WATER FOR CLIMATE RECOVERY

IN ONDAVKA RIVER BASIN

Evaluation of the after project implementation in the basin Ondavka

"REVITALIZATION OF THE CLIMATE IN DRIED-OUT COMMUNITIES IN EASTERN SLOVAKIA VIA HYDRO-CLIMATE RECOVERY"

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Content

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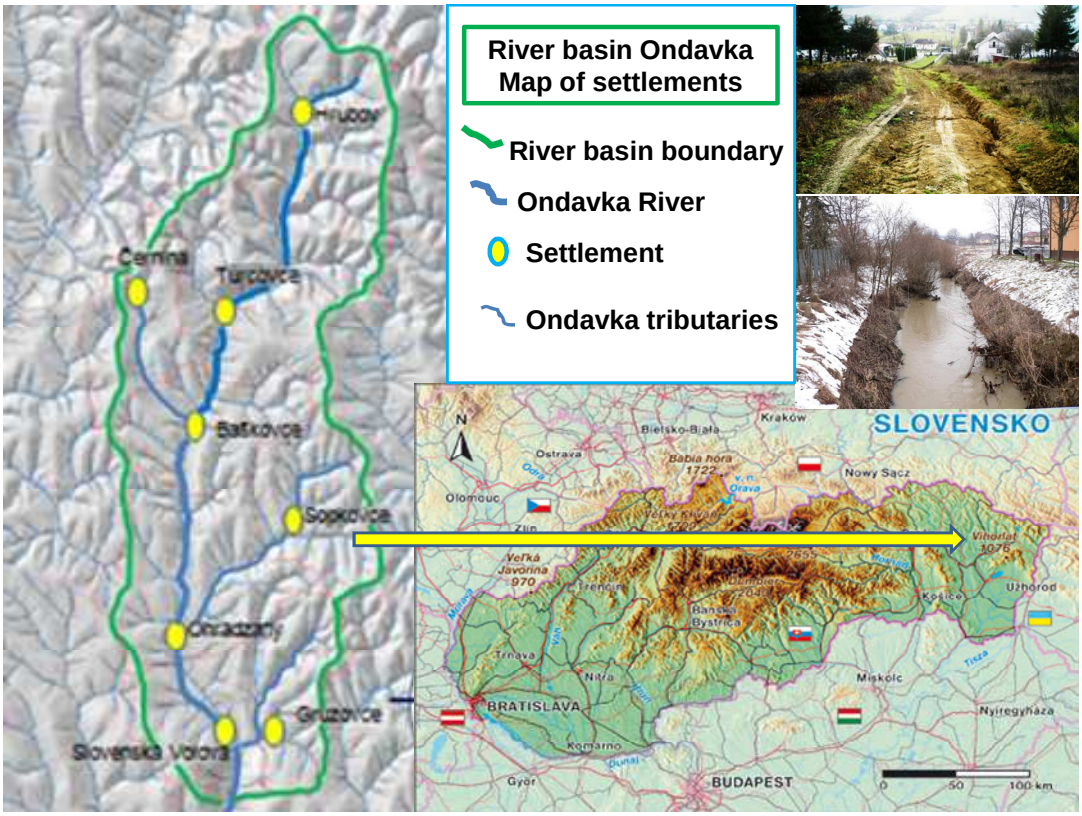
1. INTRODUCTION

The project was implemented in in the northeastern part of Slovakia in Prešov region (50 km from the Ukrainian border and 30 km from the Poland border) in the district Humenné and river basin Ondavka, in the 8 municipalities (see map). It is a micro-region, which is in the deep recession. Analysis of the demographic curve is that the region is dying. It is characterized by strong emigration, so it was great that the project was implemented here. Of the many interviews it was obvious, that the first time people realized that enjoyed a rare nature and their prospects in the region depends on it, how will care about nature.



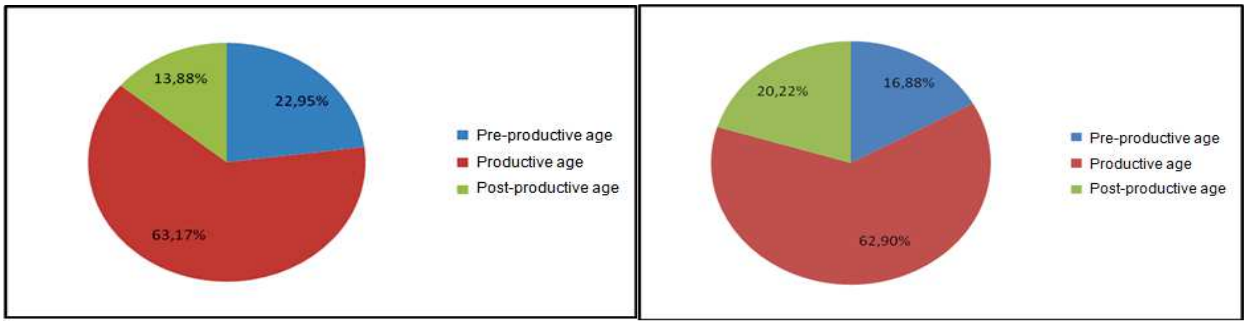
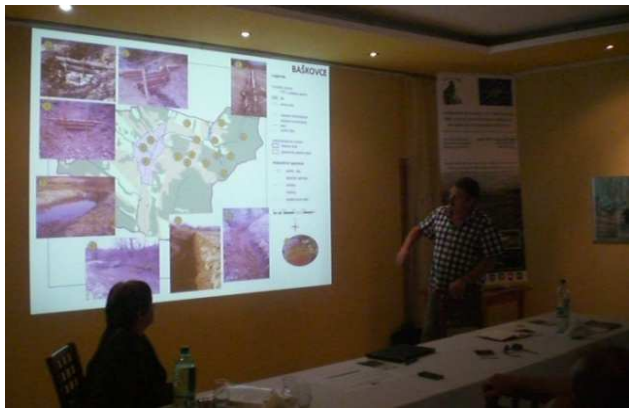


Chart: The structure of population by age productivity a) in the Prešov region and b) Ondavka River basin

The aim of the project was the implementation of an innovative and demonstration project to adapt to climate change through an integrated rainwater retention in the basin Ondavka, exactly in municipalities: Baškovce, Černina, Gruzovce, Ohradzany, Slovenská Volová, Sopkovce, Turcovce. Integrated measures for the protection of water in the basin Ondavka include those types of measures which will strengthen retention of rain water in damaged parts of the forestry and agricultural and urban land through water conservation elements. I can retain cyclically and slow the runoff of rainwater, reducing thus the flood and erosion risks as well as risks from drought and climate change. Significant effects are expected for improving ecosystem of the most damaged parts of the river basin, which have so far contributed significantly to floods and droughts.

Water demand and the decline in the damaged structures of forestry and agricultural activities and urban landscape is serious handicap sustainable development, regions and entire countries to serious degradation the entire chain of environmental functions of ecosystems. Industrialization of the country by agriculture, forestry and land use development can be mitigated or even avoided by implementing measures within the framework of flood protection, if the measures will focus on prevention of floods and droughts. It is therefore necessary in all types of landscape, building green infrastructure, which can in time of heavy rainfall to retain a rain water in the landscape, other way, in times of drought the water colud be released. It is a whole range of measures - from wetlands through water retention measures to new technology solutions for collecting rainwater and recycling it inside towns and villages.


The project is financially supported by the LIFE + program. Developing green infrastructure forestry and agricultural activities in the damaged parts of the country and the local municipality basin is Ondavka could be a suitable model example of how to find and solve the associated environmental security benefits, economic growth and social needs of any territory in Slovakia and other EU countries.

This publication summarizes the results of project implementation for the period from 1.8.2012 to 30.4.2015 in individual municipalities and collectively.

2. IMPLEMENTED MEASURES

2.1 Implemented Measures

During this project were implemented measures that could be generally divided into three groups. The first group, measures are built mostly in forest ecosystems. Other measures are in the agricultural land, and finally the measures build in urban areas. In the forest ecosystem was built mainly wooden small dams, in ravines and erosion grooves. This type of measures is the most

numerous and it also has the largest volume summary retention. In agricultural landscape was mostly build indent on the roads. At the urban areas was build rainwater gardens that collect rainwater from roofs and hard surfaces.

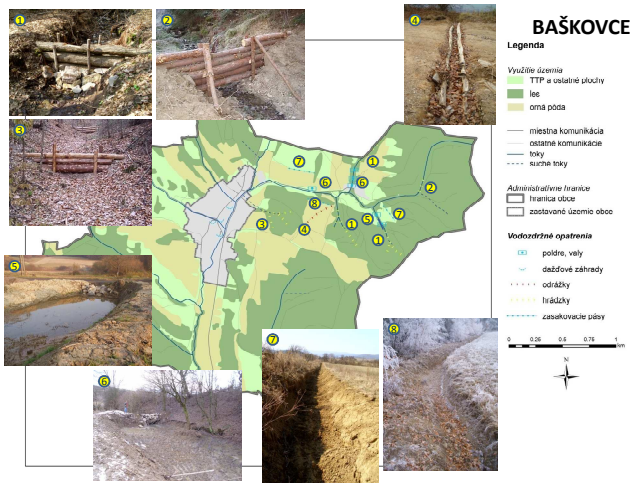
Some of the municipalities in this project have been included on the agenda Landscape Restoration and Integrated River Basin Management SR in 2011 (see pictures).

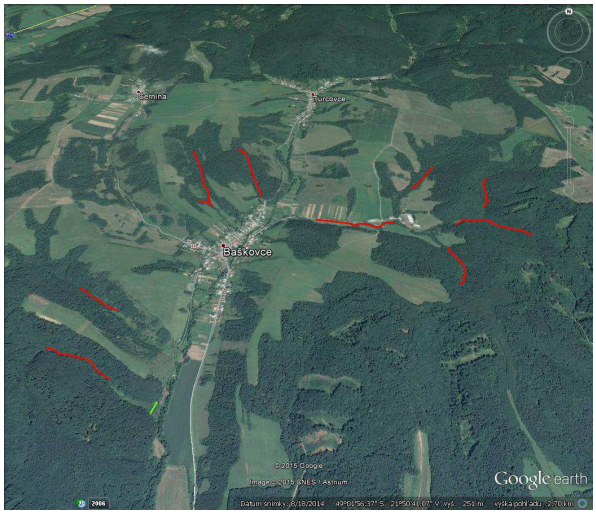





Baškovce

At cadastral area of Baškovce municipality was mostly constructed wooden dams in forest and agricultural lands dingles.

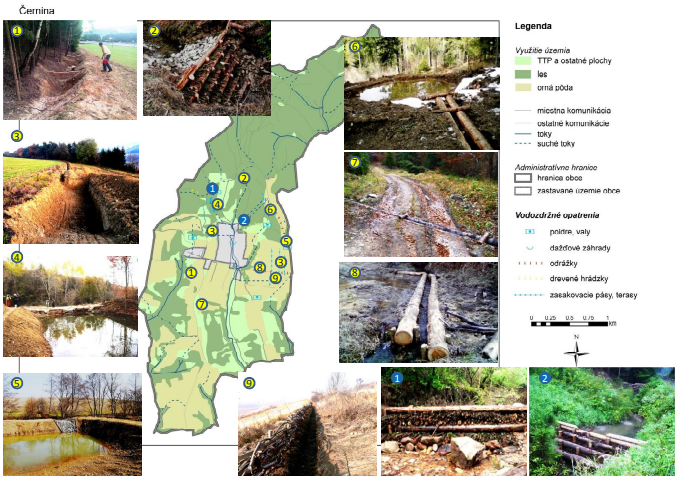


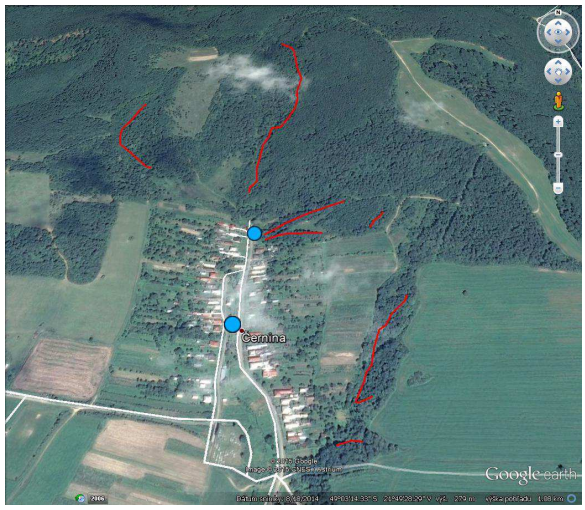


The advantage of interlaced dams constructed in ravines and erosion grooves is that they are quickly full of sediments, causing the preservation of wood and then it has a much longer life.

Černina

At cadastral area of Černina municipality was constructed 118 water retention measures. Detaily 2 rainwater gardens located in the urban and 116 small wooden dams in countryside.

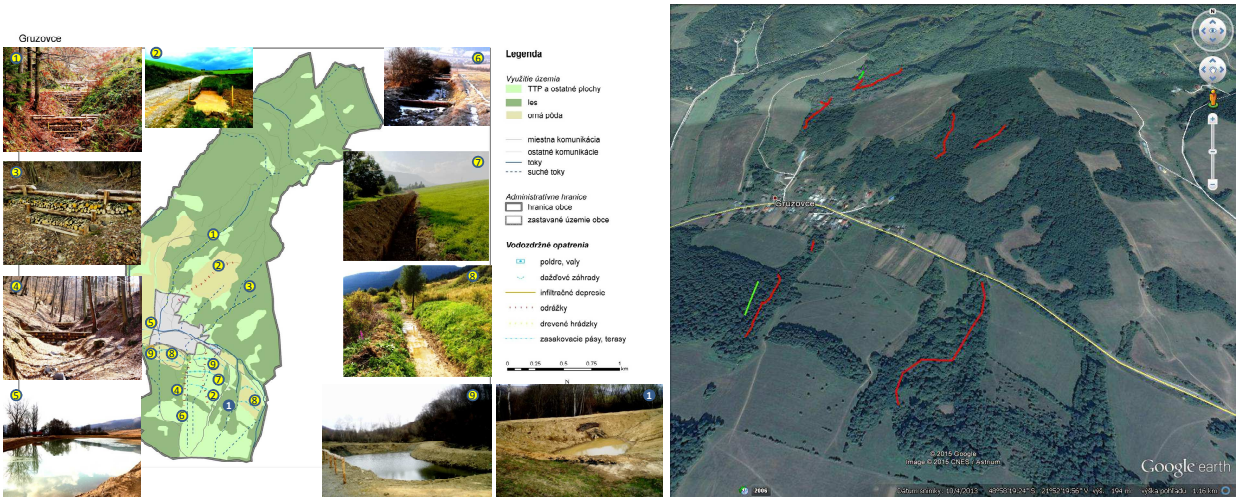




Urban areas has significantly contribution on drying because the majority of rainwater drained from reinforced areas and in naturally occurring rainfall. Therefore, we decided to collect rainwater into green zones, which also will help irrigate new features local vegetation.

Gruzovce

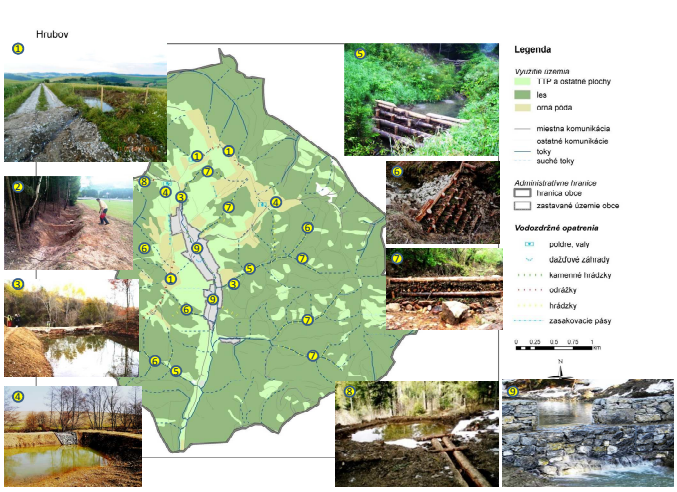
At cadastral area of Gruzovce municipality was constructed 101 wooden dams and 26 indents in countryside.

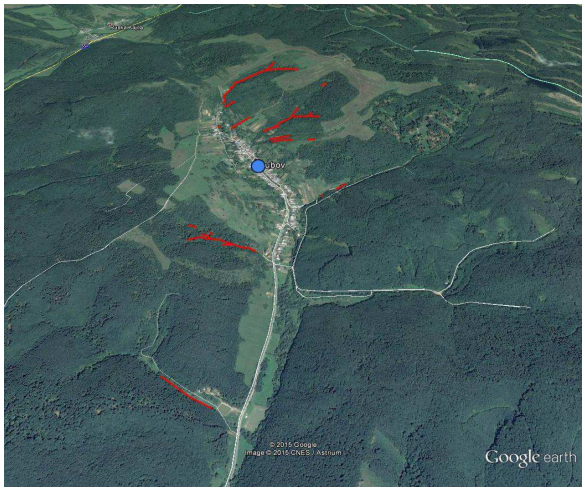


Wooden dams in Gruzovce proved their justified during the heavy rain on 24th of July 2014, during the few minutes their were full of sediments, which would otherwise end up in the urban area of the village.

Hrubov

There Hrubov was constructed 203 wooden dams in ravines in the rural area of the municipality and one rainwater garden in the grounds of elementary school, which collects rainwater from the roof of the school building.





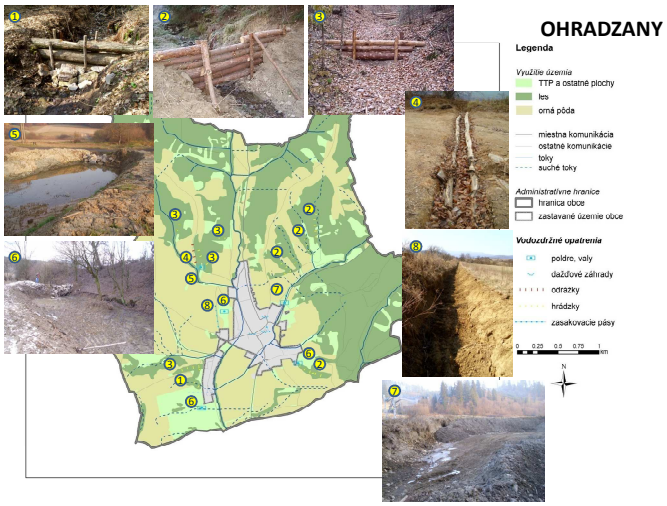
Rain garden in this village was realized from plants purchased through the project and donated by the citizens of the village. The decision on the location on the school yard are seemly

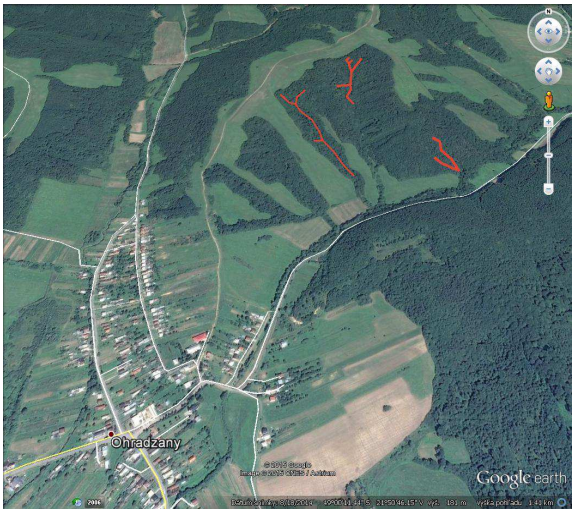
to fill space, garden also serve as illustrative demonstration of responsible management of rainwater, as well as didactic tool for the local children.

Wooden dams already at the beginning of the project implementation proved their justified when, during torrential rains on 24th of July 2014 in the area called Domovka prevent clogging of space in houses sediments from forestry and agricultural land over the Domkova area.

Ohradzany

Ohradzany municipality is most at risk of flooding, as in it running into two major flows. As these flows are important water management, therefore the working side inflows, which are not important water management.







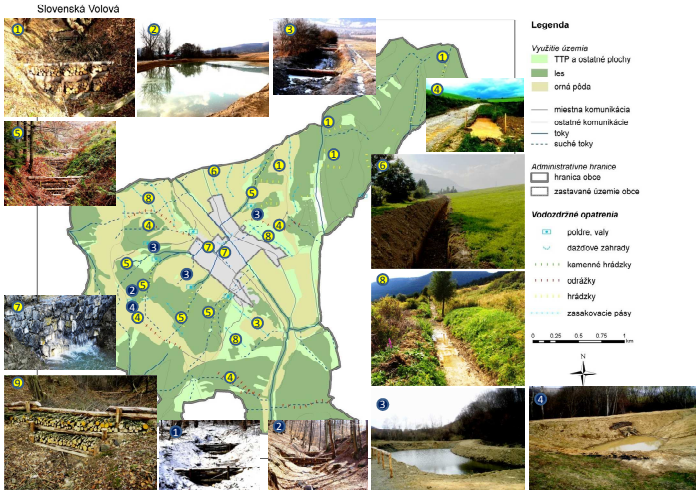


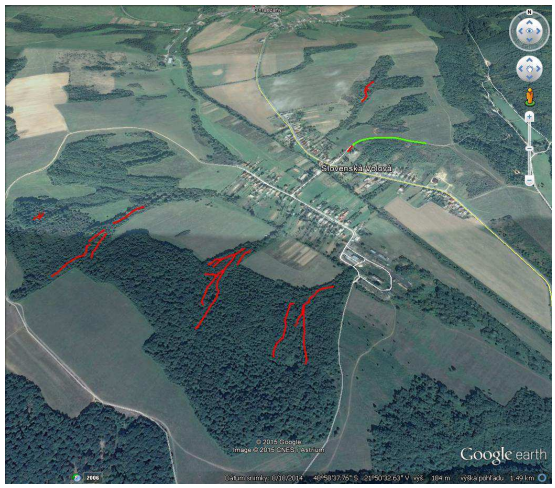

Ohradzany have been included on the agenda Landscape Revitalisation and Integrated River Basin Management SR in 2011. It means that in lot of areas of cadastral area of Ohradzany were already constructed water retention measures. Therefore, in this project we focused on concrete area which was not revitalized yet.

Slovenská Volová

At cadastral area of Slovenská Volová municipality was constructed enormous190 water retention measures.

Indent on the road were builted in order to interrupt and divert surface runoff rainwater. The long-term problem of clogging roads after rains around the cemetery was removed by a series of such measures. To immediately solve this problem showed by residents lived at close quarters the road.



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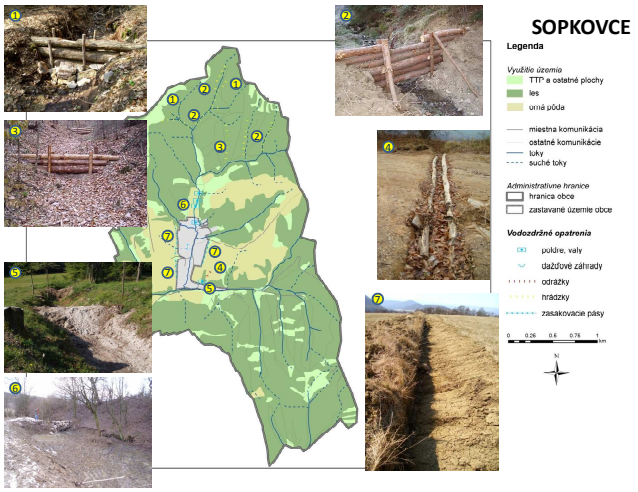
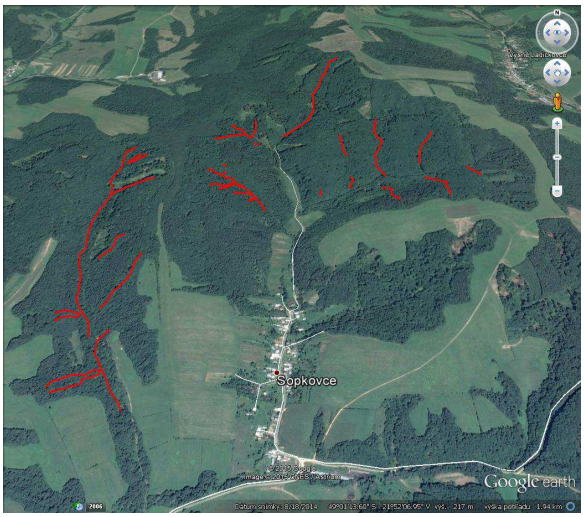
Sopkovce

At cadastral area of Sopkovce municipality was constructed enormous 256 wooden dams in foresty area. The largest representation in the cadastral area of the village are the forests. In these forests, an intensive logging and is there a large number of ravines and mining roads, that importance contribute to flooding in the village. Due to the large number of wooden dams with a large variance, was the risk of flooding significantly reduced during the torrential rains.

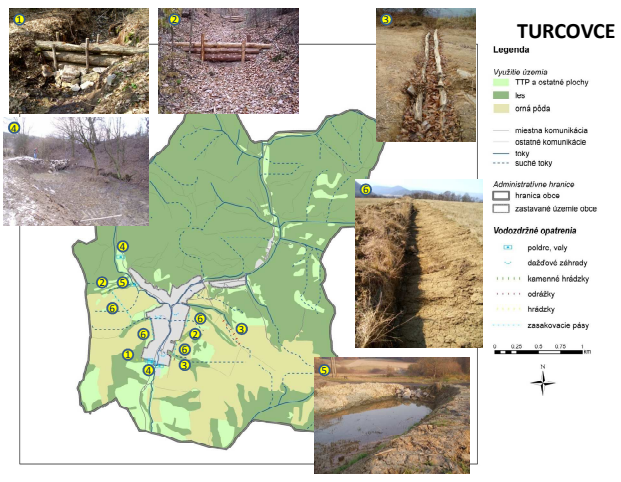


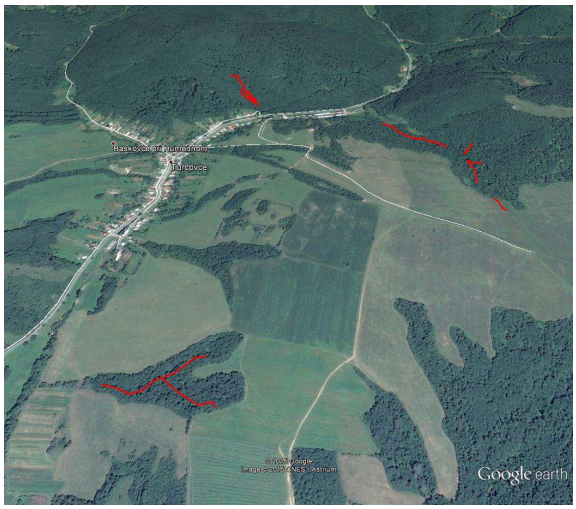



Turcovce

At cadastral area of Turcovce municipality was constructed 94 wooden dams in foresty and agricultural area. Turcovce have been included on the agenda Landscape Revitalisation and Integrated River Basin Management SR in 2011. It means that in lot of areas of cadastral area of Turcovce were already constructed water retention measures. Therefore, in this project we focused on concrete area which was not revitalized yet.

The biggest problem in the village Turcovce is the location of pastures above the tree line, where rainwater accumulates and creates enormous erosion grooves that deepen with each rainfall. By the building a wooden dems in these erosion grooves, was stopped the process of enlarging them and it is expected that within a year the erosion furrows will be filled with sediment and disappear.










2.2 Cumulative assessment of the measures implemented

During the eleven months period, together 114 people worked in 8 in teams, one team in each village. It was created 1 148 objects of water retention measures by the physical volume of 21,300 m^3. It is a measure constructed by cyclic retain rain water in ecosystems to enhance its infiltration into the soil and slowing it down runoff from the damaged landscape, without which

the rainwater drained away quickly and contributed to flooding. From expert estimates based on us while the volume of water retention capacity is actually higher, because retention of rainwater in water conservation measures and increasing the infiltration of water into the soil. Therefore, water retention capacity of completed measures is estimated higher by about 30%. Thus, the cyclic water-retention capacity is about level 28.000 m^3. Characteristics of precipitation in the region Ondavka say, that the runoff from intense rainfall occurs five times or more per year.

Thanks to this project a systematic method was developed concerning evaluation of damaged land, how to quantify damaged land influence on outflow creation and formation of flood risks and risks of droughts as well as how to effectuate renewal of damaged land by way of water retaining capacities. Based on this principle analysis of state of damaged land was performed in first part of project realization followed by preparation of technical, capacitive and logistic conditions for realization of particular water retaining elements and subsequently by realization of measures on the ground. Structure of responsibility based on this logic was developed relating to individual parts of the project and resulting structure of people looks like this:

1. **Water ambasador** – person responsible for environment analysis, solution proposal, and definition of labour logistic of fieldwork and monitoring of work performed - on the whole there were 4 water ambassadors in the project.
2. **Water master** – person responsible for fieldwork realization and for the quality of performed work - on the whole there was 5 water masters in the project
3. **Water worker** – person responsible for manually carrying out measures in field – on the whole there was 114 water workers in 8 villages of Ondavka river basin.

Municipality	Number of implemented measures	Retained volume (m3)
Baškovce	100	4 511,7
Černina	117	3 218,4
Gruzovce	100	1 328,4
Hrubov	204	3 741,9
Ohradzany	80	2 433,2
Slovenská Volová	189	2 220,2
Sopkovce	256	5 325,6
Turcovce	94	1 648,0
Sum	**1 140**	**24 427,4**

Implementation of the project showed interest and willingness of people to participate in protecting their environment and sharing. While assume some degree of responsibility on the state of the country.

It was interesting how the locals treat this project in response to the Program Landscape Revitalisation and Integrated River Basin Management SR (first and second implementation project in 2011). Some workers in the project already had experience with building measures of the government program, but only during the project fully aware of the importance of their work. While had the possibility to carry out other types of measures and identify their strengths and specificities.




Transfer of knowledge and experience of workers from the first to the second stage was also an interesting process. Training new staff in the second stage with the help of those who worked in the first phase revealed as individual workers understand. The process of knowledge transfer was one of those moments when people are involved this project demonstrated the viability of the idea and after the project.


3. MONITORING OF THE IMPLEMENTATION AND PROGRESS OF WORK

Monitoring involved direct field work, meaning that the monitoring team monitored rainwater run-off during and immediately after precipitation. Sedimentation building in the small dams were observed and documented. The immediate results of the implemented measures include less mud/sad building at the bottom of logging roads and agricultural roads. Sedimentation build-up in the dams is also a noticeable difference as the dams capture sedimentation runoff thus slow down water runoff as well.

The result is a database of the measures implemented in the field, map and photo documentation of the measures implemented, which is freely available on the project website *http://www.ludiaavoda.sk/69-sk/aktuality/.*

The establishment of the work was done in the field. They recorded the types, numbers and volumes of completed water conservation measures so as to be able to track the progress of the work and its comparison with the project and the timetable. Outputs of monitoring implementation and progress of work were made into short monitoring report.

Measurable indicators to evaluating the impact of this project:

- ✓ **The number and type of completed water conservation measures -** in this indicator, the number made arrangements;
- ✓ **Volume of realized measures -** The volumes of water retention measures have been calculated according to the volumes of geometrical elements which correspond most closely measures and their combination.
- ✓ When indents on agricultural and forest roads is calculated as the volume of water retention area paths from which to limit runoff, multiplying the volume of water falling on the surface of the road in case of extreme crash 100 mm.This indicator is one of the main indicators of project implementation;
- ✓ **The effectiveness of water conservation measures -** for errands in the field was determined the water level passage height. This could be made based on the presence of organic or

inorganic residues, for example, o wooden dams, or small ponds and streams directly in the measures implemented;

- ✓ **Sediment -** sediment monitoring in implemented water retention measures were described in errand in the field. The volume was the estimate;
- ✓ **Water -** determined the presence resp. absence of water in different types of water retention measures;
- ✓ **Soil moisture -** by manual hygrometer was determined soil moisture in the close area of implemented measures as an additional indicator of the impact of measures;
- ✓ **Vegetation** - consider the presence or. the absence of new plants in implemented measures where there did not occur previously. If it was possible to determine the species of plants and its ecological requirements (water, nutrients). This indicator is used to verify the impact of the measures on the overall revitalization of the country;
- ✓ **Photographic material -** complements the above-mentioned indicators;

4. CONCLUSION

Aim of this project rests on realization of innovative and demonstrative project of climate revitalization trough rain water retention in Ondavka basin. Integrated protection of water measures in Ondavka basin involved those types of measures which will reinforce the rain water retention in damaged parts of the forest and agricultural as well as urban areas trough water retention elements. Water retention elements are able to cyclically retain and slow down outflow of rain water from forest, agricultural and urban areas and thereby reduce flood and erosion risks as well as risks of drought and climate change. Necessity of water and its decrease in damaged structures of land is serious handicap to sustainable development, regions and whole states with serious degradation of the whole chain of environmental functions of ecosystems. Negative impacts of land industrialization could be reduced thanks to measures which could proof to be significant contribution in integration of local communities into building of water retention measures in damaged land structures for flood, drought and climate change prevention.

It was a significant aim of the project to increase public involvement in damaged land revitalization. Interconnecting of environmentally and socially innovative solutions is providing us with opportunity to contribute more actively, more effectively and more integrally to

environmental risks elimination and at the same time to reinforce environmental and economic interests of villages with local economic support on the basis of green infrastructure. Green infrastructure construction right at the level of communities can be much more effective in solving floods and droughts prevention than contemporary technical and engineering solutions. Green infrastructure can be an important contribution to environmental safety and social justice. In time of heavy rains green infrastructure is able absorb surplus water and to release this water during droughts. This involves whole series of measurements – starting from water meadows, water retention elements in forest and agricultural lands damaged by floods to new technological solutions of rain water collecting and it’s recycling in urban areas of cities and villages.

Rain water retention launches chemical and biological ecosystemic renewal processes and reinforces photosynthesis intensity. Thanks to this the vegetation in nearby zones which were provided with measures is secured with enough water to avoid water stress (water shortage). Approximate annual growth of water in small water cycles thanks to water retaining measures is circa 140 thousand m^3. These renewal processes effectuated by realized measures have positive influence but were never measured. It was proved by research during similar nature renewal project where forest ecosystems in Tatra National Park (2014) were damaged by wind disaster that water retaining measures positively influence vegetation diversity and vitality of small animals in ecosystems. We presuppose that water retaining measures in Ondavka basin have similar effects. However this can be proven only by serious research which did not took place. Inasmuch as it is not possible to continue with project it is not possible to attain the exact results. It is nevertheless necessary to work on it from long term perspective.

Most significant contribution of the project is active participation of local communities on water retention measures realization. Creation of job opportunities during green infrastructure realization is bringing along number of social and environmental opportunities but also economic benefits. Premature halting of the project prevented us to quantify some parameters but even now it is evident that rain water retention in lands damaged ecosystems is dealing not only with local floods prevention but also contributes to water reserves creation, reinforcement of photosynthesis and trough this to carbon sequestration in biomass, water evaporation increase through vegetation,

natural thermoregulatory processes. Simply put, land with reduced presence of extremes is becoming more attractive, safer, more competitive and socially more interesting.