WWF SUBMISSION

in the area of ecosystem, interrelated areas such as water resources and adaptation under the Nairobi Work Programme (NWP)

The SBSTA 44 invited Parties, NWP partner organizations and other relevant organizations to submit, by 25 January 2017, information on:

I. Lessons learned and good practices in relations to adaptation planning processes that address ecosystems and interrelated areas such as water resources;
II. Lessons learned and good practices in monitoring and evaluating the implementation of ecosystem-based adaptation; and
III. Tools for assessing the benefits of mitigation and adaptation to enhancing resilience and emission reductions that ecosystem-based adaptation provides.

WWF takes this opportunity to share with others its experiences and lessons learned under the Nairobi Work Programme. The submission provides some insight of WWF offices experience in the area of ecosystems, interrelated areas such as water resources and adaptation. Please find below the WWF experience in Mexico and Hungary, activities and lesson learned.

A. Mexico: Implementing an Integrated System of Water Reserves for the Environment as a National Early Adaptation Strategy

A.1: Description of relevant activities and collaborating partner institution/s (if any):

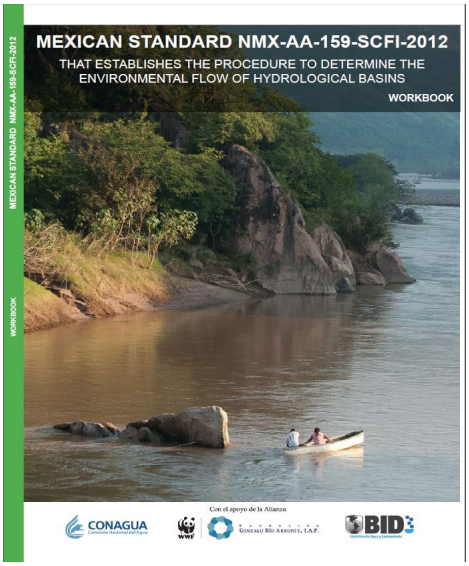
The National Water Reserves Program (NWRP) is a joint initiative of the National Water Commission (CONAGUA by its initials in Spanish), the National Commission of Natural Protected Areas (CONANP by its initials in Spanish) and WWF Mexico that started in 2012 in order to establish an integrated national system of water reserves for the environment. The main benefits of this initiative are:

- ✓ Definition of sustainable limits on water availability, which foster the principle of saving water and managing the demand placed on this resource, and thus reducing risk from water scarcity and conflicts.
- ✓ Guarantee the connectivity of the entire basin and to conserve ecosystems and maintain environmental services such as storing, conducting and supplying water, improving water quality, and protection from extreme events and its impacts, specially floods and drought exacerbated by climate change.
- ✓ The introduction of integrated planning and management of both subterranean and surface water; especially in regions with little surface water, such as in the north of the country.
- ✓ The preservation or controlled release of peak flows to prevent the interruption of river channels, invasion of riverbeds, and as a consequence, diminish the risk against extreme events.
- ✓ Reinforcement of the strategy for the conservation of the nation's most important ecosystems and their environmental benefits: 97 Natural Protected Areas, 55 Ramsar sites, and additional 78,500 km^2 of river basins.

An Environmental Water Reserve (EWR) is a presidential decree to allocate an annual volume of water that should remain in the environment so it cannot be allocated through water permits. Out of 700 river basins existing in the country, 356 are part of this program and the commitment of the Mexican federal administration is to complete all decrees by the end of 2018. The NWRP is part of the Water National Program and the National Climate Change Special Program.

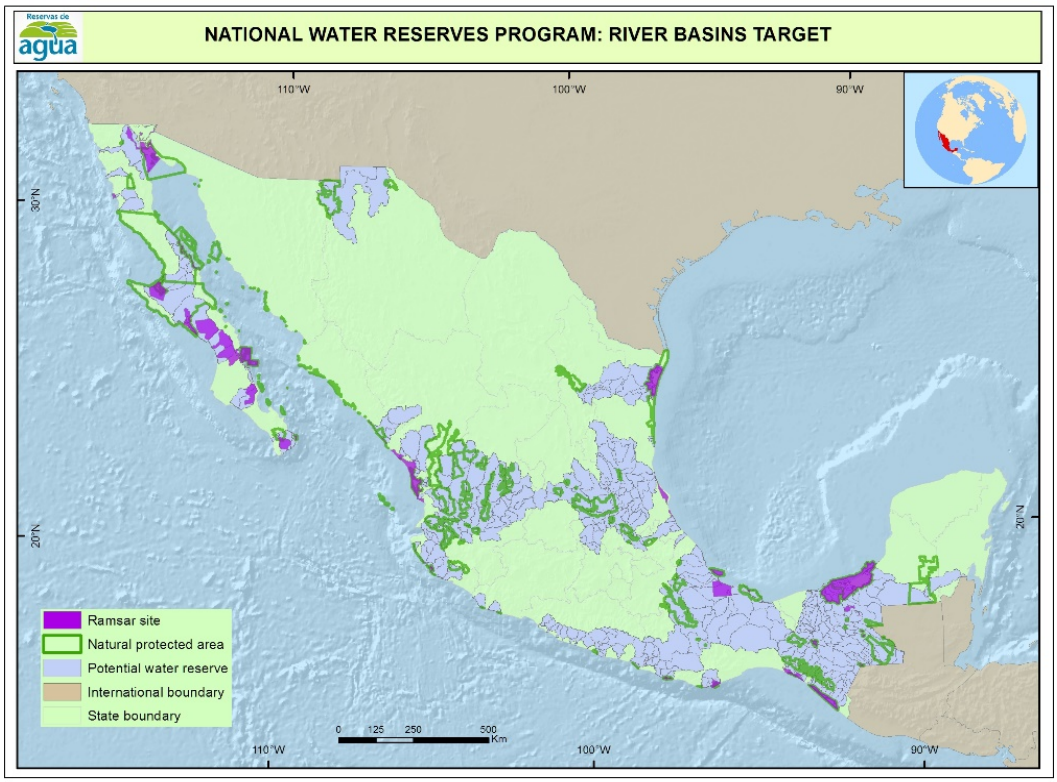
Relevant activities of this program began in 2007 when CONAGUA conducted a working group of experts whose aim was to establish a procedure and technical specifications to determine the environmental flow of rivers that could guide the agreement about mean annual water availability, water permits and future infrastructure projects that could imply water transfers between river basins. Two key concepts were adopted in this group as the foundations of environmental flow determination: the Natural River Flow Paradigm and the Biological Condition Gradient. Both concepts acknowledge the natural flow regime as the main driver of changes in a variable environment to which ecosystems and species adapt. The result of all this work was a Voluntary Norm to Determine Environmental Flows that provide a diversity of hydrological and hydro-biological methodologies that can be used depending on the available information and capacities. This norm was published in November of 2012.

Pictures 1: Mexican Standard of Environmental Flow and working group session



During 2011, WWF Mexico and CONAGUA conducted a scoping study that identifies potential water reserves throughout the country. Potential water reserves were defined as watersheds with favorable conditions - high biological richness and high conservation values, availability of water and low pressure for water users - for ensuring ecological flows as stated under the National Water Law. The study identified 189 basins where water reserves could be established. Later in 2016, CONAGUA identified 167 additional potential water reserves that are hydrologically and administratively connected to the 189 basins firstly identified.

Figure 1: Mexico National Water Reserve Program: River Basins Target



Número de instrumentos

After identify the target areas, WWF Mexico with the support of strategic local NGOs and academia conducted technical studies in six pilot working areas to determine the environmental flow using the voluntary norm. They include 43 river basins with a total surface area of 92,000 km² (4.5% of the national territory) in which the longitudinal, vertical and lateral connectivity will be maintained for 4,500 km of main water channels, 31 aquifers, 17 Protected Natural Areas and 13 Ramsar Sites. On average, the reserve water volume represents 53% of the mean annual runoff, and in total amounts to 49,000 hm³ per annum, which represents around 11% of the mean annual national runoff. In terms of their biological meaning, these water reserves will guarantee the water requirements of 546 species that enjoy some kind of protection category, and 99 of these species will be used directly in the analyses to determine environmental flows.

On 15 September 2014, the first reserve decree was signed by the President, including 11 river basins in the San Pedro Mezquital hydrologic sub-region, which supplies water to the Marismas Nacionales Biosphere Reserve and a Ramsar Site. This decree establishes the reserves for the environment, domestic and urban public use, and the generation of electricity for public use, for the next 50 years. It sets out the conditions for authorizing these uses and for guaranteeing that they act in a complementary and synergistic manner. Later on September 2016, the President signed the second decree in the El Fuerte River that covers 4 river basins in the northwest of the country. The rest of the decrees are still in process under CONAGUA control with CONANP and WWF Mexico support.

Pictures 2: San Pedro Mezquital River

Finally, in order to provide empirical evidence of the role of water reserves for the environment as an Ecosystem Based Adaptation strategy, the Inter-American Development Bank is financing a vulnerability analysis to identify and estimate potential impacts of water reserves on providing adaptation services, particularly related to flood and drought control. This project is coordinated by WWF Mexico with the technical support of the Alliance for Global Water Adaptation. Results of this analysis will be available by mid-2017.

A.2: Key results:

- The publication of the Voluntary Norm to Determine Environmental Flows was the first main results of this project since it set the common scientific ground to understand and define the adequate volume for water reserves according different environmental targets.
- 2 decrees already signed and published that reserve water for 15 river basins
- 6 technical studies that will justify the decree of 43 new water reserves.
- The Ramsar Resolution XII.12 promoted by CONANP during the COP 12 that "calls to action to ensure and protect the water requirements of wetlands for the present and the future". In this resolution, the Ramsar Convention call parties to use water reserves to ensure water need of wetlands using the Mexican water reserve program as an example.

A.3: Description of lessons learned and good practices:

i. Technical understanding and political will to push this initiative forward inside CONAGUA are essential for success: Environmental flow theory and its empirical determination could be a complex topic to understand and apply. Investing on build capacities and effective communication of the framework and implications of water reserves for the environment at regional and national level is a permanent work of WWF Mexico. At the same time, WWF Mexico is aware that reserving water for environment could led to conflict with potential future water users so it is necessary that CONAGUA show political will to face this conflict.

ii. The fact that CONANP, a federal institution devoted to environmental protection, and WWF Mexico, an international NGO, have been partners of the NWRP has built a very productive communication platform that has made that these partners understand better the different perspectives of water management for people and ecosystems. It also has favored a more transparent follow-up and visibility of the results

iii. Local NGOs, local water governance institutions and academia are indispensable actors to make the NWRP a real participatory process among water user at river basin level. In the development of this initiative, the creation of a relationship of trust between government, civil society and academia has been decisive. Civil society organizations are allies in the recognition of the needs for allocating water for the environment, and thus in the strengthening of the management.

A.4: Description of key challenges:

The NWRP has been implementing for 4 year now and it remains 2 two years to achieve the commitment of 356 river basins protected by water decrees. At the moment, only two decrees has been published which means an important delay in the program execution. CONAGUA is aware of that and has expressed its political will to WWF Mexico of moving forward fast and decree 200 rivers basins during 2017, considering the NWRP is a presidential commitment and part of the National Water Program and the Climate Change Special Program. Having the required technical staff, time, financial resources and political will to fulfill this task is considered the main challenge for the successful implementation of the project.

A.5: Planned next steps:

CONAGUA, CONANP and WWF Mexico have a collaboration agreement and a work plan where detailed activities, responsible and due dates are identified for this year. These institutions are in frequent communication through monthly coordination meeting to foresee and report progresses.

B. Hungary: Innovative adaptation approach to climate change in Hungary.

B.1. ADAPTATION PLANNING PROCESSES ADDRESSING ECOSYSTEMS AND INTERRELATED AREAS SUCH AS WATER RESOURCES

Description of relevant activities and collaborating partner institution/s:

WWF Hungary together with a local community of a village, a National Park an energy company and other partners has initiated an innovative climate change adaptation project next to the River Tisza in north-eastern Hungary. Its goal was to use ecosystem services for local climate change adaptation while restoring the area's natural floodplains and increasing and diversifying local income streams.

The Tisza is a major tributary of the river Danube and an important ecological corridor between the Danube and the Carpathians. The area is home to globally significant species and provides many ecosystem services to local communities such as food, raw materials, medicinal plants, but also flood mitigation, carbon sequestration and habitats for species. Local communities and businesses have limited knowledge of their dependence on these services. Intensive agriculture has been the main driver of the mismanagement of the floodplain ecosystem services. The river Tisza was regulated, channeled, the floodplain was narrowed and many habitats have been converted to non-productive croplands. Vulnerability to climate change is high, farmers and communities are exposed to unpredictable floods and long droughts.

The mismanagement of the original floodplains and climate change have led to frequent floods and droughts and brought substantial economic losses to the local villages. The community experienced 6 major, historical floods in the last 15 years, while suffered extreme unusual drought periods as well.

The stresses arising from climate change are amplifying the impacts of human stresses, leading to an accelerated deterioration of floodplain ecosystems. All of these have led to a broken balance between nature and people. A very visible symptom of this broken balance is the rapid expansion of invasive plant species.

Amorpha fructicosa is an invasive plant (shrub), which is bad for biodiversity and bad for flood management, and it has colonized large areas of many floodplains in Hungary, Croatia, Slovenia, Bulgaria and Romania. This expansion is driven by mismanagement and climate change. Invasive bushes have filled up the floodplain having covered large areas of different land use. These invasive bushes have amplified several vulnerabilities:

- As this shrub has colonised large areas of floodplain, it reduce the floodwater retention capacity between the dykes and use more water in drought periods than natural plants. It extremely amplifies local vulnerability.
- This invasive shrub contributes to habitat loss and fragmentation. Birds are not able to make a nest and large mammals such as deers or wild boars cannot hide in these ecological deserts.
- As this invasive shrub spreads quickly to wetlands, grasslands, croplands and forests, it has sharply increased land management costs. Farmers are required to use pesticides and mechanic tools to eradicate invasive shrubs which lead to further soil drainage, higher impact on soil and groundwater as well as higher land use costs.

Picture 3: *Amorpha fruticosa*, an invasive shrub expanding due to climate change and red plots marks the high density of this invasive shrubs overlapping with original land use.

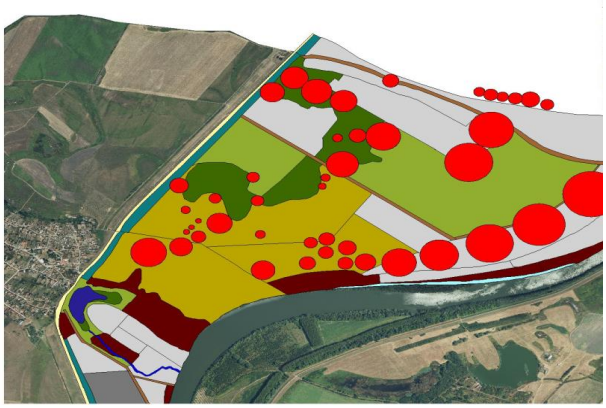
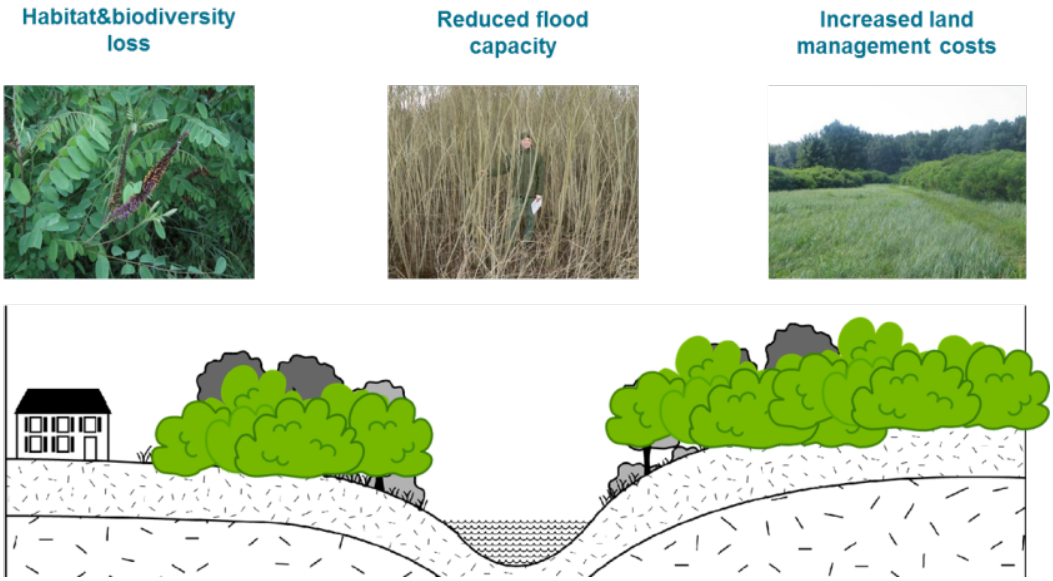


Figure 2: Vulnerabilities caused by invasive plant species in the floodplain



On the other hand, it is a promising energy source due to the high caloric value. WWF sought to address this problem, in a way, which reduces climate change vulnerability and also answers the Tisza region's socio-economic challenges. The whole adaptation process is based on better management of floodplain ecosystem services.

This initiative is intended to enhance flood security, increase resilience through local green energy generation, and prevent floodplain destruction as a result of invasive species infestation. Reducing invasive species and improving native freshwater habitat quality do not only increase the floodwater retention capacity of the floodplain, but also support natural habitats that store water and allocate water efficiently in the landscape in drought periods. One of the most important socio-economic challenges of the local communities is the energy poverty. Winter heating cost is very high and based on fossil fuels. As a solution the invasive shrubs are eradicated and utilized as energy source for both local public buildings and a nearby energy company that needs sustainable biomass supply. The result is a win-win situation for people, nature and business.

Collaborating partners and institutions:

- Local community (municipality) of Tiszatarjan village
- Local ethnic minority
- Local farmers
- National Park Directorate
- Local district-heating company (for-profit)
- Group of local farmers and land owners
- Regional Water Management Directorate (authority)
- University of Szeged (Department of Physical Geography and Geoinformatics)

Relevant activities:

- Removing invasive shrubs to provide biomass, increase floodwater retention and improve habitat quality for tourists;
- Crop change: after the removal of invasive shrubs and replacing highly vulnerable croplands, establishing and growing local energy useful native willow trees to provide biomass;
- Livestock management – this forces back invasive young shrubs and means a bigger cost saving for the community as there's no need for cutting manually; in addition it also creates more roam for floodwater and improves value for tourists because water buffaloes create small wetlands that attract water birds and other species.

All these activities have led to reduced vulnerability and improved adaptive capacity.

Key results:

The project was set up in 2008 in a 1,500 hectare large floodplain, focusing on 100 ha designated area. A local municipality owned local company was established that owns this land property. Besides, WWF also work with local farmers on implementation. First, wild bushes had been cut on 30 hectares and used in 8 local, small-scale boilers to produce `green energy ´ for the public buildings. So far this approach managed to replace 55,000 m^3 of natural gas and reduce 90 tons of CO_2 emission annually.

- The combination of grazing and invasive plant eradication is an ideal adaptation measure to increase flood security. Water buffaloes, Hungarian Grey Cattle and beavers have been reintroduced in the floodplains' project area as the former native ecological engineers are supposed to diversify the wetland's landscape. Removing and grazing invasive shrubs have increased the floodwater retention capacity of the floodplain. The resultant improvements to the landscapes and biodiversity make the area more attractive to tourists.
- Water management authority is an obvious beneficiary, as the flood risk is reduced in this section of the floodplain. However they don't pay for this service yet.
- Farmers: As invasive shrubs have been cut in many areas, the propagule sources for further expansion of invasive shrubs have been reduced. This created savings for farmers that own and use lands near the project site.
- Also benefits from the biomass from invasive shrubs and native energy useful trees. There are several public buildings and these used to use natural gas which was expensive. Now they have simple biomass boilers which use biomass from the floodplain. This means real cost savings for the community (around 35-40thousands € annually). This improves adaptive capacity as the local municipality can save this money and allocate it for other measures. Besides, as we also work with farmers, we managed to create new income source for them as well. Growing biomass in high flood and drough risk floodplain areas doesn't only diversify their income sources, but also makes them less vulnerable to floods and droughts.
- Nearby district heating (private energy) company who buy reliable, good quality biomass from the municipality and use it to heat households. There is a proper contract in place between the company and local municipality.
- Biodiversity: Reintroduced of 15 beavers, 9 water buffaloes and 44 Hungarian long-horned Grey Cattle. Semi-managed grazing has been successful in attracting new biodiversity, especially water birds. Key species include globally significant species e.g. black stork, European ground squirrel, white-tailed eagle, saker falcon, and countless water birds seems to migrate to the area.

Description of lessons learned and good practices:

1. Find the key economic driver (in this case bioenergy) and make business case (including guarantees and responsibilities).
2. Create an environment and get stakeholders to assess and speak about their vulnerabilities;
3. Take decision makers and opinion leaders of vulnerable groups to place where adaptation works well.
4. Have a vision (in this case for the floodplain);
5. Set up a pilot which needs clear property rights;
6. Make a contract (including the seller, buyer, product and guarantees),
7. Build local capacity for natural resource management;
8. Use attractive ambassadors (water buffaloes and beavers will help us communicate, persuade and replicate);
9. Plan for monitoring and evaluation, find measurable outputs;
10. Have an exit strategy (hand it 100% over to someone local and focus on replication;
11. Make it visible and visitable (trails, watch towers, blogs, online games etc);
12. Link it to megatrends. This is basically a model that allows us to become more resilient. It can be used for adapting to climate change; economic and renewable energy development etc. It can deliver multiple benefits on the ground for more stakeholders.
13. Engage as many external experts, investors, institutions as possible mainly in financing, monitoring and evaluation

Figure 3: The process of ecosystem base adaptation

Description of key challenges:

- The success and further development of this project is highly dependent on the attitude and capabilities of the local community leadership. In case of any change in the leadership might bring about negative change.
- Besides, as the area is located in the floodplain, between the dykes, there are more regulations that set up and monitored by the water management authority, which is a governmental body. In case of any change in their attitude would have impact on the project.
- Besides, biomass and bioenergy is a core element of the project, as the invasive shrub, as biomass source now has a market price. It means that the project is more profitable if the price of biomass is high.
- Data collection and monitoring is very challenging, simply because this is a new practice that local community members are not used to.

Planned next steps:

We aim to improve the biomass supply chain focusing on the biomass processing (wood-chopper) and transport. This would result in cost savings and better just-in-time supply.

We aim to replicate within the Tisza river basin, but also in other river basins where the potential is high (Sava in Slovenia and Croatia; Danube in Romania and Bulgaria; Kenya, South Africa; Colorado etc.). We have had partial success: many local municipalities, energy sector companies, affected (by invasives and floods) communities are interested, but there is no real capacity (in terms of time and funding) from our side to take them on the journey of full multiplication. If we can scale-up then the benefits from flood retention will start coming into play, and if we can quantify this benefit, the government would be more willing to pay for this as Payment for Ecosystem Services.

B.2. MONITORING AND EVALUATING THE IMPLEMENTATION OF ECOSYSTEM-BASED ADAPTATION

Description of relevant activities and collaborating partner institution/s:

1. National Park Directorate is an external partner and responsible for regular monitoring of biodiversity impacts. They monitor and make inventory of high conservation value species like water birds, frogs, raptorial birds and of course the expansion rate of invasive plant species. We have a GIS inventory.
2. Regional Water Management Directorate is an external partner and carries out tasks in the exercise of the official authority in water management. They regularly monitor the project area and check if flood risk conditions change in the floodplain.
3. University of Szeged (Department of Physical Geography and Geo-informatics) use innovative technologies to assess and measure the impact of *Amorpha fruticosa* on biodiversity and flood security. The dense stands of invasive species influence the vegetational roughness of the floodplains. We measure it in two different ways: 1) during floods, by ADCP (hydro-acoustic current meter) along transects, while 2) at lower water level, the vegetational roughness is measured directly applying Parallel Photography method on quadrates.
4. Local community (municipality) of Tiszatarjan village measures the yield of invasive alien shrubs and the consumption as biomass source. They also measure the economic parameters: temporary and permanent employment, cost saving on natural gas savings, biomass consumption, transport costs and chopping's fuel demand.
5. WWF Hungary regularly collects data from the field including the expansion rate and land coverage of invasive shrubs. We also use autonomous unmanned aerial vehicles (drones) to assess invasive plant species (coverage), and the extension of wet habitats. WWF also commissioned five external consultants to evaluate the project over the last 8 years.
6. Local district-heating company buys and uses the extra biomass source that local partners don't use locally. The energy company measures the moisture content and caloric value of biomass sources.

Key results:

- Temporary employment for workers in Tiszatarjan is between 12 and 35 depending on the period;
- Annual biomass consumption for heating local public buildings (60 – 110 tons);
- Annual cost saving on natural gas (35,000 – 40,000 €).
- Annual natural gas consumption reduction (50,000 – 65,000 m^3).
- Annual GHG emission reduction (90-100 tons of CO_2).
- Cleared and maintained floodplain (100 hectares);
- Successful re-introduction of beavers (15), water buffaloes (9) and cattle (50-60) in Tiszatarjan;
- Water storage capacity is maintained in the floodplain (250 thousand m^3);
- GIS database that contains that more water birds rest and nest, more high conservation value raptorial birds appear on the floodplain;
- Number of visitors per year (40-60);

Description of lessons learned and good practices:

- Very simple and practical guide templates are required for continuous monitoring.
- User friendly and practical monitoring tools are needed (e.g. GIS, excel sheets)

Description of key challenges:

- Data collection;
- Preparing reports based on actual data;

Planned next steps:

- Detailed cost-benefit analysis.
- Use data for multiplication;
- Develop user friendly monitoring tools for biomass consumption; invasive' harvesting; water storage capacity and biodiversity;
- Implement easy and user-friendly hydro-meteorological monitoring tools;

B.3. TOOLS FOR ASSESSING THE BENEFITS OF MITIGATION AND ADAPTATION TO ENHANCING RESILIENCE AND EMISSIONS REDUCTIONS THAT ECOSYSTEM-BASED ADAPTATION PROVIDES.

Description of the tool/method or tool kit:

- ArcGIS: We use ArcGIS for database management, thematic mapping and building simple models.
- GPS: We use GPS for field assessments and data collection.
- Drone: We use autonomous unmanned aerial vehicles to assess the extension and expansion of invasive plant species and the level of infection of high conservation value riparian habitats. We monitor the impact of eradicating invasive plants and assess the difference between managed and non-managed ecosystems.
- ADCP (hydro-acoustic current meter): To assess and measure the impact of *Amorpha fruticosa* on biodiversity and flood security. The dense stands of invasive species influence the vegetational roughness of the floodplains. We measure it in two different ways. During floods, due to the increased roughness the flow velocity decreases, which is measured by ADCP along transects. In this way the flood conductivity of the floodplains is evaluated, and the data is related to the overbank accumulation pattern. In flooding periods, we fix it to a boat to measure water current velocity and finally evaluate the role of invasive species in flood flow modification.
- HEC-RAS: At lower water level, the vegetational roughness is measured directly applying Parallel Photography method on quadrates. The data refer to the density of vegetation (up to 2 meters), and based on them the vegetational roughness could be calculated, which could be an input data of a HEC-RAS model. We use HEC-RAS (open-source) parallel photography method to perform flow calculations and assessment. It integrates the vegetational roughness too, thus it allows us to calculate and model flood level changes in case of different vegetation density.
- Scale: We use scale to measure the daily consumption of biomass in public buildings.
- We use simple excel sheets to collect data on harvesting invasive shrubs and energy plantations,

Partner institution/s (if any):

- University of Szeged uses the combination of ADCP and HEC-RAS technologies as an innovation to assess invasive plant species.
- Local district-heating company (for profit) measures moisture content and caloric value.

Key results if the tool has been tested and challenges (as appropriate):

- ADCP and HEC-RAS methodologies are to be tested.

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Mexico Case Study:

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Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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