Danube Floodplain

Reducing the flood risk through floodplain restoration along the Danube River and tributaries

Minutes of the 3rd Expert Meeting on Work Package 3 Ljubljana (18th and 19th of June 2019)

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The third of four expert meetings on WP3 took place in June 2019 in Ljubljana, Slovenia.

The workshop is organised in M13 of the project when according to the AF, the deliverables D 3.1.3 (Danube Floodplain Inventory for active and potentially restorable floodplains), D 3.3.1 (Map of floodplains) and D 3.3.2 (List of floodplains, their characteristics, restoration/preservation potential and associated measures) should be delivered. Partners have made a significant progress in the development of these deliverables and are close to final results. The workshop is intended to clearly identify the progress regarding the modelling and ranking of the floodplains by applying the FEM method on Danube and the tributaries, and provide a guidance towards the closure of these deliverables.

Main objectives of the meeting were:

- Overview of the status on floodplain assessment on actual and potential floodplains on selected tributaries or their sections, modelling results according to FEM requirements, data availability issues;
- Overview of the progress on the activities 3.1 and 3.2;
- Reviewing of FEM ranking method being implemented on tributaries and on Danube; understanding FEM and meeting the requirements; interpretation of the results;
- Open issues about methodology and approaches;
- Next steps - pending WP3 tasks and timeline.

From the all invited Danube Floodplain project partners the participants were mostly representatives of project partners and associated strategic partners working on WP3 & especially on A3.3, and representatives of some other project partners from nine countries from Danube river basin – MRBA, KOTIVIZIG, USZ, JCI, NARW, NIHWM, DRBD, BOKU, TUM, CUEI, SWME, WWF (RO), OVF, and DRSV.

Summary of the meeting

DAY I – June 18

Presenters: Wagner (SWME), Krajčič, Banovec (DRSV), Pravetz (KOTIVIZIG), Eder, Habersack (BOKU), Vesely (MRBA), Rindasu (NARW), Sarbu (NIHWM), Petrova (DRBD)

Update on Work Package 3

Representative of RP of WP3 Jan Wagner (SWME) gave a short Summary of activities.

- On the question, whether the WP3 leader has already applied for the prolongation, Wagner responded that WP3 activities are supposed to be finished by the 17th month of the project implementation (end of October 2019), so it is still possible to meet the deadline, even though we proposed a prolongation of the work package for a 6-month period.

I. MAPS OF FLOODPLAINS

Maps of Former Floodplains & Realistic Potential Floodplains on Tributaries (part of D3.3.1)

PRESENTATIONS

Krajčič (DRSV) – Former & Realistic potential FPs
Presentation about the process of delineating former floodplains along the Krka river. First, modelling of the HQ500 flood event was performed. After that, presence of built-up areas and agriculture within the former floodplain was analysed. We should exclude built-up areas and some crucial infrastructure (main road) from the realistic potential floodplains, but not agricultural land.
Discussion about the floodplain which is cut off from the river channel by a belt of housing and how to divert the water to restore the former floodplain and protect the active one, which is heavily populated and cultivated. This question is going to be discussed in the next period.
Removing housing and agricultural land from the realistic potential floodplains leaves very little to assess in terms of the FEM method.

Discussion:

Ninkovic (JCI): They are planning to work with Croatia on the Sava river. They have huge active floodplain areas, and they are fighting for their protection, because some have interest to narrow the area. Still they have some areas, which cannot be designated as realistic potential floodplains because of settlements.

Banovec (DRSV): The goal of this project is not to activate the areas by moving settlements. It is important and necessary to protect the areas that are at risk of extreme floods. The water management must consider protecting housing at the expense of flooding intensive agricultural land.

Discussion about the suitability of terminology: At the previous meetings in Bucharest and Vienna, the WP3 partners agreed about the change of terminology of the floodplains due to better understanding of terms.

Visionary Floodplain renamed to **Former Floodplain**
Operational Floodplain renamed to **Realistic Potential Floodplain**

Realistic Floodplain renamed to **Operational potential Floodplain** (will be not implemented during this project)

(See the 2nd WP3 Expert Meeting Protocol from 2nd of April 2019)

The main concern about this nomenclature is whether water management, stakeholders, and politicians will understand the correct meaning of specific terms.

- **Conclusion:** Unless we define better terms for floodplain characterisation, we stick to those agreed at the 2nd Partner Meeting in Bucharest. At this point it is most important that the terminology is not an obstacle for completing the tasks.

Maps of Former Floodplains & Realistic Potential Floodplains on Danube (part of D3.1.3)

Pravetz (KOTIVIZIG): Former and realistic potential floodplains - Danube, Hungary

Discussion:

Ninkovic (JCI): Former Floodplains were recognized in the Danube FloodRisk Project with the help of historical maps. During the Danube Floodplain project they are planning to define three Realistic Potential Floodplains on Danube.

Rindasu (NARW): Map of Former Floodplains and Active Floodplains on Danube

There are some former floodplains that can be used in this project, but they had problems with one potential area because stakeholders oppose the idea.

Eder, Habersack (BOKU): Example Austria – Machland

How to restore former floodplains, if there are settlements within the area? In some other project, they compared the transformation of a flood wave along the Austrian Danube of the current situation with a historic one. For simulating the historic conditions, the model has been modified by removing all dykes and power plants to show the situation before 1880. The results demonstrated that at the current situation the flood wave peak occurs 24 hours faster than at 1880.

They have the idea to protect the houses by using elevated roads as a ring around settlements (in some examples they already did that) or dykes around the settlements. They have to do that because some residents were not willing to move from the flooding area.

Discussion:

Rindasu (NARW): He cited a case where the residents didn't want to move from the flooding area to the relocated settlement. The reason for that was the fact that not all the infrastructure was built apart from housing (e.g. churches, schools, etc.).

Habersack (BOKU): In Austria, there is a case along the Danube where the residents of a small village prone to flooding decided to move to another location, even though they were offered that the dykes around the settlement be risen to a much greater extent.

Eder (BOKU): Update on A3.2.
As for calculating minimal parameters – they needed feedback from all the partners. If there is a problem with data availability or application of the parameters, partners should discuss with BOKU on the possible solutions.

If partners cannot obtain the building cadastre data, they can use Google Earth to mark buildings in the affected area, as satellite pictures are updated regularly and easy to use.

46 of the 49 identified floodplains will be assessed by FEM.
The Minimum set of FEM parameters must be applied on all Floodplains.
4 parameters of the medium and extended set were not chosen by partners, therefore they will not be part of the handbook.
So far, BOKU received first results from DE, RS, HR, HU (Tisza) and SL (Krka).
BOKU will update the handbook for minimum parameters with the feedback from the partners and will send out the updated version mid of July.

II. MODELLING

2D modelling of the pilot areas
Springer (TUM): Partners should prepare two scenarios on their pilot areas – a realistic and an optimistic one..
The settlements that are not fully within the modelling area must be included in the model, in order to be possible to measure the effects of the respective restoration scenarios in the settlements, and for the purposes of the CBA evaluation. The settlement behind dykes are not included. A documentation template file for all models was sent to the partners by TUM. – All Modelling partners need to provide uniform details of the models for the sake of comparability. For the rivers with dykes in the pilot area, partners may model a dyke failure within a certain scenario. Measures like lowering dykes for the restoration of former floodplain are not an option.

In some areas (e.g. Bistret) the model was calibrated with an event where the dyke broke. So the calibrated model might not be useful for situations where there was no dyke break. It is important that PPs document this case and that they check the calibration again.
Dyke failures should not be modelled in the scenarios. We analyse potential restored situations, so the dyke should be relocated but not fail.

A 4.1 Assessment of Flood Protection Impact of Floodplain Restoration Measures: Tasks according to time schedule

The deadline for creating the scenarios for the restoration of former floodplains and for implementing them in the model is September 2019, otherwise other activities will be delayed.

1D Modelling Chain

Springer (TUM): 1D Modelling Chain on the Danube starts in Germany (Baden Württemberg) and ends in Romania (Călărași).
There will be two approaches in estimating the restoration effect: scenarios for active floodplains and scenarios for former floodplains. Hydrographs from historic flood events should be obtained from the gauging stations and used in the models. Project partners are modelling their sections with three hydrological scenarios – HQ2-5, HQ10-30, HQ100 .
The aim of the model chain is to see the effect of all the floodplains acting together, and not the effect of each particular one separately.

Modelling tasks within WP3

Eder, Habersack (BOKU): Quality check models and plausibility check of modelling results
In general, unsteady hydrological input data should be preferred for all tributaries. Especially For larger tributaries, where data is available unsteady flood waves should be used. If no data from gauging stations is available for the main tributaries, TUM could provide you flood waves from the SWIM model. For smaller tributaries, it is possible to use steady hydrological input data. The documentation of the used flood waves/hydrological input data is very important. You have to provide us your used data. The documentation of the calibration of the used model and a plausibility check of the modelling results are very important for the project. For the calibration of the models, the simulated water level should be compared with measured water level. The difference between the simulated and measured water level should be in the range of 10 cm for the Danube. The comparison should be done in several control points in the models.

The calculated retention effect of a floodplain should be checked with the help of the hydrological parameters (ΔQ and Δt). The calculated ΔQ and Δt of the simulation have to be compared with the observed ΔQ_{obs} and Δt_{obs}, which were measured during a flood event close to the used hydrograph in the model in terms of return period and shape of the flood wave. For determining the observed ΔQ_{obs} and

Δt_{obs}, two measured hydrographs are used. The measured hydrograph from the closest gauging station at the beginning and at end of the floodplain are necessary to determine the observed ΔQ_{obs}

- Example 1: two stations with adifference of 500 m^3/s (ΔQ_{obs}) between the measured flood wave peaks– difference is a consequence of active floodplain – in that case there isn't any tributaries that affect flow and volume of the water; → the simulation results gave a ΔQ of 600 m^3/s, which is close enough to the observed one, therefore the plausibility of the calculated ΔQ is given!
- Example 2: in this case tributaries affect flow and volume of the water so we must subtract flood wave from tributaries to get the retention effect of floodplain.

It is suggested that the real flood event should be studied before the modelling – to get some realistic basis to refer on (flood events on Danube 2006, 2010, 2013). If the difference between the modelling results and the actual flood event is too big, we should find the reason for that discrepancy. This way we will avoid making the same mistakes with other models. Therefore, it was decided to send TUM and BOKU the hydrographs of the 3 flood events (2006, 2010, 2013) from all relevant gauging stations in your country. Furthermore, it was suggested to create hydrological longitudinal sections for the 3 events, where the measured Qmax is shown at all relevant gauging stations.

In general, It is better to use the 2D model for modelling of floodplains. If you are using 1D models for the evaluation of the floodplains, you have to check the results carefully. If there is a significant sidearm in the floodplain, where the water is flowing for a certain distance (e.g. 2km) and there is an island between the main channel and the side arm, we suggested to split the flow in the floodplain from the river channel. If results are available from 2D and 1D model, they have to be compared.

In addition, the calculated storage volume in the floodplain should be compared with the observed one.

DAY II – June 19

III. EVALUATION AND RANKING OF FLOODPLAINS

Presenters: Krajčič, Banovec (DRSV), Eder, Habersack, Scheuer (BOKU), Springer (TUM), Betz (CUEI), Blanka-Vegi (USZ), Vesely (MRBA)

Evaluated and Ranked Floodplains (part of D3.2.1 and D3.3.2) – part I

PRESENTATIONS

Krajčič (DRSV): Former & Realistic Potential FPs

Krajčič, Banovec, Jarnjak (DRSV): FEM application on Krka

Presentation about the floodplain assessment on the Krka River.

- Ranking of Floodplains by their suitability for restoration
  - Parameter -> Criterion -> Scale -> Threshold -> Classification -> Rank
    - Parameters chosen at Krka River:

MINIMUM SET OF PARAMETERS

Hydrology/Hydraulics
Peak Reduction
Floodwave Translation
Water Level

- **Result:** Presented charts of ΔQ, Δt, Δh
  For the classification process, it is necessary to calculate a relative value for ΔQ and Δt.
  The following have been suggested:
  - Peak reduction ΔQ/Q,
  - Floodwave translation Δt/t (t value can be warning time - to be discussed)
  - Water level Δh (h value to be discussed)

Ecology
Connectivity of Floodplain Water Bodies

- **Result:** Lateral Connectivity – Natural at all water levels
  Longitudinal Connectivity – Natural at all water levels
  Vertical Connectivity – Natural at all water levels

The results are all in green

On the Krka river, changes in longitudinal connectivity in the past 200 years are negligible, as no dams have been built, and the course of the river has remained virtually unchanged. Similarly, no dykes have been built (except for a section of slightly elevated road) and there were virtually no (if any) oxbow lakes present 200 years ago, and lateral connectivity as such hasn't been impeded

Existence of Protected Species

- Source: Layer „Natura 2000“ over Floodplains
  List of Protected Species

➢ **Result:** The floodplain (with pilot area) is in green, other 4 are in yellow

Total number of registered protected species (according to Natura2000 data) from all five floodplains is 57. By the Method of equal classes, the total numerus was divided into three groups of 19 (species). At the floodplains No. 1, 2, 4 and 5, there are registered from 29 to 33 species, so they are placed into yellow category (class from 20 to 38 species - grade 3). At the floodplain No. 3 there are 57 species registered – green category (class from 39 to 57 – grade 5).

- 2nd Option:
  - Anything with at least 1 protected species is already significant (3)
  - Krka -> All green

Discussion:

Ninkovic (JCI): Serbia doesn’t have any data (or there isn’t any on active floodplains) about protected areas or species which is one of minimum FEM parameters - could we consider this parameter as not applicable because they will get lower rating? The problem is in getting the information about protected species from the official institutions.

Habersack (BOKU): We should take into account that for some country one specific species could be very important, more than in some other country, while that species is very rare, and in the other it is not. I suggest that you try to identify with other sources the protected species in the area before we decide to say that this parameter is not applicable. We have to discuss, if it is really not applicable, if there are no protected species according to the Emerald Network or the Natura 2000.

Socio-Economics

Land Use

- **Result:** The results are all in green
  - Do we need to assign stricter grades to various Land Use categories?

Land use categories classification proposal:

- Built-up areas – 1
- Fields, orchards, plantations, and similar - 3
- Forests, meadows, swamps, and similar - 5

Discussion:

Scheuer (BOKU): We did a different evaluation, where agriculatural land was evaluated with the lowest grade.

Krajčič (DRSV): The aim of the floodplain restoration is flood risk reduction. In Slovenia, we do not protect agricultural land under the FRMP. the expert meetings on WP3 are above all meant to get expert opinions (water management), which will then be presented at stakeholder meetings. If agricultural land gets flooded, there is of course certain damage for the agriculture – it is higher that flooding forests for example, but much higher than flooding built-up areas. That is why we suggest putting agricultural land into category 3.

Banovec (DRSV): If agriculture benefits from rivers by using water for irrigation, they also need to accept the risk of flooding along the river channels.

Habersack (BOKU): The dilemma is if we put crops into category 5, then we don't consider any damage for farmers after flood; if we put them to category 1, then they put crop fields beside houses (as same importance). Category 3 is maybe the most suitable, because it is always better to flood the crop field and not housing (we should avoid flooding fields, but is not the same damage than damage on housing). In Austria we have the problem that, if we evaluate agricultural land with a 3 or 1 then we say that it is a damage because of flooding and then the farmers want to get a compensation for their land.

Ninkovic (JCI): Agricultural land located on water estate maybe can get lower category because farmers know that they have crops on higher hazard areas and that they should consider the risks for their activities. The problem arises for agricultural land on former FPs, which are not considered as water estate and in that case the category should be higher. With socio-economical parameters one should consider the future state of some floodplain as a guidance for water management and spatial planning.

Đurovic (DRSV): Categories 1, 3, 5 for sorting land use are based on vulnerability of categories of land use (e.g. urban use is more vulnerable than forest). Proposition to use parameter land use vulnerability instead of category land use.

Pravetz (KOTIVIZIG): Meadows and pastures are very rich from the aspect of natural richness, so they deserve a rating of 5.

Đurovic (DRSV): Proposal that Meadows and pastures have a rate of 3 .

Petrova (DRBD): We should consider also the Cost Benefit Analysis – what is better, to change the land use of some area, or to pay for damage?

Habersack: Maybe we should exclude the Land use parameter from minimum set of parameters and put into the medium set, so the parameter is not a must do anymore.

- Or, maybe we should use this parameter in the case of active floodplains, and not also for the potential floodplains.

(To be considered in the next period.)

Potentially Affected Buildings

- Aim – identification of affected population living on floodplains or commuting to floodplains.

➢ **Result:** Number of affected people (night-time, daytime)

Discussion:

Austria makes a proposition to sort potentially affected buildings in categories 1, 3, 5 with an absolute numbers (example – category 1 is more than 50 affected buildings).

Proposal for the thresholds:

5 – less than 10 houses
3 – between 10 and 50 houses
1 – more than 50 houses

Đurović (DRSV), Banovec (DRSV), Habersack (BOKU): The need of relativization of the data, to make them comparable among the floodplains – the proposal is to asses the number of houses per spatial units (n/ha) or the proportion of the area with affected buildings per total area of floodplain (percentage of the whole floodplain).

Đurović (DRSV), Ninkovic (JCI): It is better to use relative numbers instead of absolute ones of buildings (perhaps the relative number of affected buildings in %). This parameter is basically derived from vulnerability (the houses are very vulnerable, the crops medium, the forests and meadows have low vulnerability), so the parameter should be named "Land use vulnerability".

Springer (TUM): It is crucial to count potentially affected buildings in potential floodplains – they are based on HQ1000 extent excluding settlements, so there should't be any houses in fact.

- **An agreement is to use both, absolute and relative values (depends of the data availability in each country).**

Scheuer, Habersack (BOKU): Floodplain Evaluation Matrix Thresholds

BOKU presented first suggestion for thresholds for the minimum FEM parameters. It is very likely, that different thresholds will be defined for different reaches.

For the minimum parameter "Connectivity of Floodplain Water Bodies" of the ecological category some changes were presented and discussed. Based on the discussion the working flow for the determination of this parameter changed as follows:

1. Calculating 3 scenarios (mean water, bankfull flow, above bankfull) with 1D or 2D models
2. Determining the connectivity of the water bodies (e.g. branches, oxbows etc.) in the floodplain with help of scenarios. (If the river system is meandering, the connectivity is naturally at bankfull discharge and therefore it gets a 5 and no further steps are needed)
3. Checking historic maps for "natural (historic)" status of water bodies on the floodplain (3 possible outcomes):
   3.1. No "natural" (historic) water bodies on the floodplain
   3.2. Existing water bodies, where cut off by dykes
   3.3. On the historic maps "natural" (historic) water bodies existed, but at the active floodplain no water bodies left, due to human activity (e.g. dykes etc.)

Habersack (BOKU): Floodplain Evaluation Matrix Approach

The matrix which has all evaluated parameters divided in three classes was changed because it's not necessary to have all green, no red and rest. One alternative is the combination of max two yellow, max one red and rest, but calibration is still needed. When we have all results of the parameters we can decide which version we will use.

It is a problem of describing floodplains as "not important" because we are sending the message that low-ranking floodplains can be ignored and not protected. For that reason, it is better to use the following terminology: Excellent performance, very good performance and good performance.

Second idea is to divide the floodplains into three categories:

1. Important
2. More important
3. Very important

For that reason we also agreed to change the respective colours:

1. Important is yellow (used to be red)
2. More important is green (used to be yellow)
3. Very important is blue (used to be green)

Maybe these terms will have more effect on decision makers.

In the scope of WP 5, we can also discuss on how to raise the awareness of the importance of floodplains for the purposes of flood protection, firstly among the residents, and secondly among the politicians, decision makers and spatial planning managers.

For each floodplain in different categories of performance and importance some recommendations how to manage those floodplains can be given.

Also, the size of the floodplain should be considered in view of importance (larger floodplains are more important than smaller for evaluation and ranking).

Habitat modelling

Betz (CUEI): Habitat modelling
Data availability for the Pilot Areas – the basis are the data of Natura2000, inundation duration, water depth, and slope.

For the habitat modelling, which is to be performed by CUEI, the project partners will need to help with data availability .

Restructuring of the database

Blanka – Vegi (USZ): Restructuring of the database
Some changes were made in the common database – names of fields, table with explanation of abbreviations and names of the floodplains are modified, so the table doesn't have double names. There were also some other changes. The partners can require the explanation directly with USZ.

Evaluated and Ranked Floodplains

Vesely (MRBA) : FEM Morava (Implementation of the FEM methodology)
Presentation on implementation of FEM parameters

IV. WRAP-UP OF THE MEETING

Steps forward, Tasks & Schedule

- BOKU will send the handbook of medium and extended class of parameters in a few days.
- Activity leaders should send the lists of open issues, questions and suggestions which were not solved on previous and this meeting to DRSV (A3.3 leader), SWME (WP3 responsible partner) and NARW (Lead partner) (all dates in 2019) until 26th of July.
- Finishing of the Map of floodplains on selected tributaries until 30th of July.
- The first version of the FEM assessment based on minimum set of parameters is expected until 30th of July.
- 1st version of the FEM assessment based on medium/extended set of parameters is expected until 30th of August.
- The results check of first FEM assessment (BOKU) will be performed until 15th of September.
- The lead partner will convene a Skype conference for WP3 partners until 30th of September.

- Final FEM assessment should be performed until 15th of October.
- Preparation of FP fact sheets (A3.3.2) until 30th of October.
- List of floodplains, their characteristics, restoration/preservation potential and associated measures until 30th of October.
- Recommendations for floodplain assessment on tributaries including the description of implemented methods and classification criteria until 30th of October.
- The detailed Gantt Chart will be coordinated on the WP3 Activity leaders level and sent to all WP3 partners.