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Climate action, environment, resource efficiency and raw materials

BINGO

Bringing INnovation to onGOing water management – a better future under climate change

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Contributor(s):	Bergsma Emmy, Freitas Maria João, Görlitz Stefan, Hein Andreas, Iacovides Ayis, Koti Juliane, Kristvik Erle, Mouskountis Marios, Muthanna Tone, Sánchez Hernández Pablo , Strehl Clemens, Urioc Stefan, van Alphen Henk-Jan, Zoumides Christos
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Short Summary of results (<250 words)

Deliverable 6.6 – “Interim portfolio of actionable research problems/challenges exploitation and development” was prepared by CYI, KWR, LNEC, NTNU, IWW with support from their stakeholder partners under WP6 (“Ensuring Excellence and Actionable Research”), within Task 6.3 – “Actionable Research Lab”, led by CYI. This deliverable summarises the outcomes of the actionable research conducted between BINGO researchers and stakeholders. The actionable research labs accommodated in the M28 workshops enabled researchers and stakeholders to work together in real time, sharing their different experience and knowledge on the ‘unsolvable’ problems, identifying, prototyping and testing actionable solutions. A range of complex problems was addressed across research sites including the ‘wetting’ and ‘drying’ of the edges of Veluwe, the development of a digital platform for gathering information on urban drainage systems and water resources and the engagement of public to use it in Bergen, the security of the domestic water supply in Troodos with the use of desalinated water, the development of adaptation measures for addressing weather extremes in Wupper catchment, and the promotion of the hydric resources management into the political and public agenda in the Tagus site. Opportunities and constraints for the implementation of the suggested adaptation solutions were identified across the research sites, while future activities have been already planned for the finalisation of the implementation plan of the solutions.

Evidence of accomplishment

Report

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ACRONYMS

Bergen K	Bergen Kommune
CoP	Community of Practice
CYI	The Cyprus Institute
IACO	I.A.CO Environmental and Water Consultants Ltd
INTERSUS	INTERSUS Sustainability Services
IWW	Rheinisch-Westfälisches Institut für Wasserforschung gemeinnützige GmbH
KWR	KWR Water B.V.
LNEC	Laboratório Nacional de Engenharia Civil
NTNU	Norwegian University of Science and Technology
SSM	Soft Systems Methodology
Wupperverband	Wupperverband Körperschaft des öffentlichen Rechts

1. INTRODUCTION

It is the ambition of BINGO to test and operationalize a collaborative approach on co-production of knowledge for addressing complex problems related to climate change through innovative solutions. A Community of Practice (CoP) has been set up and facilitated in each research site, according to the context specificities of the sites. During the first 24 months of the project 19 workshops have been facilitated at the six research sites corresponding to the first three steps of BINGO's CoP road-map. These are the setting of the scene and the establishment of a common understanding of the water-climate risks, our preparedness and the identification of actionable measures for addressing some of these risks/problems. During these first three workshops at each site, BINGO researchers in collaboration with local stakeholders identified complex/unsolvable problems that require further attention.

Workshops M28 were devoted to *"solving the unsolvable"* and to accommodate an a*ctionable research lab*. Through these living/social labs, researchers and stakeholders (water managers, irrigators, policy makers etc.) worked together in real time, sharing their different knowledge and experiences on the complex (unsolvable) problem, identifying and prototyping actionable solutions and testing the suggested solutions.

The design of the actionable research labs was based on the *Soft Systems Methodology* (SSM) principles (Gasson, 1994; Checkland and Poulter, 2010; Burge Hughes Walsh, 2015). SSM provides a tool for tackling problematic situations. It's a tool for investigating systems' requirements in which participants mutually learn their way from finding out about the situation, to taking action to improve it (Gasson, 1994; Checkland and Poulter, 2010). During the 2nd BINGO Progress Annual Meeting (June 2017), the Actionable Research Labs were introduced and practiced. Water researchers and managers, through a roleplaying exercise became familiar with SSM principles and processes, i.e., defining, ideating and prototyping of ideas and solutions.

The main purpose of this report is to describe the process of designing actionable research between researchers and stakeholders and present the 'unsolvable' problems addressed across the research sites as well as potential actionable measures. After this introductory section, the structure of the report is as follows. Chapter 2 presents the guidelines for designing actionable research labs. Chapter 3 through Chapter 8

present the outcomes of the ‘solving the unsolvable’ workshops for each of the Bingo research sites. Chapter 9 summarises the outcomes of the workshops across research sites.

2. Guidelines for the design of the actionable research labs

The successful implementation of the “solving the unsolvable” workshops requires the participation of four stakeholders’ categories:

(a) stakeholders affected by the problematic conditions of the complex issue
(b) policy makers responsible for designing, approving and implementing solutions
(c) stakeholders relevant to the solutions development
(d) experts (including researchers)

Based on the SSM principles and the framework of Stanford Design Thinking (Institute of Design at Stanford, 2016), the following guidelines and participatory tools for the design and facilitation of the three actionable research lab exercises were provided to the BINGO researchers.

2.1. Exploring and defining the problem

During the first exercise participants discussed the initial conditions that are considered to be problematic. Developing a list of questions of ’why is it a problem’, ‘what causes a problem’, ‘what are the effects of the problem’, ‘who is involved in the problem’, ‘who wins and who loses from the problem’, ‘who holds the power’ etc. could help participants brainstorming on the context of the problem. Considering that complex situations cannot be adequately captured by words alone, participants could draw pictures of the problem (with stick figures, simple drawings, boxes, arrows…) and/or they could write their perceptions on XL post-it, which could be shared, placed and connected on an A0 sheet (on the table or wall) to obtain a “rich” picture of how and in what environment the problem situation operates.

2.2. Ideating prototyping and conceptualizing solutions

During the second exercise participants brainstormed solutions that can address the complex issue. Participants could write solutions on coloured cards or post-it and directly place them on an A0 sheet on the table or wall. During brainstorming, these multiple ideas and solutions could be transformed into prototyping. Participants could agree on three voting criteria, i.e., “the rational choice”, “the most unexpected/innovative”, “the most likely to delight” and vote. After the voting, the group

could agree on which solutions and how many (e.g., 1, 2, 3 …) to move to prototyping. During the prototyping process, subgroups were created for the selected solutions discussing the activities and people that are part of each solution. Participants could write the activities on coloured cards or post-it, place them on an A0 and map the interactions with arrows, thus creating a conceptual model.

2.3. Testing solutions

The solutions testing could be done as a role play or as a facilitated brainstorming. A compromise on the solution of the problem should be reached, while participants needed to negotiate or brainstorm about the feasibility (technical, financial, institutional) of the prototypes. Stakeholders could commit themselves in experimenting (in a self-organized pilot) and/or putting in practice (in their own organizations and activities) in an actionable roadmap the solutions that should be “immediately undertaken” as an outcome to follow till the end of the project.

3. SOLVING THE UNSOLVABLE AT THE VELUWE RESEARCH SITE

3.1. Background

3.1.1. Organisation of the workshop

The workshop was organised by the Province of Gelderland in Nunspeet, The Netherlands on 7 November 2017. In total, 15 persons attended the workshop. The agenda of the workshop is presented in Table 1.

Table 1 Agenda of Veluwe "Solving the Unsolvable" Workshop

Time	Session
10:00	Welcome and introduction
10:30	Vitens Case: Climate change and water supply
11:30	Selection of 'unsolvable problem'
11:50	Joint exploration of the 'unsolvable problem'
12:30	Lunch break
13:30	Taking actions
14:30	Testing actions
15:30	Wrap up

3.1.2. Objectives of the workshop

The objectives of the workshop were:

- to select and explore an 'unsolvable problem'
- to identify actions for the different participants for the next 6 months
- to discuss continuation of the CoP within and beyond the BINGO project

3.1.3. Material distributed to participants

- A large table with potential hazards, risks, measures and stakeholder involvement at the Veluwe
- A table with the characterization of participants and their role in the workshop (see Table 2), which allows a better understanding of the "range of end-users", and if some group was "overpowering", and if other(s) were absent.

3.1.4. Role of participants in the workshop

The roles of the participants in the workshop as well as the sectors they represent are presented in Table 2.

Table 2 Sectors and roles of workshop participants

Sector		Number of participants	Role in the workshop**
R&I (Public and Private)		3	O
Policy Bodies	Municipal level	0	
	Supra-Municipal level*	3	O; S
	National level		
Utilities – Water companies		2	S
Sector Organizations		6	S

*Collection of municipalities

** Stakeholders: S
Organizers: O

3.2. Short summary of workshop including outcomes and results

3.2.1. Project updates

Henk-Jan van Alphen gave a brief update on the status of the BINGO project, particular the work done at the Veluwe research site.

3.2.2. Vitens Case

Jolijn Engelenburg presented a case which Vitens proposed to discuss with the CoP, based on the diverging projections for water demand in the Netherlands (which ranges from -15% to +30%). Three groups where asked to discuss how Vitens can deal with these diverging projections. The first group was asked to find ways to decrease water demand in the higher scenario. Additional locations for abstraction of groundwater should be found at the edges of the Veluwe, in the agricultural areas, not at the center.

The second group advised against additional abstractions, but if it cannot be avoided, then Kootwijkerbroek is the most appropriate. Each increase in abstraction should be compensated or combined with demand reduction. The third group suggested additional abstraction in the center of the Veluwe, because it is well protected. Abstractions should be compensated by measures that reduce demand or increase infiltrations.

3.2.3. *Unsolvable problem*

There are many complex issues at the Veluwe, according to the participants. The case presented by Vitens is a good example although the scope should be broader than considering only the drinking water supply, according again to the participants. More precisely, they identified a number of issues:

- First, the difference between the wet and dry seasons at the edges of the Veluwe is increasing. Some of the stakeholders have already noticed it, for instance, in the ecological flow of the brooks and streams, in agricultural zones, in natural zones and private properties. Private land owners report that the land is either too wet or too dry (depending on the season); the latter is the most pressing issue. In the agricultural sector, there is the Delta plan Agrarisch Waterbeheer, which aims to improve the availability of water (quantity and quality) at the edges of the Veluwe. It is a cooperation between the Land- en Tuinbouworganisatie (LTO) en Waterschap Vallei en Veluwe. This could be a potential platform for cooperation with the private land owners. At the edges of the Veluwe, a number of streams are not in the desired state and need to be improved. Too little flow has an effect on the water quality. Near Oosterbeek high levels of nitrate have been reported; this is also an issue for Vitens.
- Second, there is a risk of forest fires at the Veluwe high grounds. Policies to solve this issue are gradually implemented.
- Third, the increase in temperature in the Veluwe leads to changes in species and biodiversity. The recreational sector notes the increasing number of ticks and the emergence of 'invasive exotics' (i.e., species from other ecosystems migrating to the Veluwe).
- Fourth, a relatively new issue is the increasing acidity levels at the Veluwe, which results in poorer soils.

After some discussion, the participants agreed that both the 'wetting' and 'drying' (and in particular the increasing difference in both conditions) of the edges of the Veluwe is the hardest problem to tackle. This is a complex issue that requires actions from a broad range of different actors, who also have different (or partial) interests in the case.

The group identified the following actions for each of the participating actors:

- Bekenstichting: to provide information on status of brooks and streams and to analyse possible causes for droughts
- KWR: to study the water balance of the Veluwe in collaboration with Vitens, the Province and the Water Board.
- Staatsbosbeheer: to study the effect of transition to small vegetation or CO2 storage through biomass.
- LTO: to link the BINGO results to the work in the Deltaplan Agrarisch Waterbeheer
- Land owners association: to inform land owners on latest findings regarding the issue.
- Province: to ensure an integrated and encompassing approach. The province is working on a knowledge document about the Veluwe, together with Vitens and the Waterschap Vallei en Veluwe
- Municipalities need to be involved as well.

In the second phase of the workshop, participants focused on a more concrete example of drying at the edges of the Veluwe, namely, the drying up of the eastern brooks during the summer. It is not entirely clear why this is happening. It is assumed that a dry spring and summer cause the brooks to dry up. But the Veluwe groundwater system is the source for these brooks and it typically responds very slowly to droughts. It can also be caused by a broadening of the wet profile of the IJssel river that is currently having its effect on the Veluwe edges. Only when these causes are clear, solutions to the issue can be identified.

The effects of the dry brooks are both ecosystem and culturally related. Dry streams have a big impact on the biodiversity of the area and the ecosystem in general, causing animals and plants to disappear from the area. Also, the brooks are part of the cultural heritage of the area.

Both causes and effects should be further analysed. The Bekenstichting, the foundation that promotes the interest of the brooks and streams can organize a working group to study these issues further and develop scenarios that can be further explored by the Waterschap Vallei en Veluwe. The problem at the Veluwe is that responsibilities are separated, without one organization having the ultimate responsibility, such as in the dune areas in the west of the Netherlands. As such, it is

difficult in this stage, to identify concrete actions to tackle this issue. However, the province is identified as the primary risk owner and should take action to maintain an integral vision on this issue.

The group acknowledges that much of the disparity in (perceived) interests is due to a lack of knowledge and information about the issue. Therefore, each of the participants will, in the coming months, inform its members or stakeholders about the issue, based partially on the results of the BINGO project. Another way of achieving coherence in approaching this issue is to involve the stakeholders in the formulation of policies and visions for the future of the Veluwe at both the provincial and the municipal level. The question is if the province and the municipalities are sufficiently open to such a level of involvement.

Province, Vitens, Water Board and KWR will make further steps on this issue, involving other stakeholders when necessary; the CoP will meet in about six months for an update. The group has decided to continue the work of the CoP beyond the BINGO project. The CoP will then meet every six months and discuss a concrete case with the relevant stakeholders. Everybody is asked to think about other actors that need to be involved.

4. SOLVING THE UNSOLVABLE AT BADALONA RS

The main problem concerning urban drainage in Badalona is the management of the heavy and moderate storm events that could exacerbate in a context of climate change. These events producing flooding and water deterioration of receiving water bodies have strong social and economic impacts in terms of people safety, direct and indirect damages on properties, goods and urban activities. Although this is an unsolvable problem and its full solution is not possible, the aim of the Badalona research site in the framework of BINGO project is to provide the most advanced and innovative tools and methods to mitigate the consequences of climate change in the field of urban drainage. To achieve this goal the most effective adaptation measures are being prioritized on the basis on cost benefits and multicriteria analysis and the full involvement of all the risk owner and main stakeholders managing urban drainage system in the city. The workshop will take place in January 2018.

5. SOLVING THE UNSOLVABLE AT BERGEN RS

5.1. Background

5.1.1. Organisation of the workshop

The workshop was organized by Bergen K and NTNU in Bergen, Norway on 16 November 2017. In total, 17 persons attended the workshop. The agenda of the workshop is presented in Table 3.

Table 3 Agenda of Bergen "Solving the Unsolvable" Workshop

Time	Sessions
12.00-12.15:	Welcome and introduction to the workshop
12.15-13.00:	Exploring and defining the problem
13.00-13.15:	Coffee break
13.15-14.00:	Ideating solutions
14.00-14.15:	Coffee break
14.15-15.00:	Prototyping and conceptualizing the solutions
15.00-15.05:	Coffee break
15.05-15.50:	Testing solutions
15.50-16.00:	Debriefing – conclusions - evaluation

5.1.2. Objectives of the workshop

The municipality in Bergen wishes to mobilize the public to help gather information on urban drainage systems and water courses. For this, they are developing a digital platform where people can upload pictures and share information with the municipality. Having the technical solutions in place, the remaining challenge is to engage the public to use it. The objectives of this workshop were to address and find a solution to the question *"How to succeed with public involvement?"* and to define an implementation plan for the solution.

5.1.3. Material distributed to participants

The following material was distributed to workshop's participants:

- Workshop agenda

- Background information on previous workshops and current plans for public involvement

5.1.4. Role of participants in the workshop

The roles of the participants in the workshop as well as the sectors they represent are presented in Table 4.

Table 4 Sectors and roles of workshop participants

Sector		Number of participants	Role in the workshop*
R&I	Norwegian University of Science and Technology (NTNU)	2	F; O
	University of Bergen (UiB)	1	S
City of Bergen	Agency for Water and Sewerage Works	6	O
	Agency for Planning and Building Services	4	S
	Department of Climate, Culture, and Business Development	1	S
	BSBI	1	S
Residents		2	S

*Facilitator: F
Organizer: O
Stakeholder: S

5.2. Short summary of workshop including activities

The workshop was opened by Bergen K and NTNU. An introduction of the workshop topic and objectives was given along with a summary of previous workshops and outcomes.

The workshop was divided into several working sessions, some of which were executed in groups and some in plenary. The main sessions were:

I. Definition of problem and its causes (group session)
II. Solutions to the problem (group and plenary sessions)
III. Defining an implementation plan for the solution

In the first session, the participants were divided in two groups; participants in each group brainstormed and discussed the aspects of the problem. Participants were asked

to discuss why public involvement is challenging, and find causes to why public involvement may fail. Further, they were asked to address each cause and to discuss possible solutions.

All causes and solutions were then assembled in a plenary session. Finally, an implementation plan, including criteria for success, based on discussed solutions was formulated.

5.3. Summary of workshop outcomes and results

Table 5 summarizes the outcomes of the problem definition and solutions brainstorming.

Table 5 Causes of the problem and solutions

Problem: The digital platform for public involvement is not being used	
Causes	**Proposed solutions**
The public does not know about the solution	• Promote the solution • Find the right target groups (various organizations, associations, media, schools, kindergartens, etc.) • Communicate through several platforms: email, sms, public meetings • Short film / advertisement at movie theatres
The public is not motivated to share information	• Emphasize reasons for sharing information / help the municipality. Both future risks and a positive vision for the city should be communicated • Focus on intrinsic motivation: 'your input can make a difference' • Study cultures and identify what motivates each target group • Municipal 'garden' where urban drainage management is demonstrated (e.g. by raingarden, green roof, information poster, etc.) • Provide concrete examples of how the municipality use the information • Continuous communication of results (e.g. on Facebook) • Disseminate outcomes of BINGO as popular science • Organize competitions where contributions through the digital platform are rewarded • Informative stickers on manholes • Define possible assignments/projects to be addressed by students in school • Use the World Water Day to draw attention
The public has a concern that sharing information with the municipality will result in a personal responsibility	• Clearly communicate that the aim of gathering information is mapping the current situation and to increase the municipalities overall knowledge of watercourses • Provide concrete examples of how the municipality use the information • Protection of anonymity
Social factors (such	• Target senior centers and the 'senior university'

as age, language, etc.) hinders some groups from participating	• Provide English versions of the information
Too many request from the municipality	• Focus on target groups • Assemble all information requests from different agencies of the municipality into one digital solution
The digital solution is difficult to use	• Ask from feedback from a test-group • Ensure an easy-to-remember link to the platform
Low sense of responsibility	• Show good examples to enhance understanding of the problem and individuals' role in the 'bigger picture'
Lack of knowledge	• Communicate the problem and what information is seeked, e.g. through a municipal garden

Discussion about engaging public to use the suggested technical solution

5.3.1. Implementation plan

Table 5 was used as a basis for the last task of the workshop, that is, the definition of an implementation plan for the suggested solution. The following steps were agreed upon:

- Engage residents:
    - Contact and inform target groups (schools, Turlaget, Dugnadsgjengen, etc)
    - Develop communication material:

        - Brochure: “What happens to the water?”
        - Facebook: set up a page for the project
        - Prepare information poster to be placed at Bryggen and/or Håstenarparken
        - Contact local platforms (Bergenseren, Kommunetorget)
        - Contact Newton (TV)
    - Formulate school projects
    - Award contributors with movie tickets
- Events:
    - Plan one or two events (e.g. world water day March 22nd and/or earlier in January/February)
- Municipal: Inform about the project internally
- Digital
    - Create a simpler link
    - Get domain ‘vannveier.no’
- Project
    - Scoping: revise / refine purposes and goals of the project

5.3.2. *Success criteria*

In order to be able to evaluate success, the participants defined the following measurable goals:

1. Engage at least three target groups
2. Get 1000 contributions on the digital platform
3. Media coverage: at least one external media
4. Pop-science promotion of the BINGO-project

5.4. Conclusions and remarks

The objectives of the workshop were reached and the city of Bergen has now a tangible plan for how to proceed in the work committed to involve public. In order to

secure the implementation of the plan, it will be further detailed with due dates and responsible parties.

6. SOLVING THE UNSOLVABLE AT TROODOS RS

6.1. Background

6.1.1. *Organisation of the workshop*

The workshop was organised by CYI and I.A.CO in Nicosia, Cyprus on 23 November 2017. In total, 12 persons attended the workshop. The agenda and the invitation of the workshop are presented in Table 6.

Table 6 Agenda and invitation of Troodos "Solving the Unsolvable" Workshop

Time	Session
08:30-09:00	**Registration**
09:00-09:15	**Welcome - Introduction to BINGO project** Elias Giannakis, The Cyprus Institute
09:15-09:30	**Domestic water supply in the downstream communities of Peristerona Watershed** Aris Konstantinou, Astromeritis Community
09:30-09:50	**The Vasilikos Conveyor project** Panagiota Xatzigeorgiou, Water Development Department
09:50-10:30	**Exploring and defining the problem**
10:30-11:00	**Coffee break**
11:00-11:50	**Ideating solutions**
11:50-12:45	**Testing solutions**
12:45-13:00	**Conclusions - Evaluation**
13:00-14:00	**Light lunch**

6.1.2. *Objectives of the workshop*

The ‘unsolvable’ problem in the Troodos research system, which was discussed during the workshop was “securing the domestic water supply of rural communities in the downstream area of Peristerona Watershed under climate change: the role of desalinated water and groundwater”. The specific objectives of the workshop were:

- To better understand the problem of securing the domestic water supply of downstream communities of Peristerona Watershed
- To investigate the role of desalinated water as a solution for securing the domestic water supply of those communities.

6.1.3. *Material distributed to participants*

The following material was distributed to workshop's participants:

– Workshop agenda

– Project flyers

– Cards, post-it & markers

– Evaluation questionnaires

6.1.4. *Role of participants in the workshop*

Selected external and local stakeholders were invited to the stakeholder workshop. The attending external stakeholders were officers of two governmental departments, i.e., Water Development Department and Geological Survey Department, and of the Water Board of Nicosia. Local stakeholders were represented by the community leader of Astromeritis village. The roles of the organizations that are represented by these stakeholders are presented below (Table 7). The workshop was held during working hours in Nicosia, which affected the participation of community leaders. See Annex I for the full list of participants.

Table 7 Sectors and roles of workshop participants

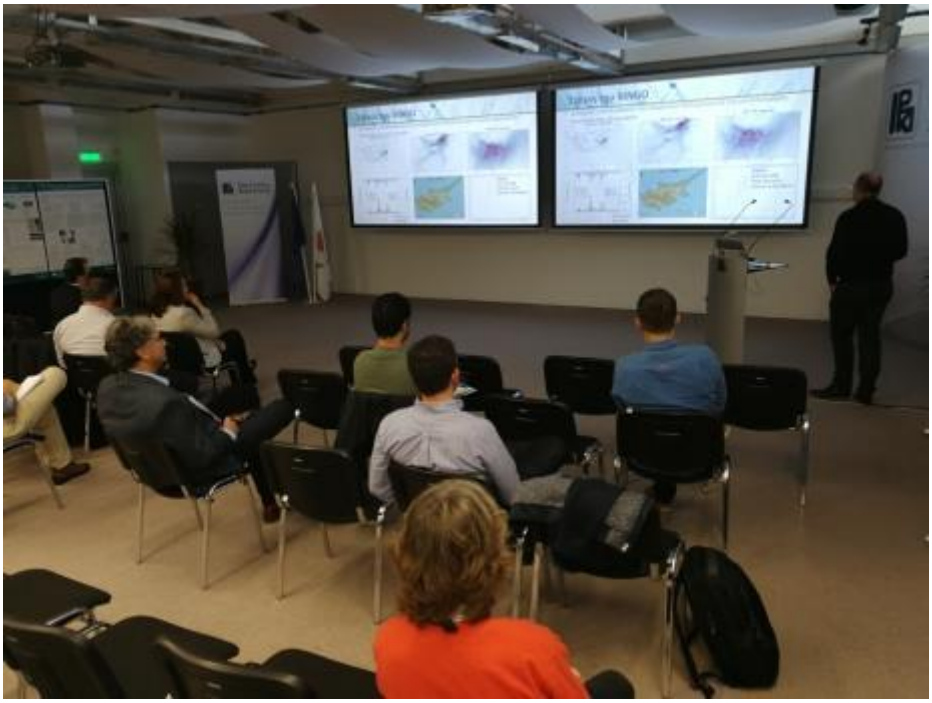
Sector	Number of participants	Role in the workshop*
R&I (Public and Private)	4 (CyI)	O, E
Policy Bodies – Municipal level	1	A
Policy Bodies – National level	4	P, S
Utilities – Water companies	1	S
Sector Organizations	2 (IACO)	E

* Stakeholders affected by the problematic conditions of the complex issue: A
Policy makers responsible for designing, approving, implementing solutions: P
Stakeholders relevant to the solutions development: S
Experts: E
Others (specify): O (Facilitators)

6.2. Short summary of workshop including activities

The workshop consisted of three main parts. In the first session of the workshop, participants were welcomed by Adriana Bruggeman (CyI). Elias Giannakis (CyI) gave a short overview and updates of BINGO activities, supported by a powerpoint

presentation, and outlined the objectives of the workshop. Aris Konstantinou (Astromeritis community leader) described the existing domestic water supply conditions and water usage in the downstream communities of Peristerona Watershed. Panayiota Hadjigeorgiou (Water Development Department) gave a brief presentation of the Vasilikos Western Nicosia Conveyor Water Supply Project, which aims to ensure reliable and continuous potable water supply for the downstream communities of Peristerona Watershed, through their access to desalinated water supply.



Overview and updates of BINGO activities in Cyprus

In the second session of the workshop, participants discussed the unsolvable problem, that is, the security of the domestic water supply of downstream communities of Peristerona Watershed, its causes and impacts, in order to obtain a clear picture of the problem and its context. Participants identified the key players involved in the problem (authorities, sectors) and their interactions (e.g., who wins and who loses from the problem, who holds the power) and discussed how these relationships will be affected with the introduction of the desalinated water. The main findings of this working group session were summarized on flipchart sheets.

In the third session of the workshop, participants brainstormed solutions that can optimize the option of transferring and using desalinated water. Participants identified the main actors involved in those solutions and explored their feasibility (technical, financial, regulatory). The main findings of the discussion were again summarized on flipchart sheets.

Discussion about the main actors involved in the suggested solution

6.3. Short summary of outcomes and results

6.3.1. Causes and impacts of the problem

Participants identified the following main causes of the problem:

(a) Poor water demand management during the last 50 years
(b) Climate change impacts; reduction of precipitation
(c) Population increase
(d) Changes in lifestyle that require more water consumption per capita
(e) Old water supply distribution networks with high leakages
(f) Uncontrolled urban development; due to the expansion of residential areas, in some cases domestic water supply is used for irrigation in residential plots, where buildings have not yet been constructed.

(g) Lack of state planning for defining the zonation of the area (e.g., agricultural); the territory of the area has radically changed due to 1974 war.

Participants agreed that the main impacts of the problem are: (a) disruptions in domestic water supply, and (b) pressure on groundwater bodies.

6.3.2. *Key players*

The key players in the existing water supply situation are the community councils, Water Development Department, Public Health Services, Geological Survey Department, District Administration, and the Auditor General. The community councils are responsible for managing and providing (selling) water to households. The Water Development Department, which is the regulatory authority for water resources and water management, provides technical support to community councils. The Water Development supplies the Water Boards and some local authorities with bulk water supply. Water quality checks are performed at least once a month by the Public Health Services. The Geological Survey Department supports the communities if there is a need for further groundwater exploitation. The water charges of each community are checked by the District Administration and are approved by the Water Development Department. The accounts of community councils are checked annually by the Auditor General of the Republic of Cyprus.

The Water Board of Nicosia is in charge of domestic water supply and the supply network in the larger area of Nicosia. They can take over water supply responsibilities of nearby communities (economies of scale).

6.3.3. *Introducing the solution*

Desalinated water as a source for domestic supply was considered an unfeasible solution by the stakeholders during the M15 BINGO workshop. However, many other communities in Nicosia district, which are reliant on groundwater resources for domestic water supply, are experiencing insecure water supplies and deterioration in water quality. Secondly, water supply for the urban area of Nicosia was not secure either, because the city depends on a single pipeline for its desalinated water supply. To improve the security of potable water supply for Nicosia and 28 communities in western Nicosia district the Water Development Department developed the Vasilikos Western Nicosia Conveyor Water Supply Project. The project includes a pipeline from

the Vasilikos desalination plant to the Nicosia service area, pumping stations, storage reservoirs and local conveyor pipelines. The project is implemented in phases, with the downstream Peristerona area as the last section, and is expected to be completed in 2021.

6.3.4. *Impacts of the solution*

- The price of water will increase; today the cost of groundwater abstraction for Astromeritis community, including its transfer, is 0.30 euro/m^3. The Water Development Department will sell to community councils desalinated water at a price of 0.82 euro/m^3; households will pay more than 1 euro/m^3.
- The current water losses in the distribution network will become much more expensive.
- The cost of the improvement of the local water distribution networks will be covered by both Community Councils and the Water Development Department.
- Community councils remain the local water supply authorities; they can select the source of water (i.e., groundwater vs desalinated water) for domestic use at their own discretion. Thus, community councils can determine the demand for the desalinated water since they can also use groundwater from boreholes.
- According to the Water Development Department, previous experience has shown that communities, which have access to both desalinated water and groundwater resources, use water more rationally, compared to communities with access to one source of water.
- According to the Astromeritis community leader, community councils are aware of the problems with the quantitative and qualitative status of aquifer, and will allocate boreholes a role as a back-up source. For example, in the past decades in Astromeritis five boreholes were operating, whereas today only two boreholes remain feasible to operate.
- Regulatory acts, which explicitly mention that one of the objectives of this project (i.e., Vasilikos Conveyor) is the protection of aquifer, could further enhance the use of desalinated water. On the other hand, considering that groundwater is the main source for irrigation, the provision of desalinated water for domestic supply may increase abstractions of groundwater for agricultural use.

- It is expected that local households will be willing to pay the increased price of desalinated water because it will ensure access to continuous and good quality water supply.
- Concerns were expressed about the financial feasibility of the project since community councils can still abstract groundwater for domestic water supply, which is a cheaper option. One solution that can ensure the financial feasibility of the project could be the imposition of restrictions on borehole drilling and groundwater extraction.

6.3.5. Opportunities for improving the solution

- The Water Board of Nicosia has formally declared its intention of establishing and operating provincial water supply authorities, which will allow an integrated management of water supply.
- The Union of Communities is against the creation of provincial water supply authorities, but each community could independently select to join. In general, communities don't want to lose the control of domestic water supply because this would result in an important loss of revenues.
- The charges of Water Board of Nicosia are lower than the fees the Water Development Department charges the communities, according to the Water Development Department officers.
- An important part of the volume of water distributed through the community water supply network is not recorded by the consumers' water meters due to water leaks that are detected in time, damages to the network by third parties and poor position of water storage tanks. Community cannot manage these problems effectively. In many cases, community councils are also unable to collect households' late fees.
- The use of treated sewage water for irrigation and green infrastructure can alleviate the pressures on water resources and increase the water availability for domestic uses.
- The installation of water saving equipment for both domestic water use and gardens could result in significant water saving
- The regular maintenance and repair of the water distribution systems could substantially minimize leakages and water losses. The very ageing parts of the water distribution network should be replaced because the corrosive capacity of desalinated water will damage it.

- Awareness campaigns including lectures in schools, seminars and distribution of informative leaflets could educate local society and youth on climate change and water resources challenges and the importance of water conservation.
- The environmental cost associated with greenhouse gas emissions for the production of desalinated water has been incorporated in the bulk price of water (0.05 out of 0.82 euro/m3).
- Further research could be conducted on the implementation of the above issues and opportunities and on the effect of the increase in water prices on water management and water use.

6.4. Conclusions

Two main factors were considered in the economic feasibility of the discussed solution:

- The large social benefit for households, which will have continuous access to good quality water (i.e., ensure water supply irrespective of climatic conditions)
- The ratio of 60% desalinated water and 40% treated water from dams

All participants agreed that the net outcome of the discussed solution is positive for the communities and inhabitants of Nicosia, and that the reduced abstraction of groundwater could improve the quantitative and qualitative status of the aquifer. The financial cost of the solution is high. However, the social benefits of the option counteract this investment.

7. SOLVING THE UNSOLVABLE AT WUPPERVERBAND (Wupper Association (WA)) RS

7.1. Background

7.1.1. Organisation of the workshop

The workshop was organised by IWW, Wupperverband and INTERSUS in Wuppertal, Germany on 10 November 2017. In total, 30 persons attended the workshop. The agenda and the invitation of the workshop are presented in Table 8.

Table 8 Agenda and invitation of Wupperverband “Solving the Unsolvable” Workshop

Time	Session
09:00-09:15	Registration
09:15-10:00	Welcome - Introduction to BINGO project
10:00-11:15	Climate change in the Wuppertal catchment area - adaptation options to climate change risks and their assessment
11:15-11:30	Coffee break
11:30 -12.30	Summary and final discussion
12:30-13:00	Lunch
13:00	End of workshop


AGENDA

7.1.2. Objectives of the workshop

The ‘unsolvable’ problem in the Wupperverband research system, which was discussed during the workshop was “weather extremes in the Wupper catchment area: risks and concrete adaptation measures – preparation of two case studies”. The specific objectives of the workshop were:

- Discussion on the first case study proposal "Too much water - flooding due to heavy rain"

- Discussion on the second case study proposal "Not enough water - ensuring security of supply"
- Finding interested stakeholders for in-depth work on case study proposals

7.1.3. Material distributed to participants

The following material was distributed to workshop's participants:

- Program flyer / workshop agenda
- Invitation letter with objectives of workshop
- Evaluation questionnaires

7.1.4. Role of participants in the workshop

The roles of participants and the sectors they represent are presented in the Table 9. See Annex I for the full list of participants.

Table 9 Sectors and roles of workshop participants

Sector		Number of participants	Role in the workshop**
R&I (Public and Private)		6	O, E
Policy Bodies	Municipal level	2	A, P
	Supra-Municipal level*	4	A
	National level		
Utilities – Water companies		14	A, S
Sector Organizations		4	E

*Collection of municipalities

** Stakeholders affected by the problematic conditions of the complex issue: A
Policy makers responsible for designing, approving, implementing solutions: P
Stakeholders relevant to the solutions development: S
Experts: E
Others/specify: O (Facilitators)

7.2. Summary of workshop outcomes and results

7.2.1. Protocol of the agenda

<u>BINGO-overview and status of work</u>

After a brief welcome and introduction of the participants, the BINGO project was briefly introduced by Juliane Koti. Following this, Marc Scheibel presented the status of work from work packages 2 and 3. In particular, the experiences gained in dealing with

the data from the weather models and the first results of the measurement campaign were discussed. In summary, it can be stated that the use of regional climate models is particularly suitable for statistical evaluations, such as long-term behavior and trends. Concrete situations can be derived from this as possible scenarios to which one should be prepared. The introduced measuring campaign proves to be technically stable (good for the operational business) and already shows good, usable results.

In the first two BINGO workshops in 2016, the risks, challenges and potential for conflict due to weather extremes in the Wuppertal catchment area were discussed. In May 2017, the third workshop focused on possible adaptation measures and focal points of investigation in the Wuppertal catchment area. Based on this, the aim of the fourth workshop was to discuss two concrete case studies, which can be further elaborated in 2018. Therefore, following the presentation of the work status from work packages 2 and 3, Marc Scheibel introduced the subject of two case study proposals in the Wuppertal catchment area.

Overview and updates of BINGO activities in Wupper

The first case study entitled "Too much water - floods by heavy rain" should deal with the city of Wuppertal. One risk is the increasing soil sealing, which is a problem not only for Wuppertal also for the whole North Rhine-Westphalia. In addition, there are

problematic factors such as rising heat periods, urban densification and the resulting socio-economic damage potential caused by urban flooding, as well as an increasing concentration of precipitation (to put it simply: "Continuous rainfall becomes a concerted heavy rainfall and greater periods of drought"). For a case study in the city of Wuppertal, there are several advantages:

- necessary data are already existing
- many types of measures conceivable are already in discussion or in the HWRM
- ongoing investigation in a suitable context (mutual synergies)
- good transferability for other regions

The second case study entitled "Not enough water - Ensure security of supply!" should refer to the situation at the Great Dhünn Dam. Factors which justify the problem are e.g. changes in precipitation distribution, increasing water demand with increasing heat and dry periods and (increased) demands on aquatic ecology.

The benefits of choosing this case study on "Not enough water" are:

- already very good data set and experience (experienced situations)
- some measures already considered and in the discussion
- ongoing investigation in the appropriate context (interest and mutual synergies)
- good transferability for other regions

Discussion about the two case study proposals in the Wuppertal catchment area

Climate change in the Wuppertal area - adaptation options to climate change risks and their assessment

Discussion on the first case study "Too much water - flooding due to heavy rain"

In the discussion of the first case study "Too much water - flooding caused by heavy rain" in the city of Wuppertal, in addition to the drivers already identified by Marc Scheibel - increasing sealing, increasing heat stress, urban densification and increasing concentration of precipitation - further factors were identified, such as the resulting damage: the individual behavior of those affected, population development, urban land use planning (which may influence the emergence of heavy rainfall events through regulations such as green roofs), as well as the general economic situation, as municipalities would be more likely to develop land to generate revenue due to economic constraints to generate.

Options for action or adaptation included the use of green and other public areas as retention areas and emergency waterways, the acquisition of suitable land by the municipalities, the targeted promotion of such measures by the federal and state governments, and the education of those affected.

Stakeholders involved are politicians (including specialist committees), land-use planning and all participating ministries (which would require significant contributions), citizens and funding agencies. It was made clear that land-use planning alone cannot fulfill this role (input from and coordination with other ministries is necessary, e.g. urban planning and development) and that this is a cross-cutting task. The coordinating office for climate protection of the city of Wuppertal is an important contact for BINGO (project "Best Climate" and from 2018 in-house teams on the topics heavy rain and heat islands). Assessment criteria used to allow decisions on options were: potential damage and frequency (with annuality sometimes seen as less meaningful for heavy rainfall events); besides purely economic categories, human health is also necessary (analogous to the HWRM-RL); the question of whether land must be purchased; and side effects / secondary effects on quality of life (and thus acceptance).

Data availability in Wuppertal is basically good to very good (presentation by Marc Scheibel). Another source of concern could be the impact analysis on heat islands (Wuppertal City Climate Protection Coordination Office). As a requirement for the results of the analysis, the participants needed transparency of the results and open, understandable and clear communication. It was also noted that it was currently unclear whether annual events for heavy rain should be communicated.

Implementation hurdles for implementing measures against heavy rainfall are: unclear responsibilities for "wild" surface runoff (e.g. via roads), the prevailing opinion in road / traffic planning that water "does not belong on the roads", the discrepancy between concern and decision-making responsibility, the difficulty of realizing the necessary citizen participation (many critical questions on land valuation and insurance exist here), as well as the relatively unconcrete, "soft" pressure to act (because of future and abstract problem). The time horizon for comprehensive implementation of measures and implementation of "full" risk management is medium to long term (20-30 years). Uncertainties should be clearly stated in communication, since heavy rain forecasts concern always probabilities.

Discussion on the second case study "Not enough water - ensuring security of supply"

The Discussion on the second case study "Not enough water - ensuring security of supply" (Great Dhünn dam) Marc Scheibel identified various drivers: increasing sealing, changes in precipitation distribution, increasing water demand with increasing heat and dry periods and (increased) demands on aquatic ecology.

Options for action or adaptation were a reduction in line losses (in particular in the distribution network, municipal utilities), efficiency measures, the merger of the water associations into a single network, a new plan approval (e.g. for minimum outflows from the dam) and the reduction of evaporation from the water surface of the dam. In addition, the water savings on the customer side was addressed as an option. However, it was stated in detail that lower water charges (to consumers) are in principle not possible; the resistance would be too great.

The district government as an important licensor was seen as an involved player. As an evaluation criterion to allow decisions about options, the possible loss of image in the event of changing / deteriorating water quality was mentioned. Data availability on the topic is basically good to very good for the Dhünn dam (presentation by Marc Scheibel). In addition, there are already several feasibility studies. For possible networking of the water associations. As a requirement for the results of the analysis, it was important for the participants that both conflicts of use and prioritization are presented, as well as the costs and benefits of possible networking / interconnection of the water boards. In any case, the results should be developed in cooperation with the operators / suppliers (in particular those present: Water supply association Rhein-Wupper, Wupperverband and WSW Energie & Wasser AG).

Implementation hurdles for implementing measures were seen as existing institutional structures, the duration of changes in these structures (also with regard to planning findings) and the desire of each individual association to remain independent; the difficulty in communicating supply bottlenecks in the region (and consequently low acceptance of the problem) and the differences in the treatment of surface water and groundwater (in case of a change to temporary supply of groundwater).

7.2.2. Outlook and future workshops

For the further elaboration of the two discussed case studies in the fourth stakeholder workshop, the project team will prepare a 2-page working document for each case, based on the results of this workshop. These two documents are expected to be distributed in January 2018 to the workshop participants via email. These documents shall be the background for two additional workshops with smaller groups. One workshop will focus on case study 1 "Too much water - flooding caused by heavy rainfall (Wuppertal region)" and the other on case study 2 "Not enough water- ensuring security of supply (Great Dhünn dam area").

In summary, the planning of the future work and the outlook can be structured as follows:

- Nov 2017: Contact of case study partners by IWW

- Jan 2018: Preparation of a two-page case study document (working paper) by IWW and coordination with interested case study partners (objectives, criteria, methodology, data)
- 1st Quarter 2018: Appointment and realization of two case study workshops in small groups
- Oct 2018: First evaluation of the results as well as discussion of the results in the fifth official BINGO M40 workshop in a big round.

8. SOLVING THE UNSOLVABLE AT TAGUS RS

8.1. Background

8.1.1. *Organisation of the workshop*

The workshop was organised by LNEC in Lisbon, Portugal on 16 November 2017. In total, 33 participants attended the workshop. The agenda of the workshop as well as the invitation are presented in Table 10.

Table 10 Agenda and invitation of the Tagus "Solving the Unsolvable" Workshop

Time	Session
09.00h –	Welcome & Housekeeping
09.40h –	"BINGO Share Moment" on interim activities
10.00h –	Tagus Research Actionable Living Lab Challenges
10.30h –	Exploring the Problem
11.15h –	To do's – Exploring actionable roadmaps
12.00h –	Designing a Roadmap for Another Agenda in Bacia do Tejo
12.45h –	WS Evaluation, Tools Assessment and Next Steps
13.00h –	Farewell Lunch

8.1.2. *Objectives of the workshop*

The objectives of the workshop were:

- To share BINGO results so far
- To explore "How to push the topic Hydric Resources Management into the Political and Public Agenda?" (# institutional; #communication, # citizenship, # schools….)

8.1.3. *Material distributed to participants*

The following material was distributed to workshop's participants:

- BINGO stickers & cards for individual identification
- General program
- WS#M22 Adaptive Measures co-productions
- Individual Permission form for data sharing
- Individual evaluation form
- Tools Evaluation Form

8.1.4. *Role of participants in the workshop*

The types of the organizations represented in the workshop are portrayed in Table 11, while the roles of participants in the workshop sent are presented in Table 12. See Annex I for the full list of participants.

Table 11 Characterization of participants (types of organizations)

Policy bodies		
National	*Regional*	*Local*
DGADR – Agriculture and Regional Development National Board **IPMA** – Portuguese Institute for Sea and Atmosphere **ERSAR** – Water Regulator	**DRAP LVT** – Agriculture & Fishing Regional Department **ARH Tejo - APA** - Environment Portuguese Agency / Administration of the Tagus River Basin and West	**CIMLT** – Lezíria do Tagus Inter-Municipal Community
Associations	**ABL** – Loures Beneficiaries and Irrigation Association **CAP** – Portuguese Farmers Confederat**ion** **ABLGVFX** – Lezíria Grande and Vila Franca de Xira Beneficiaries Association	
Water Utility	**EPAL** – Lisbon Water Supply Utility **Águas Ribatejo** – Ribatejo Water Supply Utility **Águas Santarém** – Santarém Water Supply Utility	
Research institutes	**LNEC** – National Laboratory of Civil Engineering **SPI** – Portuguese Society for Innovation	

Table 12 Sectors and roles of workshop participants

Sector	**Number of participants**	**Role in the workshop***
R&I (Public and Private)	15	E, F
Policy Bodies – Regional / Municipal	4	A; P; S, E

level		
Policy Bodies – National level	5	A; P; S; E
Utilities – Water companies	5	A, S, E
Sector Organizations	4	A, S, E

* A = Stakeholders affected by the problematic conditions of the complex issue
P = Policy makers responsible for designing, approving, implementing solutions
S = Stakeholders relevant to the solutions development
E = Experts
F = Facilitators

8.2. Short summary of workshop including activities

8.2.1. Welcome and Housekeeping

Participants were welcomed, as usual, by BINGO team and invited to have a coffee while socializing with each other. Five Working Tables were previously prepared to accommodate 5 main actors' perspectives: #1 farmers, #2 politicians; #3 decision makers; #4 regulators and #5 citizens. Participants were invited to pick randomly a card corresponding to each actor perspective and to sit at the corresponding table. The facilitator ensured that all participants were familiar with the WSM28 role in the BINGO WS' roadmap and with the participation ethic code. The working day agenda was shared and participants were briefed on the planned interactions and exercises.

8.2.2. BINGO Mulheim Moments

A brief presentation of BINGO Mulheim Annual Meeting moments was introduced and shared by DGADR (Bingo member), from the point of view of a stakeholder participant, focusing on the dynamics of the project and presentations' outputs.

8.2.3. BINGO Share Moment

Then BINGO LNEC team (Teresa Viseu, Manuel Oliveira and André Fortunato) briefed participants about BINGO ongoing activities and results regarding climate predictions.

As in former meetings, this presentation initiated a fruitful debate among all participants regarding the provided information.

8.2.4. *Tagus Research Actionable Living Lab Challenges*

The facilitator briefed the participants on the theme to explore in the Actionable Lab ("*How to push the topic Hydric Resources Management into the Political and Public Agenda?*" *(taking into perspective dimensions such as: institutional; communication, citizenship, schools curricula….)* and helped participants to remember previous co-productions and developed rationale in former WS.

The dynamics of the Actionable Lab were also explained in detail, as participants were expected to co-produce two actionable roadmaps for addressing the topics under discussion: Roadmap #1 for a general Agenda and Roadmap #2 for an actionable and immediate Agenda in the Tagus Site.

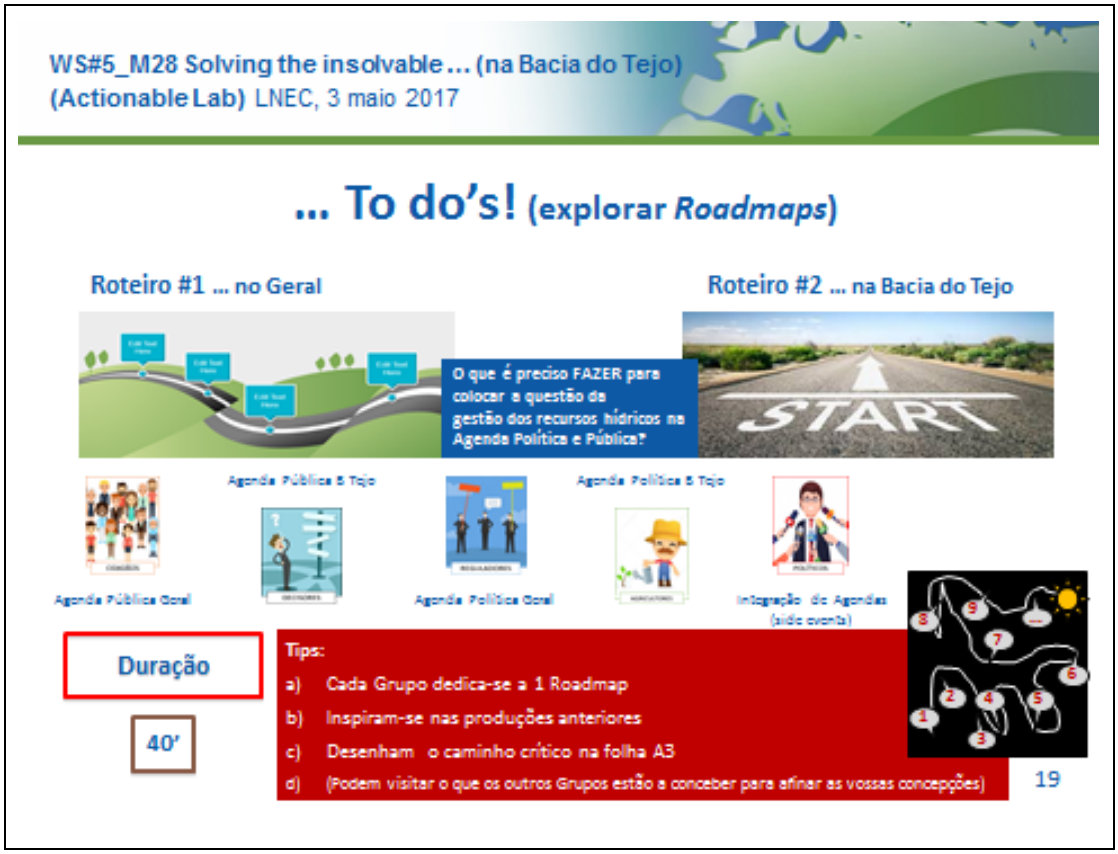
8.2.5. *Exploring the Problem: Roleplaying*

In order to explore the problem, each Working Table was invited to adopt its actor perspective (#1 farmers, #2 politicians; #3 decision makers; #4 regulators and #5 citizens) and to figure out and prepare a roleplaying on "*What would it mean to … (each actor perspective) … to have the Hydric Resources Management into the Political and Public Agenda?"*.

Participants of each Working Table shared their outcomes through a short performance and a Quick Scan of co-productions was settled around the main dimensions to be addressed in roadmaps.

8.2.6. *To do's – exploring actionable roadmaps*

Inspired by previous exercises and previous co-productions, participants in each Working Table were invited to develop an actionable roadmap following a teasing exercise: "What needs to be done in order to effectively put the *Hydric Resources Management into … the Political and Public Agenda?".*



Participants in each Working Table developed a specific roadmap: (i) Citizens: General Public Agenda; (ii) Decision Makers: Tagus Site Public Agenda; (iii) Regulators: General Political Agenda; (iv) Farmers: Tagus Site Political Agenda; and (v) Politicians: Both Agendas' integration (transversal).

8.2.7. *Designing a Roadmap for Another Agenda*

A global Agenda was drafted based on each Working Table contributions and a global discussion and debriefing was developed around common issues and immediate feasible initiatives. Participants also agreed to meet again in early 2018 to continue further on monitoring and developing the Roadmaps.

8.2.8. *WSM28 Evaluation, Tools Assessment and Next Steps*

At the end of the morning working session, participants were invited to review the CoP's Tools used during the five workshops and to contribute to their evaluation (Annex III). Also, participants fulfilled the individual WSM28 evaluation form and were invited to follow BINGO activities and outcomes in the Basecamp Platform. Participants continued on networking interactions during the lunch.

8.3. Short summary of outcomes and results

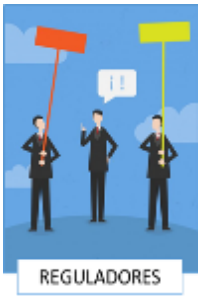
8.3.1. The Problem

"How to push the topic Hydric Resources Management into the Political and Public Agenda?" (taking into account perspective dimensions such as: institutional, communication, citizenship, schools curricula…)

8.3.2. Exploring the Problem

"What would it mean to… (each actor perspective) … have the Hydric Resources Management into the Political and Public Agenda?"

	• Fair dialogue, transparency and clear criteria when dealing with public administration • Projects valued and approved according to water efficient use criteria • Farmers optimize available water management in their daily activities • Research is oriented to farmers' concerns and challenges
	• A Government Task Force around Water concerns involving different Ministers is settled and the President of Republic pays a special attention and dedication to the theme • Investments on new equipment and reconverted/new irrigation solutions are assumed and implemented • Legislation is no more a difficult barrier to act • There is enough and reliable information available to everyone • Spread technical skills are available and supporting both decisions and good practices • Diplomatic Affairs with Spain regarding integrated Water management are a relevant deal and plays a relevant role in the Government Task Force • Critical barriers in order to enhance good and enlarged collaborative governance are identified and solved

	• Good alignment between different decision levels • Enough and reliable information is shared and available to all actors, thus helping joint decisions • Enough and trained Human Resources participate also actively in data collection and a real time monitoring system is a true tool • Decisions are more focused on structural strategic plans than on emergency ones • There are no financial constraints impeding structural investments • There is a reduction of water use conflicts due to better and controlled licenses • Companies decide to invest on public awareness around "water issues" (less water consumption) through a company costumers "open doors" policy and an early age school program support ("the water long path till my tap")
	• Legislation is still a difficult barrier to act, but misguided and confusing interpretations are clarified and reframed in order to enable efficient activities for the sector • There are investments on better and effective monitoring and control tools and means (human resources) • General Investments on facilities support a reduction on water stress and use conflicts
	• Still confused about what real means "water stress", about what people should do to face it, and about what to expect from public administration examples • Tired from "words and words" that common people don't understand • Lessons from ancients and grand-children (learned at the school!) inspired individual actions to take care and to save water • … "if not us, what would happen, when…?" (citizens feel that nobody else does significant things to care about natural resources

The main identified relevant topics and challenges to address were the following:

- *Data & Information* – complementing tacit and technical knowledge to enhance awareness, to deepen perceptions on what can make the difference and to enlarged implication
- *Regulation & Social Rules* – enabling better understanding, actions and control
- *Structural Investments in facilities & human resources* – supporting structural approaches instead of "reactive" and "emergency" ones

- *Communication* – exploring social networks and traditional "coffee corners" settings and innovating through "experimental" and "face-to-face" learning moments

8.3.3. *To do's – exploring actionable Roadmaps*

The following Roadmaps have been designed:

For a General Political Agenda:

1. To propose a regular Government Ministers Council dedicated to water issues
2. To activate the National Council for Water
3. To stress a review of the actual legislation
    a. Identification of problems and needs near main actors and related sectors
    b. Benchmarking of best regulation practices
    c. Scenarios Design on implementing impacts considering different solutions (i.e., minimum levels; *pro rata* solutions; general data sharing, etc…)
    d. Use of a design thinking approach
4. To create a Water Join Force near different sectors (media, political forces, economic agents and citizen organizations)
5. To involve the Environment Ministry to stress an inventory of water uses and availabilities
6. To involve the Economy Ministry to stress investments in water start-ups and in real time monitoring innovation technology
7. … To invite the President of Republic to participate in a BINGO Workshop!

For a Political Agenda in Tagus Site

1. To stress a "regime pact" around water issues in the region
2. To reduce conflicts of use stress by a join force to overlap legislation struggles and responsibilities' clarification (i.e., in VALA Real)
3. To promote a discussion in the region around the social and economic values of water
4. To discuss the irrigation qualification and possible investments in water storage capacity

5. To map possible Mini-Hydric solutions implementation

For a General Public Agenda

1. To propose the integration of “water issues” in the school curricula (in a similar way as to recycling issues)
    a. Training on “water issues” for teachers
    b. Didactic and friendly learning materials production
2. To promote an “H2-School Context” (engaging all school community towards a more efficient water use)
3. To promote “H2 Weeks” for children and families (i.e. Summer Camps) near water spots (i.e. Castelo de Bode Dam, rivers) and around water diverse uses experiences (i.e. agriculture)
4. To promote a Senior H2-School
5. To engage utilities in promoting a “Water Saving” National Context
6. To promote a “Water Cycle Citizen Curator” Price, sponsored by the President of Republic
7. To promote “water issues” near “water sports” activities
8. To ensure more investment from public and private actors in water communication and awareness-raising programs

For a Public Agenda in Tagus Site

1. To promote a “Water Day” in local schools (“Our Water, Our River”)
2. To promote public visits/tours to the Tagus River and its water infrastructures
3. To prepare a multimedia product around water issues, resources and uses in the region
4. To implement a “Water GEOcaching” in the region
5. To promote public debates around water issues joining different actors (water utilities, citizens, farmers, researchers, …) “let’s talk about water!”
6. To promote an integrated awareness-raising Campaign - “Save Water, Save your Day” (advertising panels, ATM machines, water bills, local radios and press, municipal newsletters; social networks, morning TV programs, …)

8.3.4. Additional Comments

This workshop profits a lot from former co-productions and already installed interactions between participants, but also occurred in a particular moment in Portugal

and Lezíria do Tejo where the population still griefs and debates the heavy impacts of big fires during late Summer. Also a “severe drought” situation was announced by public authorities and emergency initiatives were marking a public debate and daily concerns. Therefore, the question adopted for this actionable lab, the BINGO so far moment, the debate and the co-productions resulted in an increased engagement and interest from participants. The focus in the real question and concrete actions in a high collaborative and creative environment was also very valued and stimulated to be continued. At the end of this Workshop it was decided that besides this report, an executive summary (in Portuguese language) should be produced with the main CoP co-productions and with the first roadmap designs in order to support high-level contacts/meetings with decision makers and politicians. It was also suggested that some of the ideas of the Roadmap for the Tagus Site should be developed and implemented engaging local stakeholders, even as an experimental model.

9. CONCLUSIONS

An interim portfolio of actionable research problems was developed in the Deliverable 6.6. The actionable research labs accommodated in the workshops across BINGO research sites enabled researchers and non-researchers to work together in real time and address 'unsolvable' problems, already identified in previous workshops that require further attention and actions.

In Veluwe, the participants agreed that the 'wetting' and 'drying', and in particular the increasing difference in both conditions of the edges of Veluwe, is the hardest problem to tackle. The problem requires specific actions from a broad range of different actors such as the provision of data on the status brooks and streams, water balance analyses and the study of the impact of CO2 storage through biomass. In Bergen, the main objective was to mobilize citizens to provide information on urban drainage systems and water resources through a digital platform that is currently developed. The 'unsolvable' problem in the Troodos research system was to investigate the role of desalinated water as an adaptation option for securing the domestic water supply of the rural communities in the downstream area of Peristerona Watershed. Participants agreed that the net outcome of using desalinated water is positive for the communities and inhabitants of Nicosia. Two complex problems were investigated in the Wupperverband research system related to weather extremes impacts, namely, "too much water - flooding caused by heavy rainfall" in the Wuppertal region and "not enough water - ensuring security of supply" in the Great Dhünn dam area. This resulted in several actionable adaptation options such as the use of green and other public areas as retention areas, the merger of the water associations into a single network, the reduction of evaporation from the water surface of the dam and educational activities. The inclusion of the hydric resources management into the political and public agenda was the 'unsolvable' problem addressed in the Tagus research site. To effectively include the hydric resources management in the political and public agenda participants took into account perspective dimensions (e.g., institutional, communication and citizenship) and designed four roadmaps: a general political agenda, a political agenda for Tagus, a general public agenda and a public agenda for Tagus.

In all workshops, specific opportunities and barriers for the implementation of the suggested solutions as well as key actors to promote these solutions were identified. Future activities and workshops have been already planned for the finalisation of the implementation plan of the tested solutions.

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ANNEX I – LIST OF WORKSHOPS PARTICIPANTS

List of Veluwe workshop participants

No	First name, surname	Organization
1	Cees Collé	Provincie Gelderland
2	Emmy Bergsma	KWR Water
3	Erik Klein Lebbink	Staatsbosbeheer
4	Flip Witte	KWR Water
5	Henk-Jan van Alphen	KWR Water
6	Jolijn van Engelenburg	Vitens
7	Marcel Vossestein	
8	Rino Jans	Bosgroepen
9	Sjoerd Rijpkema	Vitens
10	Suzanne Buil	Provincie Gelderland
11	Teun Spek	Provincie Gelderland
12	Wim Zeeman	Stichting sprengen en beken
13	René Holdert	Gelders Particulier Grondbezit
14	Wietse Bruggink	Provincie Gelderland

List of Bergen workshop participants

No	First name, surname	Organization
1	Marit Aase	Agency for Water and Sewerage Works
2	Monica Jackson	University of Bergen
3	Frode Krydsby	Agency for Planning and Building Services
4	Jan Ove Strand	Agency for Planning and Building Services
5	Rolf William Rasmussen	Resident
6	Helge Hellevik	Resident
7	Erle Kristvik	Norwegian University of Science and Technology
8	Tone Muthanna	Norwegian University of Science and Technology
9	Torstein Dalen	Agency for Water and Sewerage Works
10	Per Vikse	Department of Climate, Culture, and Business Development
11	Svein Petter Kveim	Agency for Planning and Building Services
12	Beate Høgh	Agency for Water and Sewerage Works
13	Gunn Breisnes	Agency for Water and Sewerage Works
14	Ingunn Renolen	Agency for Planning and Building Services
15	Mary Økland	BSBI
16	Nazia Zia	Agency for Water and Sewerage Works
17	Magnar Sekse	Agency for Water and Sewerage Works

List of Troodos workshop participants

No	Mr./Ms	First name, surname	Stakeholder characterization: Affiliation & Institution
1	Ms	Adriana Bruggeman	Researcher; The Cyprus Institute
2	Ms	Agathi Hadjipanteli	Executive engineer; Water Development Department
3	Mr.	Ayis Iacovides	Consultant; IACO Ltd
4	Mr.	Aris Konstantinou	Community Leader; Astromeritis Village
5	Mr.	Elias Giannakis	Researcher; The Cyprus Institute
6	Mr.	George Demetriou	Technical Manager; Water Board of Nicosia
7	Mr.	George Zittis	Researcher; The Cyprus Institute
8	Mr.	Marios Mouskountis	Consultant; IACO Ltd
9	Mr.	Ntinos Poullis	Executive engineer; Water Development Department
10	Ms	Panayiota Hadjigeorgiou	Executive engineer; Water Development Department
11	Mr.	Christos Christofi	Hydrogeologist; Geological Survey Department
12	Mr.	Christos Zoumides	Researcher; The Cyprus Institute

List of Wupperverband workshop participants

No.	Institution	Vorname	Nachname	Unterschrift
1	Bezirksregierung Köln	Madeleine	Berkemeier	
2	Stadt Wuppertal	Ute	Bücker	
3	InterSus	Stefan	Görlitz	
4	Rheinisch-Westfälisches Institut für Wasserforschung GmbH (IWW)	Andreas	Hein	
5	Wupperverband	Daniel	Heinenberg	
6	WSW Energie & Wasser AG	Markus	Klemann	
7	Wupperverband	Torsten	Klingenhoff	
8	Technische Betrieb Solingen (TBS)	Tycho	Kopperschmidt	
9	Rheinisch-Westfälisches Institut für Wasserforschung GmbH (IWW)	Juliane	Koti	
10	Bergisches Energiekompetenzzentrum	Lara	Lehnstaedt	
11	Wupperverband	Alexander	Löcke	
12	Wupperverband	Paula	Lorza	entschuldigt
13	Wupperverband	Thorsten	Luckner	
14	Bezirksregierung Düsseldorf	Bruno	Meyer	
15	Technischen Betriebe der Stadt Leverkusen (TBL)	Simone	Möller	
16	Bergisches Energiekompetenzzentrum	Simon	Möser	
17	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen (LANUV)	Nicole	Müller	
18	Wupperverband	Peter	Nieland	

No.	Institution	Vorname	Nachname	Unterschrift
19	Verbraucherzentrale NRW e.V.	Fatma	Öksüz	
20	Bezirksregierung Köln	Lars	Plewa	
21	Stadt Remscheid	Marc	Riehmer	
22	Wupperverband	Marc	Scheibel	
23	Rheinisch-Westfälisches Institut für Wasserforschung GmbH (IWW)	Clemens	Strehl	
24	Stadt Wuppertal	Susanne	Varnhorst	
25	Kommunal Agentur NRW GmbH	Stefan	Vöcklinghaus	
26	Wasserversorgungsverband Rhein-Wupper	Günter	Wasserfuhr	
27	WSW Energie & Wasser AG	Jens	Antz	

Mit meiner Unterschrift erkläre ich mich damit einverstanden, dass Fotos, die während der heutigen Veranstaltung gemacht werden, für Zwecke der Veranstaltungsberichterstattung und allgemeinen Öffentlichkeitsarbeit in verschiedenen Medien veröffentlicht werden.

28	UWB Wpt	Frenk	Lupnik	
29	SD Natur + Umwelt SS	Komossa	Elena	Komossa
30	UWB W'tal	Hasert	Nabil	

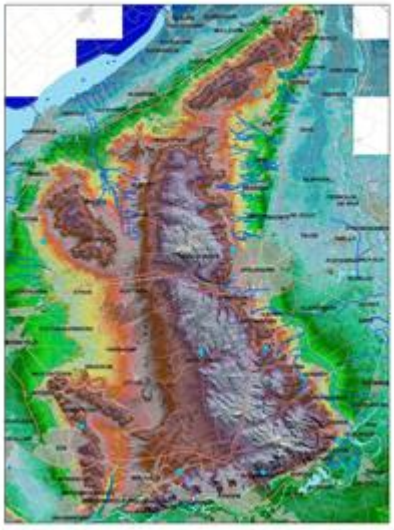
List of Tagus workshop participants

Name	Organization	5th Tagus WS 16th of Nov 2017
Sónia Pinto	Águas de Santarém	X
Paulo Machado	Águas de Santarém	X
Inês Matos	Águas do Ribatejo	X
José Gervásio	Águas do Ribatejo	X
Isabel Maria Guilherme	ARH/Tejo - APA	X
Helena Alves	ARH/Tejo - APA	X
Catarina Madaleno	ABLGVFX	X
Pedro Vaz	ABLGVFX	X
João Alves Moreira	ABL	X
Alexandra Brito	CAP	X
Natasha Oliveira	CIMLT	X
Alberto Freitas	DGADR	X
Claudia Brandão	DGADR	X
Vasco Costa	DRAP_LVT	X
Basílio Martins	EPAL	X
Margarida Monte	ERSAR	X
Paula Freixial	ERSAR	X
Vanda Pires	IPMA	X
Ana Estela Barbosa	LNEC	X
André Fortunato	LNEC	X
Elsa Alves	LNEC	X
Fernanda Rocha	LNEC	X
João Craveiro	LNEC	X
Manuel Oliveira	LNEC	X
Maria João Freitas	LNEC	X
Maria José Henriques	LNEC	X
Paula Freire	LNEC	X
Rafaela Matos	LNEC	X
Sheila Holz	LNEC	X
Silvia Amaral	LNEC	X
Solange Mendes	LNEC	X
Teresa Viseu	LNEC	X
Rita Andrade	SPI	X

ANNEX II – WORKSHOPS PRESENTATIONS

Veluwe workshop presentations

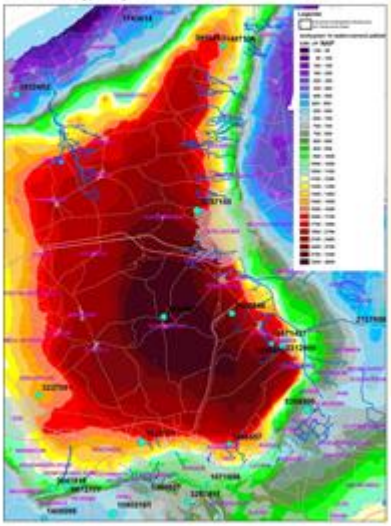
Hydrogeological setting



3

Hydrogeological setting

Veluwe Isohypsen jaren 90 in cm NAP



4

Water balance Veluwe

Veluwe surface area 125000 ha

Rain 830 mm/j – 1037 Mm^3/j

Error of 20 %

5

Site Characteristics Summary

- Slow responding system due to deep groundwater levels
- Sensitive to changes in land use and climate because evaporation is large and the variation in evaporation between different land covers is large
- Potential conflicts between drinking water and nature
- Strategic groundwater reservoir for the Netherlands

Relate changes in groundwater levels to:

- Service continuity
- Veluwe streams
- Groundwater levels for nature

6

Veluwe Lysimeter station

6 lysimeters in heather

Veluwe Lysimeter Station

7

Evapotranspiration by trees

Pot experiment (179 trees)

- Aim: to improve evapotranspiration numbers of coniferous and deciduous trees.
- 10 different tree species
- Semi-controlled conditions using automated subsoil irrigation.

8

Model simulations

Historical scenarios (3)	Recent past (1)	Near Future (27)	Climate Scenarios (2)
Projecttions e.g.: around 1750 around 1850 around 1950	1980 – 2015	2015 – 2024 5 x current L & W = 5 5 x 1 L scenario's = 6 5 x 1 W scenario's = 6 5 x 4 combi L&W = 12	Temperate 2050, 2100 Warm 2050, 2100

9

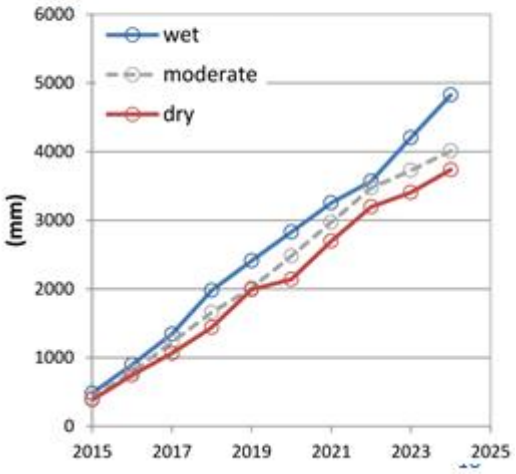
Decadal prediction based on WP2

Potential groundwater recharge

Difference dry and wet:

+- 1000 mm (25%),

2.5 years of recharge

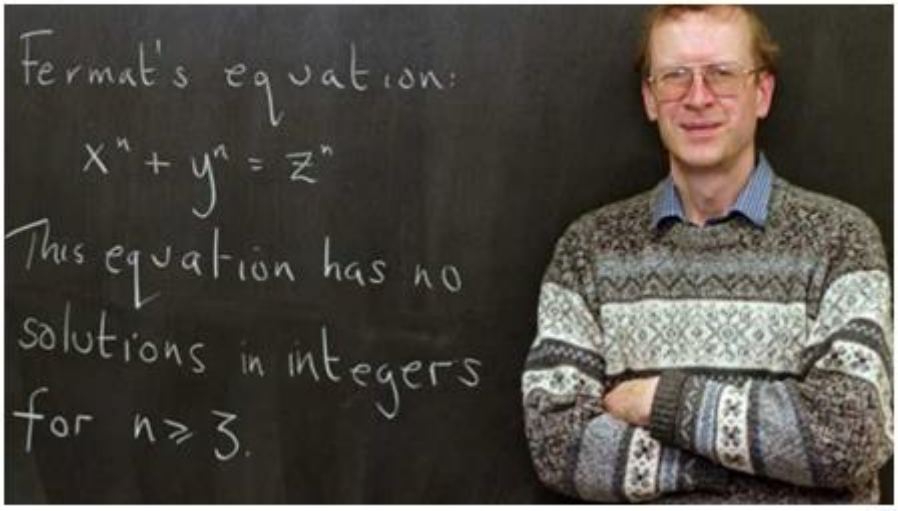


Outlook for year 3

1. Update evapotranspiration model.
2. Simulations with WP2 data (recent past and near future).
3. Combine near future simulations with water and land use scenario's.

11

"Solving the Unsolvable"



12

Bergen workshop presentations

BINGO
a better future under
CLIMATE CHANGE

The BINGO project has received funding from the European Union's Horizon 2020 Research and Innovation programme, under the Grant Agreement number 641739.

M28 Workshop:
"Solving the unsolvable"

Agenda

12.00-12.15:	Introduksjon – Mål for dagen
12.15-13.00:	Utforske og definere problemstilling
13.00-13.15:	Kaffe/benstrekk
13.15-14.00:	Idemyldring: Løsning
14.00-14.15:	Kaffe/benstrekk
14.15-15.00:	Prototype og konseptualisering
15.00-15.05:	Kaffe/benstrekk
15.05-15.50:	Testing av løsning
15.50-16.00:	Konklusjoner/Evaluering

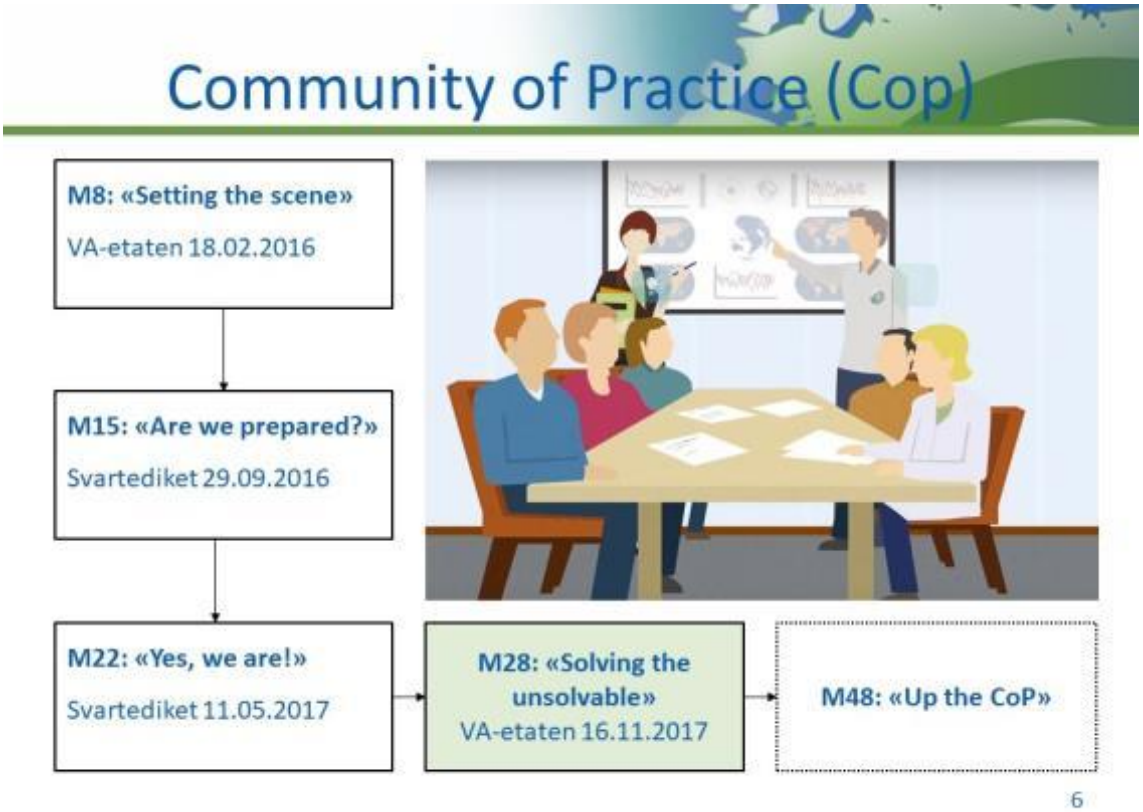
2

Program for dagen

1. **Introduksjon – mål for dagen**
2. Problemformulering
3. Idémyldring: hva er mulige løsninger?
4. Planlegging av løsningen
5. Test av løsning

3


BINGO
a better future under CLIMATE CHANGE
Bringing INnovation to onGOing Water Management
Funded by Horizon 2020
Coordinated by LNEC - Portugal
WP1
Koordinering
WP2 - Klima
Klimaprojeksjoner og nedskalering
WP3 – Hydrologi
Analyse av vannets kretsløp
WP4 - Risiko
Konsekvenser av ekstremvær
WP5 - Strategi
Tilpasningstiltak og strategier
WP6
Anvendbar forskning!
WP7
Formidling og kommunikasjon
The BINGO project has received funding from the European Union's Horizon 2020 Research and innovation programme, under the Grant Agreement number 641739.


Community of Practice (Cop)
M8: «Setting the scene»
VA-etaten 18.02.2016
M15: «Are we prepared?»
Svartediket 29.09.2016
M22: «Yes, we are!»
Svartediket 11.05.2017
M28: «Solving the unsolvable»
VA-etaten 16.11.2017
M48: «Up the CoP»
6

BINGO objective Bergen

Preparation of urban drainage systems to **avoid CSO** during **extreme precipitation conditions**

7

Hvor vi slapp sist....

Tiltak (ID)	Beskrivelse
M I	Reservoarer og flomveier for utjevning av flomtopp (ved ekstrem nedbør og fare for ødeleggelser/skader)
M II	**Beboerinnvolvering for innhenting av informasjon**
M III	Separering av fellessystem
M IV	"Takrenneprinsippet" - Løvstien: separat vannvei for å lede rent vann fra fjell til fjord
M V	Kontinuerlig måling av vannkvalitet (resipient)
M VI	Blågrønne overvannsløsninger
M VII	Redusere infiltrasjon/innlekk til avløpssystem og antall ulovlige påkoblinger

8

«Solving the unsolvable»

Hvordan lykkes med beboerinnvolvering?

9

Program for dagen

1. Introduksjon – mål for dagen
2. **Problemformulering**
3. Idémyldring: hva er mulige løsninger?
4. Planlegging av løsningen
5. Test av løsning

10

Øving 1

- Utforske og definere problemet
  - Hvorfor er det et problem?
  - Hva forårsakes problemet av?
  - Hva er konsekvensene av problemet?

  - Hvem er involvert?
  - Hvem taper / hvem vinner?

11

Øving 2:

- Idémyldring: Løsninger
  - Alle løsninger er gode
  - Skrives opp på et stort ark

  «Valg» av løsninger (rangering)

  Valg av løsning for videre arbeid

12

Øving 3:

Løsning: Konsept

- Mindre grupper
- Hva innebærer løsningen:
  - Aktiviteter
  - Personer

Post-its på A0 – tegn interraksjoner?

13

Øving 4

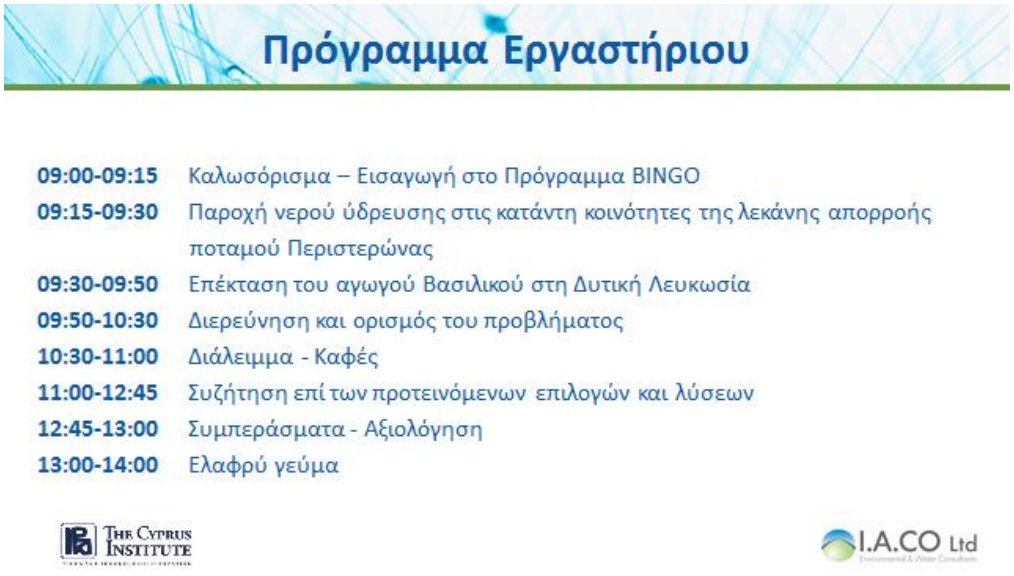
- Suksesskriterier for løsningen?
  - Når er vi fornøyde?

14

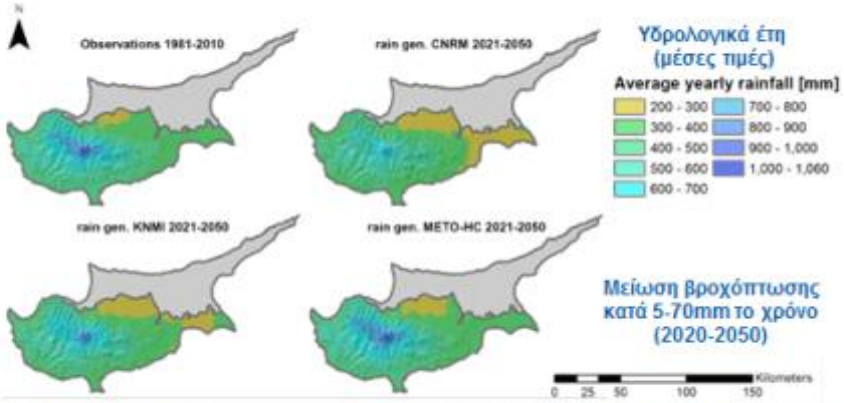
BINGO PARTNERS

15

Troodos workshop presentations



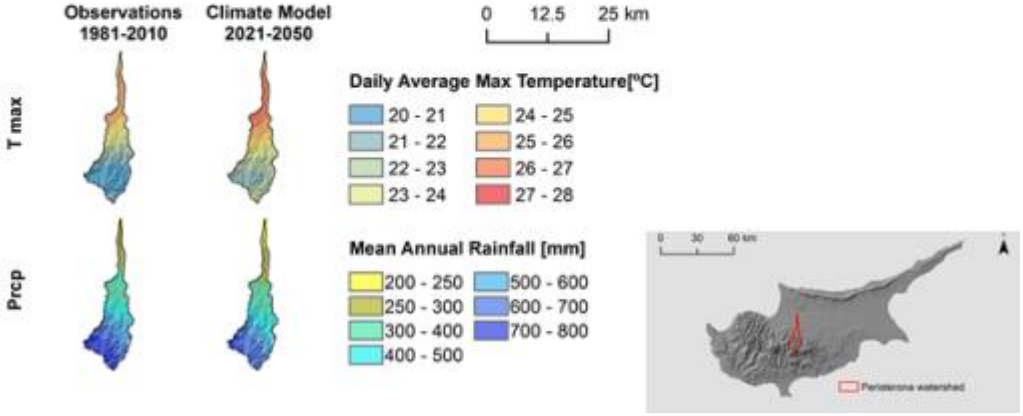
Στόχοι του BINGO



- Αξιολόγηση επιπτώσεων των κλιματικών αλλαγών και η επίδραση τους σε βασικούς τομείς όπως τα νοικοκυριά (ύδρευση) και η γεωργία (άρδευση)

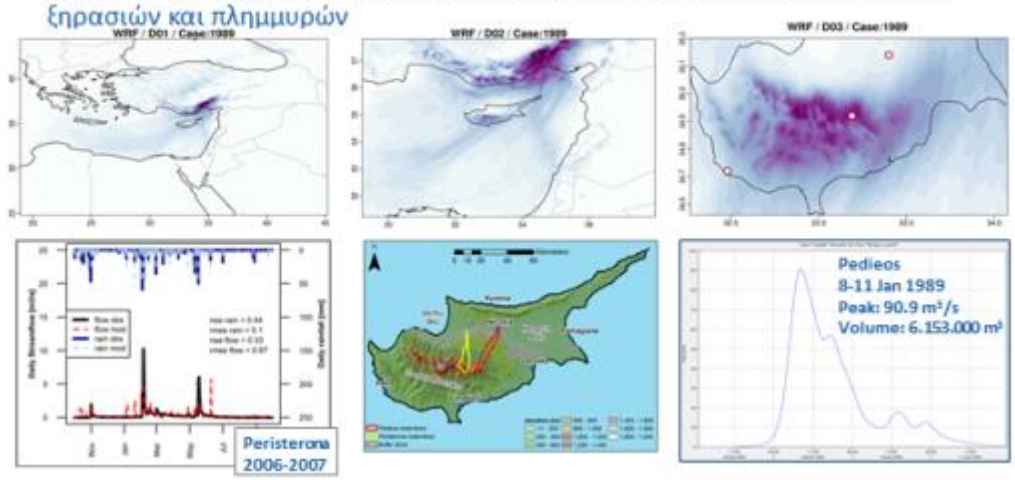
Στόχοι του BINGO

- Βελτίωση κλιματικών προβλέψεων σε τοπικό επίπεδο



Στόχοι του BINGO

- Δυναμική υποκλιμάκωση των κλιματικών δεδομένων για την μοντελοποίηση ξηρασιών και πλημμυρών



Στόχοι του BINGO

- Εμπλοκή των χρηστών νερού για καλύτερη κατανόηση των προκλήσεων που αφορούν τους υδάτινους πόρους
- Διερεύνηση και ιεράρχηση μέτρων προσαρμογής και διαχείρισης των κίνδυνων όπως η ξηρασία

Παρακολούθηση ροών σε συνεργασία με ΤΑΥ

Παρακολούθηση εμπλουτιστικών έργων σε συνεργασία με το ΤΑΥ & ΤΓΕ

Παρακολούθηση ροών νερού στο δάσος σε συνεργασία με το Τμήμα Δασών

1η Συνάντηση: Φεβρουάριος 2016

- Αναγνώριση κίνδυνων σχετικά με τις κλιματικές αλλαγές
  - Άρδευση
  - Ύδρευση
- Η **ξηρασία** (μείωση βροχόπτωσης) αποτελεί το βασικότερο κίνδυνο για τις δυο αυτές χρήσεις νερού στις κοινότητες του Ποταμού Περιστερώνας

The Cyprus Institute

I.A.CO Ltd

Συνεντεύξεις: Ιούνιος 2016

- 6 συνεντεύξεις σχετικά με την πολιτική και τη διακυβέρνηση των υδάτινων πόρων
  - **3 κοινοτάρχες (ύδρευση)**, 2 αρδευτικά τμήματα, **1 κοινοτάρχης (ανακυκλωμένο)**
- Πολίτικες & αρμοδιότητες: ξεκάθαρες & δουλεύουν σωστά
- Εξάρτηση από υπόγειο νερό για ανάγκες άρδευσης & ύδρευσης
- **Ύδρευση**: επαρκείς ποσότητες για κάλυψη αναγκών, επιπλέον γεωτρήσεις για έκτακτη ανάγκη. Η ζήτηση στη Κάτω Μονή είναι στα όρια της προσφοράς.
- **Ανακυκλωμένο νερό**: νέα πηγή για άρδευση

The Cyprus Institute

I.A.CO Ltd

2η Συνάντηση: Σεπτέμβριος 2016

- Αναγνώριση και ιεράρχηση υφιστάμενων και πιθανών μέτρων αντιμετώπισης της ξηρασίας

3η Συνάντηση: Μάιος 2017

- Θέματα διακυβέρνησης των μέτρων αντιμετώπισης της ξηρασίας (ρόλοι, αρμοδιότητες, πόροι)
- Καθορισμός κριτηρίων για την αξιολόγηση των κοινωνικοοικονομικών επιπτώσεων των μέτρων προσαρμογής

Στόχοι της σημερινής συνάντησης

Οι στόχοι της σημερινής συνάντησης είναι:

- Η διερεύνηση του ρόλου του νερού αφαλάτωσης στην διασφάλιση της παροχής νερού ύδρευσης στις κοινότητες
- Η αναγνώριση και διερεύνηση πιθανών συμπληρωματικών λύσεων

Τμήμα Αναπτύξεως Υδάτων

Συνοπτική Παρουσίαση
Αγωγού Βασιλικού – Λευκωσίας ΤΑΥ

Παναγιώτα Χατζηγεωργίου
Ανώτερη Εκτελεστικός Μηχανικός
Προϊστάμενη Υπηρεσίας Προγραμματισμού

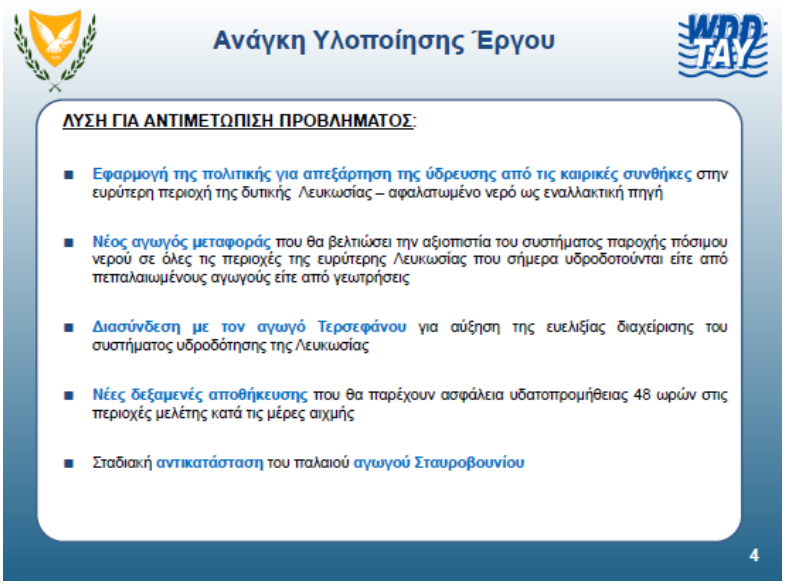
23 Νοεμβρίου 2017

Περιεχόμενα

- Ανάγκη Υλοποίησης του Έργου
- Συνοπτική Περιγραφή
- Πρόοδος Εργασιών
- Αναμενόμενα Αποτελέσματα

2


Ανάγκη Υλοποίησης Έργου
Υφιστάμενη Κατάσταση:
Η Λευκωσία υδροδοτείται από τον αγωγό Τερσεφάνου και από τον αγωγό Σταυροβουνίου.
Απουσία εναλλακτικής πηγής υδροδότησης - ευάλωτη η ασφάλεια ύδρευσης σε περίπτωση τεχνικής αστοχίας του σημερινού συστήματος παροχής πόσιμου νερού
Ο αγωγός Σταυροβουνίου είναι πεπαλαιωμένος και παρουσιάζει προβλήματα με την εσωτερική επικάλυψη – μπορεί να επηρεάσει την ποιότητα του νερού
Οι δήμοι Λακατάμιας και Τσερίου υδροδοτούνται από τον αγωγό Μαζέρα
Ο αγωγός Μαζέρα είναι πεπαλαιωμένος με περιορισμένη παροχετευτικότητα που στο μέλλον θα αδυνατεί να καλύψει τις ολοένα αυξανόμενες ανάγκες σε νερό
Οι 28 Κοινότητες της δυτικής Μεσαορίας και ημιορεινής Λευκωσίας υδροδοτούνται ως επί το πλείστον από γεωτρήσεις, μερικές από τα ταχυδιυλιστήρια Ταμασού και Κλήρου, κάποιες από τον αγωγό Περιστερώνας
Απουσία εναλλακτικής πηγής υδροδότησης – πρόβλημα ασφάλειας ύδρευσης (ποιοτικά και ποσοτικά)
Επιδείνωση του προβλήματος λόγω της κλιματικής αλλαγής (μειωμένη απόδοση γεωτρήσεων, χειροτέρευση της ποιότητας)
Περιορισμένη παροχετευτικότητα αγωγών – συχνά προβλήματα λειτουργίας
ΛΕΥΚΩΣΙΑ
ΛΑΡΝΑΚΑ
ΛΕΜΕΣΟΣ
3


Ανάγκη Υλοποίησης Έργου
ΛΥΣΗ ΓΙΑ ΑΝΤΙΜΕΤΩΠΙΣΗ ΠΡΟΒΛΗΜΑΤΟΣ:
Εφαρμογή της πολιτικής για απεξάρτηση της ύδρευσης από τις καιρικές συνθήκες στην ευρύτερη περιοχή της δυτικής Λευκωσίας – αφαλατωμένο νερό ως εναλλακτική πηγή
Νέος αγωγός μεταφοράς που θα βελτιώσει την αξιοπιστία του συστήματος παροχής πόσιμου νερού σε όλες τις περιοχές της ευρύτερης Λευκωσίας που σήμερα υδροδοτούνται είτε από πεπαλαιωμένους αγωγούς είτε από γεωτρήσεις
Διασύνδεση με τον αγωγό Τερσεφάνου για αύξηση της ευελιξίας διαχείρισης του συστήματος υδροδότησης της Λευκωσίας
Νέες δεξαμενές αποθήκευσης που θα παρέχουν ασφάλεια υδατοπρομήθειας 48 ωρών στις περιοχές μελέτης κατά τις μέρες αιχμής
Σταδιακή αντικατάσταση του παλαιού αγωγού Σταυροβουνίου
4


Γενική Διάταξη Έργου Αγωγός Βασιλικού-Λευκωσίας
Μάμμαρι
Αστρομερίτης
Δεξαμενή ΣΥΛ
Μιτερό
Καμπιά
Νήσου
Καπέδες
Δεξαμενή Σταυροβουνί
Διυλιστήριο Χοιροκοιτίας
Κοφίνου
Μονάδα Αφαλάτωσης Βασιλικού
ΛΕΜΕΣΟΣ
ΛΑΡΝΑΚΑ
Μήκος Αγωγού: 167 Km
Παροχετευτικότητα: 60.000 m³/ημέρα
Υλικό : Ελατός Χυτοσίδηρος (DI)
Διάμετρος : 800-300 mm
Σενάριο κανονικής λειτουργίας αγωγού
Παροχή 30.000m³/ημέρα στο ΣΥΛ και 22.000 m³/ημέρα στις 28 Κοινότητες
Σενάριο Εκτακτης ανάγκης
Παροχή 52.000m³/ημέρα στο ΣΥΛ (σε περίπτωση τεχνικού προβλήματος στον αγωγό Τερσεφάνου)

Έργο Αγωγός Βασιλικού – Φάση Α

Το Έργο υποδιαιρείται σε δύο φάσεις και σε διάφορα επί μέρους αυτόνομα τμήματα τα οποία δύνανται να προσφοροδοτηθούν ξεχωριστά

- **Φάση Α** (Συνολική διάρκεια 29 μήνες) περιλαμβάνει:
  - **Τελική Μελέτη** της Φάσης Α και **Κατασκευή** σε τρία τμήματα:
  - **Τμήμα 1**: Χοιροκοιτία – Σταυροβούνι,
    - Διάρκεια 16 μήνες
    - Αγωγός (16Km, 800mm, DI)
    - Δεξαμενή Χοιροκοιτίας (10.000m³)
    - Δεξαμενή Σταυροβουνίου (10.000m³)
    - Αντλιοστάσιο Κοφίνου
  - **Τμήμα 2:** Σταυροβούνι – Νήσου – Καμπιά
    - Διάρκεια 14 μήνες
    - Αγωγός (30Km, 800-300mm, DI)
    - Δεξαμενή Καμπιά (1.200m³)
    - Αντλιοστάσιο Νήσου
  - **Τμήμα 3**: Νήσου -Λευκωσία
    - Διάρκεια 14 μήνες
    - Αγωγός (23Km, 800mm, DI)
- Η κατασκευή του τμήματος του αγωγού από τη Μονάδα Αφαλάτωσης Βασιλικού μέχρι το Διυλιστήριο Πόσιμου Νερού Χοιροκοιτίας έχει ήδη ολοκληρωθεί από το ΤΑΥ

Έργο Αγωγός Βασιλικού – Φάση Β

Φάση Β (διάρκεια 4 χρόνια)

Κατασκευαστικές εργασίες:

- **Τμήμα 4**: Ταμασός- Κλήρου
- Διάρκεια 25 μήνες
- Αγωγός 42Km
- Αντλιοστάσιο Καμπιών
- Αντλιοστάσιο Αρεδιού

- **Τμήμα 5**: Δυτική Μεσαορία
- Διάρκεια 29 μήνες
- Αγωγός 53Km
- Δεξαμενή Λακατάμιας 2.500m³
- Δεξαμενή Δυτικής Μεσαορίας 1.200m³
- Αντλιοστάσιο Λακατάμιας
- Αντλιοστάσιο Ακακίου

Αποτελέσματα Μελέτης Βιωσιμότητας

- Η Μελέτη Βιωσιμότητας ολοκληρώθηκε από το ΤΑΥ με τη βοήθεια της Ευρωπαϊκής Τράπεζας Επενδύσεων (ΕΤΕ) και εξέτασε τρία εναλλακτικά σενάρια – Σενάριο 1: Πλήρης ανάπτυξη του Έργου, Σενάριο 2: Να μην κάνουμε τίποτα, Σενάριο 3: Να κάνουμε το ελάχιστον, και κατέδειξε ως βέλτιστη επιλογή το Σενάριο 1, με κεφαλαιουχική δαπάνη περίπου €56 εκ.

- Εξέταση εφικτότητας έργου - Χρηματοοικομομική ανάλυση (ταμειακών ροών, πηγών χρηματοδότησης, δαπανών επένδυσης και λειτουργίας & συντήρησης)

  Χρηματοοικονομικοί Δείκτες (i=4%)
  - Καθαρή Παρούσα Αξία (FNPV) = € (91.5)εκ.
  - Εσωτερικός Βαθμός Απόδοσης (FRR) = -25%

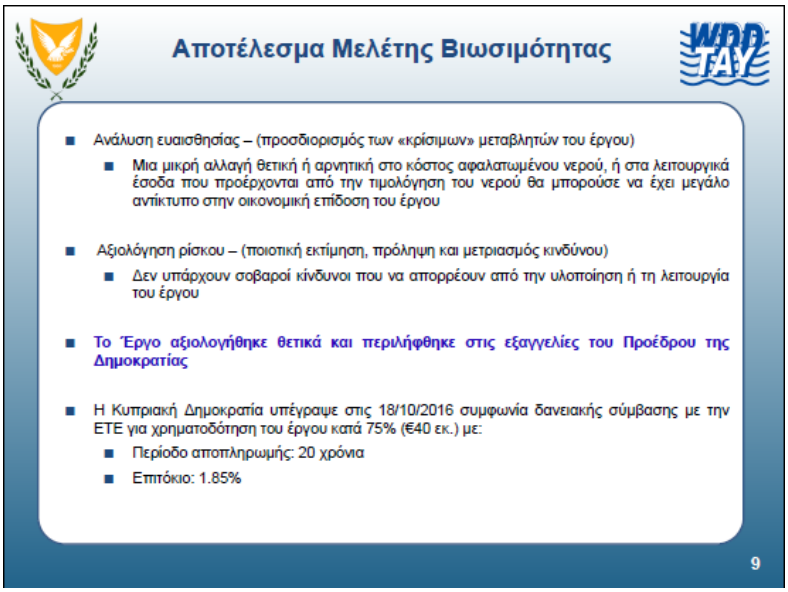
  → Απαιτείται χρηματοδότηση για να είναι το έργο οικονομικά βιώσιμο

- Αξιολόγηση συμβολής έργου στην οικονομική ευημερία της περιοχής (συνυπολογίζονται και τα κοινωνικά οφέλη / κόστη από την πραγματοποίηση της επένδυσης)

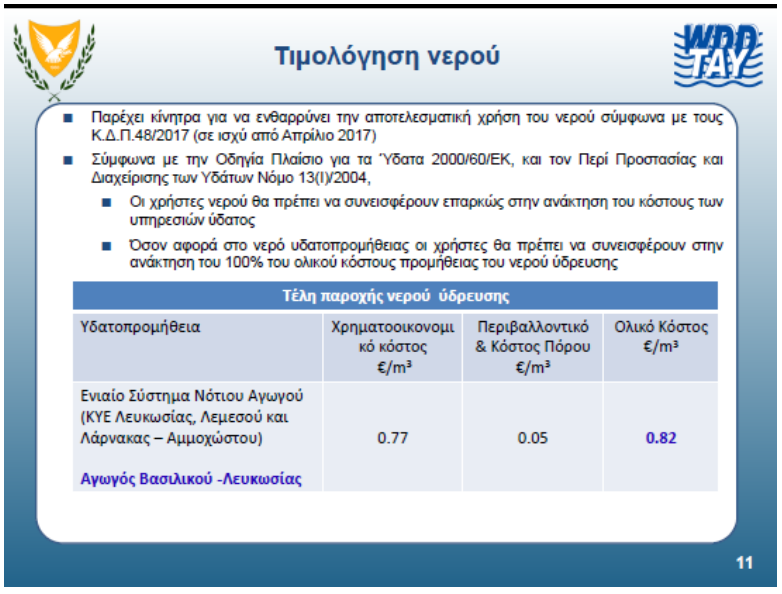
  Δείκτες Οικονομικής Επίδοσης (i=5%)
  - Καθαρή Παρούσα Αξία (ENPV) = € 80.6εκ.
  - Εσωτερικός Βαθμός Απόδοσης (EIRR) = 14,9%
  - Λόγος Οφέλους-Κόστους = 1,3

  → Το έργο συμβάλλει στους στόχους της περιφερειακής πολιτικής της ΕΕ και συνάδει με τη στρατηγική

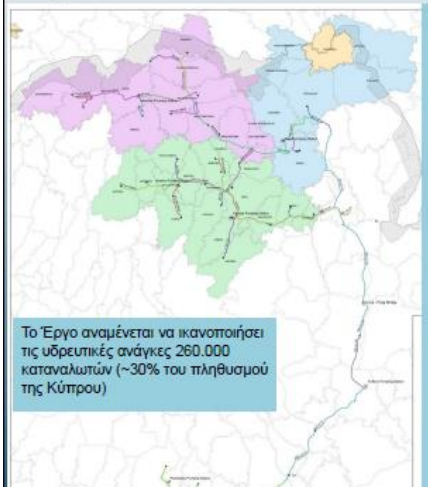
8


Αποτέλεσμα Μελέτης Βιωσιμότητας
Ανάλυση ευαισθησίας – (προσδιορισμός των «κρίσιμων» μεταβλητών του έργου)
Μια μικρή αλλαγή θετική ή αρνητική στο κόστος αφαλατωμένου νερού, ή στα λειτουργικά έσοδα που προέρχονται από την τιμολόγηση του νερού θα μπορούσε να έχει μεγάλο αντίκτυπο στην οικονομική επίδοση του έργου
Αξιολόγηση ρίσκου – (ποιοτική εκτίμηση, πρόληψη και μετριασμός κινδύνου)
Δεν υπάρχουν σοβαροί κίνδυνοι που να απορρέουν από την υλοποίηση ή τη λειτουργία του έργου
Το Έργο αξιολογήθηκε θετικά και περιλήφθηκε στις εξαγγελίες του Προέδρου της Δημοκρατίας
Η Κυπριακή Δημοκρατία υπέγραψε στις 18/10/2016 συμφωνία δανειακής σύμβασης με την ΕΤΕ για χρηματοδότηση του έργου κατά 75% (€40 εκ.) με:
Περίοδο αποπληρωμής: 20 χρόνια
Επιτόκιο: 1.85%
9


Πρόοδος Εργασιών
ΦΑΣΗ Α
Η Οριστική Μελέτη και τα κατασκευαστικά σχέδια της Φράσης Α αναμένεται να ολοκληρωθούν εντός Νοεμβρίου 2017 (Σύμβαση ΤΑΥ15/2015)
Η Μελέτη Εκτίμησης των Επιπτώσεων στο Περιβάλλον ετοιμάστηκε και υποβλήθηκε στην Περιβαλλοντική Αρχή (Σύμβαση ΥΠ1/2017). Αναμένεται γνωμάτευση μέχρι το τέλος του έτους
Η προμήθεια σωλήνων και εξαρτημάτων βρίσκεται σε εξέλιξη μέσω της Συμφωνίας Πλαίσιο και αναμένεται η παραλαβή για τη Φάση Α μέχρι το τέλος του 2017
Η έναρξη των κατασκευαστικών εργασιών της Φάσης Α προγραμματίζεται εντός του 1ου εξαμήνου 2018, και η ολοκλήρωση αναμένεται στα μέσα του 2020
ΦΑΣΗ Β
Η έναρξη της οριστικής μελέτης της Φάσης Β προγραμματίζεται εντός του 2018 και αναμένεται να ολοκληρωθεί στα μέσα του 2019
Η προμήθεια σωλήνων και εξαρτημάτων προγραμματίζεται τέλος του 2019
Η ολοκλήρωση των κατασκευαστικών εργασιών αναμένεται τέλος του 2021
Αρχές του 2022 όλες οι Κοινότητες της Δυτικής Μεσαορίας θα έχουν πρόσβαση σε πόσιμο νερό άριστης ποιότητας και επαρκούς ποσότητας
10


Τιμολόγηση νερού
Παρέχει κίνητρα για να ενθαρρύνει την αποτελεσματική χρήση του νερού σύμφωνα με τους Κ.Δ.Π.48/2017 (σε ισχύ από Απρίλιο 2017)
Σύμφωνα με την Οδηγία Πλαίσιο για τα Ύδατα 2000/60/ΕΚ, και τον Περί Προστασίας και Διαχείρισης των Υδάτων Νόμο 13(Ι)/2004,
Οι χρήστες νερού θα πρέπει να συνεισφέρουν επαρκώς στην ανάκτηση του κόστους των υπηρεσιών ύδατος
Όσον αφορά στο νερό υδατοπρομήθειας οι χρήστες θα πρέπει να συνεισφέρουν στην ανάκτηση του 100% του ολικού κόστους προμήθειας του νερού ύδρευσης
Τέλη παροχής νερού ύδρευσης
Υδατοπρομήθεια
Χρηματοοικονομικό κόστος €/m³
Περιβαλλοντικό & Κόστος Πόρου €/m³
Ολικό Κόστος €/m³
Ενιαίο Σύστημα Νότιου Αγωγού (ΚΥΕ Λευκωσίας, Λεμεσού και Λάρνακας – Αμμοχώστου)
0.77
0.05
0.82
Αγωγός Βασιλικού -Λευκωσίας
11

Αναμενόμενα Αποτελέσματα



Το Έργο αναμένεται να ικανοποιήσει τις υδρευτικές ανάγκες 260.000 καταναλωτών (~30% του πληθυσμού της Κύπρου)

- Βελτίωση των υδατικών συστημάτων και πρόσβαση σε πόσιμο νερό
- Δυνατότητα απρόσκοπτης παροχής καλής ποιότητας και επαρκούς ποσότητας πόσιμου νερού στις κοινότητες που εντάσσονται στο έργο
- Ασφάλεια στην υδροδότηση της πόλης της Λευκωσίας
- Σταδιακή επαναφορά του υδροφορέα δυτικής Μεσαορίας που σήμερα αντιμετωπίζει πολλά ποσοτικά και ποιοτικά προβλήματα
- Βέλτιστη αξιοποίηση του νερού που παράγεται στην μονάδα αφαλάτωσης Βασιλικού
- Αποδέσμευση αντίστοιχων ποσοτήτων νερού που σήμερα παρέχεται προς τους Δήμους του έργου από τους αγωγούς Τερσεφάνου και Σταυροβουνίου για χρήση στο ΣΥ Λευκωσίας

Ευχαριστώ για την προσοχή σας

phadjigeorgiou@wdd.moa.gov.cy

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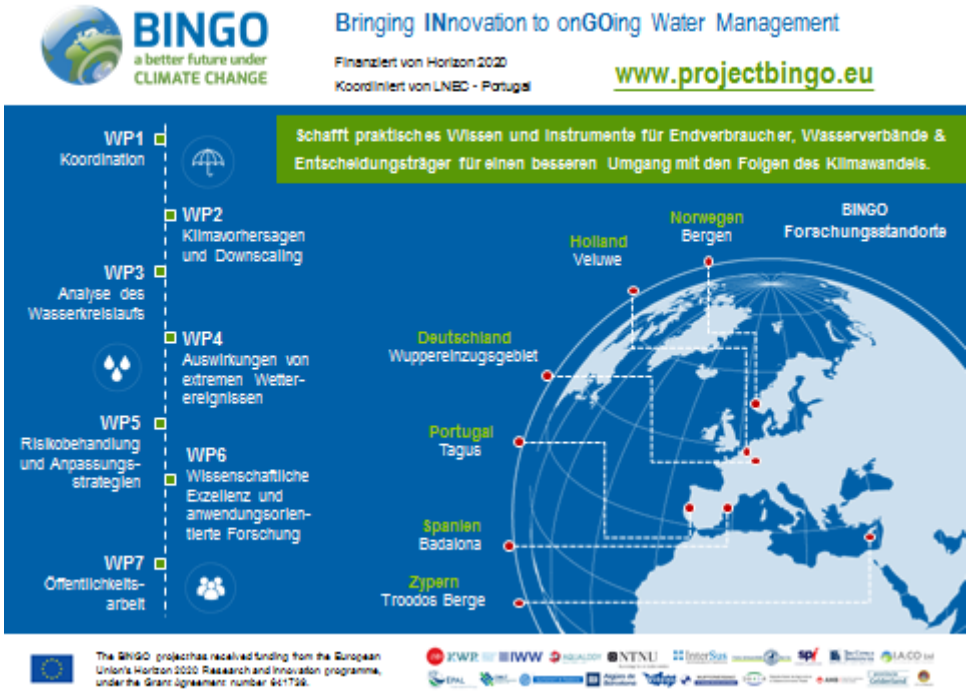
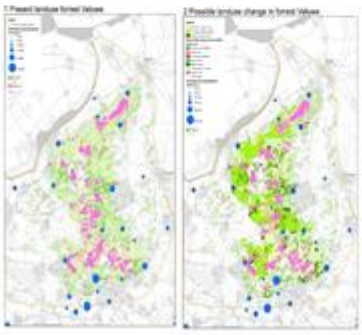
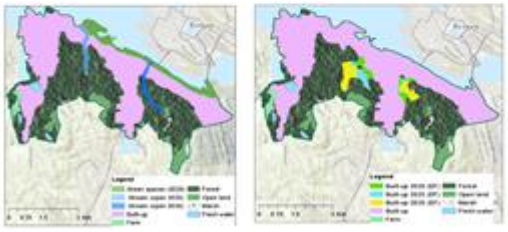
Wupperverband workshop presentations



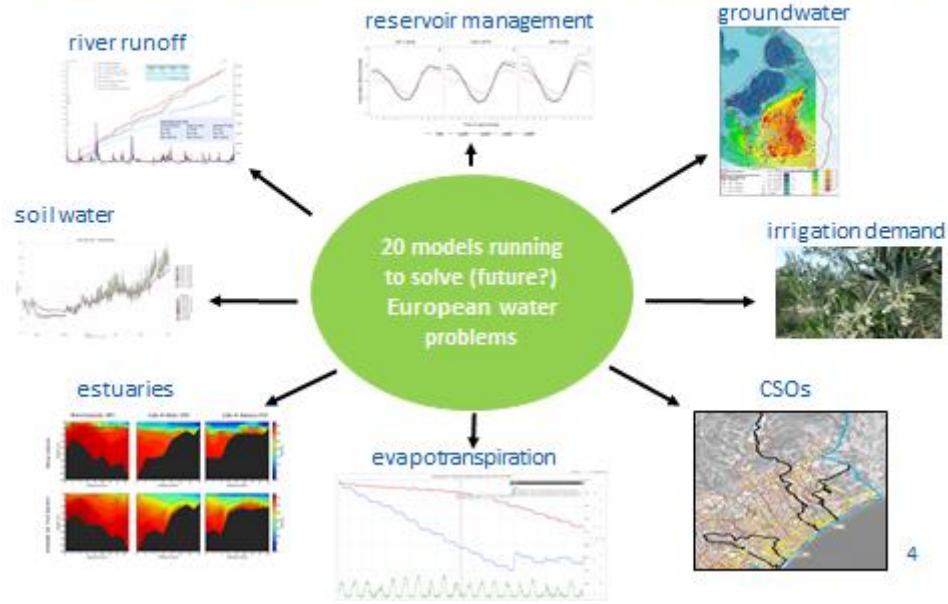
Main achievements
Scenarios

All sites developed land-use and water use scenarios

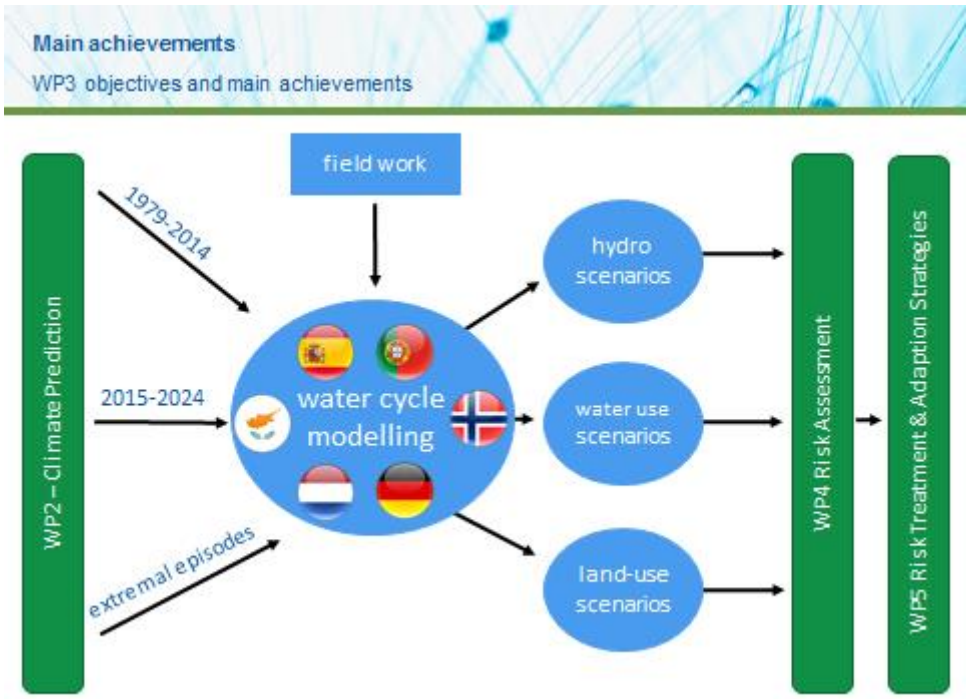




Main achievements
Modelling



4



Agenda

4. Stakeholderworkshop

9.00 - 9.15 Registrierung und Begrüßung

9.15 - 10:00 BINGO-Übersicht und Stand der Arbeiten

- Kurze Übersicht zum Projekt BINGO
- Stand der Arbeiten für das Wuppereinzugsgebiet – weitere Modellläufe und Indices Auswertungen
- Vorstellung der repräsentativen Fallstudien zu den Themenbereichen:
  - „Zu viel Wasser - Überflutungen durch Starkregen"
  - „Zu wenig Wasser - Versorgungssicherheit gewährleisten"

10:00 - 11.30 Klimawandel im Wuppereinzugsgebiet – Anpassungsoptionen an Klimawandelrisiken und deren Bewertung

- Diskussion zu ersten Fallstudie „Zu viel Wasser - Überflutungen durch Starkregen": welche mögliche Handlungsoptionen können wir uns vorstellen um die Auswirkungen von Überflutungen zu reduzieren und welche Informationen werden benötigt um Entscheidungen zu forcieren (Bewertungskriterien)
- Diskussion zur zweiten Fallstudie „Zu wenig Wasser - Versorgungssicherheit gewährleisten": welche mögliche Handlungsoptionen können wir uns vorstellen um die Versorgung mit Roh- und Brauchwasser optimal zu gewährleisten und welche Informationen werden benötigt um Entscheidungen zu forcieren (Bewertungskriterien)

11:15 - 11:30 Kaffeepause

11:30 - 12.30 Zusammenfassung und Abschlussdiskussion

- Resümee der Fallstudiendiskussionen
- Abschließende Diskussion zur weiteren Vorgehensweise für beide Fallstudien (Rollen der Akteure, Datenverfügbarkeit, Kommunikation von Ergebnissen, Entscheidungsprozesse) und die Übertragbarkeit der Ergebnisse für ähnliche Fälle

12.30 - 13.00 Mittagsimbiss

6

BINGO
a better future under CLIMATE CHANGE

Wupperverband

Untersuchungsgebiet Wupper

Arbeitspakete WP2 und WP3

Marc Scheibel (schei@wupperverband.de)
Paula Lorza (pla@wupperverband.de)

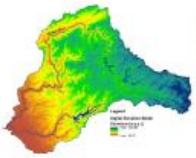
4. BINGO Workshop
Wuppertal, 10 November 2017

The BINGO project has received funding from the European Union's Horizon 2020 Research and Innovation programme, under the Grant Agreement number 641739.

@EU_BINGO

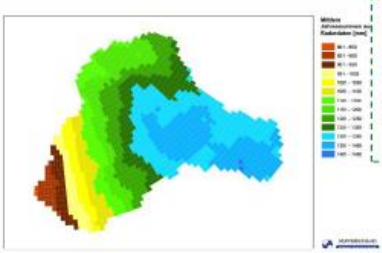
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER

Einzugsgebietscharakteristiken



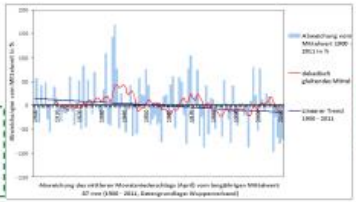
Höhenprofil:
von ca. 480 bis ca. 35 m NHN

Braunerde: ca. 75,3% der gesamten Fläche (813 km²)



Hohes Niederschlagsaufkommen im Einzugsgebiet:
Mittlere Jahressumme zwischen 800 und 1.400 mm/Jahr

Saisonale Verschiebungen:
- Einzelne Monate trockener,
- Winterhochwässer weniger,
- Starkregen im Sommer mehr



Der April wird trockener…
(Abnahme von ca. 25 mm vom mittleren monatlichen Niederschlag)

Landnutzung	Anteil in Prozent	Fläche [km²]
Wald	32.8	266.8
Grünland	30.8	250.3
Versiegelte Flächen	25.3	205.6
Acker	8.7	70.3
Oberflächengewässer	2.0	15.9
Andere	0.4	3.3
Summe	100.0	812.3

…der November feuchter
(Zunahme von ca. 20 mm vom mittleren monatlichen Niederschlag)

2

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER

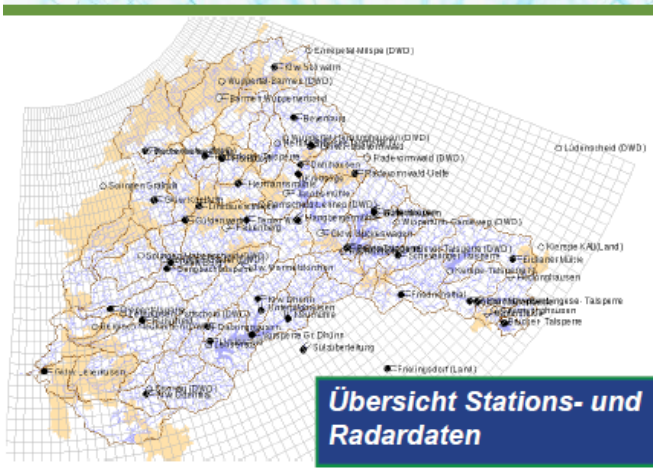
Arbeitsschritte und Ziele mit Bezug zur Hydrologie innerhalb des EU Horizon2020-Projekt BINGO (Bringing INnovation to onGOing water management) - (Arbeitpakete WP2 und WP3):

1. Aufbereitung langjähriger historischer Zeitreihen (110 – 55 Jahre)
2. Identifikation und Ausprägung von vergangenen Wetter Extremen und Anomalien
3. Ableitung von statistischen Kenngrößen und Schwellwerten von klimatologischen und hydrologischen Indikatoren zur Beschreibung von Wetter Extremen
4. Analyse der bereitgestellten Klimarealisationen für die Zukunft (z.B. MiKlip, ReKliEs-De) und Vergleich mit den historischen Daten (Trends)
5. Berechnung von Szenarien auf Basis der klimatologischen und weiterer Einflussparameter wie Landnutzung oder Wassernutzung und deren Auswirkungen
6. Optimierung des operationellen Vorhersage Modells (verbesserter Dateninput, Schwellwerte zur rechtzeitigen Einleitung von Maßnahmen)

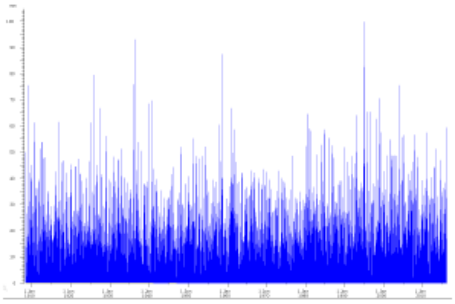
3

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER

WP2 und WP3



Übersicht Stations- und Radardaten



110 Jahre Tageswerte
55 Jahre Schreiberdaten
15 Jahre Radardaten

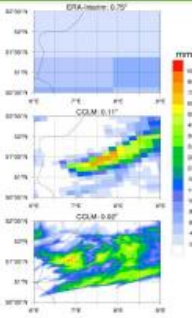
Messtyp	Zeitliche Auflösung	Räumliche Verteilung	Klimatologische Repräsentanz
Tageswerte	niedrig	niedrig bis mittel	hoch
Schreiber	mittel bis sehr hoch	mittel	hoch bis mittel
Radar	hoch	hoch	niedrig

4

Klimaprognosen aus regionalen Modellen (RCM)

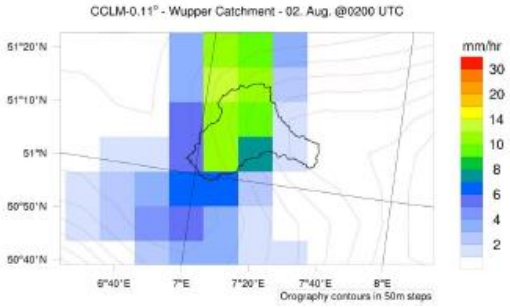
Freie Universität Berlin

Nesting	
Global	ERA-Interim (Reana.) / MPI-ESM (MiKlip)
12km	COSMO-CLM 0.11° (CORDEX-EU)
2.2km	COSMO-CLM 0.02° at research sites, for extremal episodes



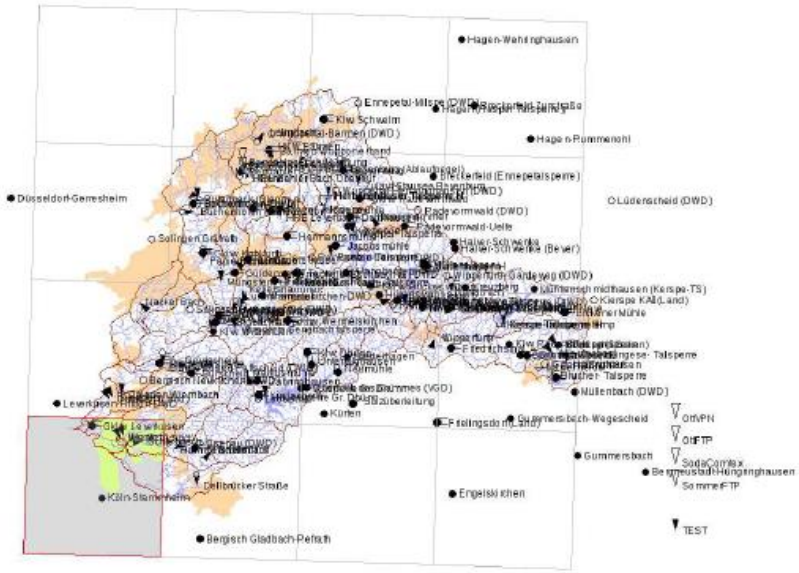
Übersicht Rasterschwerpunkte Referenzdaten und ausgewählte Vergleichsstationen

Input - Klimadaten (Beispiel vom RCM)



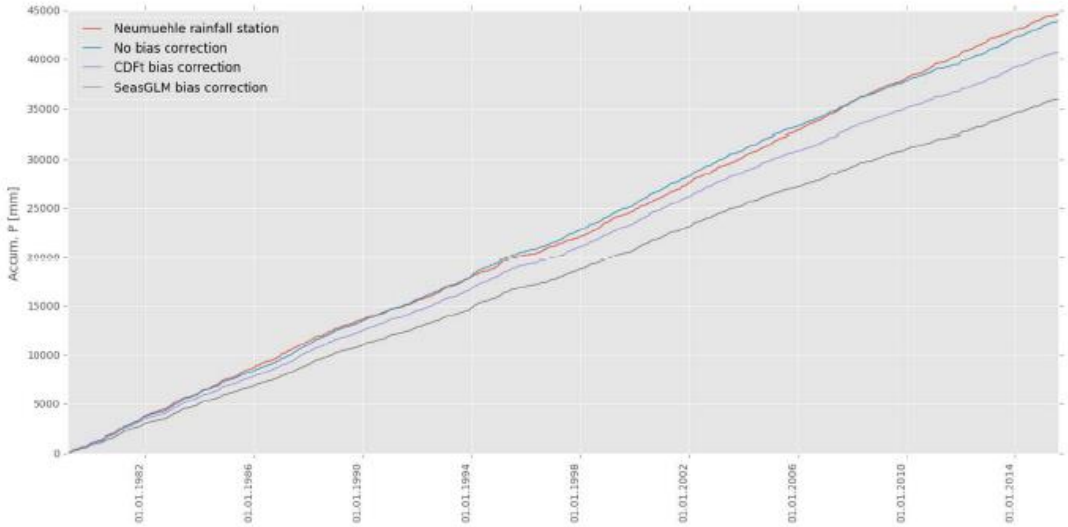
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

TopoRast: notwendiges Tool zur Verwaltung der Rasterdaten



Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

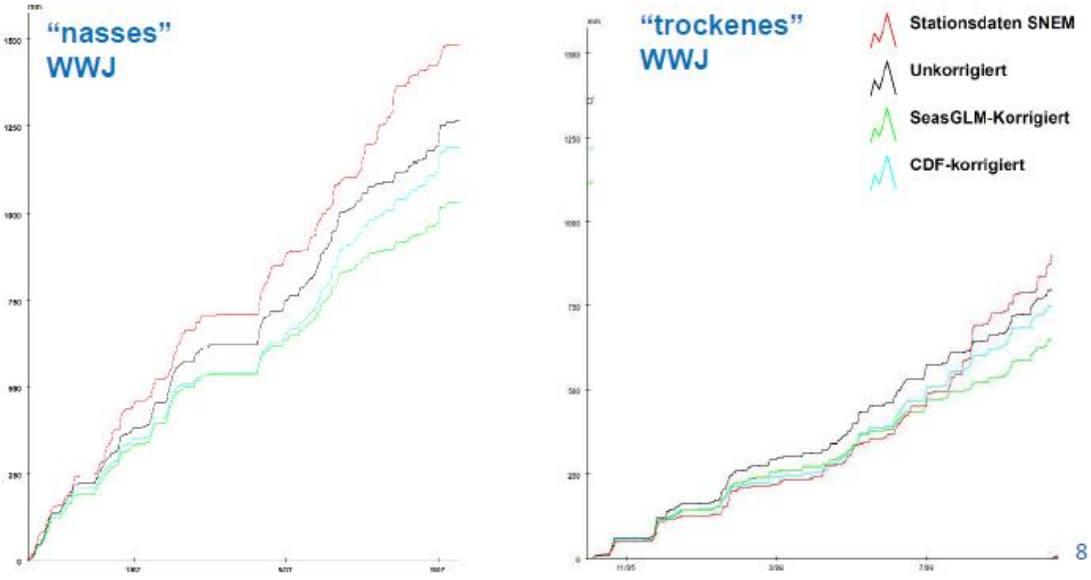
Vergleich zwischen verschiedenen Bias-Korrekturverfahren und gemessenem Niederschlag im gesamten Referenzzeitraum



7

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

Vergleich zwischen verschiedenen Bias-Korrekturverfahren und gemessenem Niederschlag für zwei unterschiedliche wasserwirtschaftliche Jahre



8

Wupperverband

UNTERSUCHUNGSGEBIET WUPPER

WP2 und WP3

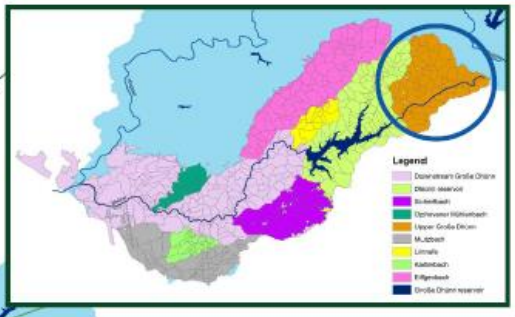
Hydrologische Modellierung (hier: NASIM)

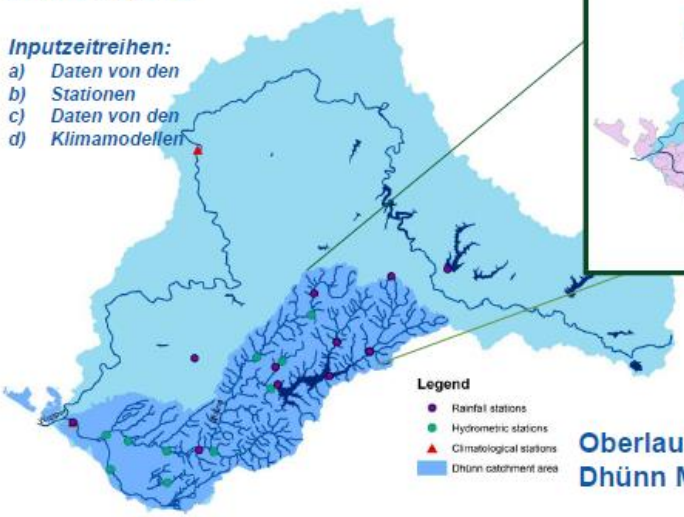
Dhünneinzugsgebiet aufgeteilt in neun Gebiete

Inputzeitreihen:

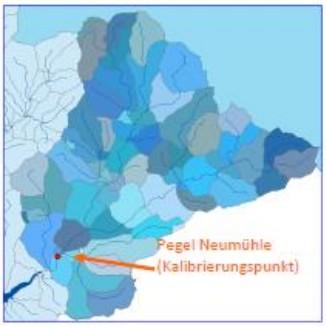
a) Daten von den
b) Stationen
c) Daten von den
d) Klimamodellen

Dhünneinzugsgebietsfläche: 203 km²





Oberlauf Große Dhünn Modell

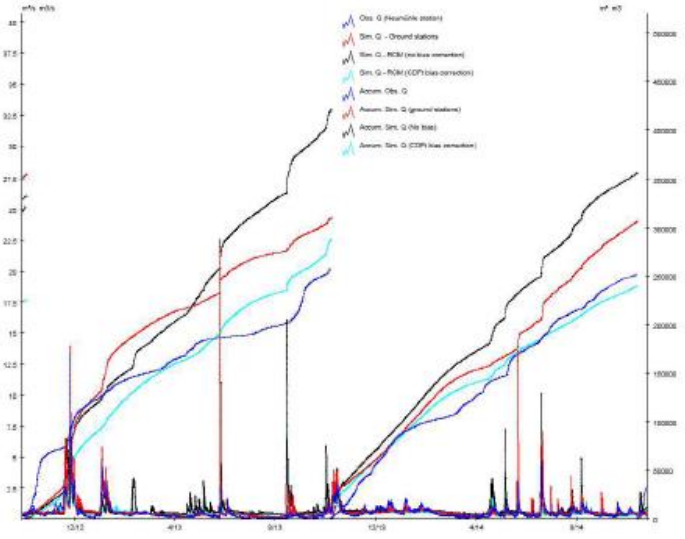


Wupperverband

UNTERSUCHUNGSGEBIET WUPPER

WP2 und WP3

Beobachteter und simulierter Abfluss für zwei wasserwirtschaftliche Jahre mit verschiedenen Datensätzen (Oberlauf Große Dhünn Model)



Dunkel blau: beobachteter Abfluss;

Rot: sim. Abfluss mit Stationsniederschlag;

Schwarz: sim. Abfluss mit unkorrigierten Daten;

Türkis: sim. Abfluss mit CDF-korrigierten Daten

Inputzeitreihen:
Niederschlag, Temperatur und potenzielle Verdunstung (nach Haude)

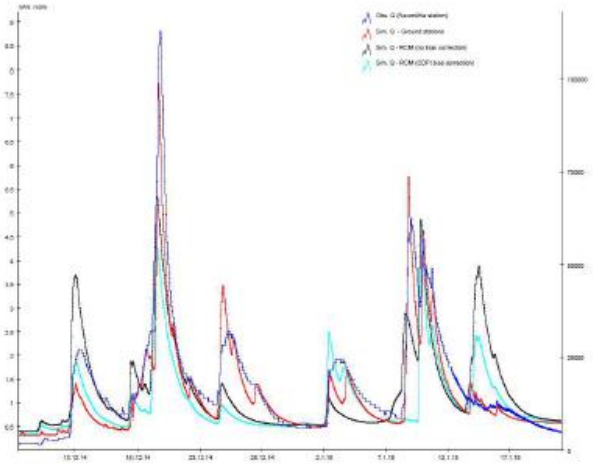
10

Wupperverband

UNTERSUCHUNGSGEBIET WUPPER

WP2 und WP3

Beobachteter und simulierter Abfluss für zwei wasserwirtschaftliche Jahre mit verschiedenen Datensätzen (Oberlauf Große Dhünn Model)



Dunkel blau: beobachteter Abfluss;

Rot: sim. Abfluss mit Stationsniederschlag;

Schwarz: sim. Abfluss mit unkorrigierten Niederschlagsdaten;

Türkis: sim. Abfluss mit CDF-korrigierten Niederschlagsdaten

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Wupperverband

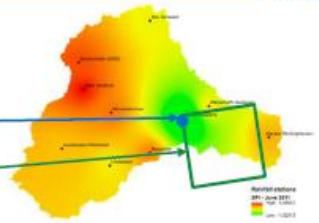
UNTERSUCHUNGSGEBIET WUPPER

WP2 und WP3

Weitergehende Unter-suchungen zu Indizes:

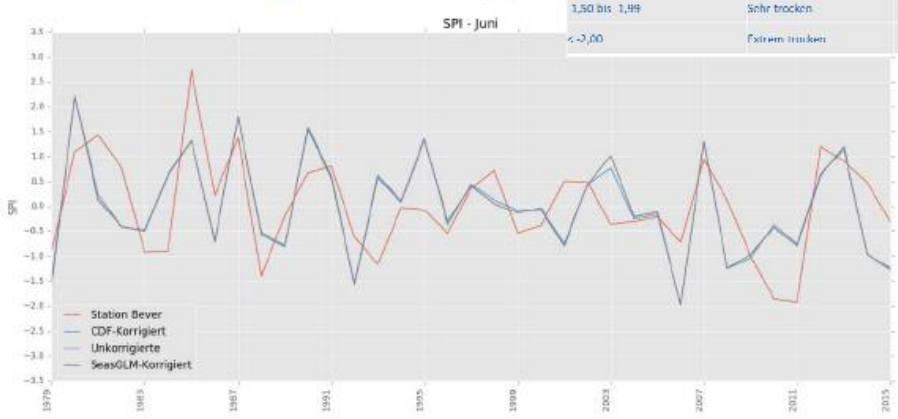
SPI für Juni für den ganzen Zeitraum:

- Station Bever
- Referenzzelle



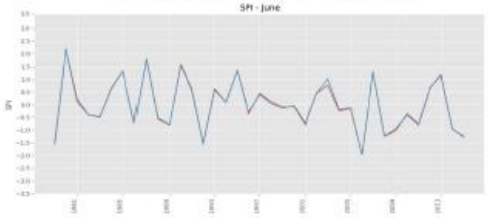
Dürreklassifizierung durch SPI (Standardised Precipitation Index) und entsprechende Ereigniswahrscheinlichkeiten (Lloyd-Hughes und Saunders, 2002)

SPI Wert	Kategorie	Wahrscheinlichkeit [%]
> 2,00	Extrem feucht	2,3
1,50 bis 1,99	Sehr feucht	4,4
1,00 bis 1,49	Moderat feucht	9,2
0,00 bis 0,99	Mild feucht	34,1
0,00 bis -0,99	Mild trocken	34,1
-1,00 bis -1,49	Moderat trocken	9,2
-1,50 bis -1,99	Sehr trocken	4,4
< -2,00	Extrem trocken	2,3

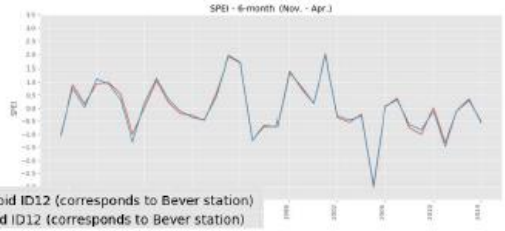


12

SPI (Standardised Precipitation Index)



SPEI (Standardised Precipitation Evapotranspiration Index)



CDFt bias-corrected - centroid ID12 (corresponds to Bever station)
Not bias-corrected - centroid ID12 (corresponds to Bever station)

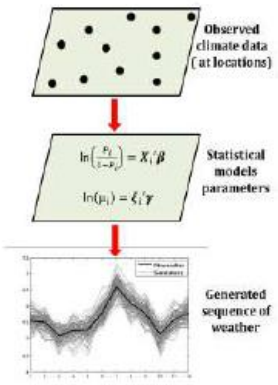
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

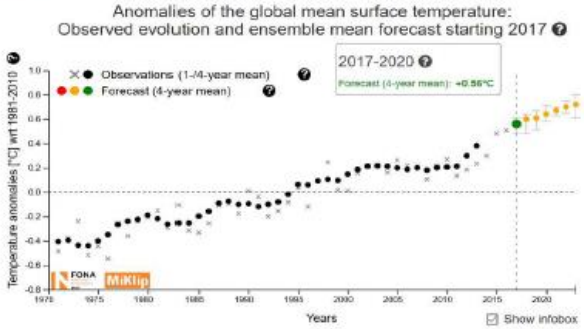
Freie Universität Berlin

Nächste Datensätze

Dekadische Klimaprognosen

und stochastischer Wettergenerator

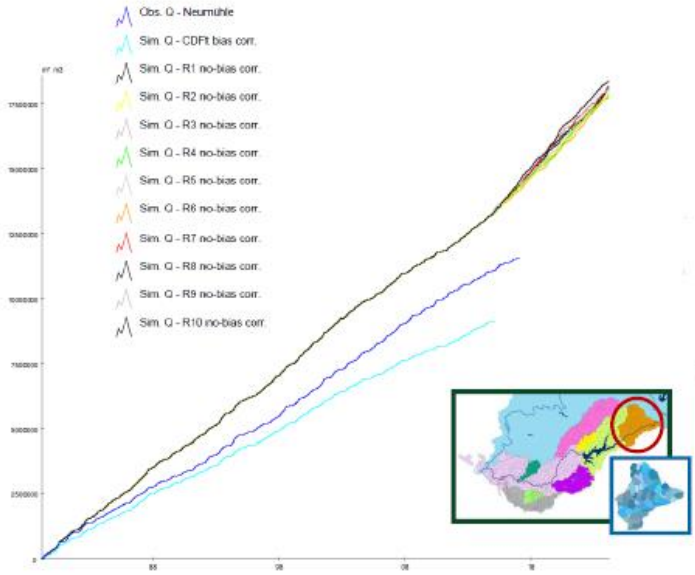




http://www.fona-miklip.de/decadal-climate-prediction-system/decadal-forecast-for-2017-2026/

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

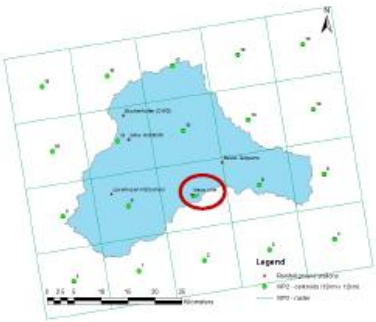
Simulierter Abfluss: 1979 – 2024 (Referenzpegel: Neumühle)



Dunkel blau: beobachteter Abfluss;

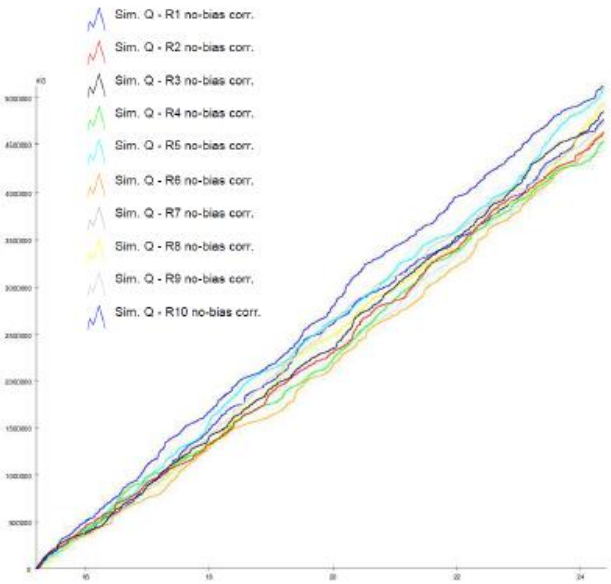
Schwarz: sim. Abfluss mit unkorrigierten Niederschlagsdaten;

Türkis: sim. Abfluss mit CDF-korrigierten Niederschlagsdaten



Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

Simulierter Abfluss: 2015 – 2024 (Referenzpegel: Neumühle)



	Datum	Kum. Q [m³]	Diff. [%]
R1	31.12.2024 07:30	5125229,0	
R9	31.12.2024 07:30	4458579,5	13

Kumulierter, simulierter Q – R1 ist ca. 13% größer als kumulierter, simulierter Q – R9

R9 ergibt den kleinsten kumulierter Q

R1 ergibt den größten kumulierter Q

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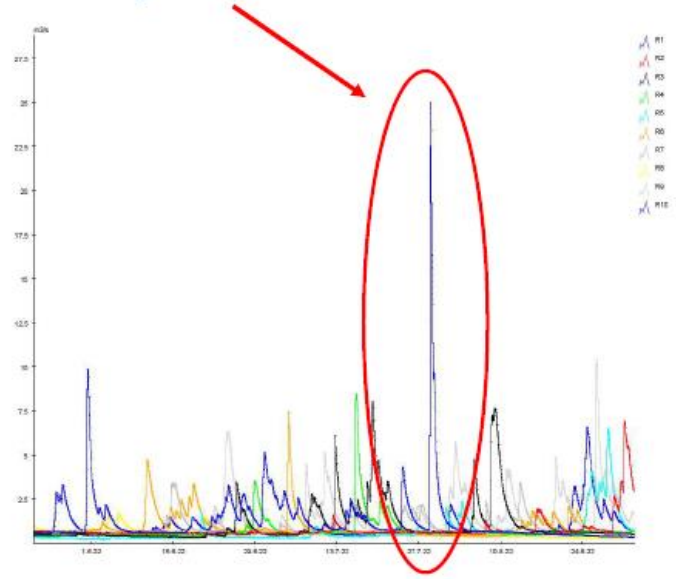
Simulierter Abfluss: 2015 – 2024 (Referenzpegel: Neumühle)

Ungeeignete Interpretation: *„Es wird Hochwasser am 29.07.2022 geben“*



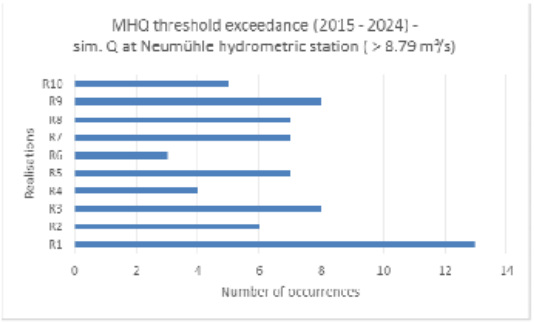
Daher → **statistische Kenngrößen!**

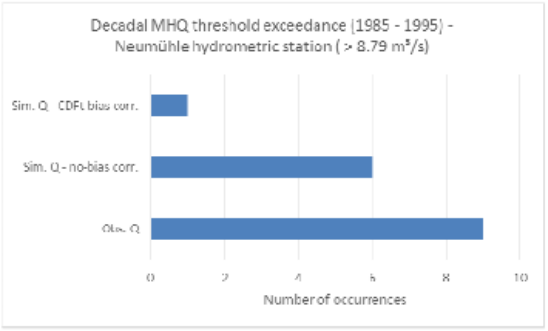
- **Häufigkeiten von Überschreitungen bzw. Unterschreitungen definierter Schwellenwerte aus der Historie statt absoluten Mengen**
- **Trendanalyse**
- **Bestimmung repräsentativer Indizes**

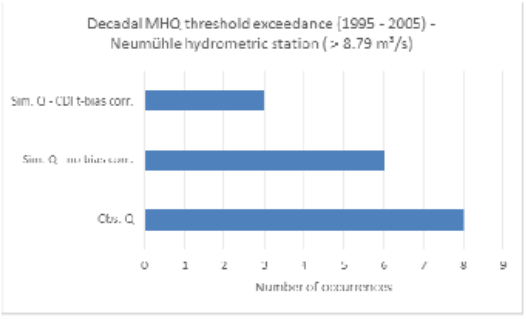
„Wie oft?“ statt „Wann?“

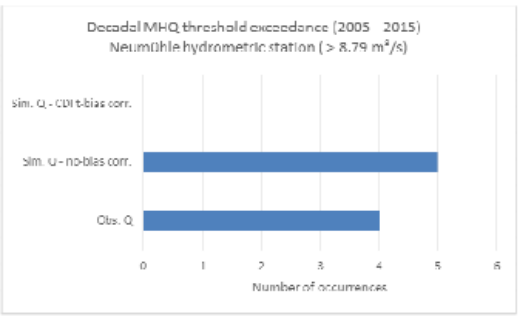
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

Anzahl von Ereignissen - MHQ Überschreitungen (> 8,79 m³/s): 1979 – 2024 (Referenzpegel: Neumühle)



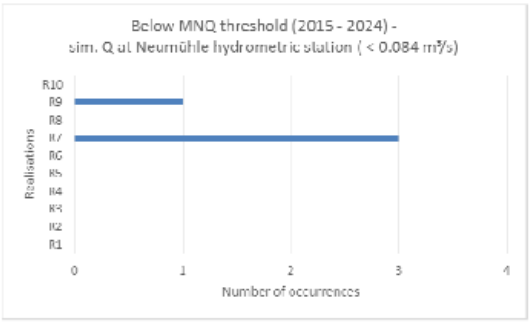


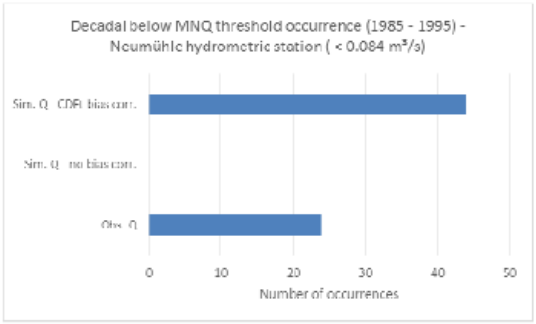


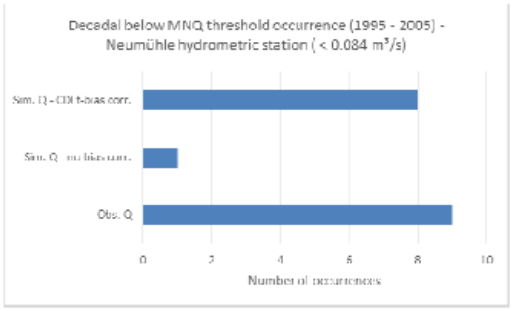


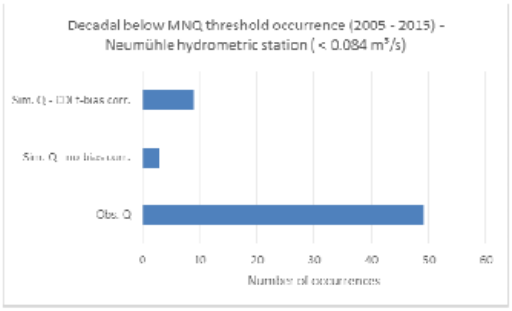
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

Anzahl von Ereignissen - MNQ Unterschreitungen (< 0,084 m³/s): 1979 – 2024 (Referenzpegel: Neumühle)



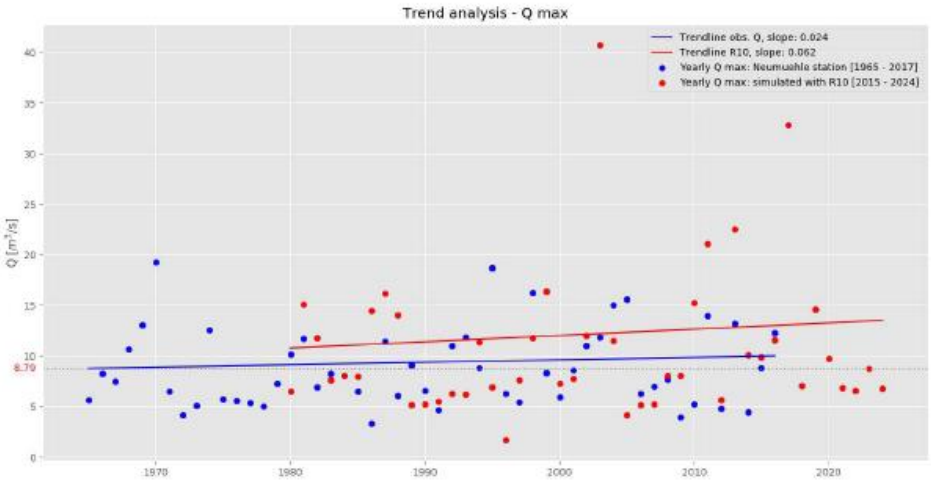






Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
WP2 und WP3

Trendanalyse: 1979 – 2024 (Referenzpegel: Neumühle)



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BINGO Feldstudien / Messungen

Verdunstungsmessungen (über Grasreferenzflächen):

• Verdunstung ist eine wichtige Komponente des Wasserhaushaltes und somit des Wasserdargebotes → Verlust für die Abflussbildung

Bodenfeuchtemessungen:

• verbesserte Kenntnisse über den Einfluss des Bodens auf die Abflussbildung und Ableitung von Anfangsbedingungen

Räumliche Verteilung des Niederschlages:

• wichtig zur realistischen Abbildung der Abflussbildung und –konzentration (für Planung, Bemessung und Betrieb von Anlagen und dem Hochwasserschutz)

Ziel: Bestimmung von Schwell- und Warnwerten zur Beurteilung von Prognose-Szenarien → Optimierung der operationellen Modelle zur rechtzeitigen Entscheidungshilfe: agieren und nicht nur reagieren!

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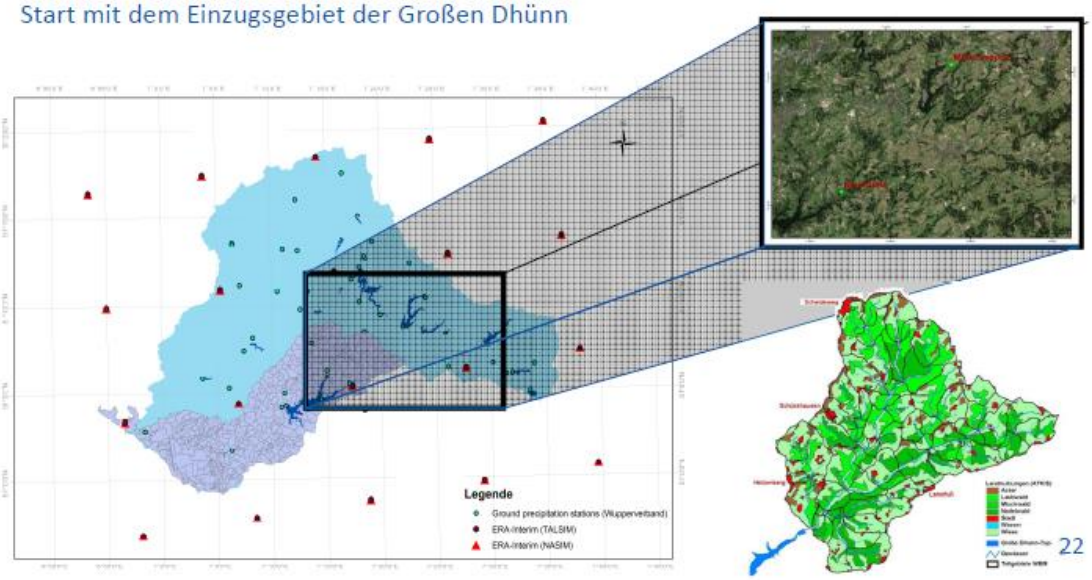
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Feldstudien

BINGO Feldstudien / Messungen
Verdunstung und Bodenfeuchte

Start mit dem Einzugsgebiet der Großen Dhünn



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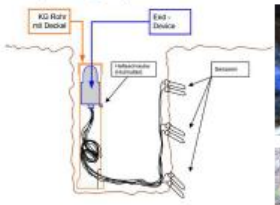
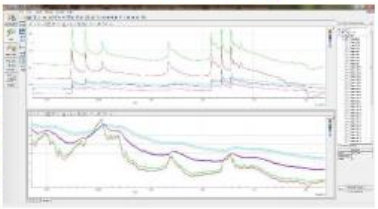
Wupperverband

UNTERSUCHUNGSGEBIET WUPPER — **BINGO Feldstudien**

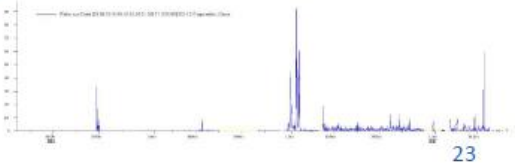
- **Station Niederhagen: ca. 300 m stromaufwärts der Station Neumühle – im Betrieb seit 1983**
  - Installation von einem Lysimeter (Eijkelkamp) – installiert auf Wiese, Oktober 2016
  - Bodenfeuchtesensoren: SMT100 (Truebner) und 5TM (Decagon) / Matrixpotentialsensoren: MPS6 (Decagon) – installiert auf Wiese, Laub- und Nadelwald, Dezember 2016



Bodenfeuchte-und Temperatur



Evaporation gross



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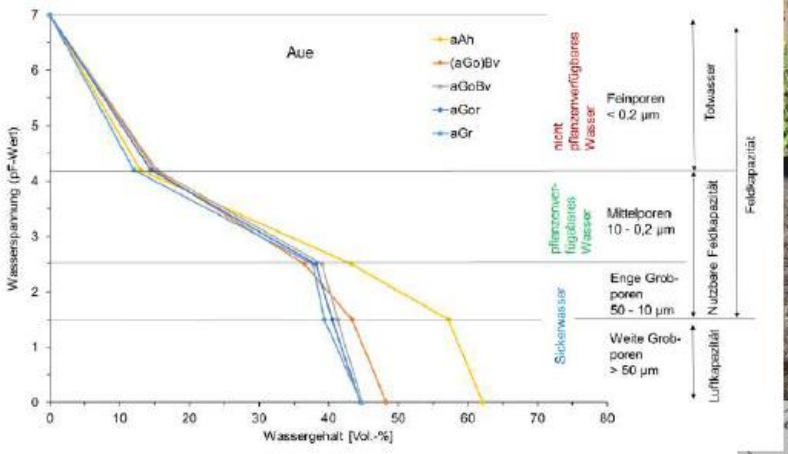
Wupperverband

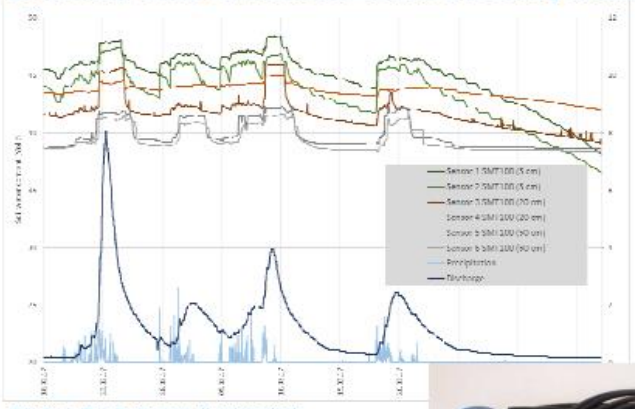
UNTERSUCHUNGSGEBIET WUPPER — **BINGO Feldstudien**

pF-Kurven (Wiese)



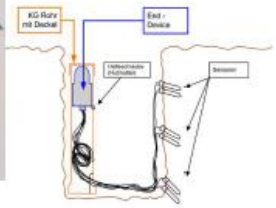
- Analyse von Bodenproben im Labor (Wiese, Laubwald und Nadelwald)
- Interpretation von Messungen

Zeitreihen von Bodenfeuchte vs. Niederschlag und Abfluss



- Installiert im Dezember 2016
- Interpretation von Messungen vs. Ergebnissen vom Labor

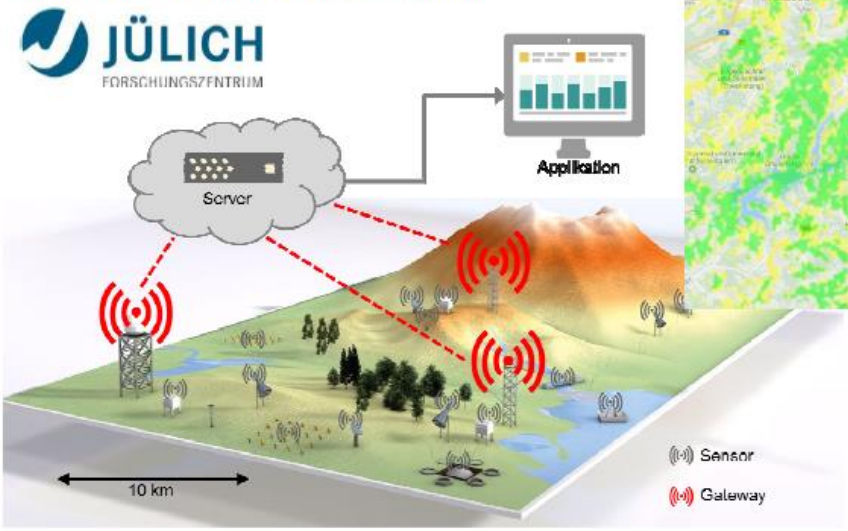
Station Niederhagen (Lysimeter) und Pegel Neumühle



Zeitreihen von Bodentemperatur

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Feldstudien

SoilNet LoRa - Einzugsgebietmonitoring



- Verbesserung des ersten Testsystems
- Auf der Suche nach einem optimalen Standort (Installation im Jahr 2018)

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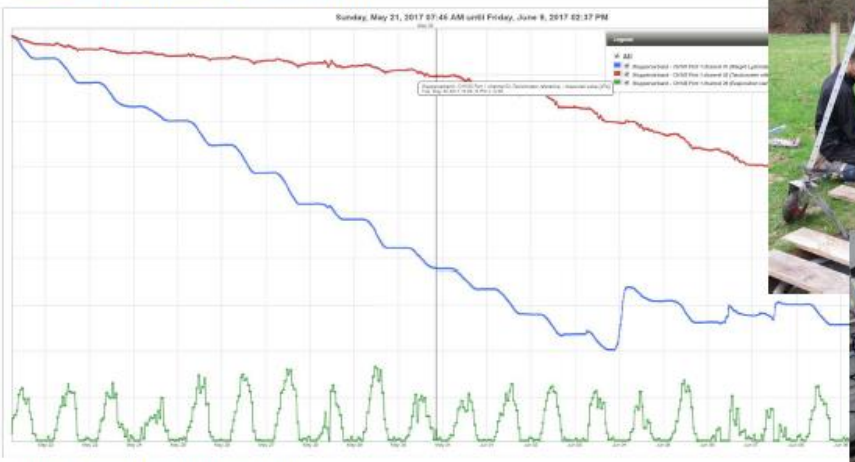
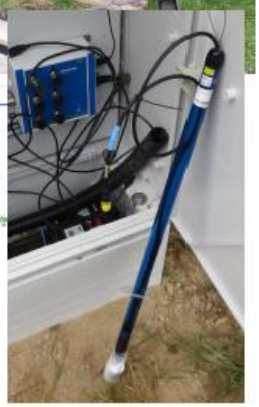
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Feldstudien

Zeitreihen von Verdunstung, Bodenfeuchte und Wasserpotential (Eijkelkamp):



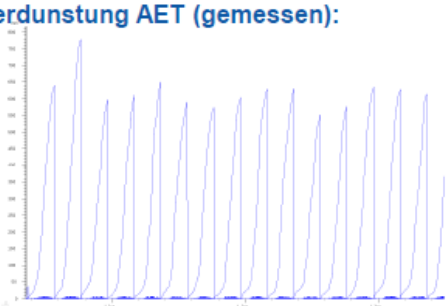


Niederhagen station (lysimeter)

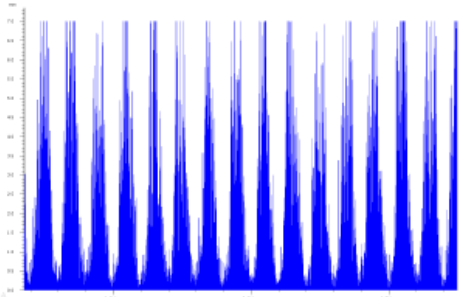
- Installiert im September 2016
- Kontinuierliche Zeitreihen seit Mai 2017

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Feldstudien

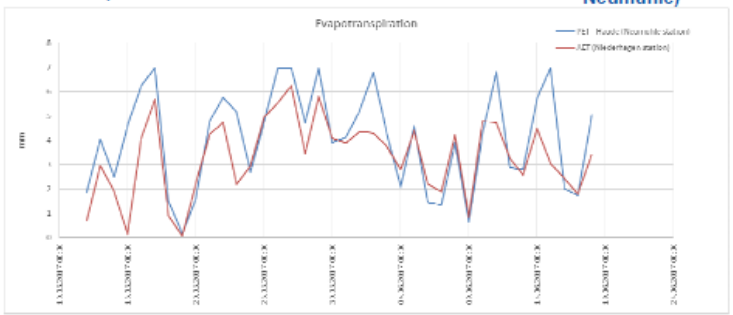
Vergleich zwischen potentialle Verdunstung - PET (nach HAUDE) und tatsächliche Verdunstung AET (gemessen):



PET (nach Haude) – jährliche Summe (Station Neumühle)



PET (nach Haude) – tägliche Werte (Station Neumühle)



AET (Lysimeter - Station Niederhagen) und PET (Station Neumühle)

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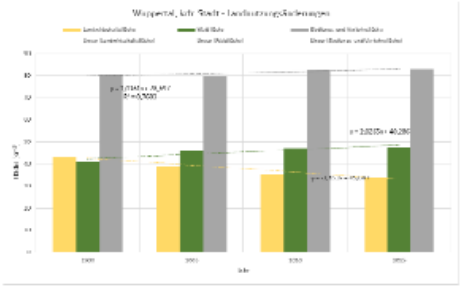
WP2 / WP3 - Nächste Schritte

1. Bias Korrekturen mit Mustern aus Radardaten
2. Vertiefte Analyse und Aufbereitung der Indices wie SPI, SPEI, WEI (Weather Extremity Index), Vorregenindex, etc. mit den dekadischen Prognosen
3. Weitere statistische Auswertungen der Ergebnissen der hydrologische Modellierung mit zukünftigen klimatologischen Szenarien
4. Sociohydrologie: Hydrologische Modellierung mit zukünftigen Land- und Wassernutzungsszenarien und Auswertung der Effekte (Szenarien wurden auf Basis von ***SCENES storylines*** im Verbandsgebietskontext festgesetzt)
   - → „Economy first“
   - → „Sustainability eventually“



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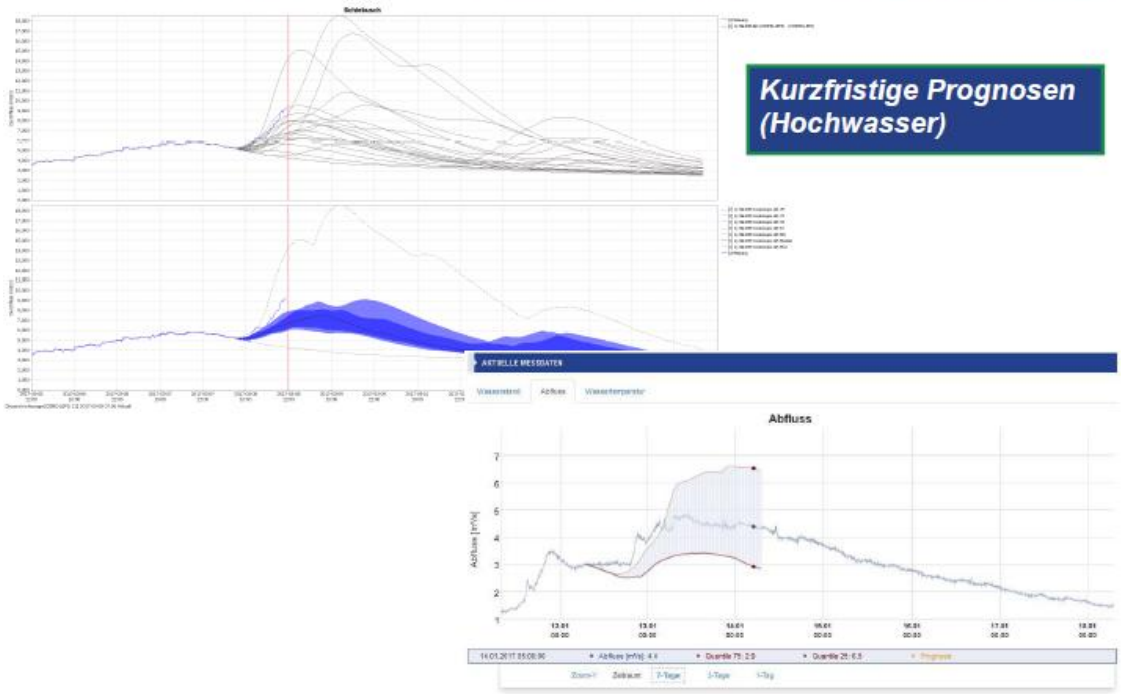
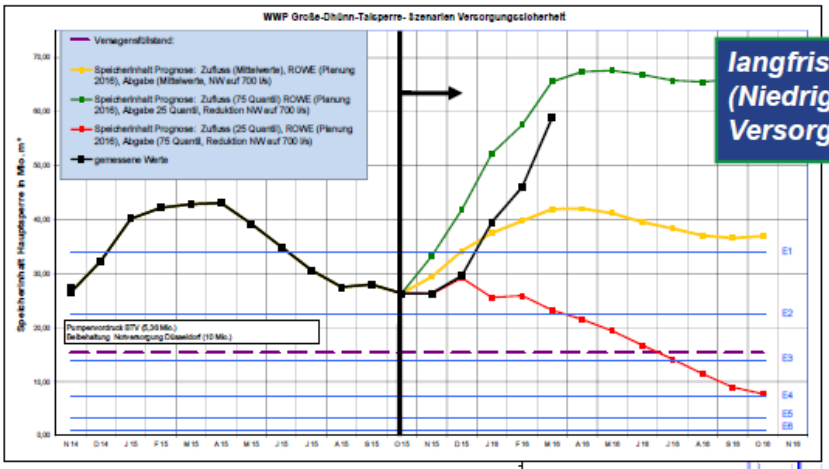
Diskussion: Kommunikation von Unsicherheiten

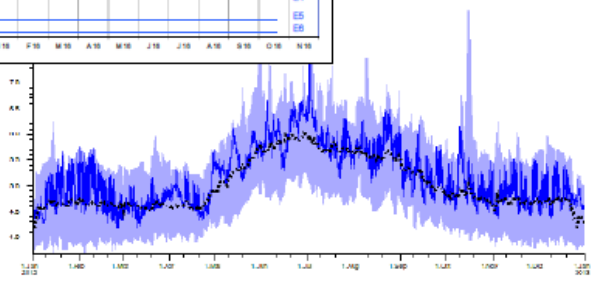


Wupperverband
UNTERSUCHUNGSGEBIET WUPPER

Diskussion: Kommunikation von Unsicherheiten



langfristige Prognosen (Niedrigwasser, Versorgungssicherheit)



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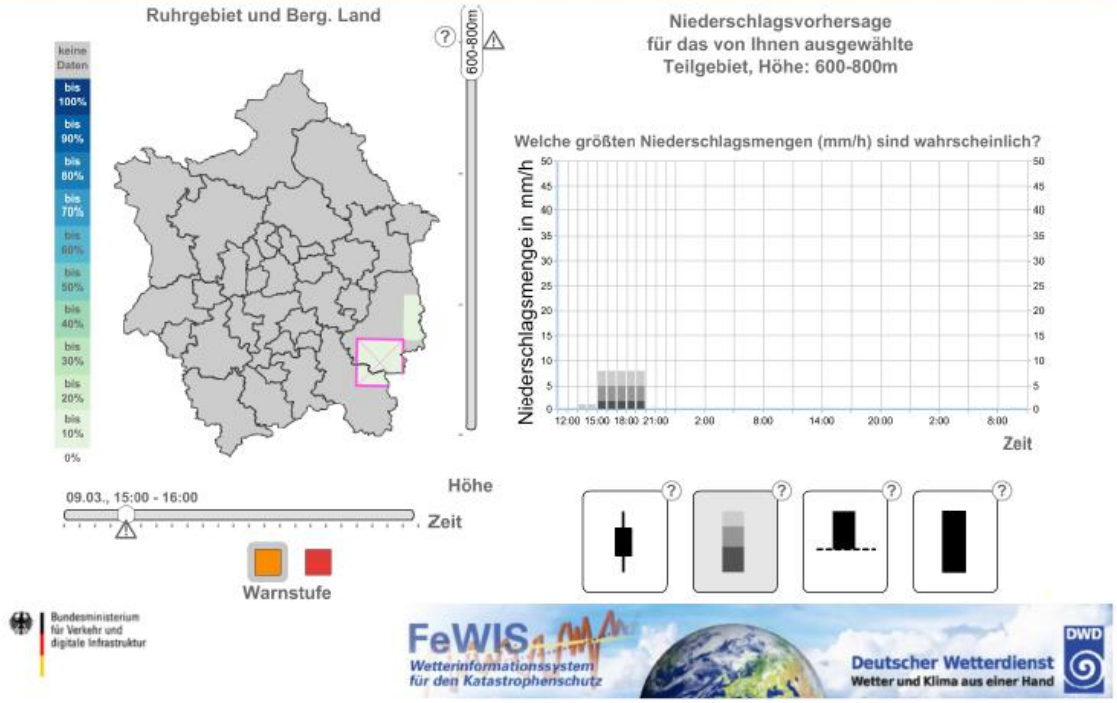
Kommunikation von Unsicherheiten – Beispiel DWD



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Extreme Wetter Ereignisse

Resultierende Handlungsfelder:

Wasserversorgung, Wasserqualität, Hochwasser und Sturzfluten

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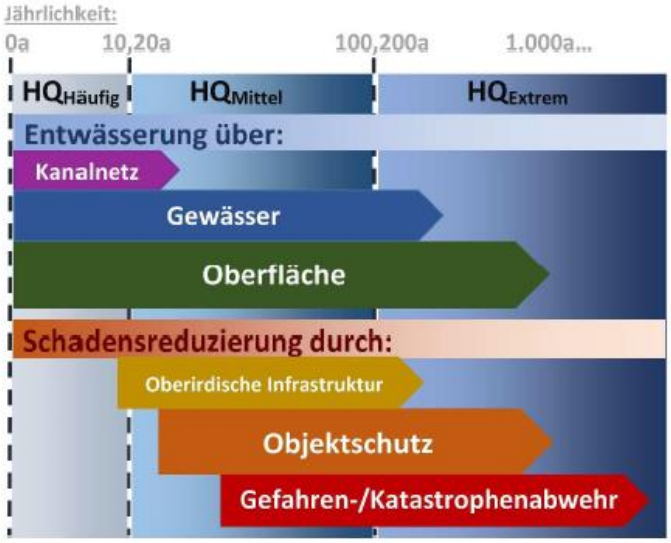
BINGO Fallstudien

1. „Zu viel Wasser - Überflutungen durch Starkregen“

Kategorien:

- Entwässerungssysteme
- Wild abfließendes Oberflächenwasser
- Flusshochwasser
- Grundhochwasser



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UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien

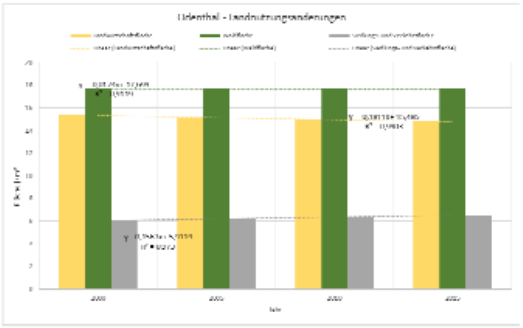
1. „Zu viel Wasser - Überflutungen durch Starkregen“

Faktoren für die zunehmende Problematik:

- **Steigende Versiegelung der Flächen**: In NRW wurden in den letzten Jahren durchschnittlich ca. 10 Hektar bislang unverbaute Fläche mit Straßen oder für Siedlungen bebaut.

→ Beispiele - Verbandsgebiet (2000 – 2015):

Zunahme in den letzten 15 Jahren:
Odenthal: 0,37 km² Versieglung
Wipperfürth: 1,39 km² Versieglung
Hückeswagen: 1,61 km² Versieglung
Wuppertal: 2,55 km² Versieglung
Solingen: 3,91 km² Versieglung
Remscheid: 2,16 km² Versieglung
Marienheide: 1,16 km² Versieglung
Radevormwald: 0,88 km² Versieglung



- Das hat zur Folge: Hitzeinseln in den Ballungsgebieten, Förderung konvektiver Ereignisse, höhere Abflusskonzentration, höheres Schadenspotenzial durch Wertsteigerung

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Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien

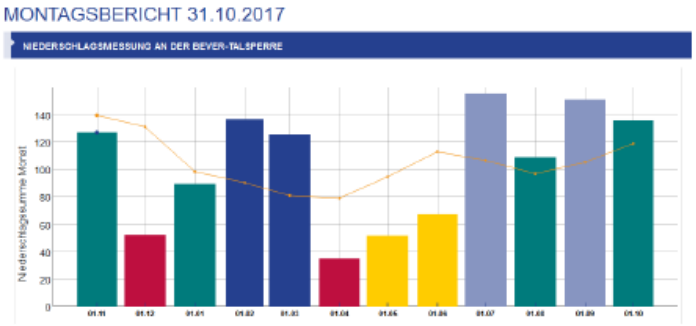
1. „Zu viel Wasser - Überflutungen durch Starkregen“

Faktoren für die zunehmende Problematik:

- **Steigenden Hitzeperioden** haben zur Folge: Hitzeinseln in den Ballungsgebieten extremer, Förderung konvektiver Ereignisse

- **Weitere Bebauung und höherwertige bzw. technisierte Inventare**: höhere Schäden, Vulnerabilität der Versorgung bei Ausfall

- **Zunehmende konzentrierte Niederschläge** (Die Jahresverteilung ändert sich: „Dauerregen wird zu konzentriertem Starkregen und größeren Trockenperioden“)



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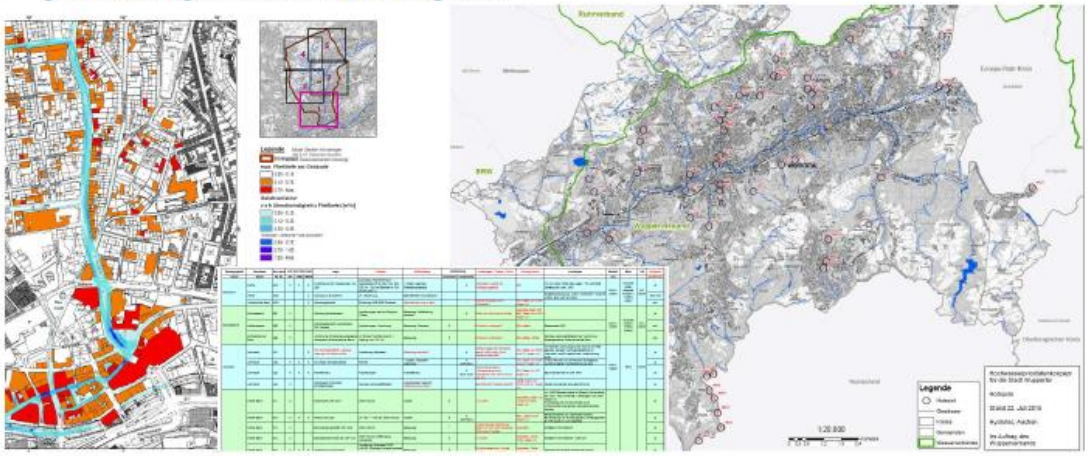
1. „Zu viel Wasser - Überflutungen durch Starkregen“

Fallstudie Wuppertal ausgewählt weil:

- bereits sehr gute notwendige Datenlage
- viele Maßnahmentypen denkbar und bereits in der Diskussion bzw. auch im HWRM
- laufende Untersuchung im passenden Kontext (gegenseitige Synergien)
- gute Übertragbarkeit für andere Regionen



Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien

1. „Zu viel Wasser - Überflutungen durch Starkregen“

Diskussion zu führen über:

- Welche Kenngrößen bilden hier die Veränderungen/Unsicherheiten/Entscheidungshilfen ab?
  Vorschlag zum Klimawandel: *Häufigkeiten von Überschreitungen definierter Schwellwerte (aus der Historie) statt absoluten Mengen*
- Welche Randbedingungen müssen einbezogen werden?
  - Vorschlag und Abstimmung der Bewertungskriterien:
    - z. B.: vorhandene Restriktionen, Flächenbesitz oder Grunderwerb erforderlich, Umsetzbarkeit bzw. Machbarkeit, Kosten der Maßnahme, Wirkung, Effektivität, verhinderbare Schäden (Nutzen), Wirtschaftlichkeit, Nutzen für „Gesundheit“ bzw. „Leib und Leben“ berücksichtigen, Akzeptanz in der Bürgerschaft und Politik
  - Zusammenstellung der Bewertungskriterien für die erarbeiteten potenziellen Maßnahmen.
  - Bewertung der einzelnen Maßnahmen in einer Bewertungsmatrix (Maßnahmenkriterien und zugehörige Gefahrenkriterien)
  - Ausarbeitung der Priorisierung der Einzelmaßnahmen (Ergänzung der Matrix). Steckbriefe ergänzen. Darstellung der Priorisierungsergebnisse in der Maßnahmenkarte. Empfehlungen für die Umsetzung.
- Möglichkeiten und Grenzen der Vorbereitung(-warnung)

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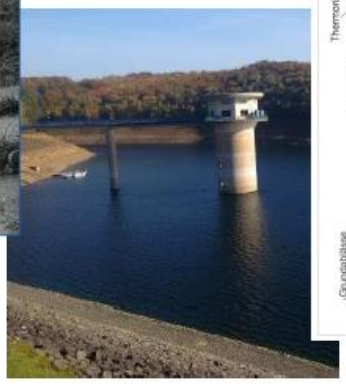
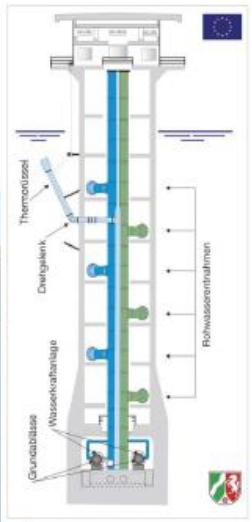
Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien

2. „Zu wenig Wasser – Versorgungssicherheit gewährleisten“

Kategorien:

- Ökologisches Schadenspotenzial nimmt zu
- Wasserversorgung eingeschränkter
- Wasserqualität ändert sich





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UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien

2. „Zu wenig Wasser – Versorgungssicherheit gewährleisten“

Faktoren für die zunehmende Problematik:

- **Steigenden Versiegelung der Flächen**:
  - Grundwasserneubildung → Niedrigwasser, Erhöhung Bedarf, Hochwasserschutzräume
  - Forstwirtschaft (Verdunstungsverhalten, Wasserqualität - gerade bei Trinkwassertalsperren)
- **Änderungen in der Niederschlagsverteilung**:
  - Verschiebung des Niederschlagsaufkommens innerhalb des Wasserwirtschaftsjahres (trockene Winter und Frühjahre)
  - Bedeutet für Rückhaltebecken: Verschiebung des Bedarfes von Hochwasserschutz(räumen)
  - Spezial Trinkwassertalsperren: kurze heftige Ereignisse führen in den naturnahen EZG teilweise zu geringeren Abflüssen durch höheres Verdunstungs- und Versickerungspotenzial

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2. „Zu wenig Wasser – Versorgungssicherheit gewährleisten“

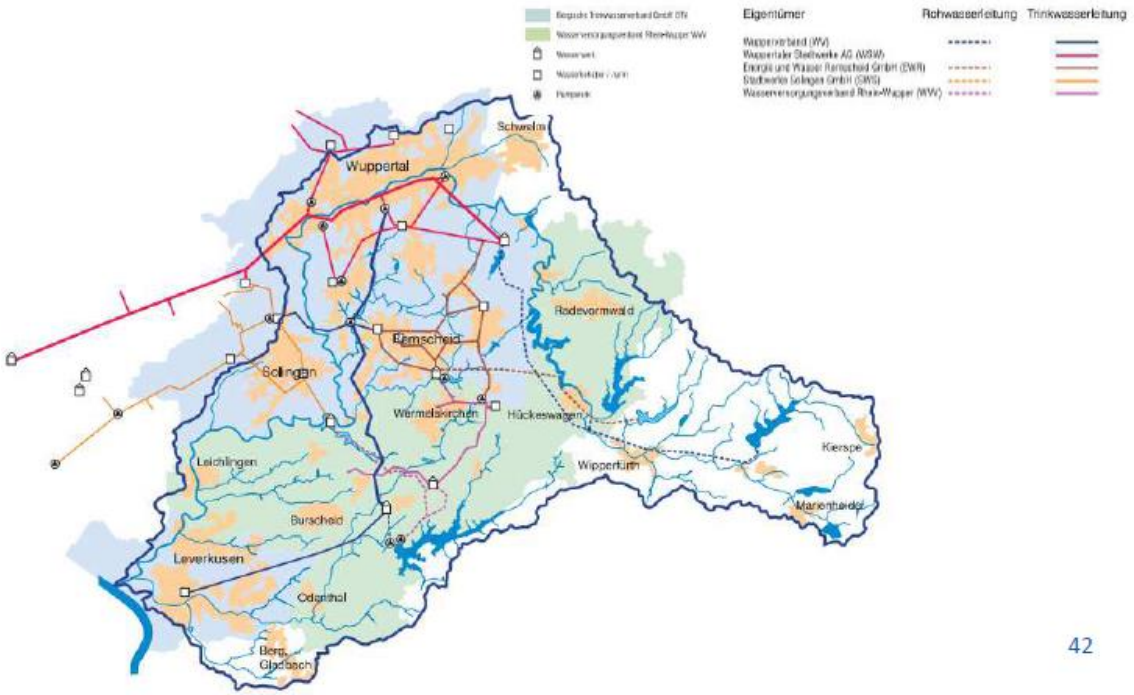
Faktoren für die zunehmende Problematik:

- Temperatur → zunehmende Hitze- und Trockenperioden erzeugen erhöhten Wasserbedarf (z.B. Bewässerung), Verdunstung, Wasserqualität
- (erhöhte) Ansprüche an die Gewässerökologie

Fallstudie Große Dhünn Talsperre (GDT) ausgewählt weil:

- bereits sehr gute notwendige Datenlage und Erfahrungen (erlebte Situationen)
- einige Maßnahmen bereits angedacht und in der Diskussion
- laufende Untersuchung im passenden Kontext (Interesse und gegenseitige Synergien)
- gute Übertragbarkeit für andere Regionen

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER
BINGO Fallstudien



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BINGO Fallstudien

2. „Zu wenig Wasser – Versorgungssicherheit gewährleisten“

Diskussion zu:

- Welche Kenngrößen bilden hier die Veränderungen / Unsicherheiten / Ziele / Entscheidungshilfen ab? Welche Berechnungen müssen dazu durchgeführt werden?
- Welche Randbedingungen müssen einbezogen werden? Wichtung der Zielgrößen.
- Handlungsrahmen, Akteure
- Möglichkeiten und Grenzen der Vorbereitung (operatives Vorhalten von Kenngrößen / Situationsanalyse → TASK, WATExR)

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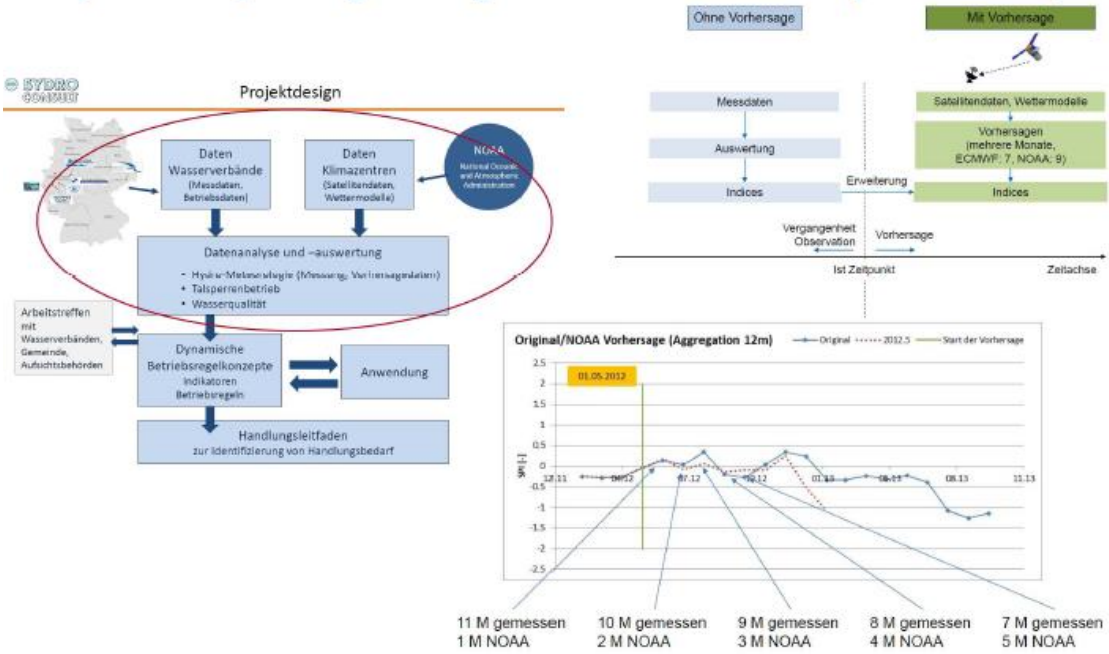
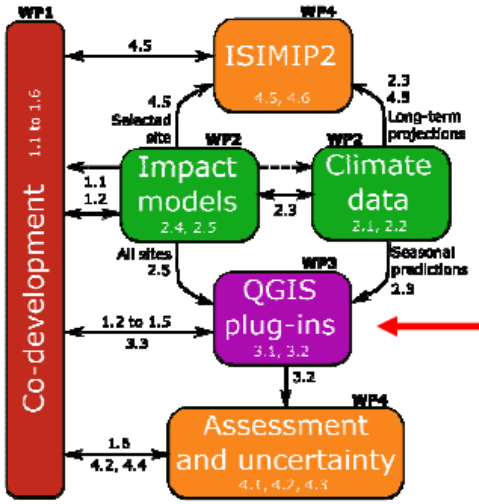
Andere, laufende Projekte

Talsperren Anpassungsstrategie Klimawandel - TASK (2017 – 2019)



Andere, laufende Projekte

WATExR – Integration of climate seasonal and ecosystem impact modeling for an efficient adaptation of water resources management to increasing climate extreme events

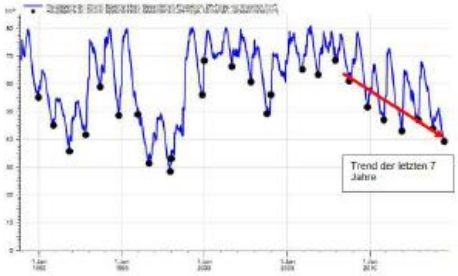


WATExR
Climate seasonal prediction for adapting water resources to extreme events

FEWS statt QGIS (im Untersuchungsgebiet Wupper)

BINGO Fallstudien

2. „Zu wenig Wasser – Versorgungssicherheit gewährleisten“



Maßnahmen für die GDT:
Umgesetzt:

a. Zeitweise (kurz: wie lange?) Reduktion der Rohwasserentnahme aus der GDT um 20 Prozent
b. Ersatz teilweise durch Grundwasser (Solingen) – nur möglich für Solingen und Wuppertal?

In Diskussion:

a. Mit der Genehmigungsbehörde in der Diskussion: Reduktion der Niedrigwasserführung von 1.000 l/s auf 700 l/s am Referenzpegel Manfort
b. Vernetzung der Rohwassergebiete „OST“ und „WEST“: Vergrößerung des Einzugsgebietes (Machbarkeitsüberprüfungen) für potentielle Überleitungen in das Einzugsgebiet der GDT bzw. der angeschlossenen Wasserversorgungsbetriebe
   i. Überleitung von der Kerspe-Talsperre in die Vorsperre GDT (Druckrohr)
   ii. Überleitung aus der Neye/Eschbach Talsperre bis zum Wasserwerk Schürholz des WVV (Konzeptstudie EWR)

Denkbar:

a. Überleitung aus der Kerspe-Talsperre an die Eschbachtalsperre (alte Überleitung aktivieren)
a. Verteilung zwischen BTV und WVV
b. Wassersparende Maßnahmen (Geräte, Verhalten)

Wupperverband
UNTERSUCHUNGSGEBIET WUPPER

Vielen Dank für Ihre Aufmerksamkeit

BINGO
a better future under CLIMATE CHANGE

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ANNEX III – PARTICIPANTS EVALUATION

Evaluation of Veluwe workshop

The average score is given in bold next to each question (1: inadequate – 5: very good)

1. Meeting preparation and logistics	
Meeting information provided in advance (e.g. dates, venue, agenda)	**3,6**
Meeting venue (adequacy of the room where the meeting took place)	**4**
Materials distributed during the meeting to support the sessions	**3,4**
Comments: -	

2. Overall assessment of the meeting	
Attainment of the objectives of the meeting (the objectives of meeting were met)	**3,8**
Positive and collaborative atmosphere among participants	**4,3**
Duration of the meeting (1=totally inadequate; 5=adequate)	**4,1**
Opportunity for individual participation and input in the meeting	**4,4**
Comments: -	

3. Evaluation of the sessions	
Clarity of presentations/speakers	**4**
Discussions (moderation, conclusions reached)	**4**
Comments: -	

II. In your opinion, what were the most positive and less positive aspects of the

meeting?

Positive aspects:

- positive and collaborative atmosphere
- everyone agrees on continuation of CoP after BINGO
- sharing information, meeting colleagues
- creating awareness

Negative aspects:

- hard to reach concrete results
- facilitator
- not many options to change in Veluwe water regime

III. What suggestions do you have for future meetings?

- work on concrete cases
- provide a number of presentations with concrete information

Evaluation of Bergen workshop

Unfortunately, time ran out and no time was left to workshop evaluation. It is planned to contact participants and ask for an evaluation in order to use the feedback in preparation for future workshops.

Evaluation of Troodos workshop

Seven workshop participants completed the evaluation questionnaires. Individual scores are given below each question (1: inadequate – 5: very good). The average score is given in bold next to the question; S = stakeholder

1. Meeting preparation and logistics						
Meeting information provided in advance (e.g. dates, venue, agenda)						**4.7**
5	5	4	5	5	4	
Meeting venue (adequacy of the room where the meeting took place)						**5**
5	5	5	5	5	5	
Materials distributed during the meeting to support the sessions						**4.8**
5	5	5		5	4	
Comments: S03: Very useful and interesting meeting						

2. Overall assessment of the meeting						
Attainment of the objectives of the meeting						**5**
5	5		5	5	5	
Positive and collaborative atmosphere among participants						**5**
5	5	5	5	5	5	
Duration of the meeting (1=totally inadequate; 5=adequate)						**5**
5	5	5	5	5	5	
Opportunity for individual participation and input in the meeting						**5**
5	5	5	5	5	5	
Comments: S03: The organizers of the meeting are the most appropriate persons to evaluate the attainment of the meeting's objectives						

3. Evaluation of the sessions						
Clarity of presentations/speakers						**5**
5	5	5	5	5	5	
Discussions (moderation, conclusions reached)						**5**
5	5	5	5	5	5	
Comments:						

II. In your opinion, what were the most positive and less positive aspects of the meeting?

S01: The most positive aspect of the meeting was the common acknowledgement of the large benefits of transferring and using desalinated water in the downstream communities of Peristerona Watershed

S05: Stakeholders exchanged ideas and views during this useful meeting

S06: The less positive aspect of the meeting was the low participation of community leaders; the most positive aspect was the very good structure of the meeting

III. What suggestions do you have for future meetings?

S01: Discussion about the insolvable issues of irrigation and specifically of irrigation water saving measures

S04: The regular organization of such meetings can strengthen the collaboration of the competent authorities and enhance the exchange of views and knowledge

S05: These meetings could be organized at the research site to maximize the participation of community leaders

S06: Monitoring of the impacts of the suggested adaptation measures (e.g., acceptance and use of recycled water, reduction of water consumption per capita)

Evaluation of Wupperverband workshop

Seventeen workshop participants completed the evaluation questionnaires. The average score is given in bold next to the question (1: inadequate – 5: very good).

1. Meeting preparation and logistics	No.	Ø
Meeting information provided in advance (e.g. dates, venue, agenda)	**16**	**4,1**
Meeting venue (adequacy of the room where the meeting took place)	**16**	**4,0**
Materials distributed during the meeting to support the sessions	**17**	**3,9**
Comments: • not easily accessible by public transport, better accessibility		

2. Overall assessment of the meeting	No.	Ø
Attainment of the objectives of the meeting (the objectives of meeting were met)	**15**	**3,5**
Positive and collaborative atmosphere among participants	**17**	**4,2**
Duration of the meeting (1=totally inadequate; 5=adequate)	**17**	**4,3**
Opportunity for individual participation and input in the meeting	**16**	**4,5**
Comments: • the concrete goal has not become clear • smaller discussion groups		

3. Evaluation of the sessions	No.	Ø
Clarity of presentations/speakers	**15**	**3,9**
Discussions (moderation, conclusions reached)	**14**	**3,8**
Comments:		

In your opinion, what were the most positive and less positive aspects of the meeting?

Positive aspects:

- Case studies Dhünn Talsperre
- Open discussion
- Covered topics

Less positive aspects:

- Not all participants / experts could attend
- Reference to the overall context is missing
- Too much content at status presentation

What suggestions do you have for future meetings?

- Concrete presentation of the project goals for Wuppertal and overall project goals at EU level
- More time per topic
- Make context clearer
- Clarify specific goals

CoP WS Tools Evaluation

At the end of the workshop participants were asked to score all tools used during the BINGO Tagus workshops from 1 (not inspirational) to 3 (very inspirational), to justify the most inspirational ones and to identify generalization constrains. The available list was as follows:

- ✓ General: Self Introducing Games; BINGO so far; CoP Flashbacks; Welcome& Farewell (coffee & lunchs)
- ✓ WSM8: SWOT/RWC (Tagus Basin context); Shopping (on relevant and difficult topics in Tagus Basin); Lego-PESTLE (on risk dimensions); Mapping (risk perceptions in Tagus Basin); Storytelling (events); Personas
- ✓ WSM15: Backcasting (dreams & nightmares)
- ✓ WSM22: Ideas Rope; CATWOE; Systemic Cross-test
- ✓ WSM28: Roleplaying; Roadmap

Participants should only score the tools used in the workshops they have attended (21 participants filled the questionnaire).

All tools have been scored with “inspirational” & “very inspirational” points and none has received constrains with respect to generalization. Based only in the maximum scores, the highest scored CoP Tools were:

(i) tools used in the current session (Roadmap and Roleplaying exercises);
(ii) tools enabling interactions and networking (Welcome & Farewell Coffee/Lunches and Self-Introducing Games);
(iii) tools based and/or oriented to data sharing and data co-production (Bingo so far…, SWOT using Round World Café and Mappings); and
(iv) tools pushing to “other feet experiences” (Personas, Roleplaying)

Positive and negative aspects of the workshop

In our opinion the most positive aspect of the workshop was the confirmation of (a) a relevant confidence between participants to share and discuss sensitive topics; (b) a comfortable attitude towards workshop collaborative approach and ethic code; (c) a very supportive coach to new members’ integration and participation; (d) a high co-

productive ambiance and focus on potential “actionable” roadmaps co-design, directly concerning each other’s and the Tagus Basin particularities; and (e) a sharing interest in keeping going on multi-sectoral and multi-level participants’ engagement.

Participants stressed in their workshop Evaluation Form the opportunity to experiment “different shoes” and rhythmic creative dynamics, thus enabling thedesign of concrete solutions. The informality, the ideas’ exchange freedom and the quality of in-groups debates were also valued and participants were very supportive to maintain this approach in future meetings. The diversity of contributions allied with a concrete problem focus was also underlined as a step forward in collaborative approaches and feasible solutions design (even not yet so “out of the box”!)

The most negative aspect of the workshop identified by participants was the lack of time (i) to go deeper in the exercises and to ensure a full use of the table materials from previous co-productions; (ii) to keep going on discussions and ideas development; and (iii) to stabilize more robust conclusions and commitments to action at the end. As this workshop was a “half day” session, it was also harder to ensure a more balanced time allocation between “introduction and BINGO so far moment” and the creative collaborative exercises; participants suggested a different time schedule organization (less introductions and more time for collaborative exercises). Also, the meeting room was not the room used in the previous workshops, and the participants suggested to use the former one (an appropriation sign?)

Suggestions for future workshops

Participants suggested (i) to keep focusing in “concrete” challenges and creative solutions design; (ii) to come back to “one day” workshop or just choose “one collaborative exercise at once”, keeping the same rhythm and dynamics; and (iii) to allocate more time to “debriefing” and going deeper in ideas and co-production moments.

Comments on the Dynamic of the Actionable Lab

This was the 5th workshop in Tagus Site, so most participants already know each other and are already used to BINGO collaborative debates. Even though some of them

meet in other contexts, participants expressed during the meetings how they value to meet and discuss, in the BINGO CoP collaborative way, with new people with different perspectives.

In all workshops there are always new participants, and/or participants that didn't attend all the meetings, and it is very interesting to notice how group always coach the new members. As we noticed in the tools evaluation form, the self-presenting icebreaker games have been very valued. As the time schedule of this meeting was very narrow we skipped out this moment and some participants stated that they missed it. As a matter of fact informal moments are really relevant and even though they were initially strange to participants, they got used of it and pushed to not dismiss those moments in the meetings.

Also, participants were more and more comfortable with the collaborative and "lab" approach, as for instance, less and less they asked for explanations on how the exercises should run. Participants are also valuing more and more the exchange and debate moments and the creative co-production rhythm, even though some claims for "more time to well structuring" ideas were expressed.

Most of participants are always struggled with available time for long sessions. This is the challenge in developing such approaches, because, too long time allocation to the creative exercises usually "narrow" the richness of outputs and as far as participants are highly co-productive they feel more available to keep going in exploring the debates and to request more time. Actually “lack of time” has been always a topic in all workshops and this is a topic to figure out deeply as it is really almost paradoxical: the more time is allocated to this kind of exercises, the most time participants demand to be engaged in...

The focus in concrete and “actionable” questions and ideas, was also very valued this time, eventhough in the first workshops participants were mainly oriented to more "conceptualizing" or "concept” debates. Actually, there is a path of joint confidence and shared references allowing that "to do's" issues are gaining more and more room. Participants also were more familiar with “actionable” tools, as co- productions are revealing a core coherence of concerns and are gaining density on “how to address them” while going deeper and deeper explored.

TOP 8 Scored Tools Description

#1 - Roadmap (WSM28)

Each Group was devoted to design a roadmap with concrete actions and tasks to develop ideas to be implemented towards pushing water issues to (a) a Public Agenda in general; (b) a Public Agenda in Tagus Basin; (c) a Political Agenda in general; (d) a Political Agenda in Tagus Basin; and (e) a high level integrated Political & Public Agenda. Each Group shared their roadmaps in a common Wall Paper and began an actionable discussion.

Pros Comments: enables ideas creation sprints, supports ideas organization, enables syntheses and feasibility approaches, quick focus on actionable tasks and activities.

#2 - Roleplaying (WSM28)

Participants were sorted by groups that should take the "shoes" of different stakeholders: (a) politicians; (b) CEO's decision makers; (c) regulatory bodies; (d) farmers; (e) citizens. Each group should work on a situation that revealed what should mean "to put water issues in the political and public agenda" (the topic chosen to the actionable lab), taking account "their shoes", and perform it to all participants. A collective debriefing followed identifying, drivers, triggers, solutions, conflicts and/or shared visions.

Pros Comments from Participants: allows to make real "real situations", fosters mutual learning , allows to "personify" ideas and different situations and worldviews, "out of the box", fun & revealing

#3 - Welcome & Farewell (lunch & Coffee) (general)

Participants are welcome with a coffee moment to enhance socialization and ice-breaking, invited to have lunch together and stay a little more after meetings around a meal. Candies, cookies, fruits and coffee were also available across the sessions in an informal mood.

Pros Comments from Participants: enables socializing and meets other stakeholders; promotes informal networking outside the room; it's nice and warming

#4 - Self Introducing Games (general)

Participants are asked to present themselves by telling a personal tip, a story, a position about a sorted word-card. Sometimes these games also enable to distribute randomly participants by small working groups tables.

Pros Comments from Participants: promotes dialogues and initiatives; enables icebreaking and interaction; increases participation; is appealing and is a stimulus.

#5 - BINGO so far…(general)

BINGO Research team shares on going work and results, followed by a debate and a debriefing of ToP5 main ideas debriefing

Pros Comments from Participants: to feed daily life activities with BINGO results; to update information; to better acknowledge BINGO project, to enable the building of a shared communication base

#6- SWOT in RWC (about RS context) (WSM8)

Each of the four tables was devoted to one of the SWOT dimensions (Strengths, Weakness, Opportunities and Threats) addressing 3+1 previous challenges: a) water and services provision; b) urban floods; c) agriculture and droughts; and d) other issues. In each

table participants were invited to give inputs and to promote the discussion about its SWOT dimension and moved to another table after 15 minutes' time. Each table maintained one "resident facilitator" (some tables just preferred to maintain two facilitators) to keep the discussion alive and to make sure that "all" contributions and ideas were registered in post-it in the four available color "challenges" post boards. At the end, each table facilitator made a short résumé and the collective production were placed in the big central table while an open debate was facilitated.

Pros Comments from Participants: enables to focus in the Research site and reach different points of view

#7 - Mapping risks (WSM8)

Participants were invited to state their perceptions on risk vulnerabilities as well as on protected areas in the territory, in order to create a joint evaluation of "impact zones". A big map of the Lower Tagus Basin was posted at the room wall, and each participant sign on it, by using different color post-its and brief words. Participants were invited to identify and mark a) places they identify as more vulnerable to risks (using red post-its); b) places they identify as less vulnerable to risks (using green post-its); and c) places they are more acquainted with, since they usually move in.

Pros Comments from Participants: enables to share established knowledge, is interactive; reveals perceptions about the territory and "blind zones", enables a quick scan of eventual critical points

#8 - Personas (WSM8)

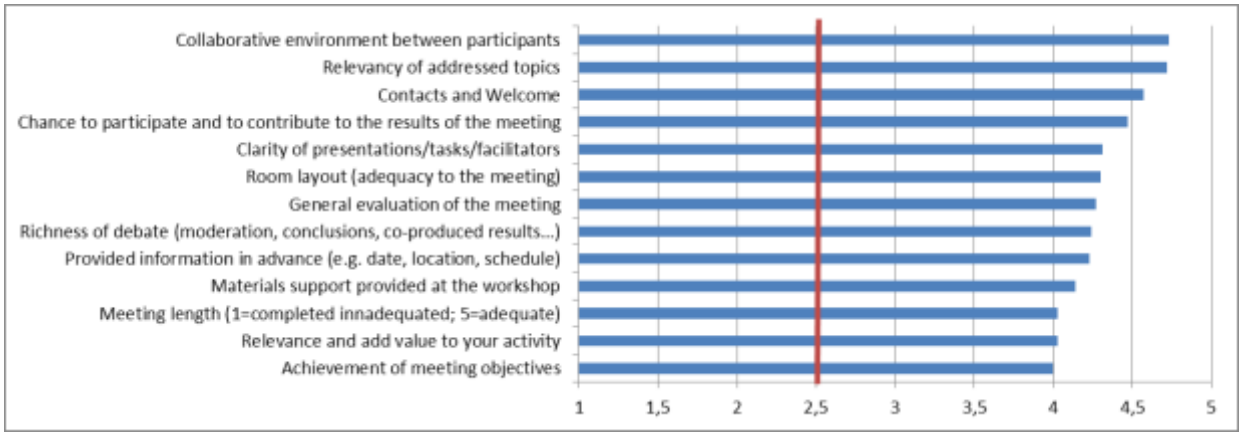
Each group built a "Persona" and explored a profile: (a) I am… a drought in Tagus Basin; (b) I am … a little farmer at the Tagus Basin; (c) I am … a teenager living at Tagus Basin; and (d) I am … a decision maker. Each group shared with everyone their "Persona" and interactions between the different "Personas" were encouraged.

Pros Comments from Participants: very participative and pushed to think in a different way, reveals accurate details that are usually lost in more conceptual discussions

Overview of the Workshop evaluation by Participants

5th session – 16th of november 2017
Nº of evaluations: 30 (score scale: 1.00 to 5.00)

Achievement of meeting objectives	4
Relevance and added value to your activity	4,03
Meeting length (1=completed inadequate; 5=adequate)	4,03
Materials support provided at the workshop	4,14
Provided information in advance (e.g. date, location, schedule)	4,23
Richness of debate (moderation, conclusions, co-produced results…)	4,24
General evaluation of the meeting	4,27
Room layout (adequacy to the meeting)	4,3
Clarity of presentations/tasks/facilitators	4,31
Chance to participate and to contribute to the results of the meeting	4,47
Contacts and Welcome	4,57
Relevancy of addressed topics	4,72
Collaborative environment between participants	4,73



Comments in the WSM28 Evaluation Form

Positives

#2	Very dynamic ambiance allowing creativity and the emergence of innovative ideas
#3	Very important to put ourselves in other stakeholders roles
#5	Building concrete ideas
#6	Everything was OK
#8	In general high participation of all participants. The presentations on BINGO ongoing activities and results were very clear
#11	Diversity of information and participants' backgrounds. Interactivity between all
#13	informality
#14	The possibility to debate the different questions and to listen different opinions from participants
#15	Rhythm; freedom of expression; exchange of ideas, even if not directly focused on the exercises' objectives

#17	Keep going with ideas bloom
#19	Very dynamic
#20	Dynamism in results production
#21	The opportunity to address very concrete and real situations
#22	Participation and interaction between participants
#23	The debate successful and interesting in general. Very good. Surprising in some creative aspects
#24	The approach to climate changes, namely to Tagus Basin
#25	Dialogue and interactivity
#26	Very important the opportunity to listen different points of view and different concerns. Cross-checking opportunity. Listen what new researchers are doing
#27	Meeting around a very relevant issue with a very "hand-on" objective. We reached to identify the problems and began to draft solutions in a very transversal way
#28	The addressed issues. The length of the meeting
#29	Rhythm and quality of the achieved collaborative work
#30	Diversity of contributions

Negatives

#2	Not enough time for tasks accomplishment
#3	Not enough time to cover all aspects of the issues.
#5	The room had not sufficient natural light and was not well ventilated. Delay in the meeting beginning didn't allowed to go deep in the debates
#11	Need more time to prepare the exercises
#12	The room was too narrow for so many participants
#13	Very short time to formalize with assertiveness the ideas. Too much "conceptual" discussion between participants
#15	The group division didn't facilitate a "theme" orientation (random distribution not facilitated!). Difficulty to focus on the object
#16	Too much time allocated to introductions and status reports. Lack of time to prepare ideas
#17	There were not many ideas "out of the box"
#20	More time is needed to go deeper in discussing the issues
#21	Lack of conclusions
#22	Need to close the meeting with conclusions
#23	The room has no good acoustic conditions and accessibility was not friendly; this should be improved
#24	I realize how it exists a delay on addressing the issues
#25	More discipline at the time schedule
#29	Unbalanced time (too much details in BINGO so far session!)
#30	Too short time of length

Suggestions

#2	Longer sessions and with a break moment
#3	Presentations could have been more detailed and sent in advance.

	(Not clear the relevance of documentation available on the working tables)
#8	Maybe to make a break during the session to make it less speed-up. For such questions more time was desirable
#13	To focus on “how to do” concrete actions/projects
#15	Another time distribution (less speeches and more time to participation)
#16	To keep the length of the workshop, but give more room to the discussion work
#17	Keep the methodology used today
#20	Coming back to an all-day dynamic, despite everyone’s time constrains. The relevance of these issues deserves our availability for a deeper and profound debate
#29	The results of the modelling predictions should be presented in a more integrated and synthetic way. New participants should be invited to present themselves
#30	More time allocated to the workshop (morning + afternoon)