The programme involves raising existing embankments in some places, building reservoirs and increasing the speed of water drainage in the high-water riverbed.
- **Hungary's Second Review of its Water Management Plan** - In order to implement the Water Framework Directive, Hungary has prepared its National River Basin Management Plan, which has been updated twice so far. The Plan aims to bring the country's waters into good status by 2027.
- **Second National Climate Change Strategy** – This document sets out the strategic orientations to combat climate change up to 2025, looking ahead to 2050. It sets out the priorities for decarbonisation, adaptation and awareness-raising.
- **Common Agricultural Policy Strategic Plan** – It presents the support measures for agriculture and rural development that Hungary will implement from the Common Agricultural Policy between 2021 and 2027.
- **WWF Hungary's Tisza 21 Concept** – Background study and concept on how to achieve sustainable development of the Tisza Plain based on nature based water retention and land use.

3 Stakeholders of the RSP

3.1 Main stakeholders

As a key part of realising our vision is to make space in the landscape for water retention, a central question is who uses the land, who are the game changers. In the Pannonian Plain, which makes up the largest part of the Tisza catchment in Hungary (Tisza Plain), **the biggest land user is intensive agriculture,** mainly arable farming. Intensive agriculture produces mostly grain, maize, oil seeds and fibre crops. However, agriculture provides a living for less and less people. The Eastern part of Hungary, including the Tisza Region has to cope with poverty, ageing population in most villages, outward migration from rural areas and concentration of land ownership.

Figure 3: Stakeholder workshop in the Bereg (Photo: László Szöllősy)

Climate change-related drying and increasing frequency of weather extremes as trends are evident to an increasing number of the public, farmers and decision-makers. However, (mal)adaptation to climate change is now being mostly driven by short-term, individual approaches, leading to accelerating depletion of resources (e.g. drilling new or deeper wells, overuse of surface and groundwater aquifers). There are a number of legal and financial instruments that take a short-term view and encourage maladaptation and overuse of water (e.g. by making it easier to obtain permits to drill wells, making irrigation cheaper for farmers in drought periods). Farmers are interested in being provided by cheap water for irrigation, where possible. **The key sectors for achieving our vision are water management, agriculture, forestry, fishery, water intensive industry, municipalities, the national government and NGOs.**

Large farmers, agricultural companies have a dominant voice in local land use. Though, small farmers have little power in interest representation, **even one small farmer may block NWRM in a basin.** One of the ways to change this situation is for farmers to see NWRM solutions that work and are profitable, and that offer them an alternative. At present, it is not a very attractive option for farmers to store water on their land, as this can reduce the yield of arable crops. But droughts are causing increasing damage. **Together with farmers, we are looking for land use alternatives** that will ensure a transition to mosaic-like land uses that have a place for water in them, but also provide opportunities to build profitable value chains and ensure that farmers can receive attractive amounts of agricultural support from the agricultural subsidy system (knowledge co-production). Such incentives have already appeared in the Hungarian support system of the Common Agricultural Policy and we are lobbying to make them even more attractive to farmers. **The national agricultural strategy must also change:** in addition to the focus on arable production, strengthening resilience must become a top priority.

The water management administration is centralized and has a hierarchic structure, with the Ministry of Energy on top. Water management is focused on draining the waters as quickly as possible, but has no good answers for droughts. However, **a slow change has already started in the water management sector**, what may allow NWRM to be included in flood risk management (e.g. building reservoirs, widening floodways, initiatives to retain inland water).

For these reasons, **we will focus on implementing successful NWRM-based model projects** in specific landscapes (Bereg, Nagykörű) as a first step, but in parallel we will also **lobby intensively** to change the water management policy, land use policy and CAP subsidies framework in a positive direction.

3.2 Stakeholder map

The figure below shows that stakeholders can be engaged to different degrees. The following tables show the stakeholders that have been involved and those that are planned to be involved.

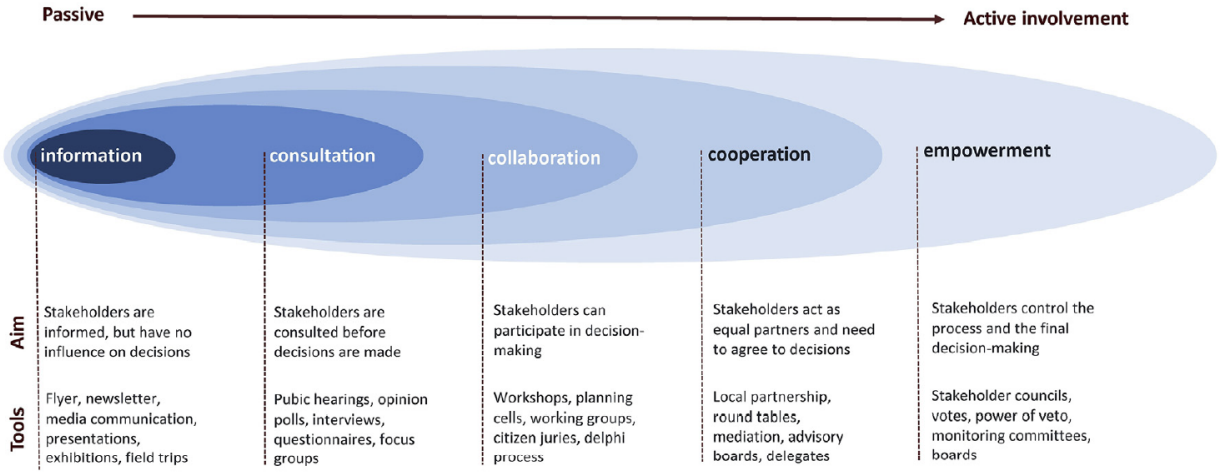

Figure 4: Level of stakeholder engagement (Source: Grygoruk and Rannow, 2017: 10.1016/j.jenvman.2016.10.066)

3.2.1 Description of main stakeholders

ID #	Name of stakeholder	Acronym	Sector	Involvement status		Scale (level)	Ownership	Description: Expectations, interests, responsibilities	WebLink
National level stakeholders									
1	Ministry for Agriculture	AM	Agriculture	To be invited	COL	National	Public	Responsible for agricultural subsidies, regulation	https://kormany.hu/agrarminiszterium
2	Ministry of Energy	EM	Water resources	To be invited	COL	National	Public	Highest level authority of water management	https://kormany.hu/energiaugyi-miniszterium
3	General Directorate of Water Management	OVF	Water resources	Already involved	COO	National	Public	Central authority for water management	https://www.ovf.hu
4	National Directorate General for Disaster Management Ministry of the Interior		Water resources	To be invited	COO	National	Public	High level authority of water management	https://www.katasztrofavedelem.hu
5	Hungarian Chamber of Agriculture	NAK	Agriculture	To be invited	COL	National	Public	Interest representation for farmers. It promotes intensive farming, but may be convinced to support NWRM at local levels.	https://www.nak.hu
6	VIZITERV Environ Plc		Water resources	Already involved	EMP	National	Public	Government-owned water planning company that designed the Bereg landscape's water management system, which will be involved in technical implementation	https://environ.hu
7	Vadonleső – 'Wilderness Spotters'		Environment, climate and disaster	To be invited	CON	National	Public	A citizen-science programme coordinated by the Ministry of Agriculture. Data on plants and animals observed in nature can be uploaded into the database voluntarily.	https://vadonleső.hu/
8	WWF Hungary	WWF HU	Environment, climate and disaster	Already involved	EMP	National	NGO	MERLIN Case Study project manager **Member of Case Study Board**	https://wwf.hu/en/home/
9	National Society of Conservationists – Friends of the Earth Hungary	MTVSZ–FOE	Environment, climate and disaster	Already involved	COO	National	NGO	An influential network of NGOs	https://mtvsz.hu/en

ID #	Name of stakeholder	Acronym	Sector	Involvement status		Scale (level)	Ownership	Description: Expectations, interests, responsibilities	WebLink
Sub-national level stakeholders									
10	Municipality of Szabolcs-Szatmár-Bereg County		Cross Sector (governance, regulation, etc.)	Already involved	CON	Sub-national	Public	Municipality of the county including the Bereg. Its leader is supportive for NWRM.	https://www.szszbmo.hu
11	Municipality of Jász-Nagykun-Szolnok County		Cross Sector	Already involved	CON	Sub-national	Public	Municipality of the county including Nagykörű. Its leader is supportive for NWRM.	http://www.jnszm.hu
12	Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Agriculture		Cross Sector	Already involved	COO	Sub-national	Public	Government authority responsible for agriculture, fishery in the Bereg (besides other areas)	https://kormanyhivatalok.hu/kormanyhivatalok/szabolcs-szatmar-bereg
13	Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Environment and Nature Protection		Cross Sector	To be invited	COO	Sub-national	Public	Government authority responsible for environmental and nature protection in the Bereg (besides other areas)	https://kormanyhivatalok.hu/kormanyhivatalok/szabolcs-szatmar-bereg
14	Jász-Nagykun-Szolnok County, Government Office Dept. of Agriculture		Cross Sector	To be invited	COO	Sub-national	Public	Government authority responsible for agriculture, fishery in Nagykörű (besides other areas)	https://kormanyhivatalok.hu/kormanyhivatalok/jasz-nagykun-szolnok
15	Jász-Nagykun-Szolnok County, Government Office Dept. of Environment and Nature Protection		Cross Sector	To be invited	COO	Sub-national	Public	Government authority responsible for environmental and nature protection in Nagykörű (besides other areas)	https://kormanyhivatalok.hu/kormanyhivatalok/jasz-nagykun-szolnok
16	Hungarian Chamber of Agriculture, Szabolcs-Szatmár-Bereg County Organization	NAK-SzSzB	Agriculture	Already involved	COO	Sub-national	Public	The local organization of the Hungarian Chamber of Agriculture competent in the Bereg (besides other areas).	https://www.nak.hu/kamara/120-rolunk/orszagos-elnokseg/17-vezetoseg-orszagos-elnoksegi-tagok

ID #	Name of stakeholder	Acronym	Sector	Involvement status		Scale (level)	Ownership	Description: Expectations, interests, responsibilities	WebLink
Catchment level stakeholders									
17	Upper Tisza Regional Water Directorate	FETIVIZIG	Water resources	Already involved	EMP	Catchment	Public	Water management authority competent in the Bereg (besides other areas)	https://fetivizig.hu
18	Middle Tisza Regional Water Directorate	KÖTIVIZIG	Water resources	To be invited	COO	Catchment	Public	Water management authority responsible for Nagykörű (besides other areas)	https://www.kotivizig.hu
19	Alliance for the Living Tisza	SZÖVET	Environment, climate and disaster	Already involved	INF	Catchment	NGO	An NGO for NWRM in Nagykörű	http://elotiszaert.hu
Regional level stakeholders									
20	Hortobágy National Park Directorate	HNPI	Environment, climate and disaster	Already involved	EMP	Regional	Public	Nature protection authority responsible for much of the Pannonian Plain (including the Bereg and Nagykörű) **Member of Case Study Board**	https://www.hnp.hu/en
21	Bereg Multi-purpose Microregional Association	BeregTöT	Cross Sector	Already involved	COL	Regional	Public	Coordination body including nearly all of the 26 municipalities of the Bereg.	http://www.beregtot.hu
22	Upper Tisza Valley Rural Development Association		Other	Already involved	EMP	Regional	Public	A local 71-member rural development group able to apply for special agriculture funds, facilitating project development in the Bereg **Member of Case Study Board**	http://felso-tiszavolgye.hu/
23	Farmers' Consultant Office of NAK in Vásárosnamény		Agriculture	Already involved	CON	Regional	Public	Local agricultural consultants of NAK-SzSzB. They may have a very important role in involving and informing local farmers in the Bereg.	https://www.nak.hu/kamara/ugyfelszolgalat-es-falugazdaszok
24	Tourinform, Bereg Office		Other	Already involved	CON	Regional	Public	Government-owned destination management office in the Bereg, very supportive	https://vasarosnameny.hu/idegenforgalom/tourinform-iroda-elerhetosegei
25	Nyírerdő ZRt.		Forestry	Already involved	CON	Regional	Public	Government-owned forestry company in the Bereg	https://nyirerdo.hu/en/home
26	Vásárosnamény Farmers' Club		Agriculture	Already involved	COL	Regional	Private (Commercial, investor, etc)	Farmers' association in the Bereg **Member of Case Study Board**	https://hu-hu.facebook.com/vasarosnameny.gazdakor.3
27	Association for Hungarians in the Carpathian Basin	KMME	Other	Already involved	EMP	Regional	NGO	They run several projects to promote sustainable water management in the Upper Tisza region	http://kmme.hu/
28	E-Misszió Association	E-Misszió	Environment, climate and disaster	Already involved	EMP	Regional	NGO	They help facilitating the involvement of local stakeholders in the Bereg **Member of Case Study Board**	https://e-misszio.hu/
29	Choose the Water Network		Environment, climate and disaster	Already involved	CON	Regional	NGO	A network of NGOs for NWRM along the Tisza	https://viz-valaszto.hu/

ID #	Name of stakeholder	Acronym	Sector	Involvement status		Scale (level)	Ownership	Description: Expectations, interests, responsibilities	WebLink
Local level stakeholders									
30	Bockerek Hunting Company		Other	Already involved	CON	Local	Private (Commercial, investor, etc)	Hunting company in the Bereg	http://kelet-nimrod.hu/bockerek
31	Nagykörű, local small farmers		Agriculture	To be invited	CON	Local	Private (Commercial, investor, etc)	Their support is inevitable for success.	
32	Nagykörű, local large farming companies		Agriculture	To be invited	CON	Local	Private (Commercial, investor, etc)	Their support is inevitable for success.	
33	Small scale local product producers in Nagykörű		Agriculture	Already involved	EMP	Local	Private (Commercial, investor, etc)	Local production can be enhanced by the extension of wetlands	
34	Beregi Tiszahát Anglers' Association		Fishery	Already involved	INF	Local	Community group	Anglers' association in the Bereg	
Municipal level stakeholders									
35	Municipality of Tarpa		Cross Sector	Already involved	EMP	Municipal	Public	**Member of Case Study Board**	https://www.tarpa.eu/
36	Municipality of Jánd		Cross Sector	Already involved	EMP	Municipal	Public	**Member of Case Study Board**	https://jand.hu/
37	Municipality of Nagykörű		Cross Sector	Already involved	EMP	Municipal	Public	Initiator of local projects	http://nagykoru.hu
38	Foundation for Nagykörű		Other	Already involved	EMP	Municipal	NGO	Initiator of local projects	https://nagykoruertalapitvany.hu

3.2.2 Main stakeholders grouped by sector and level

	Water resources	Agriculture	Fishery	Forestry	Environment, climate and disaster	Cross Sector (governance, regulation, etc.)	Other
National	Ministry of Energy	Ministry for Agriculture			WWF Hungary		
	General Directorate of Water Management	Hungarian Chamber of Agriculture			National Society of Conservationists – Friends of the Earth Hungary		
	National Directorate General for Disaster Management Ministry of the Interior				Vadonleső – 'Wilderness Spotters'		
	VIZITERV Environ Plc						
Sub-national		Hungarian Chamber of Agriculture, Szabolcs-Szatmár-Bereg County Organization				Municipality of Szabolcs-Szatmár-Bereg County	
						Municipality of Jász-Nagykun-Szolnok County	
						Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Agriculture	
						Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Environment and Nature Protection	
						Jász-Nagykun-Szolnok County, Government Office Dept. of Agriculture	
						Jász-Nagykun-Szolnok County, Government Office Dept. of Environment and Nature Protection	
Catchment	Upper Tisza Regional Water Directorate				Alliance for the Living Tisza		
	Middle Tisza Regional Water Directorate						
Regional		Vásárosnamény Farmers' Club		Nyírerdő ZRt.	Choose the Water Network	Bereg Multi-purpose Microregional Association	Tourinform, Bereg Office
		Farmers' Consultant Office of NAK in Vásárosnamény			Hortobágy National Park Directorate		Upper Tisza Valley Rural Development Association
					E-Misszió Association		Association for

	Water resources	Agriculture	Fishery	Forestry	Environment, climate and disaster	Cross Sector (governance, regulation, etc.)	Other
							Hungarians in the Carpathian Basin
Local		Nagykörű, local small farmers	Beregi Tiszahát Anglers' Association				Bockerek Hunting Company
		Nagykörű, local large farming companies					
		Small scale local product producers in Nagykörű					
Municipal						Municipality of Tarpa	Foundation for Nagykörű
						Municipality of Jánd	
						Municipality of Nagykörű	

Cell colour code:

EMP	Empowerment
COO	Cooperation
COL	Collaboration
CON	Consultation
INF	Information

Font colour code:

Already involved

To be invited

4 Green deal goals

This RSP focuses on the lowlands of the Hungarian part of the Tisza River Basin. Today the Tisza runs between flood protection dikes and has no connection with most of its former floodplains. However, there are at least 150,000 ha of deep floodplains (active and morphological floodplains), which could be safely reconnected to the river and used for floodplain farming.

Our long term goal is to preserve and develop the natural floodplains / river ecosystem along the Tisza River. **Our target is that water retention based, nature friendly, sustainable floodplain management system is introduced** in the Hungarian part of the Tisza River Water basin, wherever possible, but at least on 150,000 ha, in order to improve biodiversity and provide benefits for local communities.

If the vision is realised, **measurable outcomes** will include: improved habitat condition and the creation of new semi-natural habitats: grasslands, forests, wetlands. The sustainable use of local natural resources will play a greater role in the livelihoods of people in the region and living standards will improve. Damage from climate change, inappropriate land use and water management will be reduced.

Overall, the long-term impact will be to **improve the ecological status of the Tisza Region, the livelihoods of its inhabitants and increase their resilience** to climate change.

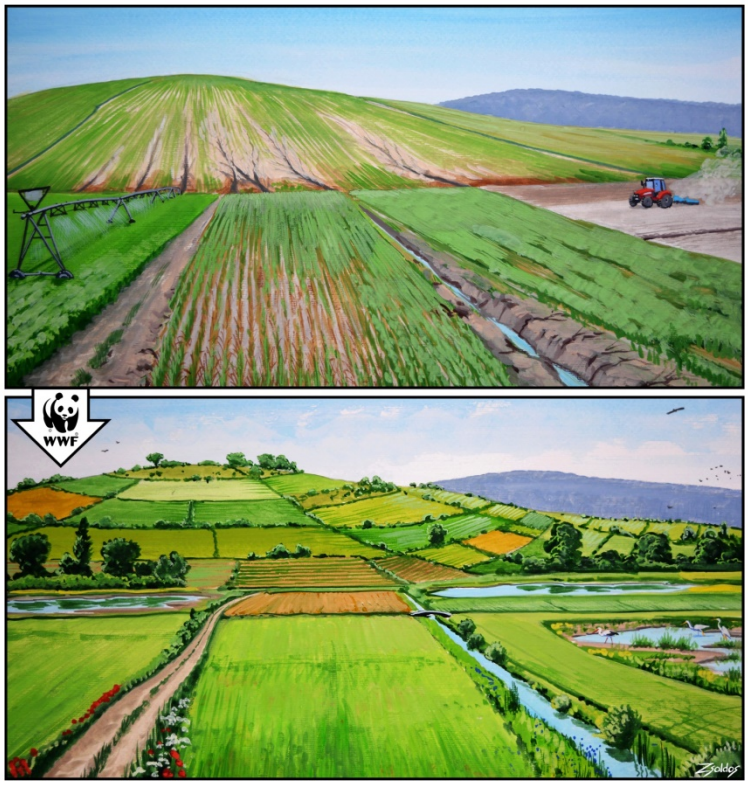

Figure 5: A vision of how water retention changes the landscape (Painting by Márton Zsoldos)

The EU Green Deal (GD) goals were included in the MERLIN proposal. Each case study has identified both primary and secondary GD goals. Primary goals are the main goals that the RSP seeks to achieve. Secondary goals are additional or potential goals to which the RSP can contribute to. **In this chapter we will present which Green Deal goals are important in our RSP.**

4.1 SMART Green Deals relevant for the region: primary goals

4.1.1 Climate regulation

The extent of intensively cultivated arable land will decrease, and so will the amount of carbon released by regular ploughing. New wetlands and forests can absorb more carbon. In the climate adaptation focus areas the share of extensive farming increases, which can lead to lower carbon emissions, higher biodiversity and greater resilience. By retaining water, increasing biodiversity and restoring small water bodies, the 'sponge effect' can be enhanced and the local impact of climatic extremes reduced. Restoring soil condition improves its capacity to absorb carbon and hold water. More extensive wetlands and associated habitats improve the microclimate, reduce persistent precipitation deficits and make the environment more resilient to climate change.

Indicator	*Goals*		
	2030	*2040*	*2050*
• Carbon sinking potential increased in the Hungarian part of Tisza Basin	+3%	+8%	+15%

Method: In the beginning of the RSP implementation the current total carbon sequestration potential of the area concerned is determined. The GHG sequestration potential is determined by land cover type and by the amount of water discharged (t/ha or t for the whole area concerned). The GHG sequestration capacity will increase with the increase in the area with higher sequestration capacity (arable land with no-till cultivation,

wetlands, grassland, forests etc.) and with the increase in water stored in the landscape compared to the baseline. The percentages of increase are the targets to be achieved.

4.1.2 Biodiversity net gain

The condition of natural habitats in the Tisza Basin is deteriorating and the main causes are water scarcity, building on arable land and intensive agriculture, which is reducing habitats to smaller and smaller areas. We are designing and implementing profitable land use models that will allow more water to enter the landscape, which will improve the biodiversity of habitats linked to agriculture. With the reappearance of water, the condition of protected and Natura 2000 sites can be improved. Targeted habitat restoration work is also needed in national park areas.

Indicators	***Goals***		
	2030	***2040***	***2050***
• Increase the area of floodplain re-connected to river (ha)	+8000 ha	+60,000 ha	+150,000 ha
• Improve conservation status of HD Annex I listed habitats including wetland and freshwater habitats, focusing on selected indicator species in re-connected areas	At least no deterioration*	On average 1 degree better than the baseline	On average 2 degree better than the baseline
• Improve conservation status of HD Annex II and Annex IV listed species including wetland and freshwater species, focusing on selected indicator species in re-connected areas	At least no degradation*	On average 1 degree better than the baseline	On average 2 degree better than the baseline
• Improve conservation status of Annex I listed species in the Birds Directive, focusing on selected indicator species in re-connected areas	At least no degradation*	On average 1 degree better than the baseline	On average 2 degree better than the baseline

* For water scarcity and other reasons, the biodiversity status in the target areas is mainly characterised by deteriorating trends. Stopping this trend would already be an achievement.

4.1.3 Drought resilience

We develop farming and land use models that make large areas suitable for water retention. This will allow greater amounts of water to be stored on the surface and in the soil from rainfall surpluses, internal runoff and flooding in landscapes, reducing the devastating effects of droughts.

Indicators	***Goals***		
	2030	***2040***	***2050***
• Increase of the area of rewetted wetlands, other than peatlands (ha)	+8000 ha	+60,000 ha	+150,000 ha
• Increase of the area of agricultural lands with applied schemes for water retention (ha)	+6000 ha	+40,000 ha	+120,000 ha

4.1.4 Sustainable Food Systems (F2F)

The floodplain farming model diversifies the structure of agricultural production, thereby improving food security in several ways. First, it shifts farmers away from monoculture cash-crop production towards a more diversified and higher added value farming structure, building short supply chains that diversify farmers' incomes. Water retention, environmentally friendly farming increases climate resilience, reduces dependence on fossil resources. Environmentally friendly farming produces healthier, better quality products, thus improving food quality and indirectly the health of consumers. Moreover, by including 2-5% of arable land into water-retention based land use, the resilience of conventional agriculture in the greater impact area can be increased. (For more on the drivers and tools of the transition, see below ‘5 From general goals to actions’.)

Indicators	***Goals***		
	2030	***2040***	***2050***
• Change of the land cover: reduction of intensively farmed arable land, and increase in areas used according to environmental conditions (e.g. grasslands, wetlands, forests)	+6000 ha	+40,000 ha	+120,000 ha
• Increase in economic value generated by agriculture in climate adaptation and water retention focus areas compared to previous land use	+10%	+30%	+40%
• Number of farms receiving agricultural subsidies for NWRM (units/year)	10,000	30,000	50,000

4.1.5 Inclusivity

The transformation of land use is being done in a participatory way. Building floodplain management based on water retention at the landscape level requires cooperation between land users, because water knows no

parcel boundaries. We can optimise landscape use if as many people as possible work together. Our model therefore brings a new approach to participatory water and land use planning and economic development.

Indicators	Goals		
	2030	2040	2050
• Level 1 – Public Access to Environmental Information			
○ Presence of project website, social media, specific app	Project image, online tools created		
○ Number of visitors / year to website, social media, specific app	1 M	1.5 M	2 M
• Level 2 - Public Consultation – Including or additional to the Case Study Board			
○ Information sessions about the site/project	5/site/year	5/site/year	5/site/year
○ Public consultation processes held	5/site/year	5/site/year	5/site/year
○ Number of participants in information sessions about the project	10,000	25,000	50,000
• Level 3 - Public Active Involvement			
○ Ability to join a formal stakeholder forum/board/working group	Case Study Board (CSB) / each site set up, min. 3 meetings / year	Min. 3 CSB meetings / year / site	Min. 3 CSB meetings / year / site
○ Surveys to measure representation within engagement and impact of the engagement	Surveys show positive attitudes towards RSP implementation at the sites and nationally	Surveys show positive attitudes towards RSP implementation at the sites and nationally	Surveys show positive attitudes towards RSP implementation at the sites and nationally

4.2 SMART Green Deals relevant for the region: secondary goals

4.2.1 Flood resilience

According to models, climate change in Hungary is projected to bring mainly decreasing precipitation, longer dry spells and occasional extreme precipitation. However, extreme floods may also occur. Since the early 2000s, emergency reservoirs have been built at high cost in several locations along the Tisza to absorb extreme floods. The nature-based model of water retention and landscape use that we want to implement by 2050 would create smaller reservoir areas (polders), connected to Tisza, but also to each other via streams, former wetlands, channels, not solely for flood emergency purposes, but better adapted to the landscape. This would not only improve the water supply to landscapes, but also make flood control more cost-effective, i.e. create multifunctional systems.

Indicators	Goals		
	2030	2040	2050
• Increase of the area of rewetted wetlands, other than peatlands (ha)	+8000 ha	+60,000 ha	+150,000 ha
• Increase in the volume of channel retention gained as a result of restoration (m^3)	+0.2 billion	+0.4 billion	+0.7 billion
• Increase of the storage capacity (m^3) of the floodplain (outside the stream channel)	+0.5 billion	+1 billion	+2 billion

4.2.2 Health and wellbeing

By retaining water and increasing biodiversity, more and better quality habitats will be created. We want to showcase some of these through the development of ecotourism. Based on the theory of biophilia, we can say that people's mental and physical well-being is enhanced by proximity to nature. Thus, allowing more people to recreate in near-natural environments will also increase well-being. But even greater benefits can come from increasing the resilience of affected communities to climate change (especially heat waves and droughts) by retaining water and increasing biodiversity. Reserving water in landscapes improves the local microclimate and reduces the vulnerability of the population to heat waves, thus reducing the number of excess deaths expected due to climate change. As wetlands expand, the number of mosquitoes is expected to increase, and an increase in the prevalence of vector-borne diseases cannot be excluded. This is a trade-off that needs to be seriously monitored and appropriate preventive measures put in place.

Indicators	Goals		
	2030	2040	2050
• Increase of the length of active travel routes within or connected to the restoration areas (km of routes per km^2 of restoration	1,000	1,500	3,000

scheme)			
• Incidence of serious vector-borne diseases (number of cases/year)	10	30	30

4.2.3 Financing the transition

While transforming water management infrastructure and encouraging farmers to move towards water retention-based farming practices will require public funding, we also aim to attract significant private capital. Farmers (especially young ones) may be open to investing in new, environmentally friendly production methods that open up new markets for them. By switching to extensive and organic farming, a farmer can save money by reducing the use of expensive fossil and other industrial inputs. Innovative use of the landscape opens up opportunities for innovative bankable solutions. For example, increasing climate resilience reduces weather-related damage, which may attract the attention of insurers and integrators.

It is well known that large market and public sector investors (e.g. EBRD, EIB) are increasingly willing to invest resources in green solutions. So far, the resources available for investment are more than the resources needed for potential green projects. The aim is to prepare bankable solutions and projects (e.g. through the WWF Bankable Nature Solutions initiative) that can use these funds to implement as many landscape rehabilitation projects as possible along the Tisza.

Indicator	***Goals***		
	2030	***2040***	***2050***
• Private finance mobilised [€/year]	100 million	200 million	400 million

4.2.4 Circular economy

The model strengthens the circular economy by retaining and infiltrating water, thus improving the functioning of small water cycles. It delivers water to the landscape primarily by gravity, by nature-based solutions, rather than through costly, fossil energy-intensive irrigation that damages groundwater aquifers. The use of extensive farming methods reduces the water footprint of agricultural production.

Indicator	***Goals***		
	2030	***2040***	***2050***
• Water capture (rainfall storage capacity in floodplain, m^3)	+0.2 billion	+0.4 billion	+0.8 billion

4.2.5 Green growth

Many types of extensive land use require more human labour. Recruiting the right workforce in ageing and depopulated areas is a challenge. There are several possible answers to this.

Loss minimisation. Much of the land that is suitable for water retention is of poor quality and only the current distorted support system keeps arable production viable. There is a growing trend in the agricultural support system to place heavy premiums on water retention. If this direction is maintained, farmers can massively extensify their production and convert them into climate-adaptation focal areas.

Agricultural innovation. Extensive land use has the potential to produce many low labour-intensive products that farmers today do not usually think about. Examples include leaf protein production, the direct production of biogas (energy) and compost from biomass, and many other possibilities. With the farmer pioneers (champions) and leading research institutes (e.g. Institute of Agricultural Economics) in Hungary, these will be collected, presented and transferred to the public.

Diversification of the local economy. Landscape management based on water retention shall not only create jobs in agriculture, but also open up new opportunities in other sectors such as local processing, marketing, short supply chains and tourism.

Attractive living conditions in rural areas. Economic development should also be combined with other rural development interventions to improve the quality of life and encourage young people to stay in the countryside.

Indicators	***Goals***		
	2030	***2040***	***2050***
Green growth			
• Number of jobs created	50,000	150,000	100,000
• Nature conservation area accessible to visitors (ha)	20,000	35,000	50,000
• Number of people visiting the area	100,000	150,000	400,000
Flood protection and other hydrological ecosystem services			
• Hectares of flood retention zone created	+6000 ha	+40,000 ha	+120,000 ha
• Grazing in floodplains (number of cattle or horses)	100,000	200,000	400,000

5 From general goals to actions

5.1 Drivers of change and windows of opportunity

Climate change-induced weather extremes, declining surface and groundwater resources, biodiversity collapse, pollinator loss, soil loss are rapidly eroding the production base of intensive agriculture. Today, Hungary's agriculture mainly produces arable crops for the world market, mostly unprocessed. The unpredictable fluctuations in the prices of inputs (e.g. energy, fertilisers) and products for sale, and the intensification of competition (e.g. the rise in cheap, but low quality Ukrainian imports) are leading more and more producers to abandon their activities. **Given the dwindling natural basis for production and the economic problems of the sector, Hungarian agriculture urgently needs a strategic change of direction,** as the processes threaten to collapse.

Water retention and climate adaptation can be an escape route to reduce farmers' dependence on industrial inputs, increase the natural basis of production and improve their resilience. There are also commercially viable models of small-scale production, water retention and soil regeneration farming in Hungary. These initiatives can be helped to become **champions** and models by transforming the support, legal and institutional framework. The change of direction in agricultural strategy must include **research** into and creation of viable, new value chains for conservation land use and water-retention based farming.

The paradigm shift in land use and agriculture is a long, iterative process, spanning several decades. Climate change and overuse of resources require extensification of production in both crop and livestock production, introducing eco-farming on a large scale. In the future of Hungarian agriculture, products from **extensively reared animals, natural aquatic fish, high-quality, organically produced fruit and vegetables** must play a greater role. High quality processing, branding and marketing that emphasises uniqueness are tools for increasing added value. Developing local production – local processing – local consumption systems, short supply systems also offer untapped opportunities. Such developments will also increase the diversity and resilience of the economic structure, in contrast to the current Hungarian strategy, which mainly produces homogeneous, undifferentiated mass products.

The use of **new, innovative technologies and products** can make water retention and the use of natural landscapes profitable. For example, biomass from extensively cultivated grasslands and wetlands can be used to produce leaf protein or biogas and compost with huge yields. Research institutes (e.g. the Institute of Agricultural Economics) can help the transition to a more sustainable path by developing innovative products and value chains, researching regenerative farming models. The Ministry of Agriculture can support these, launching pilot programmes and the Chamber of Agriculture can help by raising awareness and showcasing models and champions.

The decline in the popularity of farming and rural life is an inescapable problem. Labour shortages and ageing regions may hinder ideas for developing the use of the countryside in close proximity to nature. The lack of labour can to some extent be filled by precision agriculture tools, but these are only accessible to a few and difficult to integrate into our vision of sustainable landscape management because of a number of ecological, social and economic concerns. This calls for a **focus on the development of rural living conditions and communities**, and the launch of targeted public programmes for that.

However, the decline in the number of farms also represents an opportunity. With appropriate subsidies, **older farmers can be offered the alternative of converting part of their land from production to climate adaptation, water retention focal areas, creating habitats.** This is a possibility for farmers to exit agriculture profitably, secure their own future and pass on value to those who come after them. CAP afforestation support is a good example in this respect. Many farmers are securing their pensions by taking advantage of high afforestation payments and withdrawing their land from cultivation. Research shows that in Hungary **there are at least 3-400 thousand hectares** of land (most of that in the Tisza Basin) where current intensive farming should be converted to extensive farming or removed from agricultural production. These could be the primary target areas for land use conversion.

Overall, the **paradigm shift** to NWRM based extensive land use and climate adaptation in the Tisza Basin is **forced by the economic and ecological unsustainability of current land use. However, it can be promoted by targeted public programmes** to build profitable value chains and improve the living conditions of rural communities. Appropriate agricultural support and legal incentives will provide the framework for the shift.

Undoubtedly, such a large-scale change will have its losers. Farmers' capital, knowledge, experience and marketing solutions are mainly suited to intensive arable production. Suppliers of assets and inputs are primarily geared to these needs. Community and public programmes for land-use change should also take into account the need to ensure that the transition is gradual and minimise losses for operators. Changes and restrictions initiated for sustainability may be seen by many as an unacceptable constraint. Some of these objections are reasonable and need to be addressed: **maintaining a fair livelihood is an essential aspect. However, maintaining the extra profits from the exploitation of landscapes is not a legitimate expectation.** Finding the boundary between the two will be a sensitive issue in the process of paradigm shift for policy makers and communities.

5.2 Theory of change

A complex paradigm shift would be needed to reach our long term goal and improve the environmental, social and economic situation in the Tisza region, but this cannot be done in a single step. The theory of change is summarized below:

1. Develop a **Tisza Strategy** for the Hungarian part of the river basin with key stakeholders from water, agriculture, industry, spatial planning sectors, municipalities, science and civil society.
2. Implement successful, local **pilot projects** in landscapes, where the retention of inland water, the reconnection of floodplains to the river, benefits land users and local communities and helps to reduce the damage of climate change.
3. The success of these examples can convince farmers and decision-makers in other landscapes with water retention potential to adopt such solutions. Demonstrating the unsustainability of the current situation and the alternatives based on NWRM is a priority task through local, regional and national communication. **Changing public opinion puts pressure on decision-makers to initiate profound changes.**
4. **Changing the technical, legal and support framework conditions** is a government responsibility. In order to push for the necessary large-scale government action, economic and social actors that build on and benefit from the new type of NWRM must become a critical mass. It is the will of key economic players and voters that will push the government to turn around water management, land use, agriculture and rural development.
5. The sustainable development of the Tisza Plain based on NWRM, must be made a strategic objective. To achieve this, it is necessary to implement legislative reforms, reform the subsidy system and launch major investments in infrastructure. This requires the establishment of an inter-ministerial committee or a government commission. **A governmental program for the sustainable development of the Tisza basin is necessary.**
6. **The infrastructure for water management based on NWRM needs to be developed on at least 150,000 hectares and the land use to enable it needs to be implemented.** A set of climate adaptation objectives should be integrated into the planning processes of agriculture, industry, municipalities and the general public.

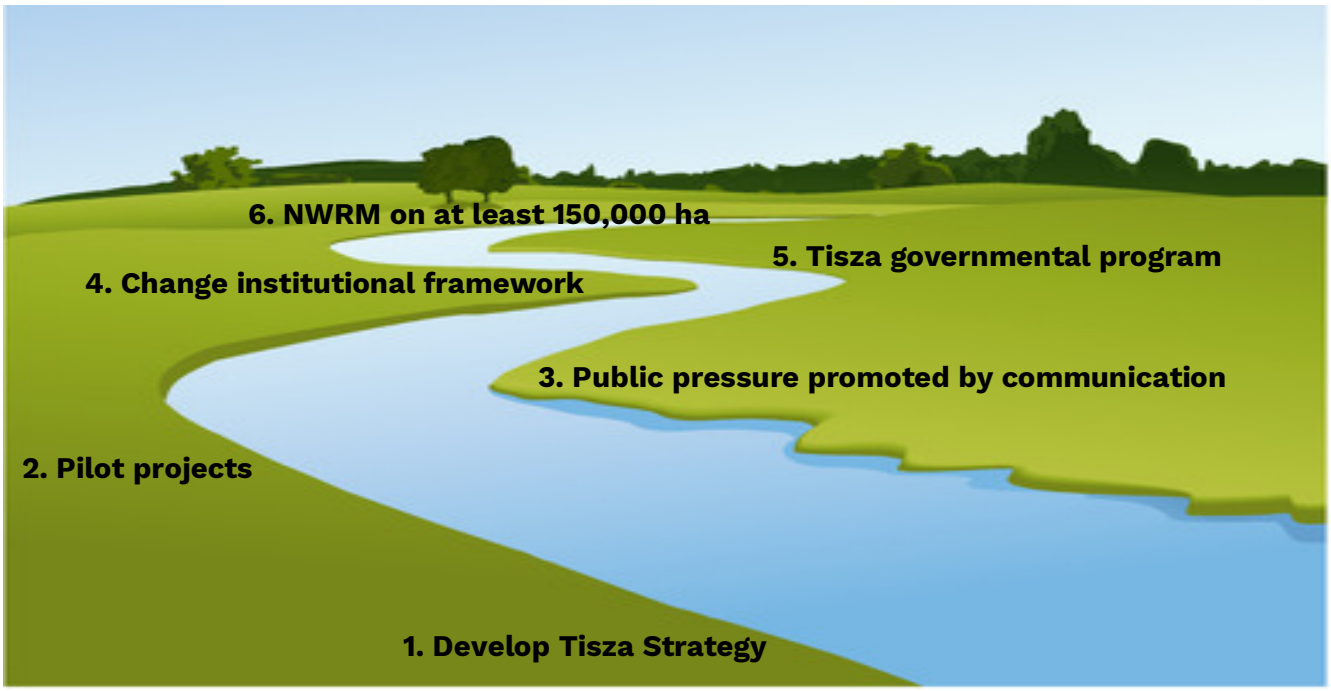

Figure 6: Milestones of the Theory of Change (Artwork by czibo via 123RF.com, edited by the authors)

5.3 Actions

The following section identifies the specific actions that are behind the goals. The activities are prioritised under each objective.

5.3.1 Climate regulation

Action CLIM 1 - Creating the Tisza Strategy

Based on the cooperation of key stakeholders from water, agriculture, industry, spatial planning sectors, municipalities, science and civil society the Tisza Strategy for the sustainable development of the whole Tisza River Basin in Hungary (46,380 km^2) will be created by 2027. The strategy sets out a coherent framework for sustainable water management and land use, and for achieving a social and economic paradigm shift creating new opportunities based on NWRM. This could be the basis for launching a government programme for implementation, which could be funded from national and EU sources.

Action CLIM 2 – NWRM Pilot Projects

By 2030, NWRM-based floodplain management will have been implemented in at least 3 areas as a result of the pilot projects started earlier: Bereg (6,000 ha), Nagykörű (300 ha), Tisza-Túr Reservoir (1,700 ha). Under the pilot schemes agricultural lands will be flooded with water from the Tisza. In the (potentially) flooded areas, farmers are converting to floodplain farming. Local processing of organic products (e.g. fish, meat from grazing animals, fruit) will be started by setting up local factories and short distribution chains. Cooperation will be developed between farmers, quantitative and qualitative risks from other water uses will be reduced too. Their experience and the needs identified will provide input for basin-scale planning. Results will be continuously monitored, providing feedback to the processes.

Action CLIM 3 - Water retention in deep floodplains and channels in the Tisza river basin

Based on a model that has been under development at the Budapest University of Technology for 20 years, the deep floodplains and background reservoirs (150,000 ha) will be delineated in the entire Hungarian catchment of the Tisza where floods can be diverted and inland waters can be retained. The principles and operation of the system will be developed and the necessary land use change locations will be identified. The conditions for the switchover will be discussed with local farmers; training and consultation will be provided for them. Wherever possible, water replenishment and land use change and monitoring the results will be implemented with national and EU funding. In this context, a complex analysis of the relationship between the landscape and the river is needed to find ways to slow down the incision of the riverbed, raise water levels and allow for

gravity flow with solutions that are acceptable from a conservation point of view (ensuring the free flow of the river). The research and modelling will be done by 2027. The conversion process of all the areas can be implemented by 2050.

Action CLIM 4 - Support municipalities to harmonize their SECAPs with the Tisza Strategy

Several municipalities have already prepared their Sustainable Energy and Climate Action Plans (SECAPs) along the Tisza. Until 2027, in the planning process of the Tisza Strategy, we will examine how sustainable land use tools based on water retention can be integrated into these and make recommendations to municipalities for specific climate adaptation projects. The revised SECAPs can also serve as a model for other municipalities who want to prepare one for their own area. Municipal green-blue infrastructure and the development of model "sponge cities" could start from 2028, with national and EU funding.

5.3.2 Biodiversity net gain

Action BIOD 1 - Restoration of priority habitats and habitat development in the NWRM pilot sites

In the pilot sites of the NWRM-based floodplain management (Bereg [6,000 ha], Nagykörű [300 ha], Tisza-Túr Reservoir [1,700 ha]), priority habitats will be restored and new habitats will be created through targeted programmes, based on the presence of water. The results of the restoration will be monitored. As landscape water recharge and habitat rehabilitation, natural processes take longer to occur, larger scale results are expected by 2040.

Action BIOD 2 - Habitat development in deep floodplains and channels in the Tisza river basin

By treating the Tisza, its tributaries, reclaimable deep floodplains and the drainage channels as a coherent system, sites will be identified where priority habitats can be restored and new habitats created based on the presence of water. Large-scale results of restoration and habitat enhancement projects will be visible from 2040 onwards. The results of the restoration will be monitored in the longer term.

5.3.3 Drought resilience

Action DROU 1 - Analyse the benefits of NWRM in agricultural production and opportunities to replace or optimize irrigation by it

Research and modelling will be carried out to understand the effects of water retention, floodplain farming and regenerative agricultural technologies and their potential to replace irrigation or prevent the need for that. Farm and regional level recommendations will be designed on the optimisation and harmonization of irrigation and NWRM and disseminated for stakeholders within the Tisza Strategy planning process. The benefits of NWRM in drought management will be tested on model farms in regions particularly affected by drought and the results will be presented widely from 2028.

5.3.4 Sustainable Food Systems (F2F)

Action F2F 1 – New economic models for water-friendly agriculture in co-creation with farmers

The key to water retention and therefore climate adaptation is to find the place for water in the landscape. Farmers must be motivated to adopt farming practices that tolerate or require water. To this end, research, lobbying and advisory work should be carried out, and model programmes should be launched. Social attitude research, economic analyses, land use analyses will be carried out. Based on research results proposals for NWRM based floodplain farming models will be elaborated, including new, sustainable, healthy products and value chains, new local economic structures, how to use best the CAP subsidies. New local economy models will be co-created with land users, which covers consultation for land users, dissemination, monitoring the effects and feedback of experience, comments and results into the development process. The results of research and co-creation can be used as input for planning and implementing the complex, targeted governmental investment programs for boosting NWRM based local economies funded by EU and national sources (see Action GGRO 1 below).

Action F2F 2 - Lobby for CAP and legal framework modifications to facilitate water retention-based land use change

Based on research and the input from land users proposals for CAP modifications to facilitate water retention-based land use change will be elaborated. Lobby activities will be carried out to support the integration of new, water-based payment proposals into the funding and legal framework.

5.3.5 Inclusivity

Action INCL 1 – Communication and empowering stakeholders to be active in promoting the scaling-up

To implement the Tisza strategy, activities will be carried out to inform and involve stakeholders and the wider public between 2028 and 2050. An effective communication strategy will be designed. Public communication in the media will be built on that. A series of forums to support implementation and co-creation will be organised at local, regional and national level. Economic modelling, monitoring results will be presented for the professional and general public to argue for effectiveness of NWRM. Champions (successful NWRM land users and local economy developments) will be presented. Direct advice to stakeholders (especially farmers) on water retention and floodplain management will be an important part of the awareness-raising (e.g. by the Chamber of Agriculture advisory system, self-developed training tools, expert advice).

Action INCL 2 - Collaboration: forming of strategic partnerships with different stakeholders

To build social support for the paradigm shift, from 2025 we will build an ever-widening coalition of those who are positive about change. The target groups to be involved: local / regional NGOs that are open to plan and implement environmentally sound agricultural and sustainable rural development models in the Tisza River Basin in Hungary; national-level NGOs or networks with similar objectives; research workshops investigating the possibilities, benefits and feasibility of NWRM on a theoretical or practical level; public organisations, which are key actors in water, ecological, social and economic development based on NWRM at the territorial level.

Action INCL 3 - Operating Case Study Boards in pilot sites

In the pilot site Bereg, the Case Study Board (CSB) in the MERLIN Project was established to ensure the active participation of local people in the local landscape rehabilitation project. The CSB will continue to operate during the implementation of local projects. Similar CSBs will have to be established for other local landscape rehabilitation projects in the Tisza Basin from 2028. A network of these could be linked together to form an advocacy network that could become a lobby organisation for NWRM over time and help bring about structural change at the level of big policy.

5.3.6 Flood resilience

Action FLOO 1 - Harmonizing flood risk management plans with NWRM

The current flood defence doctrine will be reviewed as part of the Tisza strategy planning process. The massive reconnection of deep floodplains to the river will also provide more space to reduce flood risk. In the current flood defences, the primary location for flood drainage is the flood channel. For this reason, the presence of as little vegetation as possible is justified from a hydrological point of view. As the protected side of the floodplain is mostly occupied by agricultural land, valuable wetlands and gallery forests are largely relegated to the floodplain. This regularly causes conflicts between nature conservation and flood protection. The strategic planning process will examine how these conflicts can be mitigated by reconnecting deep floodplains. A review of the flood protection regime could take place from 2028, based on strategic research.

5.3.7 Health and wellbeing

Action HEAL 1 - Increase recreation potential of restored landscapes

The presence of water in the landscape and the creation of new habitats can improve the quality of life of the inhabitants of the areas concerned and increase their attractiveness for tourism. Landscape rehabilitation interventions could start to show results as early as 2027. Local economy and ecotourism development plans will be designed and implemented for the sites of NWRM.

Action HEAL 2 - Optimizing health effects of NWRM in pilot sites

Wetlands can act as a buffer to reduce the local impact of weather extremes such as heat waves. So, increasing the extent of wetlands can have positive health effects through climate regulation, but it can also lead to trade-offs, e.g. by increasing the number of mosquitoes. From 2027 monitoring the positive (e.g. climate resilience) and negative effects (e.g. vector-borne diseases) of NWRM will be started in the Tisza river basin. Nature-based actions will be elaborated and implemented to prevent negative effects (e.g. using natural enemies against pests).

5.3.8 Financing the transition

Action FIN 1 - Macroeconomic analysis of the benefits transition to NWRM in the Tisza Region

An important element of strategic planning is to conduct an analysis of the macroeconomic impacts of current water management and land use. This should be compared with the potential impacts of water and land use strategies based on NWRM. Previous similar studies suggest that the macroeconomic effects of the latter, mainly due to the optimisation of resource use, are far superior to the current economic model based on resource use. This explains why investing national and EU resources in the river basin to implement NWRM is worthwhile at the societal level. The results provide a basis for consultation with governmental agencies on optimizing and harmonizing public funding and climate goals. Research will take place between 2026-2029.

Action FIN 2 - Bankable projects

A growing amount of capital and credit is available for green investments as private and public banks (e.g. EIB, EBRD), investment funds are increasingly focusing on reducing environmental impacts and improving their own image. In addition to public and EU funds, bankable projects can also be sources of large-scale landscape transformation along the Tisza. There are proven models for their preparation (e.g. WWF Bankable Nature Solutions). The development of field projects could enter the phase of involving investors' projects from 2030 onwards by elaborating bankable project patterns based on best practice, connecting land users and investors, launching bankable climate resilience projects based on NWRM.

5.3.9 Circular economy

Action CIRC 1 - Support industrial sectors to optimise water use and NWRM on sites

As part of the Tisza strategy planning, a full water balance for the river basin will be elaborated. Proposals will be made to reduce and optimise water demand, which is a key issue as surface and groundwater resources become scarcer in the future. In addition to agriculture, industry is a major water user, so we will disseminate the experience of industries and businesses that are at the forefront of water stewardship approaches (champions) and launch new model programmes (2025–2030). A governmental program shall be launched to boost NWRM in industry (from 2028).

5.3.10 Green growth

Action GGRO 1 - Governmental program to boost NWRM based local economy development

The shift to a sustainable development path can be a driving force for local economic development in the eastern part of Hungary, which is facing serious economic and social problems. In addition to the F2F activities focused on agricultural production (see above), a comprehensive government rural development programme is needed to improve the conditions of rural life in the Tisza basin, strengthen population retaining ability of the countryside and provide opportunities for other sectors to participate in sustainable economic development. From 2030, sourced by national and EU sources the main actions that could be taken to achieve this include: creating viable, complex local development plans based on NWRM; enhancing cooperation between local economic and community actors; initiating local knowledge and innovation hubs; designing value chains based on NWRM and local traditions; supporting local programs by EIP-AGRI and LEADER; involving investors and connect them with local initiatives.

5.4 Connections between actions

Below we show how each activity is linked to other activities.

Action	To be coordinated with Action #																		
	CLIM 1	CLIM 2	CLIM 3	CLIM 4	BIOD 1	BIOD 2	DROU 1	F2F 1	F2F 2	INCL 1	INCL 2	INCL 3	FLOO 1	HEAL 1	HEAL 2	FIN 1	FIN 2	CIRC 1	GGRO 1
CLIM 1 - Tisza Strategy		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CLIM 2 – NWRM Pilot Projects	■		■		■	■	■	■	■	■		■		■	■		■		■
CLIM 3 - Water retention in deep floodplains	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■		■
CLIM 4 - Harmonize SECAPs with Tisza Strategy	■						■	■		■	■			■	■	■		■	
BIOD 1 - Restoration in NWRM pilot sites	■	■	■				■	■				■	■	■	■				
BIOD 2 - Habitat development in deep floodplains	■	■	■				■	■				■	■	■	■				
DROU 1 - Analyse the benefits of NWRM	■	■	■	■	■	■		■	■	■	■					■	■	■	■
F2F 1 – New economic models	■	■	■	■	■	■	■		■	■	■			■		■	■	■	■
F2F 2 - CAP and legal framework modifications	■	■	■				■	■		■	■	■	■			■		■	■
INCL 1 – Communication and empowering	■	■	■	■			■	■	■		■	■		■	■				■
INCL 2 - Strategic partnerships	■		■	■			■	■	■	■		■		■	■		■	■	■
INCL 3 - Case Study Boards	■	■	■		■	■			■	■	■			■	■		■	■	■
FLOO 1 - Harmonizing flood risk management with NWRM	■		■		■	■			■							■			
HEAL 1 - Increase recreation potential	■	■	■	■	■	■		■		■	■	■			■	■	■		■
HEAL 2 - Optimizing health effects	■	■	■	■	■	■				■	■	■		■		■			
FIN 1 - Macroeconomic analysis	■		■	■			■	■	■				■	■	■				
FIN 2 - Bankable projects	■	■	■				■	■			■	■		■				■	■
CIRC 1 – Industrial projects to optimise water use	■			■			■	■	■		■	■					■		■
GGRO 1 – Governmental program for local economy development	■	■	■				■	■	■	■	■	■		■			■	■	

5.5 Identifying the responsible stakeholders and their roles

Here, we describe the stakeholders who will take responsibility over the identified actions.

Name of stakeholder	Role	Has a role in Action #																		
		CLIM 1	CLIM 2	CLIM 3	CLIM 4	BIOD 1	BIOD 2	DROU 1	F2F 1	F2F 2	INCL 1	INCL 2	INCL 3	FLOO 1	HEAL 1	HEAL 2	FIN 1	FIN 2	CIRC 1	GGRO 1
National level stakeholders																				
Ministry for Agriculture	Funder, Monitorer, Coordinator	■		■		■	■			■	■	■			■	■		■	■	■
Ministry of Energy	Funder, Monitorer, Coordinator	■		■	■				■										■	
General Directorate of Water Management	Implementer, Monitorer, Coordinator	■	■	■		■	■	■	■		■	■							■	
National Directorate General for Disaster Management Ministry of the Interior	Coordinator	■		■	■				■											
Hungarian Chamber of Agriculture	Implementer, Monitorer, Coordinator	■		■		■	■			■	■	■			■	■		■	■	■
VIZITERV Environ Plc	Implementer	■	■	■										■						
Vadonleső – 'Wilderness Spotters'	Monitorer		■			■	■				■									
WWF Hungary	Coordinator, Monitorer	■	■	■	■	■	■		■	■	■	■	■	■			■	■	■	■
National Society of Conservationists – Friends of the Earth Hungary	Coordinator	■	■	■	■	■	■	■	■	■	■	■		■						
Sub-national level stakeholders																				
Municipality of Szabolcs-Szatmár-Bereg County	Funder, Coordinator		■		■				■		■	■			■					■
Municipality of Jász-Nagykun-Szolnok County	Implementer, Funder, Coordinator		■	■	■						■	■			■	■			■	■
Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Agriculture	Implementer, Coordinator		■	■				■	■	■	■	■								
Szabolcs-Szatmár-Bereg County, Government Office, Dept. of Environment and Nature	Implementer, Coordinator		■	■	■	■	■					■								

Name of stakeholder	Role	Has a role in Action #																		
		CLIM 1	CLIM 2	CLIM 3	CLIM 4	BIOD 1	BIOD 2	DROU 1	F2F 1	F2F 2	INCL 1	INCL 2	INCL 3	FLOO 1	HEAL 1	HEAL 2	FIN 1	FIN 2	CIRC 1	GGRO 1
National level stakeholders																				
Protection			■	■	■	■	■					■								
Jász-Nagykun-Szolnok County, Government Office Dept. of Agriculture	Coordinator		■	■				■	■	■	■	■								
Jász-Nagykun-Szolnok County, Government Office Dept. of Environment and Nature Protection	Coordinator		■	■	■	■	■					■								
Hungarian Chamber of Agriculture, Szabolcs-Szatmár-Bereg County Organization	Implementer, Coordinator		■					■	■	■	■	■			■			■		■
Catchment level stakeholders																				
Upper Tisza Regional Water Directorate	Implementer, Monitorer	■	■	■						■		■	■	■						
Middle Tisza Regional Water Directorate	Implementer, Monitorer, Coordinator		■	■				■				■		■						
Alliance for the Living Tisza	Coordinator	■	■	■		■		■	■		■	■		■						■
Regional level stakeholders																				
Hortobágy National Park Directorate	Implementer, Monitorer		■	■		■	■				■		■	■		■				■
Bereg Multi-purpose Microregional Association	Coordinator		■		■	■			■		■		■		■					■
Upper Tisza Valley Rural Development Association	Coordinator		■			■			■		■	■	■		■	■				■
Farmers' Consultant Office of NAK in Vásárosnamény	Implementer		■			■			■		■	■	■							
Tourinform, Bereg Office	Implementer, Coordinator		■						■	■	■				■					■
Nyírerdő ZRt.	Implementer, Monitorer		■	■		■	■	■		■		■			■	■				■
Vásárosnamény Farmers' Club	Implementer, Coordinator		■			■		■	■	■	■	■	■		■					■
Association for Hungarians in the Carpathian Basin	Implementer, Coordinator	■	■	■					■	■	■	■								■
E-Misszió Association	Coordinator	■	■	■		■	■		■	■	■	■	■							■

Name of stakeholder	Role	Has a role in Action #																		
		CLIM 1	CLIM 2	CLIM 3	CLIM 4	BIOD 1	BIOD 2	DROU 1	F2F 1	F2F 2	INCL 1	INCL 2	INCL 3	FLOO 1	HEAL 1	HEAL 2	FIN 1	FIN 2	CIRC 1	GGRO 1
National level stakeholders																				
Choose the Water Network	Coordinator	■	■					■			■	■								■
Local level stakeholders																				
Bockerek Hunting Company	Implementer, Coordinator		■			■		■	■		■				■			■		■
Nagykörű, local small farmers	Implementer		■			■		■	■		■		■		■	■				
Nagykörű, local large farming companies	Implementer		■			■		■	■		■		■		■	■				
Small scale local product producers in Nagykörű	Implementer		■						■						■				■	■
Beregi Tiszahát Anglers' Association	Implementer		■			■		■	■		■				■			■		■
Municipal level stakeholders																				
Municipality of Tarpa	Implementer, Coordinator		■		■	■			■		■		■		■					■
Municipality of Jánd	Implementer, Coordinator		■		■	■			■		■		■		■					■
Municipality of Nagykörű	Implementer, Coordinator		■			■		■	■		■				■	■		■		■
Foundation for Nagykörű	Implementer, Monitorer, Coordinator		■			■		■	■		■				■	■		■		■

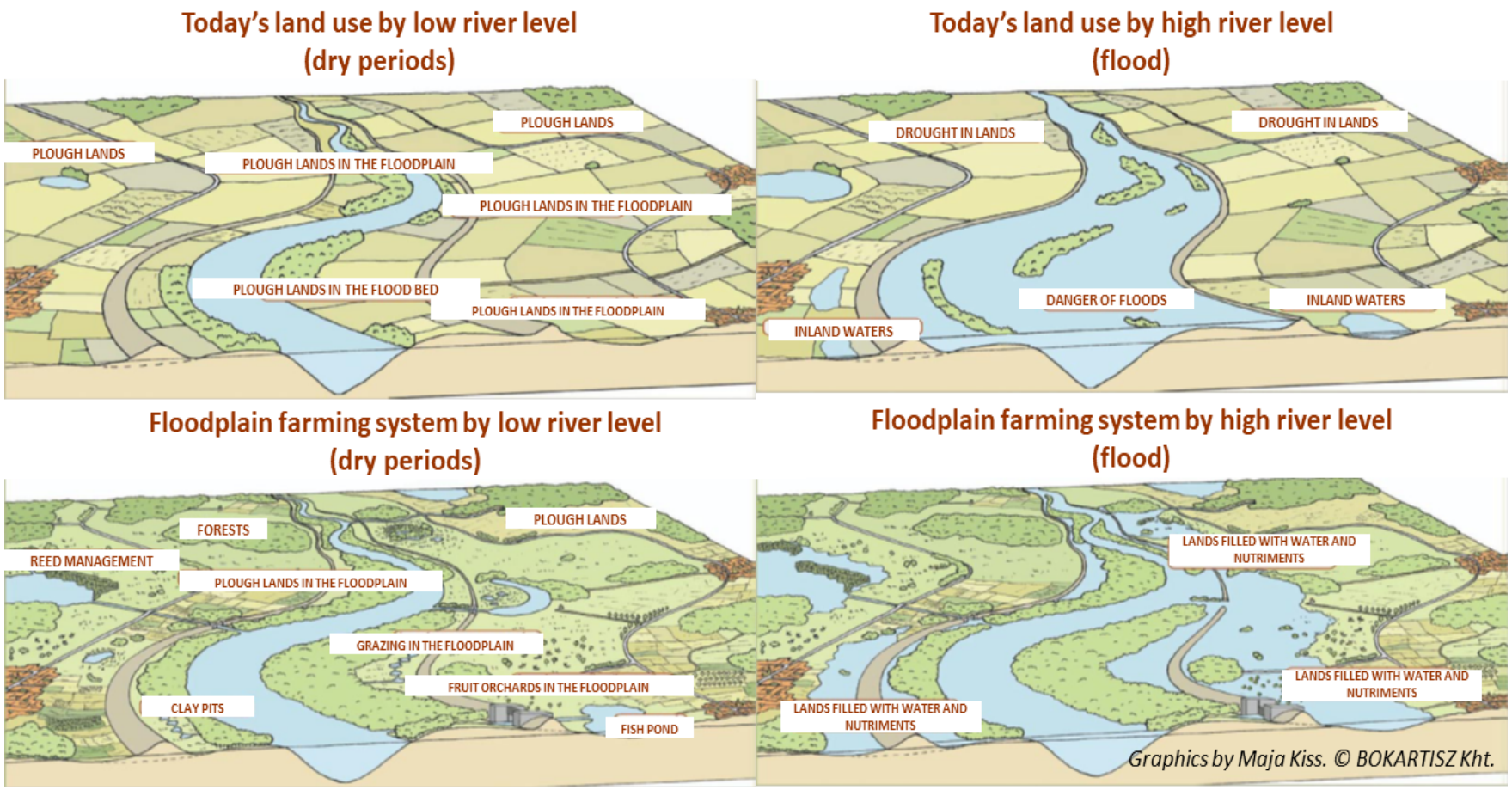

Figure 7: A comparison of the model of today's dominant land use in floodplains and the proposed model of the sustainable floodplain farming (Graphics by: Maja Kiss)

6 Timeline

The major work on the regulation of the Tisza has taken almost a century. On this basis, the development of a new system based on water retention will be a task of many decades.

	Period (2-yr interval)					Period (5-yr interval)		
	2025–2026	2027–2028	2029–2030	2031–2032	2033–2034	2035–2039	2040–2044	2045–2050
CLIM 1 - Tisza Strategy								
CLIM 2 – NWRM Pilot Projects								
CLIM 3 - Water retention in deep floodplains								
CLIM 4 - Harmonize SECAPs with Tisza Strategy								
BIOD 1 - Restoration in NWRM pilot sites								
BIOD 2 - Habitat development in deep floodplains								
DROU 1 - Analyse the benefits of NWRM								
F2F 1 – New economic models								
F2F 2 - CAP and legal framework modifications								
INCL 1 – Communication and empowering								
INCL 2 - Strategic partnerships								
INCL 3 - Case Study Boards								
FLOO 1 - Harmonizing flood risk management with NWRM								
HEAL 1 - Increase recreation potential								
HEAL 2 - Optimizing health effects								
FIN 1 - Macroeconomic analysis								
FIN 2 - Bankable projects								
CIRC 1 – Industrial projects to optimise water use								
GGRO 1 – Governmental program for local economy development								

7 Budget

Below is an order of magnitude estimate of the budget for each activity. As this is a multi-decade plan with many uncertainties, budget refinement is one of the most important tasks in the planning of the Tisza Strategy.

Action	Estimated cost (million €)	Possible sources
CLIM 1 - Tisza Strategy	**8**	• Ministry of Energy EU Horizon projects
CLIM 2 – NWRM Pilot Projects	**5**	• Ministry of Energy • EU Horizon projects
CLIM 3 - Water retention in deep floodplains	**3,750**	• Environment and Energy Efficiency Operational Programme Plus • EU Horizon projects • Common Agricultural Policy
CLIM 4 - Harmonize SECAPs with Tisza Strategy	**1**	• Ministry of Energy • Environment and Energy Efficiency Operational Programme Plus
BIOD 1 - Restoration in NWRM pilot sites	**2**	• Private funding • NGO funding • EU Horizon projects • Environment and Energy Efficiency Operational Programme Plus
BIOD 2 - Habitat development in deep floodplains	**1,250**	• Common Agricultural Policy • NGO funding • EU Horizon projects • Environment and Energy Efficiency Operational Programme Plus
DROU 1 - Analyse the benefits of NWRM	**1**	• NGO funding • EU Horizon projects • Ministry of Energy
F2F 1 – New economic models	**5**	• NGO funding • EU Horizon projects • Ministry of Energy • Ministry for Agriculture
F2F 2 - CAP and legal framework modifications	**2**	• NGO funding • EU Horizon projects • Ministry of Energy • Ministry for Agriculture
INCL 1 – Communication and empowering	**1,375**	• NGO funding • EU Horizon projects • Ministry of Energy
INCL 2 - Strategic partnerships	**1**	• NGO funding • EU Horizon projects • Ministry of Energy
INCL 3 - Case Study Boards	**4**	• Restoration project budgets
FLOO 1 - Harmonizing flood risk management with NWRM	**2,000**	• Ministry of Energy • Environment and Energy Efficiency Operational Programme Plus
HEAL 1 - Increase recreation potential	**25**	• Ministry of Economy • Economic Development and Innovation Operational Programme Plus
HEAL 2 - Optimizing health effects	**30**	• Ministry of Energy • Ministry of Interior • Human Resources Development Operational Programme Plus
FIN 1 - Macroeconomic analysis	**1**	• Ministry of Economy
FIN 2 - Bankable projects	**3,750**	• NGO funding • Ministry of Economy • Private investors

Action	Estimated cost (million €)	Possible sources
		• EBRD • EIB • Investment funds
CIRC 1 – Industrial projects to optimise water use	**2,000**	• Corporate funding
GGRO 1 – Governmental program for local economy development	**6,250**	• Common Agricultural Policy • Economic Development and Innovation Operational Programme Plus • Ministry of Agriculture • Ministry of Economy
TOTAL	**20,458**	

8 Uncertainties and assumptions, boundary conditions

The most important policy obstacles are decisions taken for short-term gain, which cause resources to be used up at an accelerating rate. Examples include agricultural policies that favour large-scale intensive agriculture with massive negative environmental effects, or industrial policies that locate water-intensive activities in water-scarce areas. The 170-year tradition of water management focusing on drainage and the Hungarian agricultural strategy based on arable raw material production are also policy strategies that urgently need to be reviewed. The increasing frequency of disasters caused by climate change is warning decision-makers and economic and social actors of the urgent need to act, although time is still necessary to be fully aware of how serious the status is. The historic drought of 2022, for example, has had a sobering effect.

A non-negligible risk with the increase in wetlands is an increase in mosquitoes and a possible increase in vector-borne diseases. Current mosquito control methods are incredibly damaging to biodiversity in Hungary. A strategy should be developed to address this aspect, which should include research and dissemination of natural methods of mosquito control (e.g. biodiversity enhancement, use of natural enemies, judicious control with biological agents, localised mosquito repellent), and health care preparedness. There is also an important role to be played in raising public awareness and developing a more tolerant attitude.

We are proposing a new water management strategy that works with nature and aims to expand floodplain farming built on nature based water retention measures in the Hungarian part of the Tisza River Basin. A diverse rural economy should be built on sustainable agricultural production by developing short supply chains, with significant improvements in rural living conditions.