DELIVERABLE 1.7

Report stakeholder workshops on cause-effect relations and potential systemic effects- FRR

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Land4Climate

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Deliverable 1.7 Report stakeholder workshop on cause-effect relations and systemic effects - FRR

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Abbreviations

CRA	Climate Risk Assessment
EU	European Union
FRR	Front Running Region
LAND4CLIMATE	Utilization of private land for mainstreaming nature-based solution in the systemic transformation towards a climate-resilient Europe
NbS	Nature-based solutions
WP	Work Package

Executive Summary

This report presents the concept and results of the workshop on cause-effect relations and potential systemic effects, held with the project partners of the different FRR. The workshop was conducted within the third consortium meeting of the LAND4CLIMATE project in Timisoara, Romania. The objective of the workshops was to collaboratively develop NbS ideas for specific hotspots, that were identified within a climate risk assessment, to mitigate the climate risks.

Nature-based solutions, FRR workshops, systemic effects, cause-effect relations

1. Introduction

The impacts of hydrometeorological hazards such as droughts, heat, heavy rainfall, and flooding, present significant challenges to regions across Europe. To address these challenges, the LAND4CLIMATE project aims to implement nature-based solutions (NbS) on private land in six frontrunning regions (FRR) in Austria, Germany, Czechia, Slovakia, Romania and Italy. As part of this effort, the project proposal included a workshop to examine the potential systemic effects of climate risks and NbS within the first WP.

The objective of the workshop is, that the participants collaboratively develop NbS ideas specifically tailored to mitigate climate risks at the hotspots, which were identified within the climate risk assessment, described in the previous deliverables 1.1 (Future-oriented local climate adaptation scenarios) and 1.3 (Visualisation of cause-effect relations and potential systemic effects). By bringing together insights and expertise from the regions, in a co-creation process, the workshop is supposed to foster solutions that are closely aligned with the local needs and conditions of the FRR.

This report presents the objectives, structure, and key outcomes of the workshop. It highlights the collaborative process of generating NbS ideas, which form the foundation for the subsequent co-design and implementation phases. The results of this workshop contribute to creating a “no-regret” list of NbS for the FRR. “No-regret” means in this context, that the NbS will always have more positive effects on the livelihoods and ecosystems within the FRR regardless of the changing climate and other developments in the regions.

The first part of the deliverable describes the benefits that co-creation can provide within the NbS implementation process. In the following section, the role of a workshop as a tool within the co-creation process is examined. The subsequent part presents the specific framework of the workshop conducted in Timisoara. Finally, the outcomes of the workshop held with the individual front running regions are presented in detail.

2. Co-Creation process for nature-based solutions

Co-creation is understood in various ways, but in the context of NbS, it refers to the process of participation, interaction, collaboration, or co-development of NbS measures involving diverse stakeholders. These stakeholders can include organized and non-organized citizens, political representatives, public authorities, private landowners, researchers or others involved in the process of implementing the measure (Naumann et al. 2023; Andersson et al. 2023).

In the guidelines for co-creation and co-governance by Andersson et al. (2023) the co-creation process is divided into five phases or (Figure 1).

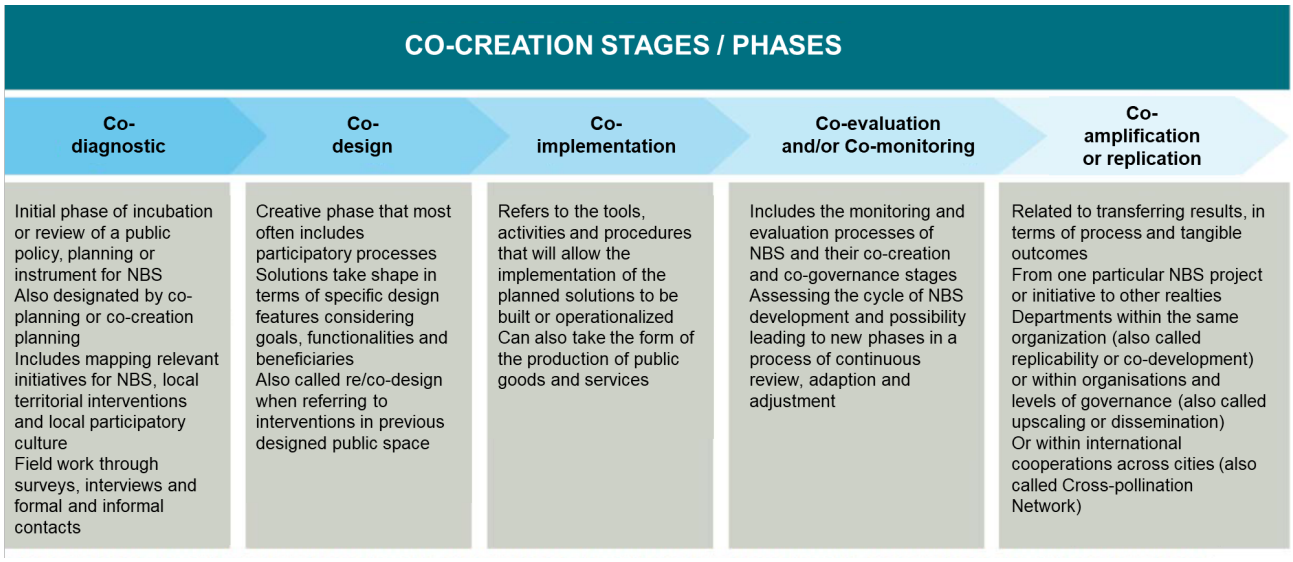

Figure 1: Stages of co-creation based on (Andersson et al. 2023)

Figure 1 shows, that the interaction and collaboration between different stakeholders is crucial throughout all NbS stages, from setting project objectives and developing design ideas for NbS to the replication process of the measures for other regions.

For an effective implementation of NbS measures and the successful utilization of all co-benefits, it is advantageous to involve a diverse range of stakeholders and scientific disciplines (Mahmoud and Morello 2021). This allows access to various insights, perspectives, skills, and knowledge resources from the participating expert groups (Dushkova and Kuhlicke 2024). Moreover it can help address potential conflicts, issues and constraints, that may arise during a project duration (Zingraff-Hamed et al. 2020). For a successful implementation, it is beneficial to involve local experts in order to leverage their knowledge of cultural aspects, preferences and needs of the local citizens (Dushkova and Kuhlicke 2024; Hafferty et al. 2023). This allows for a targeted adaptation of the measure to the specific conditions of the region where it is to be implemented. Furthermore, co-creation fosters a sense of inclusion and can improve the interest in the measure by the citizens. It enhances the sense of ownership and long-term commitment within the community, as participants develop a connection with the NbS measure, increasing acceptance and interest (Andersson et al. 2023). Furthermore, co-creation promotes transparency and therefore building trust towards the NbS measure (Frantzeskaki 2019). This can lead to the development of sustainable solutions that are accepted by all actors (Naumann et al.2023).

3. The Role of workshops in the co-creation process

In all phases of the co-creation process a range of different tools can be used to achieve the desired outcomes. One common and effective tool used in diverse NbS projects are workshops. They serve as valuable platforms for generating innovative and broadly accepted solutions (Dushkova and Kuhlicke 2024). They provide an opportunity for participants not only to develop new skills, but also to share their knowledge.

One key activity within workshops is brainstorming, which actively engages all participants in the idea creation process. This collaborative approach enhances individual self-confidence while simultaneously strengthening collective connections. Brainstorming serves as an accessible exercise that facilitates the development of solutions, which can then be accepted by all various stakeholders. Compared to traditional top-down meetings, workshops offer a more conducive environment for contributions from all participants. This participatory format encourages individuals to voice their opinions and feel involved in project discussions and actions, as they are directly invited to contribute. Wiek et al. (2014) investigated the effects of participatory research on different stakeholders involved in their research. Their findings indicate that this approach can improve the participants' understanding of vocabulary, or organizational learning. Additionally, they emphasize that participatory research activities can build and expand networks among the different stakeholders within a workshop.

Many projects, such as RECONECT, OPERANDUM, PHUSICOS, which developed NbS ideas with the co-creation approach used workshops as a foundational research method. Workshops and participating tools such as brainstorming activities are a way to obtain valuable insights and generate innovative NbS strategies and ideas. (Dushkova and Kuhlicke, 2024). Workshops and oral communication techniques facilitate the collection of diverse information from participants, allowing for the exploration of multiple perspectives on specific issues and potential problems. (Dushkova and Kuhlicke 2024).

The project URBINAT, funded by the EU and focusing on inclusive urban regeneration through co-creation of NbS, included workshops in the decision-making processes in order to better understand the stakeholder's visions, priorities and interests. By bringing together various stakeholder groups, these workshops not only promote a unified approach but also ensure full commitment to the final decisions (Andersson et al. 2023).

In the LAND4CLIMATE project, workshops will serve as a critical component for fostering collaboration and co-designing effective NbS strategies. A number of workshops are planned not only in WP1, but throughout the whole course of the project numerous different collaborative events are planned as roundtables, peer-to-peer workshops, internship events, training workshops.

The first part of the workshop on cause-effect relations and potential systemic effects will focus on validating the results of the climate risk assessment with local project partners, who possess the most comprehensive understanding of their respective regions. Additionally, the workshop aims to facilitate the development of sustainable and effective NbS measures in collaboration with project partners. These measures will specifically address the impacts of hydrometeorological climate hazards, including heatwaves, droughts, heavy rainfall, and flooding. The primary objective of this workshop is to convene diverse actors from each FRR. By bringing the partners together, the workshop will provide a platform for collective idea generation, development, and discussion. This collaborative approach is essential for ensuring that solutions are tailored to meet local needs and effectively mitigate climate-related risks.

4. Concept and course of the workshop

The workshop on cause-effect relations and potential systemic effects was conducted on the 17th of September in the course of the 3rd LAND4CLIMATE Consortium Meeting in Timisoara, Romania. A total of 35 people participated in the workshop. The conference room was equipped with six breakout tables, therefore each FRR and their tandem academic partner had their own table group available.

The workshop was divided into three parts of 90 minutes each as well as a short introduction in the beginning that outlined the objectives, structure, and expected outcomes of the day. The first part consisted of an individual work phase for all front running regions (FRR) with support of their academic tandem partners and built on the climate risk assessment (CRA) of DEL 1.3. It was designed to serve the following objectives:

- Familiarisation with data and tools: Each FRR was introduced to the specific datasets for their region and was trained on how to work with these data within the ArcGIS Dashboards, in which they were prepared. Thereby, stakeholder learned to navigate through the dashboards, to interpret the data and to understand the spatial distribution of the various climate risks.
- Validation of CRA results: The session also aimed to validate the results derived from the CRA. This step was critical for ensuring that the data and findings accurately reflected the real-world conditions and risks faced by each FRR. Participants were encouraged to critically assess the data and identify any discrepancies which will subsequently be incorporated into the possible revision of the analyses.
- Identification of climate risk hotspots: The key outcomes of this session was the identification of climate risk hotspots within each region. Participants worked closely with their academic partners to map out areas that were particularly vulnerable to specific climate risks in preparation for the second part of the workshop.

The following questions were addressed in the first part of the workshop:

Table 1: Questions for the first workshop part

Time	Topic/Question
5 min	What are your personal goals and expectations at today's workshop?
40 min	Based on the results of the climate risk assessment, where are hotspots in your region located?
20 min	Are there any results in the climate risk assessment that surprise you? - Where (climate risk and location) would you have expected a higher climate risk and why? - Where (climate risk and location) would you have expected a lower risk and why?
10 min	On which of the climate risks would you like to focus and why?
10 min	On which of the hotspots would you like to focus and why?

The second part of the workshop was also organised as an individual work phase for the FRR and their academic tandem partners. This time, the focus was set on DEL 1.5 (Visualisation of cause-effect relations and potential systemic effects – frontrunning regions). The objectives of this session included:

- Knowledge transfer on cause-effect relationships: Participants were provided with insights into the complex cause-effect relationships that underlie the identified climate risks and potential NbS measures. This knowledge was crucial for understanding how different factors interrelate and contribute to the overall climate risks and accordingly prepared the FRR for selecting suitable NbS.
- Selection of suitable NbS: Based on the insights gained from the CRA and the understanding of cause-effect relationships, participants were tasked with selecting NbS tailored to the previously identified climate risks and hotspots in their regions. For a better overview, each region was provided with a map of their respective area, on which it was possible to gather information, that were gained from the CRA. The hotspots and the prevailing climate risks at those locations can be marked using dot markers in different colours. To support the development process of suitable NbS for the identified hotspots, brief fact sheets of the NbS measures presented in Del 1.5 were provided. An example of such a fact sheet is shown in Figure 2.

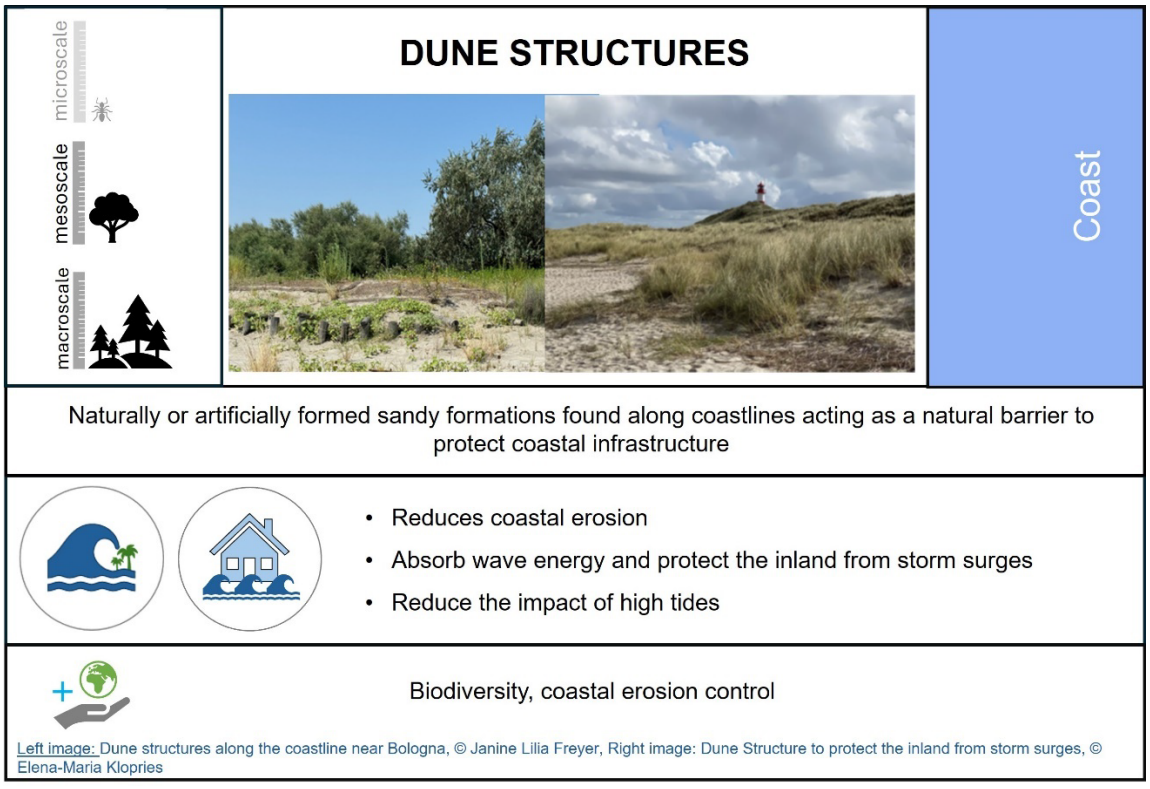

Figure 2: Example fact sheet "dune structures"

- Discussion of stakeholders' preferred NbS: In preparation for Deliverable 1.9 (List of stakeholders preferred no-regret NbS measures), the session included a discussion on the stakeholders' preferred NbS. This step was critical for ensuring that the selected solutions were not only suitable from a technical point of view but also aligned with the preferences and expectations of local stakeholders.

The following questions were addressed in the second part of the workshop:

Table 2: Questions for the second workshop part

Time	Topic/Question
20 min	What are your ideas of suitable nature-based solutions for the identified hotspots and their associated climate risks in the front runner regions, not considering restrictions as for example public landowners or financial factors?
20 min	What are the positive aspects of the NbS at the mentioned hotspots to mitigate the impacts of the climate hazards, and what potential concerns or drawbacks should be considered in the front runner regions?
20 min	Based on the positive aspects and the concerns create a list of “no regret” NbS measures, that can address the climate risks at the chosen hotspots in the FRR. “No-regret” in this context means, that the NbS will always have more positive effects on the livelihoods and ecosystems within the FRR regardless of the changing climate and other developments in the region.
10 min	What potential obstacles could still hinder the implementation of the "no-regret" measures within the FRR?
5 min	Rank the "no-regret" NbS based on their suitability for your FRR. How feasible do you think is it to implement these measures in your region?
15 min	Feedback on CRA

The third session of the workshop was dedicated to sharing and discussing the results of the work phases across all participating FRR. For this purpose, each region was given 10 minutes to present its key findings to the consortium which was followed by 5 minutes of questions and discussions of the result of each region. This enhanced cross-regional learning and collaboration, allowing regions to benefit from each other’s insights and experiences.

Throughout the workshop, participants were provided with structured worksheets that guided each phase (See Appendix). These worksheets contained specific questions and tasks that the FRR needed to address within the given time. The worksheets were designed to help participants focus on the key objectives of each session and therefore, served to enable a targeted approach. In addition to the worksheets, continuous support was provided by moderators from TU Dortmund and RWTH Aachen University. These moderators were responsible for keeping the sessions on track, facilitating discussions, and ensuring that all participants were engaged and contributed effectively. Two representatives from TU Dortmund that created the CRA were also available at all times to assist with both content-related and technical questions, so that any issues that arose could be quickly resolved.

5. Results of the workshops

In the following section, the results of the workshops for each FRR are presented. Within the first part of the workshops, the results of the CRA were examined and validated for each region. This allowed for the selection of specific hotspots to focus on and to determine which climate risks are prevalent in those areas. In the next step, each region was encouraged to develop NbS ideas, with the help of short fact sheets showing possible NbS measures listed in Del 1.5 (Visualisation of cause-effect relations and potential systemic effects), which could be implemented at the identified hotspots to mitigate the impacts of the existing climate risks. The results of the preferred no regret NbS measures for the FRR will be presented within a following Deliverable (1.9). Finally, feedback was gathered if there was enough time remaining. Unfortunately, this could not be obtained from all regions.

5.1 Germany

Participants: 2

Moderator: Janine Lilia Freyer, RWTH Aachen

For the region in Germany the approach of the first part of the workshop was somewhat different, as they already have specific addresses where NbS measures are to be implemented. Thus, it was examined which risks are present at these locations and whether they qualify as a hotspot for climate risks in the region. The following table shows the transcripts of the first part of the workshop.

Table 3: Results of the first workshop part for the German project partners

Topic / Question
1. What are your personal goals and expectations at today's workshop? ➢ More detailed insights into the Climate risk Assessment (CRA) ➢ Comparison of CRA with the experience of the county during past events with climate hazards ➢ Comparison of the results of the climate risk analysis with the locations where the NbS measures are to be implemented
2. Based on the results of the climate risk assessment, where are hotspots in your region located? *Please document your findings <u>for all</u> climate risks* Residential areas in the city of Euskirchen: Heat: ➢ Zülpicher Straße – Area very high hazard ➢ Jülicher Ring – Area high hazard – Distortion by Raster and calculation of risk by inhabitant per qm with heat hazard Heavy Rain: ➢ in comparison to the heavy rain fall hazard map of the county Euskirchen a higher risk was expected, for both areas ➢ the following maps show the heavy rain fall risk based on the heavy rainfall hazard map from the county at the two locations

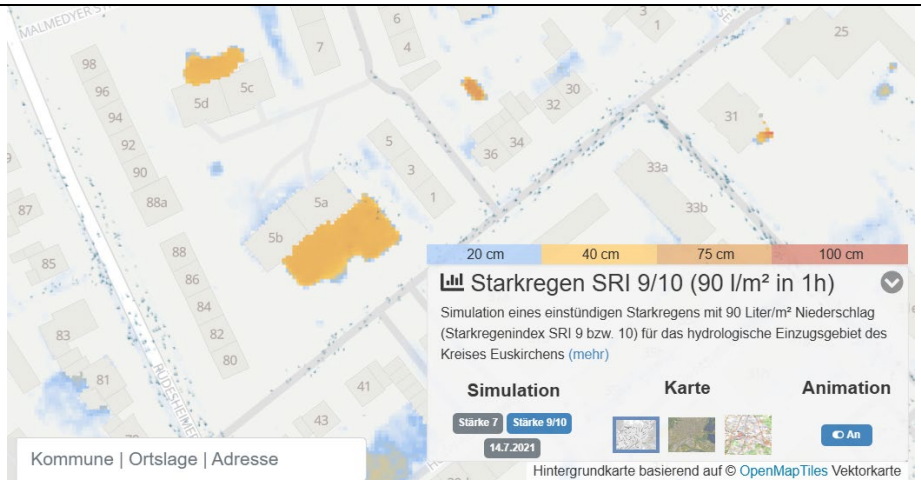

Figure 3: Extraction from the heavy rain hazard map of the county of Euskirchen at the location "Zülpicher Str."

Figure 4: Extraction from the heavy rain hazard map of the county of Euskirchen at the location "Jülicher Ring"

Potential residential areas, where gardens are to be unsealed Hotspot 3 and 4 in the map):

- Climate Risks at the locations in Zülpich: heat
- Climate Risks at the Locations in Dahlem: heat and heavy rain

Agriculture areas (Hotspot 1 in the map):

- Climate risks at the locations in Mechernich: heat and heavy rain

3. **Are there any results in the climate risk assessment that surprise you?**
   a. **Where (climate risk and location) would you have expected a higher climate risk and why?** *Please provide both screenshots and text*

- Flood risk in residential areas in the city of Euskirchen
- Due to normalization some results seem to be surprising, during discussion it could be clarified, that the results are in common with the expected ones

   b. **Where (climate risk and location) would you have expected a lower risk and why?** *Please provide both screenshots and text*

- No location was identified where a lower risk was expected

4. On which of the climate risks would you like to focus on and why? ➢ We will focus on drought, heavy rain and heat dependent on the implementation area and the focus of the NBS – the areas we want to focus on are: agricultural and residential areas
5. On which of the hotspots would you like to focus on and why? ➢ We will focus on different hotspots and areas ➢ This is also dependent on the willingness of the land owner to cooperate on implementing NbS on their land. The risk of drought is spread throughout the whole county, there are different Hotspots to choose from.

The following map highlights the hotspots, where measures are to be implemented within the county of Euskirchen. Each climate risk is assigned to a specific colour. The colours can be referenced in the legend displayed in the top corner of the left side of the image.

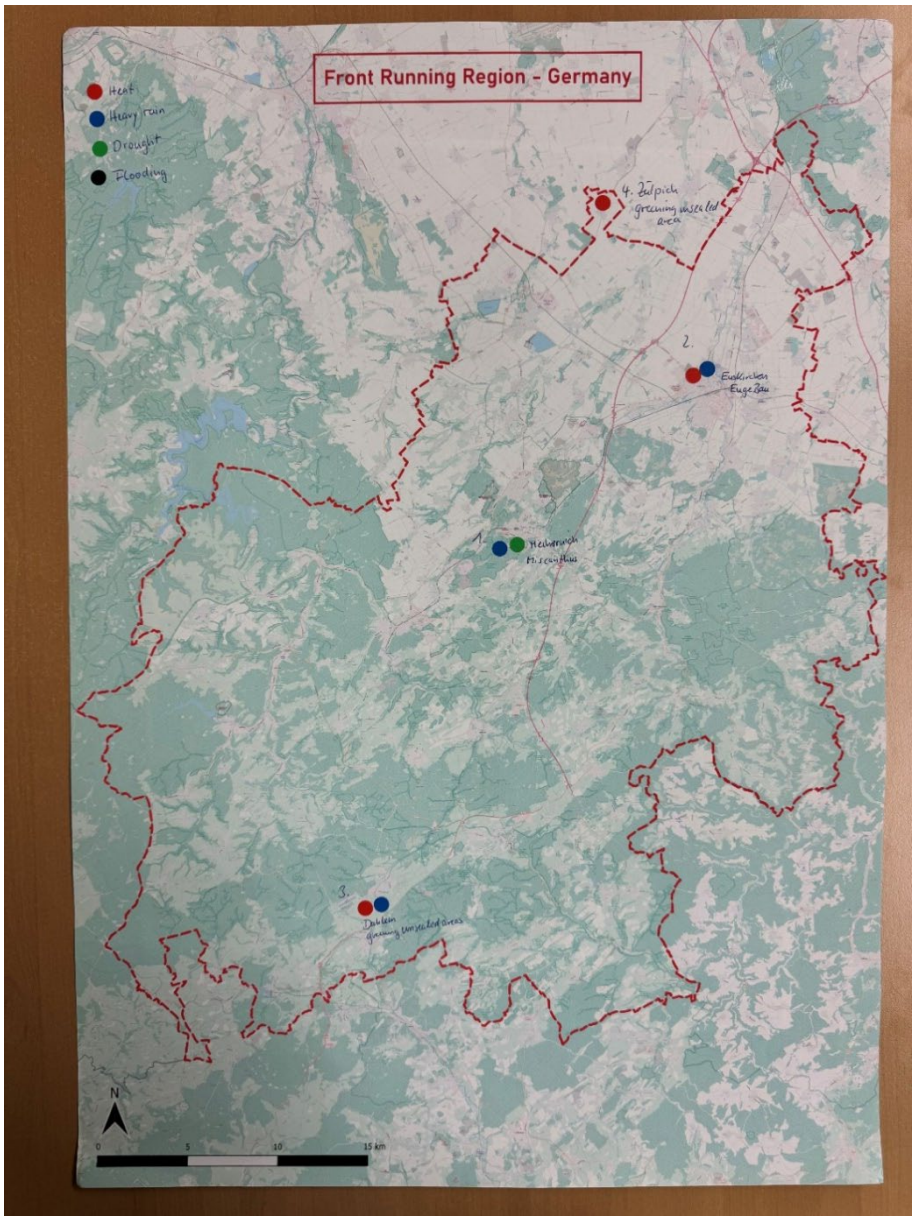

Figure 5: Map of the county of Euskirchen highlighting the locations, where NbS measures are to be implemented

In the following, the results of the second part of the workshop are presented.

Table 4: Results of the second workshop part for the German project partners

Land4Climate
A step closer to climate resilience

FRR: GERMANY				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot**	**Concerns and Drawbacks of NbS in FRR**
Hotspot 1 Agricultural area	➢ Drought ➢ Heavy Rain	Miscanthus	➢ Water retention ➢ Biodiversity (co-benefit) ➢ Soil erosion ➢ Less transpiration ➢ Water infiltration	\
		Planting of climate resilient plants (alternative)	➢ planting of drought resistant plants ➢ Adaptation to drought ➢ Usage of arable land	➢ No effect to soil, only the yield is secured ➢ May not affect the impacts of heavy rain
		Agroforestry (alternative)	➢ Storm water runoff reduced ➢ Soil health ➢ Infiltration ➢ Water retention, infiltration	\
Hotspot 2 Residential	➢ Heat ➢ Heavy Rain	Tiny forest	- Absorb & filter rainwater - Reduce the risk of urban flooding - Provide shade & evaporate cooling - Mitigate the urban heat island effects	\

		Climate parks	- Absorb & filter rainwater - Reduce the risk of urban flooding - Provide shade & evaporate cooling - Mitigate the urban heat island effects	\
		➢ Green roofs (alternative) ➢ Green walls (alternative)	➢ Reduce the surface runoff from roofs ➢ mitigate the heat island effect ➢ cool the surrounding areas	\
Hotspots 3 and 4 Residential	➢ Heat ➢ Heavy Rain	Unsealing of surface	➢ Reduced surface runoff ➢ Infiltration ➢ Groundwater recharge ➢ Mitigate heat islands ➢ Cooling / shade	\
		Bioswales	➢ Water runoff ➢ Infiltration ➢ Temperature reduction ➢ Mitigate urban heat island ➢ cooling / shade	\
		Rain gardens	➢ Stormwater runoff ➢ Infiltration ➢ Temperature reduction ➢ Mitigate urban heat islands	\

The feedback for the CRA and the workshop in general of the FRR from Germany is presented in the following table:

Table 5: Feedback from the German project partners

Topic / Question
1. What is your first impression on the results of the CRA? ➢ the resolution is too rough
2. What do you particularly like? **a. What information do you find particularly helpful?** ➢ - **b. Which functions do you find particularly helpful?** ➢ The dashboard is user-friendly and easy to use ➢ visuality
3. Where do you think is still room for improvement? **a. Is there any information you are missing?** - **b. Are there any functions that you are missing?** -
4. How did you like the workshop in general? + very specific objectives + short NbS fact sheets + A comparison with the climate risk analysis and the German “Klimaatlas” was possible - not enough time

5.2 Austria

Participants: 4

Moderator: Elena-Maria Klopries, RWTH Aachen University

The following table shows the results of the first part of the workshop, from the Austrian project partners.

Table 6: Results for the first workshop part from the Austrian project partners

Topic / Question
1. What are your personal goals and expectations at today's workshop? ➢ Better understanding of the methodology of CRA ➢ Create new / additional ideas for NBS ➢ Have a detailed look at heat and drought (flood and heavy rain are already well understood within the region) ➢ Discuss the effect of the aggregated approach in the risk assessment; since the vulnerability is no longer considered individually per subject of protection
2. Based on the results of the climate risk assessment, where are hotspots in your region located? *Please document your findings <u>for all</u> climate risks* ➢ Floods: HQ100: 2 hot spots, that are well known and are already tackled with grey solutions, HQextrem: same hotspots but some are not valid since it is defined as industrial area but is for real a pit mine ; within the agricultural sector especially critical since these are the areas that are actually used for retention and hence protection but at the same time are described in this CRA as areas at risks; especially "confusing" since normalization doesn't allow for a comparison between different sectors, it seems overrepresented ➢ Heavy Rain fall: Residential area almost all cities affected; agricultural area: all areas affected, some industrial areas affected (only few and not of much interest in the project) o residential area legend is described incorrectly (Scenario), here water depth and flow velocity are combined but it doesn't allow to distinguish between main source of hazard component which makes it difficult to decide which NbS would be suitable, building footprint is difficult to use as the only vulnerability / exposure index since it overrepresents one family home areas, input data includes flow paths but aggregated data in CRA does not → loss of important information; ➢ Heat: in residential areas there is heat hot spots and this can be validated, high sealing degree in cities lead to a lot of heat o There is no consideration of already existing measures against heat ➢ Drought: Combination of Drought in this way with agriculture does little sense since it does not include soil properties and those are important for agricultural drought, almost all the area covered; all in all it seems valid but could be more detailed
3. Are there any results in the climate risk assessment that surprise you? **a. Where (climate risk and location) would you have expected a higher climate risk and why?** *Please provide both screenshots and text* ➢ Heat is lower than expected because it has been experienced very heavily before, especially in the residential areas **b. Where (climate risk and location) would you have expected a lower risk and why?** *Please provide both screenshots and text* ➢ Not applicable
4. On which of the climate risks would you like to focus on and why? ➢ Sediment erosion near the river on agricultural land is main focus, heat in cities also important but less of a priority within L4C

5. On which of the hotspots would you like to focus on and why?

- All agricultural land along the Lafnitz, since there are a lot of farmers that can be addressed

In Figure 5 the identified Hotspots within the Austrian FRR are marked. The pink marked area shows the identified Hotspots within agricultural areas, that are to be addressed within the LAND4CLIMATE project. The black dots mark residential areas, where NbS measures can be implemented.

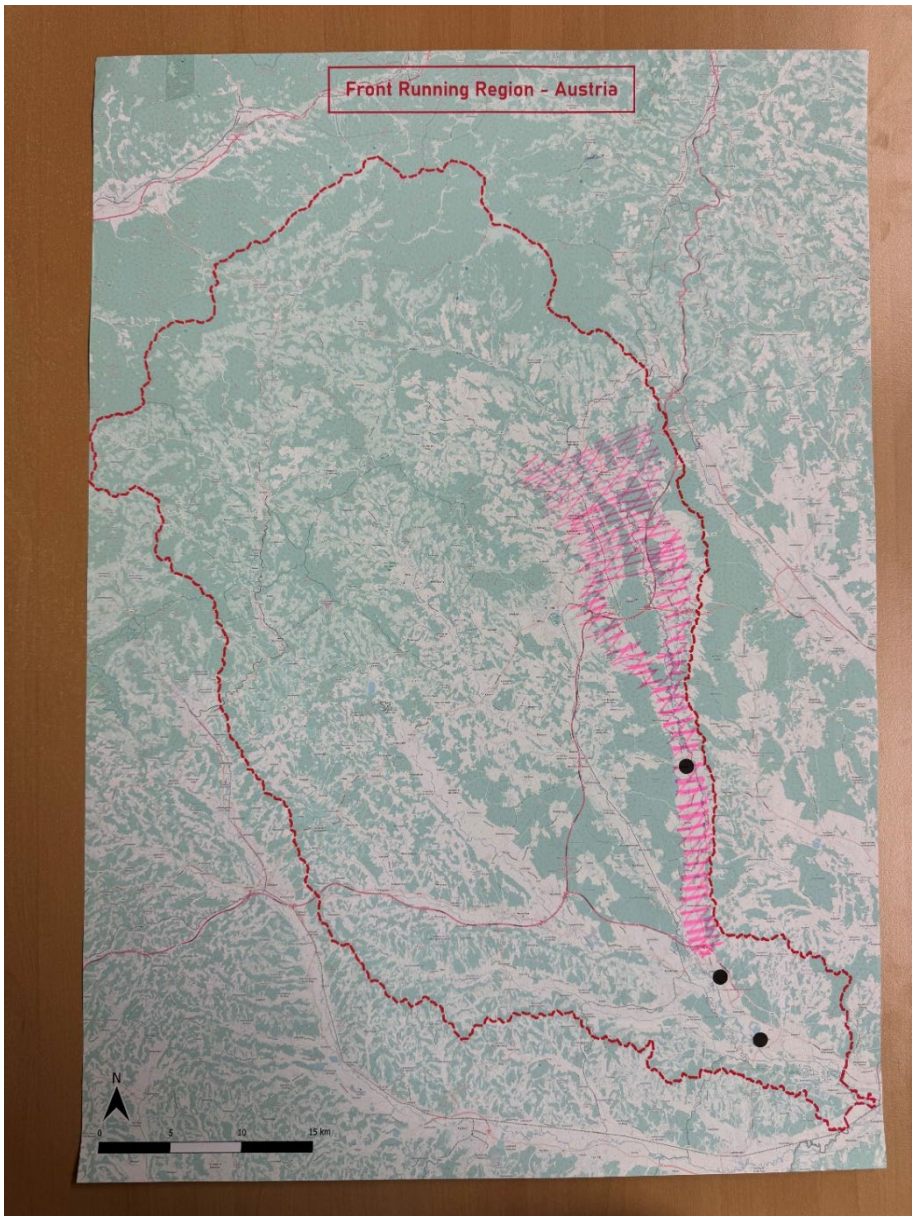

Figure 6: Map of the Austrian FRR, highlighting the locations where NbS measures are to be implemented within the project

The following table shows the potential NbS measures, that could be implemented within the FRR.

Table 7: Results for the second workshop part from the Austrian Project partners

Land4Climate
A step closer to climate resilience

FRR: Austria				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot and Pro**	**Concerns and Drawbacks of NbS in FRR**
Residential area	➢ Heat ➢ Heavy rain	Unsealing in combination with rain garden, bioswales and retention ponds	➢ Increase of Infiltration ➢ decrease of heat ➢ combination measures can increase those effects even more	➢ Less parking space in the residential areas, very cost intensive (very localized use of money) ➢ very time intensive in the planning process, there might be "hidden" risks e.g. dumb sites underneath a parking space
		Tiny Forest	➢ Social impacts like leisure time spent there ➢ micro climate ➢ biodiversity	➢ more suitable for areas with high buildings, not for single family homes, this does not apply for FRR
		Pocket Parks	➢ Social impacts like leisure time spent there ➢ beneficial for house owner if implemented in their front garden ➢ micro climate ➢ biodiversity better than for example stone gardens	➢ Positive effect is highly dependent on the exact location ➢ might not be useful at all
Agricultural area	➢ Soil erosion (during heavy rain fall) ➢ Drought	Agroforest in combination with slope reconstruction	➢ Protection against soil erosion ➢ increased infiltration ➢ better micro climate	➢ If not planned thoroughly there could be negative effects that increase soil erosion ("Düseneffekt")

	➢ Heavy rain		➢ it can be a very economically beneficial solution if forest is used as well for the wood	➢ responsibilities in areas with forest and agriculture are not the same --> could cause competency issues ➢ currently no financial aid rules available
		Hedges and slope vegetation	➢ Protection against wind erosion ➢ increased biodiversity ➢ better micro climate	➢ If not taken care of properly, it could grow into a forest and then it's no longer agricultural land and then management gets difficult ➢ no crop yield on the area of hedges --> yield loss can be compensated ➢ longevity is risky if not taken care of correctly
		vegetated buffer stripes	➢ filters nutrient run-off from farm land ➢ increased biodiversity ➢ river bank stabilization	➢ protection stripes are already compulsory (without vegetation) if financial aid from state is wanted --> second financial aid is not possible ➢ longevity is risky if not taken care of correctly
		Green drainage paths (next to Lafnitz river, that are lower than Lafnitz river bed)	➢ Sediment erosion will be decreased due to lower flow velocities (in the areas of green drainage paths) ➢ concentrated flow control, filters nutrient run-off from farm land ➢ increased biodiversity	Several land owners in succession need to agree to make it really effective, caretaking needs to be clear, usually there is only compensation for loss of yield not for costs of caretaking

			➢ river bank stabilization ➢ could have a retention effect on timing of flood wave downstream	
		Overall management adjustment	➢ soil moisture is increased and stays longer ➢ sediment erosion decreased ➢ can have a positive effect on biodiversity (but depends on new management decision e.g. type of crop)	➢ area might lose its status of agricultural land depending on type of crop e.g. Greenland ➢ reduced crop yield

The following table shows the feedback from the Austrian project partners.

Table 8: Feedback from the Austrian project partners

Topic / Question
1. What is your first impression on the results of the CRA? ➢ The scale of the results is too rough for identifying locations for NbS
2. What do you particularly like? **a. What information do you find particularly helpful?** ➢ Due to the existing data / analysis, the CRA does not deliver more information for floods (pluvial & fluvial) ➢ Heat and drought data is rough but nice to have **b. Which functions do you find particularly helpful?** ➢ -
3. Where do you think is still room for improvement? **a. Is there any information you are missing?** ➢ The indicators need to be explained to make maps understandable **b. Are there any functions that you are missing?** ➢ -
4. Other comments ➢ It would be great to have the option to add own information or layers. For example, own hotspots practise data from observations
5. How did you like the workshop in general? + Discussion and analysis were very good and important + Discussion could be in local language which simplified it

5.3 Slovakia

Participants: 6

Moderator: Peter Davids, TU Dortmund

Table 9 presents the results from the first part of the workshop for the Slovakian FRR. The text highlighted in grey was added during the approval process of the deliverable by the Slovakian project partner, 'Water and People.' The text was not included in the workshop protocol sheet.

Table 9: Results from the first workshop part from the Slovakian project partners

Topic / Question
1. What are your personal goals and expectations at today's workshop? ➢ A processing of the information we have provided into risk maps.
2. Based on the results of the climate risk assessment, where are hotspots in your region located? *Please document your findings <u>for all</u> climate risks* ➢ Heavy Rain Risk: North East of the region. ➢ Flood risk: in the valleys / riverbeds ➢ Rapid runoff of rainwater: from drainage areas of forestry and urbanized land ➢ Drought: everywhere the prolongation of periods without rain, which alternate with sudden bursts of intense rain, caused by the long-term support of channeling rainwater from the landscape, especially from the urbanized, agrarian landscape and transport infrastructure ➢ Heat: in the Villages, the formation of heat islands over urban areas that cause a temporal and spatial change in the distribution of precipitation
3. Are there any results in the climate risk assessment that surprise you? **a. Where (climate risk and location) would you have expected a higher climate risk and why?** *Please provide both screenshots and text* ➢ well, we are very pessimistic. So, the results were somewhat relieving in general ➢ Roňava has one specific feature, the basin is narrow and long, and the runoff path of rainwater into the water infrastructure is relatively short, which is why it is quickly reflected in the increase of flood flows in the main stream. In the past 13 years, the state of flood threat has occurred 37 times.  **Figure 7: Runoff in the Slovakian FRR** **c. Where (climate risk and location) would you have expected a lower risk and why?** *Please provide both screenshots and text* ➢ For Heavy Rain Risk: most surprising the high heavy rain risk, but might be explained by the open fields without barriers in that region ➢ A rather big surprise was that the streams in the forests dry up after intense rains.

Figure 8: Forest streams in the Slovakian FRR

4. **On which of the climate risks would you like to focus on and why?**
   - Mostly heavy rain runoff towards river beds. Has impact on floods in the river, measures could also contribute to biodiversity.
   - The historically damaged, industrialized and drained landscape has reduced the retention capacity of the territory and brought a higher frequency of flood waves, which bring damage to communities and also to agricultural production. By using NBS to increase the retention capacity of watersheds, the risk of floods and droughts will be mitigated and, logically, biodiversity will also be strengthened.
5. **On which of the hotspots would you like to focus on and why?**
   - Sites for NBS are based on studies carried out by ARR, as well as based on field experiences form land owners. The maps roughly confirm the proposed areas for NBS. The locations for the NBS are based on the analytical studies of the ARR of the CLIMADAM project, and then developed by the NGO People and Water with more detailed analyses and a field survey carried out in consultation with the owners. Hotspots were selected as local beacons based on the principle of land use diversity, in order to realize concrete examples of the best NBS solutions for recommendations for systemic changes in land use in the ongoing climate change.

On the Map are the locations marked, where there will be NbS implementations within the area. The different coloured dots show different locations:

Red: Matsiik Winery

Green: Klasa Forest Company

Blue: Slivnik Farm

Black: Cerhov Orchard

Red with smiley: Ranche Dante Bysta

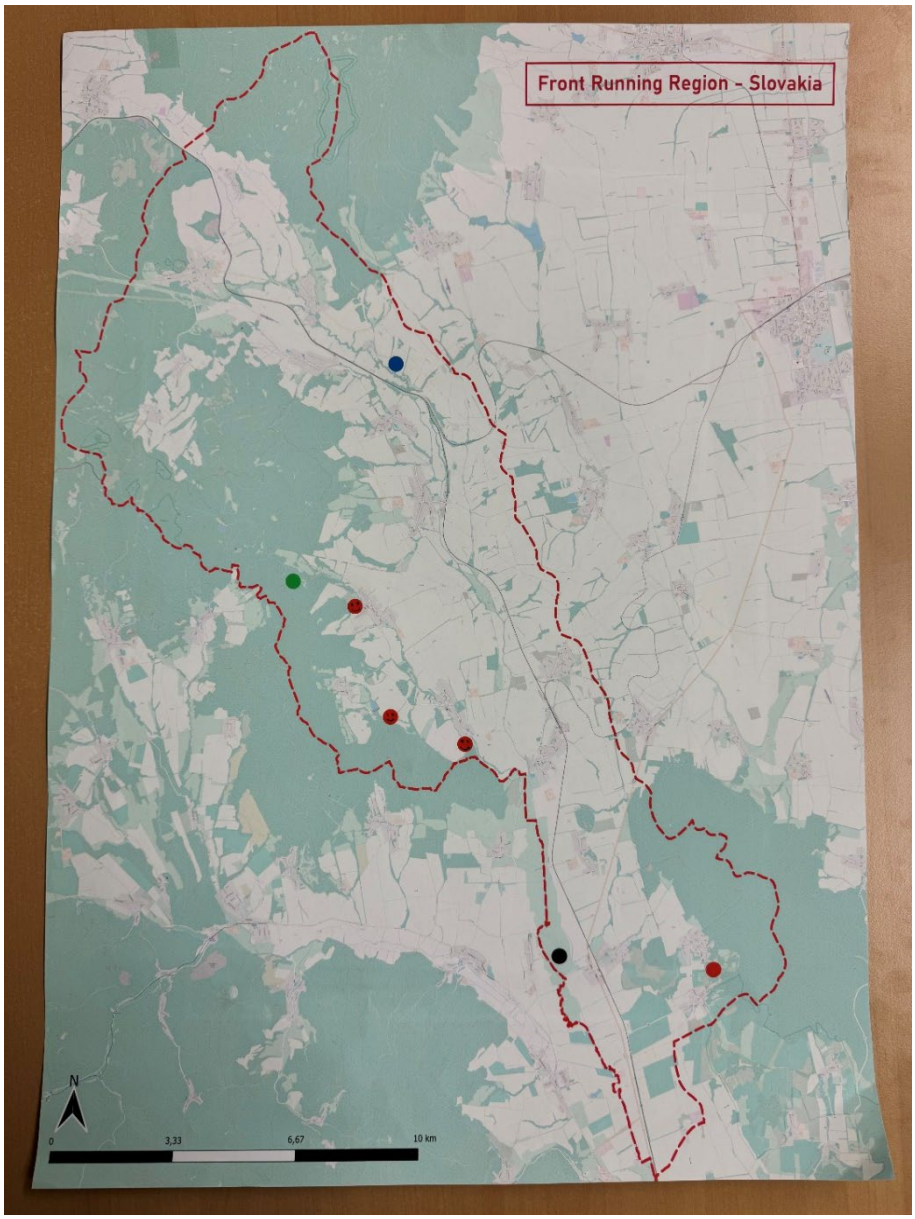

Figure 9: Map of the Slovakian FRR, showing locations, where Nbs measures are to be implemented

In the following result sheets the results of the Slovakian FRR are presented. The table also shows the Climate risks, that were identified at the marked Hotspots.

Table 10: Results of the second workshop part for the Slovakian project partners

Land4Climate
A step closer to climate resilience

FRR: SLOVAKIA				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot**	**Concerns and Drawbacks of NbS in FRR**
Hotspot: red dot Matsiik Winary	➢ Rain ➢ Flood ➢ Erosion	Water retention pits (3826 m^2)	➢ Water resource (0.8l/s) ➢ Increased crop yield ➢ Reduction of sensible heat ➢ Reduction of heat ➢ Carbon sequestration	➢ Mosquitos (positive for biodiversity) ➢ Maintenance costs
Hotspot: green dot Klasa Forest	➢ Rain ➢ Flood ➢ Erosion	Chack dams	Volume of water retention 6160 m2	
		Surface drains	➢ Water resource (1.2 m/s) ➢ Increased vapor (4108 m^3) ➢ Increased crop yields ➢ Sensible Heat reduction ➢ Summer heat reduction ➢ Carbon sequestration	
Hotspot: blue dot Slivnik Farm (140 hectares)	➢ Drought ➢ Soil Erosion ➢ Fertilizing soils	Chack dams	➢ 3.3 l/s ➢ Water resources ➢ Decrease of temperature	➢ Maintenance
		Contour trenches on slope (10.000m) (1500 m^2)	➢ Sensible heat ➢ Carbon sequestration	➢ Maintenance

			➢ Crop increase ➢ Retention volume ➢ Biodiversity support ➢ Creating water resources and increasing flows	
		Wetlands	➢ Support of CO2 sequestration ➢ Increasing evaporation and thermoregulation of the agricultural landscape ➢ Retention volume ➢ Drought ➢ Biodiversity	
Hotspot: black dot Cerhov Orchard	➢ Drought in farmlands ➢ Hold water during floods	➢ Surface cross drains ➢ Chack dams	➢ Water storage for floods ➢ Providing water for droughts ➢ Improved growth of planted trees and increased fruit production	
		➢ Remeandering river	➢ Retention 7.000 m^3 ➢ Increased vapor 4667 m^3	
		➢ Small water retention	➢ Increased crop yields ➢ Reduction of summer temperature ➢ Carbon sequestration	
Hotspot: red dot with smiley Ranche Dante Bysta	➢ Drought ➢ Heavy rain	➢ Chack dams	➢ Collect rainwater for leisure activities (horse riding) ➢ Making the environment more attractive	

		➢ Contour trenches	➢ Increase of water reserves in soil and underground ➢ Support of CO2 sequestration ➢ Decreasing temperature and increasing steam	
		➢ Wetland systems	➢ Biodiversity support	

The following table shows the feedback of the Slovakian project partners.

Table 11: Feedback from the Slovakian project partners

Topic / Question
1. What is your first impression on the results of the CRA? ➢ The maps should be more detailed ➢ Sometimes stating the obvious
2. What do you particularly like? **a. What information do you find particularly helpful?** ➢ The heavy rain risk map was very enlightening ➢ The methodology is clear **b. Which functions do you find particularly helpful?** ➢ -
3. Where do you think is still room for improvement? **a. Is there any information you are missing?** ➢ Names of villages, water bodies/rivers are missing. Would be helpful to add them **b. Are there any functions that you are missing?** ➢ Slopes, soil, erosion data, landslides ➢ Footpaths in the forests
4. Other comments ➢ It would be great to have the option to add own information or layers. For example, own hotspots practise data from observations
5. How did you like the workshop in general? ➢ Very helpful introduction

5.4 Czech Republic

Participants: 7

Moderator: Ayca Atac, TU Dortmund

The following table shows the results of the first part of the workshop for the Czech FRR.

Table 12: Results of the first workshop part for the Czech project partners

Topic / Question
1. What are your personal goals and expectations at today's workshop? ➢ To validate our personal experience with academical tools and maybe see risks and hotspots from another perspective ➢ Curiosity about the data modelling result ➢ Verification of the models ➢ Curiosity about hotspots that haven't been known before
2. Based on the results of the climate risk assessment, where are hotspots in your region located? *Please document your findings for all climate risks* ➢ *Remark:* the Layers should be transparent and allowing topographic map in the legend: if leaving on the parent layer, it should automatically turn on the sublayers ➢ Hotspots are marked on the following map
3. Are there any results in the climate risk assessment that surprise you? **a. Where (climate risk and location) would you have expected a higher climate risk and why?** *Please provide both screenshots and text* ➢ Droughts: ○ The hotspots are okay for both forest and agricultural risk ○ The resolution is rather rough: creating an artificial dividing line across the whole National Park. Is this because of the RCP resolution? ➢ Heavy rains: ○ The results are surprisingly good 😊 now looking on the result, we of course can explain why these are high/lower values, but we wouldn't be able to identify all hotspots by heart by ourselves. At one place, however, we would expect even higher risk that what is shown in the map (see the screenshot of our high-risk map) ➢ Heat: ○ Model is fine ➢ Flood Risk: ○ Generally ok, but uncertainties emerge along the borders of the territory since we do not take into account what happens on the stream beyond the boundary (e.g backwater from Elbe may affect confluences with smaller streams). This is hard to manage in the model, but it should be mentioned in the guidance document ➢ General remark: ○ The results for vulnerability include higher uncertainties due to the data available constraints (also data resolution). That said, calculating the risk by multiplying hazard and vulnerability may include limitations since we are integrating two datasets with different levels of accuracy and uncertainties. This problem can't be resolved probably, but should be mentioned in the guideline/explanation for it affects interpretation of the climate risk modelling **b. Where (climate risk and location) would you have expected a lower risk and why?** *Please provide both screenshots and text* ➢ -

4. On which of the climate risks would you like to focus on and why? ➢ National Park CB (NP): drought ➢ Krasna Lipa (KL): heavy rain and floods
5. On which of the hotspots would you like to focus on and why? ➢ We have chosen sites for NBS that comply with hotspots. But the models help us also to the future with considering other sites (even beyond the project)

The following map shows the detected hotspots for the FRR from Czechia. The legend for the coloured dots is shown in the left corner of the figure.

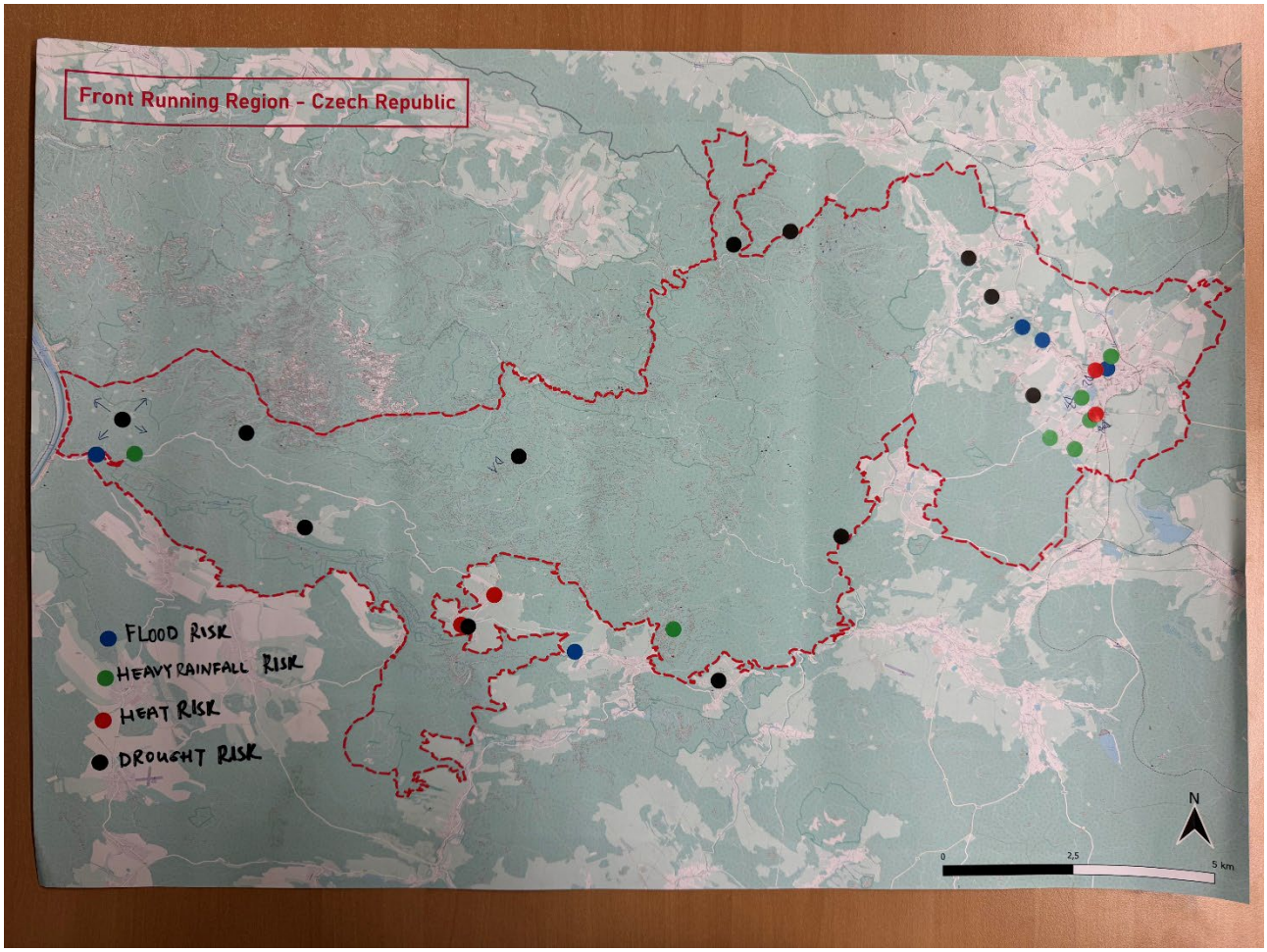

Figure 10: Map of the Czech FRR, showing the identified Hotspots and the present climate risks

The following table shows the results of the second part of the workshop.

Table 13: Results of the second workshop part for the Slovakian project partners

Land4Climate
A step closer to climate resilience

FRR: CZECH REPUBLIC				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot**	**Concerns and Drawbacks of NbS in FRR**
Entire National Park area (D1)	➢ Droughts ➢ Forest fire	Closing drainage ditches	➢ water retention ➢ groundwater refill ➢ slow-down outflow	Minimal pathways removal
		Natural Reforestation	➢ decrease of temperature ➢ increase biodiversity ➢ water infiltration	
		Diversification of species	➢ Increases biodiversity	
Krasna Lipa (D2 / D3)	➢ Heavy rains ➢ Floods	D2 Retention ponds	➢ slows down runoff ➢ decreases temperature ➢ increases biodiversity	Enough space in the most urban areas of the town
		D3 Unsealing of surfaces	➢ infiltration	None
		D3 Bioswales	➢ Slows down runoff ➢ infiltration	New development project - no problem
		D3 closing drainage ditches	➢ Slows down runoff ➢ infiltration	Uncertainty about amount of water staying on meadows
National Park	➢ Droughts ➢ Floods	Restoration of natural river courses	➢ slows down runoff ➢ increases infiltration	Fallen dry trees space

5.5 Italy

Participants: 8

Moderator: Thomas Hartmann, TU Dortmund

In the following section the results of the workshop with the Italian FRR are presented. Starting with the results of the first part of the workshop. The validation of the CRA. The whole coastal area within the Italian FRR is prone to flooding. Especially the “low lands” close to the lagoon (see map). Other risks the FRR is affected by are salt intrusion, agricultural drought due to salt intrusion and lack of precipitation as well as coastal erosion. Most of the time the climate risks strike not alone, which is a major concern. On the following map the location is marked where the NbS measure will be implemented within the FRR.

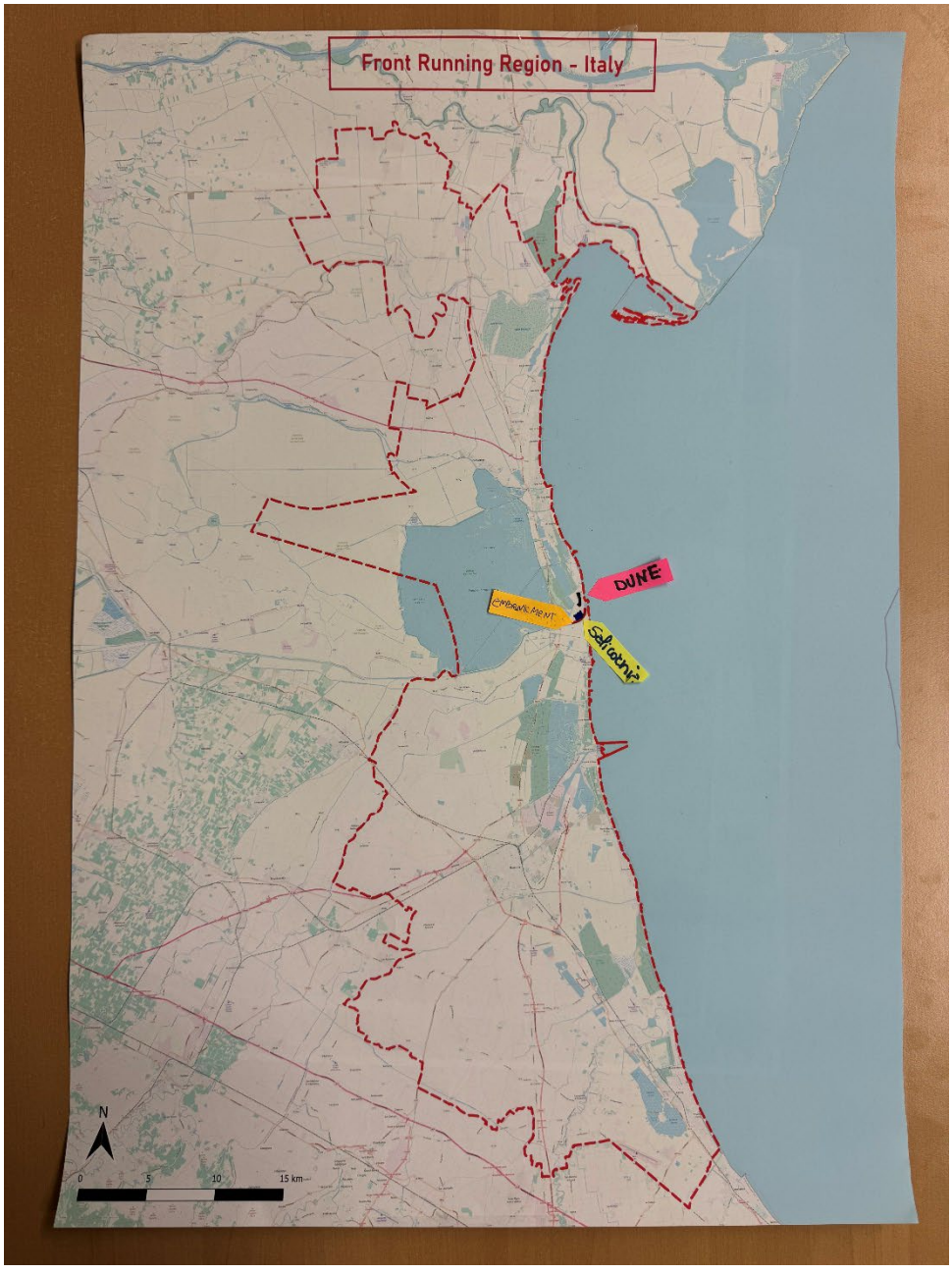

Figure 11: Map of the Italian FRR, showing the location, where the NbS measures will be implemented

The location selected to implement NbS measures in the Italian FRR, is already suffering different climate risks. In the following picture it is seen, how the location looks under good weather conditions

and during a strong winter storm, where the salt water can reach and damage the existing scrubland and pine forest behind the embankment not only at a mechanical level, but also at a chemical level, leading to a salinity increase.

Figure 12: left picture implementation location under good weather conditions and on the right after a strong winter storm

The following table shows the NbS measures, that could help mitigate the climate risk impacts within the FRR.

Table 14: Results of the second workshop part from the Italian project partners

Land4Climate
A step closer to climate resilience

FRR: ITALY				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot**	**Concerns and Drawbacks of NbS in FRR**
Coastal Area (see map)	➢ Storm surge ➢ Avulsion	Dune	➢ Prevent inundation (street) ➢ Biodiversity	Invasion of alien vegetation by the planting of the dune
		Beach nourishment	➢ can help prevent flooding	➢ no permanent solution ➢ only in winter ➢ only coastal floods
		Earth bunds	-	➢ similar but hybrid ➢ no vegetation ➢ no biodiversity preservation
	➢ Saltwater intrusion (in case of droughts it increases)	Salicornia plants	➢ Irrigation with groundwater remains possible	None

			➢ maintain agricultural practice ➢ Salicornia can be sold on the market	
		vegetated buffer strips		➢ no salt intrusion prevention ➢ no commercial use of the culture
		Agroforestry		➢ different type of solution ➢ need convert land use to forestry
	➢ Flooding	Strengthening of embankment with long-rooted plants	Serving river & coastal floods	
		Riparian buffer zone	Serving river flooding	➢ no space for further buffer zone ➢ needs to convert further agricultural land into non-commercial field

The following table shows the feedback from the Italian project partners.

Table 15: Feedback from the Italian project partners

Topic / Question
1. What is your first impression on the results of the CRA? ➢ -
2. What do you particularly like? **a. What information do you find particularly helpful?** ➢ - **c. Which functions do you find particularly helpful?** ➢ -
3. Where do you think is still room for improvement? **b. Is there any information you are missing?** ➢ Def attached to risk / hazard (extreme value) ➢ Precipitation prediction → sphera **b. Are there any functions that you are missing?** ➢ Heat risk analysis for agricultural land ➢ Storm surge analysis
4. Other comments ➢ Miscommunication: “they do flood / we do droughts”

5.6 Romania

Participants: 8

Moderator: Guillaume Bonduelle, RWTH Aachen

In the table the results of the CRA validation are presented.

The following figure shows the detected Hotspots within the Romanian FRR. Every climate risk has its own colour. The legend is shown in the left corner of figure 9.

Table 16 :Results of the first part of the workshop from the Romanian project partners

Topic / Question
1. What are your personal goals and expectations at today's workshop? ➢ To clarify what are the real problems in each FRR.
2. Based on the results of the climate risk assessment, where are hotspots in your region located? *Please document your findings for all climate risks* We have identified three hotspots: ➢ One around the residential Lugoj area ➢ One around the more agricultural area of Daicoviciu ➢ One around the residential area of Caransebes We had a bit of struggle trying to make the difference between risk area and hazard area.
3. Are there any results in the climate risk assessment that surprise you? **a. Where (climate risk and location) would you have expected a higher climate risk and why?** *Please provide both screenshots and text* ➢ In general, the residential areas are particularly impacted but it doesn't come out as a surprise. ➢ The industrial areas are also located in the hotspots. ➢ On Hotspot 2, and from our experience of the region, we expected to identify heavy rain risks but there was none on the dashboard. **b. Where (climate risk and location) would you have expected a lower risk and why?** *Please provide both screenshots and text* ➢ There was no spot where we were expecting a lower climate risk.
4. On which of the climate risks would you like to focus on and why? ➢ Floods: because they are the most frequent risk, and at the same time involving the most hazards. Also, this is a concrete climate risk for which it is easier to convince the owners to take action to mitigate those risks ➢ Drought: also very important to focus on for the vulnerable medium-sized cities that rely a lot on the surrounding crops.
5. On which of the hotspots would you like to focus on and why? ➢ We want to focus especially on the hotspots 1 and 2, because there are many inhabitants living there that could be impacted. It is also essential to investigate the hotspot 3, but the origins of the climate risks are rather located upstream outside of the study area.

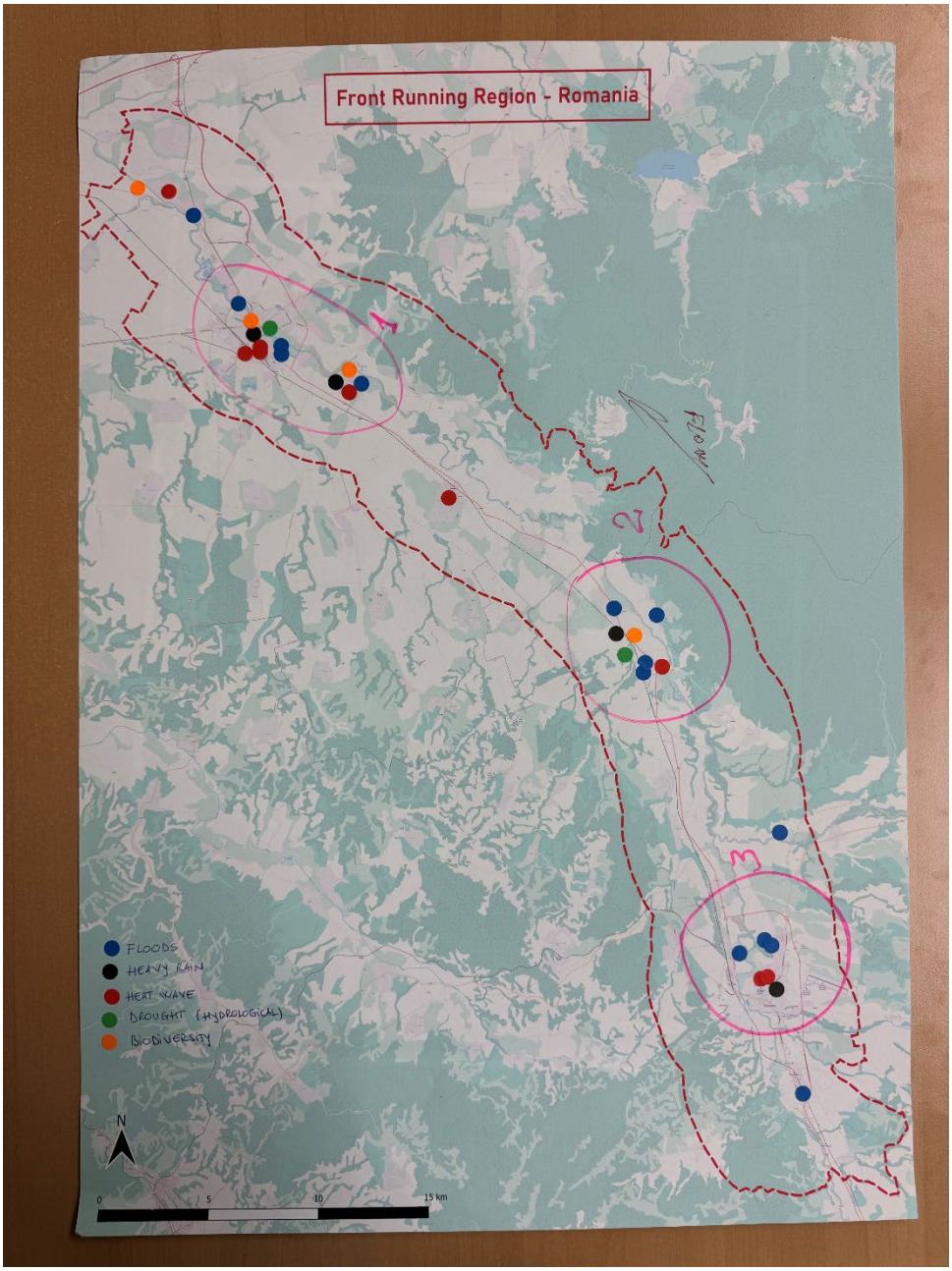

Figure 13: Identified Hotspots within the Romanian FRR and the present Climate risks

The next table shows the results of the second part of the workshop. It shows which NbS measures could be implemented at the detected Hotspots to help mitigate the effects of the climate risks, that are present there.

Table 17: Results from the second workshop part from the Romanian project partners

Land4Climate
A step closer to climate resilience

FRR: ROMANIA				
Hotspot	**Climate Risks**	**NbS idea for climate risk mitigation at specific Hotspots**	**Potential benefits of the NbS at the Hotspot**	**Concerns and Drawbacks of NbS in FRR**
1. Lugoj (Urban area)	➢ Floods ➢ Heavy Rain ➢ Heat Wave ➢ Hydrological Drought ➢ loss of Biodiversity	Re-connection of floodplains	➢ Reduces floods in Lugoj area ➢ Promoting the filtration of pollutants	➢ Sedimentation (ponds)
		Creation of retention areas	➢ Reduces floods ➢ Groundwater recharge in considered areas ➢ Supports biodiversity	➢ Increases local water level
		Riparian buffer zone	➢ Reduces flooding risk ➢ Supports drought/heatwaves mitigation ➢ Improves water policy ➢ Increases biodiversity ➢ Increases water quality	
		Bank stabilisation	➢ Increases Biodiversity	
		Retention ponds	➢ Reduces Heat waves ➢ Reduces flooding ➢ Improves biodiversity ➢ Improves air quality	

		Green/green blue roofs	➢ Mitigates heat waves ➢ Improves air quality	
		Planting of climate-resilient plants	➢ Mitigates drought	
2. C-Tin Daicoviciu - Sacu	➢ Floods ➢ Heavy Rain ➢ Heat Wave ➢ Hydrological Drought ➢ Loss of Biodiversity	Re-connection of floodplains	➢ Reduces floods in Lugoj area ➢ Promoting the filtration of pollutants	
		Creation of retention areas	➢ Reduces floods ➢ Groundwater recharge in considered areas ➢ Supports biodiversity	
		Riparian buffer zone	➢ Reduces flooding risk ➢ Supports drought/heatwaves mitigation ➢ Improves water policy ➢ Increases biodiversity ➢ Increases water quality	
		Restoration of natural river courses		
		Bank stabilisation	➢ Increases Biodiversity	
		Earth Bunds		
		Vegetated buffer strips		
		Planting of climate-resilient plants		

3. Caransebej (Urban area)	➢ Floods ➢ Heavy Rain ➢ Heat Wave	Riparian buffer zone	➢ Reduces flooding risk ➢ Supports drought/heatwaves mitigation ➢ Improves water policy ➢ Increases biodiversity ➢ Increases water quality	
		Reforestation		
		Green/green-blue roofs	➢ Mitigates heat waves ➢ Improves air quality	
		Bank stabilisation	➢ Increases Biodiversity	
		Slope vegetation		

The workshop results indicate that each region is impacted by multiple climate risks rather than a single risk. Climate hazards often strike simultaneously at a location compounding their impacts. Prior to the workshop, all regions had an initial understanding of potential hotspot locations, and the local expertise of project partners was instrumental in validating the hotspots identified through the Climate Risk Assessment (CRA). However, the climate risks that each FRR aims to address differ between regions. This is particularly evident in the Italian FRR, which, as the only coastal region, faces additional challenges from storm surges and saltwater infiltration.

The proposed NbS to mitigate climate risks at these selected hotspots varied significantly among regions. Each region confronted its own unique challenges, leading to the development of diverse implementation ideas tailored to different sectors, including forestry, built environment, rivers, coastal areas, and agricultural lands.

This allowed for a variety of ideas for NbS measures to be gathered, which can mitigate the impacts of climate hazards at the local hotspots.

Conclusions

In conclusion, the workshop provided valuable insights into the climate risks faced by each FRR and facilitated a structured approach to developing NbS ideas, to help mitigate the effects of the climate change within the region. The workshop involved validating and exploring the ArcGIS dashboard showing the results derived from the CRA, which served as a foundation for identifying hotspots for the climate hazards heat, drought, heavy rain and flooding. Participants actively engaged in brainstorming sessions to generate ideas for effective NbS measures tailored to these hotspots.

Furthermore, the workshops allowed stakeholders to list potential benefits and drawbacks of the selected NbS measures, fostering a comprehensive understanding of their implications. Feedback collected regarding both the Climate Risk Assessment and the workshop process highlighted areas for improvement and reinforced the importance of collaborative efforts in addressing regional challenges.

The results for the “no-regret” NbS measures selected by the FRR within the workshop in Timisoara will be included in the next Deliverable 1.9, where the preferred “no-regret measures” of the regions will be presented.

References

Andersson, Ingrid; Arlati, Alessandro; Bradley, Sean; Buijs, Arjen; Caitana, Beatriz; Garcia-Mateo, Mari-Carmen et al. (2023): Guidelines for co-creation and co-governance of nature-based solutions. Insights from EU-funded projects. Hg. v. Isabel Ferreira, Gerd Lupp und Israa Mahmoud. Brussels: European Commission.

Diana Dushkova; Christian Kuhlicke (2024): Making co-creation operational: A RECONECT seven-steps-pathway and practical guide for co-creating nature-based solutions. In: *MethodsX* 12, S. 102495. DOI: 10.1016/j.mex.2023.102495.

Frantzeskaki, Niki (2019): Seven lessons for planning nature-based solutions in cities. In: *Environmental Science & Policy* 93, S. 101–111. DOI: 10.1016/j.envsci.2018.12.033.

Hafferty, C.; Hirons, M.; Tomude, E. S.; McDermott, C. (2023): Recipe for Engagement in Nature Recovery and Nature-based Solutions. Hg. v. Agile Initiative Research Report.

Mahmoud, Israa; Morello, Eugenio (2021): Co-creation Pathway for Urban Nature-Based Solutions: Testing a Shared-Governance Approach in Three Cities and Nine Action Labs. In: Adriano Bisello, Daniele Vettorato, David Ludlow und Claudia Baranzelli (Hg.): Smart and Sustainable Planning for Cities and Regions. Cham: Springer International Publishing (Green Energy and Technology), S. 259–276.

Naumann, Sandra; Burgos Cuevas, Natalia; Davies, Clive; Bradley, Sean; Mahmoud, Israa H.; Arlati, Alessandro (2023): Harnessing the power of collaboration for nature-based solutions. New ideas and insights for local decision-makers. First edition. Luxembourg: Publications Office of the European Union.

Wiek, A.; Talwar, S.; O'Shea, M.; Robinson, J. (2014): Toward a methodological scheme for capturing societal effects of participatory sustainability research. In: *Research Evaluation* 23 (2), S. 117–132. DOI: 10.1093/reseval/rvt031.

Zingraff-Hamed, Aude; Hüesker, Frank; Lupp, Gerd; Begg, Chloe; Huang, Josh; Oen, Amy et al. (2020): Stakeholder Mapping to Co-Create Nature-Based Solutions: Who Is on Board? In: *Sustainability* 12 (20), S. 8625. DOI: 10.3390/su12208625

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