



DEVELOPING  
PARTICIPATORY  
ADAPTATION PLANS  
FOR RIVER BASINS  
– a handbook

# TABLE OF CONTENTS

<b>Foreword</b>	<b>2</b>
<b>Overview of the handbook</b>	<b>4</b>
<b>Setting the scene</b>	<b>5</b>
<b>The BeWater approach and methods</b>	<b>8</b>
○ Stakeholder dialogue and participation	<b>11</b>
○ Participatory development of water management options	<b>17</b>
○ River Basin Adaptation Plans – from analysis to implementation pathways	<b>28</b>
<b>BeWater case study river basins</b>	<b>36</b>
○ Pedieos river basin, Cyprus	<b>38</b>
○ Rmel river basin, Tunisia	<b>44</b>
○ Tordera river basin, Spain	<b>50</b>
○ Vipava river basin, Slovenia	<b>56</b>
<b>Key findings for river basin adaptation planning</b>	<b>62</b>
<b>References</b>	<b>64</b>
<b>Project partners</b>	<b>66</b>
<b>Colophon</b>	<b>67</b>
<b>Water Management Options</b>	<b>68</b>



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No. 612385

# FOREWORD

## *THERE'S NO BETTER TEACHER THAN EXPERIENCE*



The BeWater project, supported by the European Commission's 7<sup>th</sup> Framework Programme, offered a unique opportunity to contribute to adaptation policy design and practices with experience-based knowledge. Four research institutes located in the cardinal points of the Mediterranean region partnered with expert organisations and members of the local communities to elaborate local adaptive water management plans. Innovative approaches were developed within the project to facilitate a truly collaborative process to increase societal resilience to climate variability and change at the river basin scale.

Global change and socio-economic developments are affecting the availability of and access to fresh water for drinking, agriculture, ecosystems and industrial activities. These evolving conditions are posing challenges for the optimisation of freshwater supply and demand and highlight an urgent need to adapt current water management strategies and practices towards more integrated approaches. Threats such as water scarcity are particularly acute in the Mediterranean region, where the degree of pressure from human activities on natural resources is already high. As a response, the BeWater project provided innovative tools to facilitate the adaptation of river basins to global change via an active engagement of the local societies.

The BeWater approach developed within the project focused on creating a shared definition of what challenges needed to be targeted in the basin and then developing, assessing and prioritising a range of potential water management options to address these points along with pathways for their implementation. Four Mediterranean basins were part of the project, namely Pedieos (Cyprus), Vipava (Slovenia), Rmel (Tunisia) and Tordera (Catalonia, Spain). While each basin experienced the process slightly differently, all shared the common aim of introducing adaptation principles into water management at the river basin scale.

Adaptive management poses challenging questions that need to be tackled through



methods and practices that have a solid theoretical framework but are still to be integrated into ordinary management procedures and policy design. Knowledge sharing and mutual learning between scientists, experts, decision-makers and local society have provided the needed basis for a truly participatory approach, offering a solid ground for capacity building, awareness raising and the development of concrete proposals. The process of co-production has proven to be able to deliver results with a high degree of social acceptance, political relevance and technical interest to tackle the uncertainties and complex nature of global change.

Throughout the design of the draft adaptation plans, common aspects and needs were observed, as well as barriers and facilitators in the design and future implementation of the adaptation plans. These lessons learned are synthesized in this handbook, and outlines the different steps undertaken, provides guidelines on policy and practical considerations from the process. This handbook thus aims to foster strong transferability of the case study results for application in other river basins, in Mediterranean countries and beyond, when designing river basin adaptation plans.

**Anabel Sánchez**  
*Project Coordinator, CREAM, Spain*

# OVERVIEW OF THE HANDBOOK

This document is intended to provide the reader with the necessary information to guide a participatory development of a River Basin Adaptation Plan. The handbook begins with more general information on the context of the BeWater project and highlights the importance of adaptation, the state of the art in river basin planning, society's role in the process and finally the need for resilient social-ecological systems.

The central component of the handbook (Chapter 4) then outlines the methodological steps followed in BeWater to create the river basin adaptation plans. This begins with the initial stakeholder dialogue and participation process, followed by the development and analysis of water management options, and ending with the implementation approaches that permit the creation of the river basin adaptation plans.

In order to understand how this process was experienced in practice within the BeWater project, relevant information from the four case studies are outlined, including the challenges faced in each basin, the lessons learned and the steps forward for implementation of the plan.

Finally, some key findings and overarching lessons learned relating to river basin adaptation planning are included, presenting information gained from the project as a whole. Here, the critical differences and similarities observed between the four cases are highlighted to foster a successful future application of the methodology in other river basins.

# SETTING THE SCENE

## ○ ○ ○ Adaptation: why do we need to adapt?

Climate change is expected to affect most regions across the world, with significant impacts predicted for the Mediterranean. Water is a key channel by which these changes will influence the natural environment and therefore the well-being of societies, and is expected to have far reaching effects on the greater part of the economy<sup>1</sup>. Increases in average annual temperature and shifts in precipitation are contributing to increased water scarcity, extreme phenomena (like floods and droughts) and land degradation can – in combination with other factors – evoke significant socio-economic losses.

This situation and the urgency to take action to face its consequences is underpinned by the outcomes of different initiatives promoted by the international community,

such as “2030 Agenda for Sustainable Development” adopted by world leaders in September 2016 at the United Nations and the “Global Agreement on Climate Change” developed by the 21<sup>th</sup> Conference of Parties in Paris and adopted in November 2016. This broad and ambitious framework of actions to reduce the vulnerability of the world's population to the challenges of global change puts a strong accent on water-related issues and dedicates specific resources to face them.

Potential changes in climate and, consequently, the natural environment thus urgently need to be factored into planning and decision-making processes to ensure that society can adapt and have a sustainable supply and use of good quality water resources in the future. However, a recognized lack of coherence and co-benefits between development policies and water security objectives (e.g. optimizing water uses, improving ecological status, improving flood/erosion risk protection) as well as a number of other impediments (institutional, regulatory, financial, etc) represent a challenge for developing and implementing integrated and sustainable water management strategies.



## ○○○ Science: what is the state of the art in river basin adaptation planning?

Recognition of climate change as a crucial consideration is growing in many policy fields, including in the area of water management. However, a global screening of water management initiatives revealed that while many of these have started to integrate such considerations in water management at multiple scales, few attempts have been made to operationally integrate climate change in river basin management. The screening also highlights the need to more adequately integrate risks and uncertainties in the planning process via an adaptive approach.

The BeWater project aims to respond to these gaps by developing River Basin Adaptation Plans in each of its four Mediterranean case study areas. Considering the uncertainties with forecasted climate change impacts and emerging socio-economic conditions, the water management plans in river basins need to adopt an adaptive approach which can respond to changes in key socio-ecological factors. The BeWater approach to developing the plans draws from a number of methods identified in existing adaptation plans.

## ○○○ Society: what are society's needs in terms of local adaptation?

The communities located in impacted Mediterranean river basins will be highly affected by the outlined changes in climate. Given the cross-cutting nature of these impacts including on water resources and their uses, it is crucial to engage policy makers, local stakeholders and experts in planning processes from the earliest development phase. Co-elaboration of water management approaches helps to make community interests, demands and concerns explicit, while establishing shared definitions and common ambitions and understandings towards solutions. Ultimately, understanding these aspects, and particularly societal

needs, increases support for the final product and thereby the likelihood of long-term engagement and effectiveness.

Taking these considerations into account, the BeWater project offers a means for participatory development which moves away from the traditionally expert-dominated approaches to adaptation planning and instead facilitates a bottom-up co-design process with local stakeholders and actors. The process ensures close collaboration in creating the respective River Basin Adaptation Plans and cultivates a sense of ownership of the final products.

## ○○○ Resilience: how can resilient social-ecological systems be developed?

A growing body of research indicates that environmental problems cannot be successfully tackled without taking into account the social context surrounding these challenges.<sup>2</sup> Water management is increasingly expected to understand river basins as complex social-economic-ecological systems. In order to maximise the effectiveness of river basin management in dealing with the challenges presented by global change, building resilience will have to become an overarching goal. Here, it is particularly important that local communities engage in participatory strategies' development and play an active role in planning processes. BeWater has built a comprehensive framework that expedites this approach in the case study areas by:

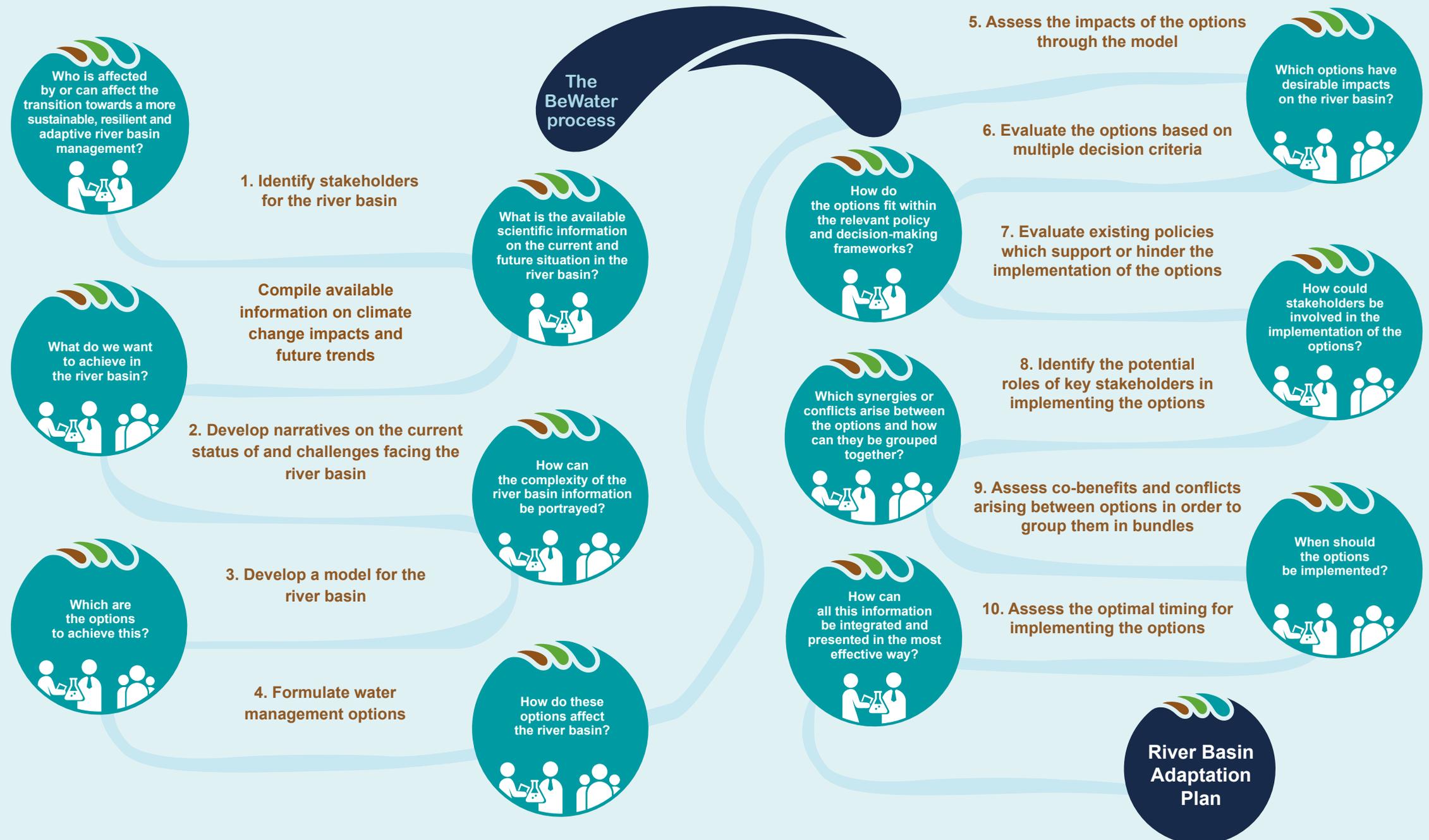
- **Enhancing the coping capacities** of stakeholders to master and resolve different sorts of water-related challenges in the basin. This leads to increased social awareness and the promotion of bottom-up processes within the basin community for planning and implementation processes.
- **Promoting adaptive capacities** through mutual and multi-directional learning amongst the project partners, entities and actors; within and between the river basins stakeholders; and within the broader society at large. This includes exploring and assessing opportunities for Research & Innovation

(R&I) collaboration between organisations, universities, small and medium-sized enterprises (SMEs) and civil society actors to boost innovation in the water sector.

- **Supporting the transformative capacities** of stakeholders by launching a process of societal transition towards improved collaborative governance and local empowerment that supports a more sustainable river basin management.



# THE BEWATER APPROACH AND METHODS



## Stakeholder dialogue and participation

To ensure that adaptation strategies for sustainable water management are informed and achievable, they need to be developed in an open process with the active participation of a diversity of stakeholders, sectors and policy areas in the river basin.<sup>3,4</sup> The importance of involving stakeholders in decision-making is increasingly acknowledged, and European water management planning now requires the participation of stakeholders and the public in the development of river basin management plans.<sup>5</sup>

Climate change adaptation planning in river basins is a complex and time intensive endeavour. It requires a methodological framework that draws on a robust analytical approach and the application of effective public participation and community engagement. There is no panacea for tackling these aspects, and thus no single optimal set of “correct” methods that should be applied.

Noting these limitations and needs, the BeWater project developed, tested and fine-tuned a flexible methodological framework that can serve as a starting point for other river basins wishing to plan for climate change adaptation. The steps and the corresponding methods applied within this framework are illustrated in the figure on the previous page.

The eleven steps representing innovative approaches developed with the BeWater project are numbered in the figure and

described in more detail within this chapter. This framework is meant to act as a starting ground for adopting a logical and test approach to future adaptation planning processes. It should be mentioned, however, that each of the steps can also be implemented slightly differently or carried out using the alternative methods listed under each step in order to accommodate local contexts. For each sub-chapter, the lessons learnt from the implementation of the described steps as experienced in the BeWater project are given.

Integrating diverse stakeholders within management discussions and decision-making processes is the best way to ensure that their perspectives and knowledge are considered. Participation can create a much richer picture of the local challenges at hand, the objectives and vision for the river basin, and ways forward to achieve these objectives. At the same

time, as many of the barriers to implementation are discussed and addressed when developing water management plans, the approach is likely to create a strong basis for successful implementation. Ultimately, the participatory approach for identifying and evaluating water management options results in increased ownership, salience and legitimacy of the process.

This section describes the steps of the stakeholder-involvement process implemented in BeWater. The lessons learned and potential challenges that may arise in the process are also provided.

### Further reading

The BeWater approach to developing the plans draws on a number of methods which were, amongst other resources, identified in a review of best practice examples and experiences from existing adaptation plans. More details on the reviewed adaptation plans and the methods applied therein are available in available in the BeWater project publication : “Compilation of best practice examples and experiences of adaptation plans” (Davis et al. 2014).



## Step 1: Identify stakeholders for the river basin

### Objective

To map, engage and integrate stakeholders in an inclusive and participatory process.

Aim to answer the question: *'Who is affected by or can affect the transition towards more sustainable, resilient and adaptive river basin management?'*

### Process

Stakeholders can be categorised according to various methods, for example which sector they belong to or their role within water management activities. Determining these categories is the first phase in the process of stakeholder mapping and should make the potentially different interests, perspectives and backgrounds clear. While an initial list should be developed at the start of the process, it is possible and unproblematic to refine the structure and the categories as needed throughout the river basin adaptation plan development process.

When engaging stakeholders in such processes, it is important to ensure that the selected representatives are well-balanced and - ideally - obtain assurances that these

individuals have the intention to be involved throughout the entire process. One might additionally aim to achieve a reasonable gender balance, for example, and thus have a quota on the minimum percentage of male and female participants.

Across the various categories of stakeholders, there will inevitably be individuals who have more expertise or knowledge of the river basin, an important stake in it, or are in a position to exert influence within decision-making processes. These stakeholders can be considered 'key stakeholders', and may be instrumental in making sure the final adaptation plans reflect the basin needs and priorities and are appropriate for implementation given the local context, (financial) resources and political framework.

A Stakeholder Database was developed to facilitate the selection of participants for major stakeholder engagement activities, with the selection process being based on Prospex' CQI method establishing selection criteria are balanced with quota in order to achieve a balanced group of participating stakeholders.<sup>6</sup>

### Alternative Methods for Step 1

There are numerous ways to organise stakeholder participation, with varying degrees of engagement and scope. Some approaches involve citizens in planning processes via **dialogue processes**, with a direct engagement of broad groups of citizens, or via **citizen fora** in which a large group of civil society representatives are gathered. These processes can be one-off or occur repeatedly, depending on the nature of the planning processes they are targeting. An **open working group** is another approach that operates publicly and includes efforts to involve society at a larger scale.

Suggested reading:  
European Environment Agency 2014

### Considerations

- Combining a scientific approach with stakeholder participation is highly complex. Technical aspects of the methodology need to be mastered, while a high level of familiarity and experience with the local setting and stakeholders, as well as with participatory approaches, is necessary.
- Stakeholder input is necessary as an integral contribution to the planning process and the outcomes of the technical methodology are used by the stakeholders to start their discussions. It is a challenge to find an appropriate balance between the flexibility needed when working with stakeholders and to maintain the structure of the technical methodologies used.
- In some cases, smaller countries like Cyprus have a limited number of senior public officers and policy-makers in each field which creates added challenges to bring all of them together. The engagement of junior officers in workshops and/or meetings can provide valuable input for the formulation of the adaptation plan in this context, while also empowering participants to act as multipliers and promoters for the adaptation plan in their organisations.
- The location of stakeholder events can be an important issue. In small countries, like Tunisia and Cyprus, most events were held in the capital city in order to encourage participation from a wide range of stakeholders. On the other hand, this can make it more difficult for community leaders and farmers to attend.

“The development of this River Basin Adaptation Plan has allowed a better understanding of the basin, thanks to the opportunity to include civil society, public administration and private sector actors from the territory in decision making processes.”

Marc Vilahur, manager of the Emys Foundation, Riudarenes, Spain



“BeWater was a great opportunity for knowledge exchange with younger generations.”

Mojca Novak Simonič, teacher at Biotechnical secondary school Nova Gorica, Slovenia

### Stakeholder workshops and interviews

Stakeholder engagement requires a combination of participatory approaches in order to ensure a sustained level of participation throughout the entire development process, and maximize the support for and successful implementation of water management plans. This could include one-on-one interviews with selected stakeholders, workshops, or open (often larger) targeted events to reach out to and involve the population at large or specific groups, like youth or a specific sector. Stakeholder workshops are particularly important as they constitute platforms for guided face-to-face interactions during which stakeholders meet personally, exchange opinions, learn from one another, develop shared insights and ultimately decide on key aspects of the adaptation plan together. Larger stakeholder events fit within outreach or dissemination activities and are particularly useful to engage the public at large.

In terms of logistics, several aspects should be considered when organising a workshop or other type of interaction with stakeholders. First, it is important to set out the rules and procedures at the beginning of a workshop. Furthermore, to capture all information given by stakeholders, it is recommended to make use of flipcharts, maps, sticky notes etc. on which stakeholders can write down comments and views. All information should be documented, e.g. using photographs of the edited materials. Finally, careful consideration is needed regarding the audio or video recordings of the workshops. The use of audio or video may affect the extent to which a stakeholder feels free to express themselves.

## ○○○ Lessons learnt

This section outlined the step to apply a bottom-up stakeholder dialogue and participation process, as implemented in the BeWater project; important lessons learned include:

- **Clearly define roles and divide responsibilities from the outset**, while ensuring sufficient in-depth knowledge of the river basin, local stakeholders, scientific methodology, and participatory approaches are covered by the individuals involved in the process. BeWater did this by having (1) a scientific party assuming a leading role for each river basin which was based within or close to the river basin and responsible for providing expertise on the local river basin and for local stakeholder management, (2) an expert party specialised in the scientific and technical methodology and (3) an expert party specialised in

engaging stakeholders through participatory approaches.

- **Minimize barriers to stakeholder engagement** by e.g. choosing easy accessible locations, and selecting dates, times and durations that accommodate local customs. Direct contact with individuals via personal correspondence is preferable to generic or group mails and helps to control the participant mix. Maintaining logistical consistency, such as moderators and contact people for each case study, is important in order to facilitate familiarity and ease with the stakeholders throughout the whole process.
- **Create appropriate conditions to encourage debate while reaching the objectives.** While the process aims to generate specific types of outcomes to create the river basin adaptation plan,



## Participatory development of water management options

It is increasingly clear that resource management decisions are implemented with less conflict and more success when they are driven by those who will be bearing their consequences.<sup>7,8</sup> This is especially relevant in the case of water management given its cross-cutting nature and the wide range of relevant stakeholders, interests and areas of expertise.

This section describes a participatory approach to involve society in the identification and assessment of water management options. The approach has been tested and applied to four different river basins in the Mediterranean to ensure sufficient flexibility to cope with the contextual differences between the river basins.

It should be noted that each of the steps are presented in a logical order, but subsequent steps may in turn feed back into previous steps in an iterative process. The steps in the approach are outlined below<sup>9</sup>:

### ○ ○ ○ Step 2: Develop narratives on the current status of and challenges facing the river basin

#### Objective

To create a shared understanding amongst stakeholders of the dynamics and main challenges in the river basin.

Aim to answer the question: *What do we want to achieve in the river basin?*

#### Process

In this step, the local stakeholders are to discuss the impacts of climate change and other pressures on their river basin, based on available scientific information and local knowledge. The goal is to build a shared understanding and to agree on the main

a welcoming and constructive stakeholder debate to achieve these results requires a positive, relaxed environment in which participants feel comfortable to express their opinions. Within BeWater, professional facilitators were used to help the stakeholders feel comfortable and deliver the desired information within a format deemed appropriate for all stakeholders.

additional bilateral conversations or interviews with scientific experts and key stakeholders after evaluating whether the original workshop outcomes generated the input needed for the next steps in the scientific process. It is important that the larger group of stakeholders gets a chance to validate any changes made during these parallel, targeted side interactions.

- **Allow space and time for iterations** in the process to fine-tune or complement certain arguments or outcomes. Within BeWater, this involved organising
- **Make use of ICT software tools for stakeholder management** in order to deal with the wealth of information related to the interactions with stakeholders. BeWater used the user-friendly Customer Relationship Management (CRM) database to reflect stakeholder categories. These databases were managed by the local case study leaders.
- **A core group of stakeholders** that participates in all workshops, consultations or other meetings helps to ensure outcomes of the stakeholder workshops are correctly captured and processed. However, the involvement of new stakeholders during the process allows reflection and verification of the outcomes of previous workshops.



“In the BeWater project, the adaptive management of the river basin has considered and processed various issues, options and measures. The approach has led to the development of a plan that will be acceptable by the civil society and which has not been imposed by the policy makers.”

Najla Khalfoun, Groundwater Department, Ministry of Agriculture, Tunisia, Tunisia

challenges to be tackled by water management and identify linkages with other relevant sectors (e.g. land management, ecosystem conservation, production etc.). The main findings and shared insights are then to be integrated into a storyline ('narrative') about the river basin. This process can involve the following action points:

- 1 **Compile available scientific information** on the estimated impacts of climate change and other factors (population development, land use, etc).
- 2 **Organise a workshop** to interact with stakeholders, which can be structured as follows: (i) resending the scientific information to stakeholders and discussing the implications, (ii) group work to answer the question 'From your perspective, what are the biggest challenges in the medium-long term for your river basin?', and (iii) group work to answer the question 'What would you like water management to achieve by 2030 in your river section?'
- 3 **Synthesise** all the information obtained in a narrative. These narratives describe stakeholders' beliefs and expectations from the water management in each river basin along a common storyline and consist of a written and a graphical component (see next step on 'Develop a model for the river basin'). The written component describes the context, the status and the challenges of water management in the river basins in a

reporting format included in the river basin adaptation plan.

- 4 **Present and discuss** the narrative with stakeholders to ensure their views were correctly captured and understood by the scientific team.

#### Considerations

- This step depends on the views, knowledge and beliefs of stakeholders. To capture these adequately, interactions are needed with stakeholders. Within the BeWater project, workshops, supplemented with interviews with stakeholders unable to attend the workshop, were an important tool to interact with stakeholders and for stakeholders to interact with one another.
- In some areas, climate change data may be limited, which can make the narratives difficult to develop. This was the case in Tunisia and Slovenia, where studies on water resource availability and extreme hydrological events require in depth research through improved analysis and modeling tools, both nationally and locally.
- The case study in Tunisia also noted that many legal frameworks in the country required updating. This is a fairly significant observation, and an important consideration that could play into river basin adaptation plan development in other cases.

#### Alternative Methods for Step 2

**Participatory vision and/or scenario development** is a further participatory approach that involves the broader public, including for example citizens, government officials, representatives from civil society organisations and experts. The method consists of different sequential steps and requires expert facilitation in order to build a coherent vision and/or several scenarios regarding possible futures of the area at hand.

Suggested reading:

- Bizikova et al. 2014



“ In the Rmel river basin, the development of water management options helps all stakeholders to collaboratively develop measures and rules related to sustainable development in future climate conditions.”

Naceur Boussaidi, Professor at Sylvo-pastoral Institute of Tabarka, Tunisia

## Step 3: Develop a model for the river basin

### Objective

To develop a coherent understanding of the dynamics in the river basin (building on the narratives compiled in the previous step).

Aim to answer the question: 'How can the complexity of the river basin information be portrayed?'

### Process

To enhance stakeholders' knowledge and understanding of a system and to be able to assess impacts of policies, participatory modelling is an important approach<sup>10</sup>. Fuzzy cognitive mapping is one participatory modelling method that allows stakeholders to be included in developing a joint understanding of river basin dynamics and the maps can be created in a relatively short period of time. A Fuzzy Cognitive Map<sup>11</sup> is a graphical representation of a system – in this case a river basin – where the components are represented as boxes and relationships as arrows. It represents a belief system, i.e. it portrays the dynamics in a system based on the understanding of individuals. In order to develop such a map together with stakeholders, it is necessary to:

- 1 **Identify factors** related to the current status and challenges of the river basin through brainstorming. Within the BeWater project, this step was carried out by reviewing all statements made by stakeholders during a first stakeholder workshop.
- 2 **Refine and cluster** the proposed factors. The clustering is done to bring ideas together that are conceptually similar, not ideas that affect each other. It is helpful to categorise factors as being challenges, drivers, or other relevant factors.
- 3 **Identify relationships** by linking the identified factors together to reflect how factors may exert influence on other factors, visualised by means of arrows.
- 4 **Identify direction of influence** by classifying the relationships identified as positive or negative, to indicate how one factor affects another factor.
- 5 **Identify strength of influence** for each of the identified relationships. The strength of the relationship can be assigned to classes, e.g. classified as 'strong', 'medium' or 'weak'.

“The process of developing adaptation measures invited the administration to take up solutions known to be important, but which were previously never implemented because of the lack of collaboration between institutions.”

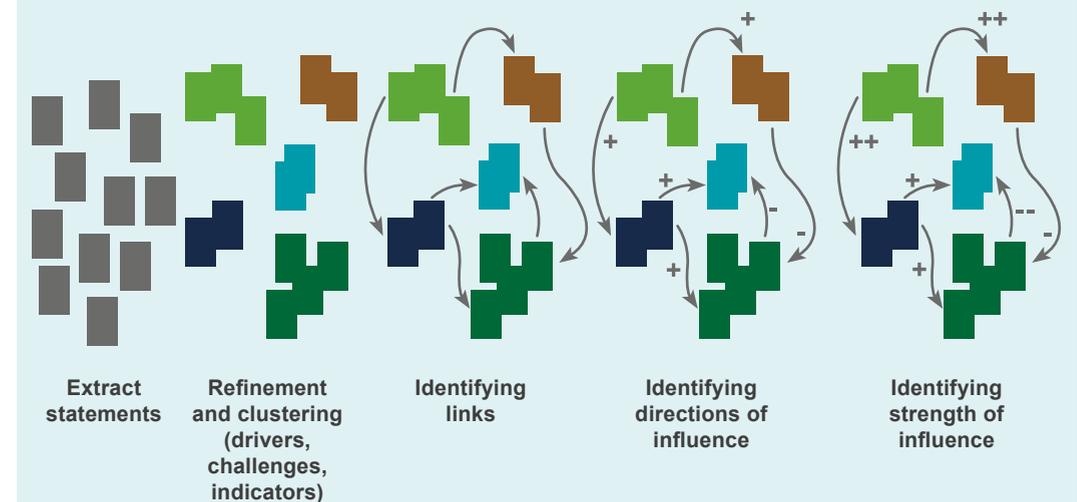
Gabriel Borràs, Adaptation Area of the Catalan Office for Climate Change, Barcelona, Spain

To be able to use the maps for assessing impacts of water management options (Step 5) a model refinement may be needed in which the map is simplified by reducing the numbers of factors to approximately 20 and by removing redundant relationships.

### Considerations

- There are multiple ways in which fuzzy cognitive maps can be constructed, ranging from entirely expert-based (i.e. without stakeholder involvement) to a fully participatory approach involving stakeholders in every step. In BeWater, the maps were constructed by experts using statements made by stakeholders in a workshop. Experts then created first versions of the maps and discussed them with stakeholders.
- Developing the fuzzy cognitive maps in a workshop setting enhances the involvement of the stakeholders, enabling them to better understand the role of the fuzzy cognitive maps in the overall analysis.

### Schematic overview of the process to create fuzzy cognitive maps



“The development of the fuzzy cognitive map has received great interest and positive feedback from stakeholders when they saw how their drawings were transformed into an analytical model.”

Annelies Broekman, Tordera case study leader, Research Center for Ecology and Forestry Applications (CREAF-UAB), Cerdanyola del Vallès, Spain

### Tools for Step 3

Several software packages are available to create fuzzy cognitive maps, including Mental Modeler ([www.mentalmodeler.org](http://www.mentalmodeler.org)) and FCMapper ([www.fcmapppers.net](http://www.fcmapppers.net); or as R package: [cran.r-project.org/web/packages/FCMapper/FCMapper.pdf](http://cran.r-project.org/web/packages/FCMapper/FCMapper.pdf)), but fuzzy cognitive maps can also be fairly easily created in a spreadsheet.

In the BeWater project, the fuzzy cognitive maps were constructed using Mental Modeler, but all model calculations were carried out in Microsoft Excel. In addition to fuzzy cognitive mapping, several other participatory modelling approaches and methods exist, for example group model building, mediated modelling, companion modelling, participatory simulation, and shared vision planning (Voinov and Bousquet 2010).

## Step 4: Formulate water management options

### Objective

To identify potential solutions to address the challenges identified by stakeholders in previous steps in order to achieve the identified objectives for the river basin.

Aim to answer the question: ‘What options are available to address the challenges in the river basin?’

### Process

Water management options need to be formulated to address the challenges expressed by stakeholders. Their formulation is based on the information collected during the first round of stakeholder work-

shops and additional interviews conducted in each basin. The information collected is further refined with stakeholders to formulate water management options, and as input to evaluate them. Water management options can be defined via the following steps:

- 1 **Identify options**, taking into account the challenges identified and the water management options suggested by stakeholders; a list of water management options can be generated.
- 2 **Characterise each option** using a common set of descriptors. Such descriptors could relate to the character

of options (i.e. demand or supply oriented), their approach to adaptation (e.g. ecosystem-based solutions, technical solutions and managerial solutions), implementation time, etc.

- 3 **Cluster options** to avoid repetition, identifying suggestions for options that are conceptually very similar. The clustering of options can be made based on the similarity of descriptors and challenges that they address. The aim is to shorten the potentially long list of suggested water management options into something more concise.
- 4 **Check for completeness** to identify gaps and redundancies in order to cover a broad variety of water management options. This builds on the characterisation of the water management options
- 5 **Refine option** descriptions as needed; this step can be carried out with involvement of stakeholders. The outcome of this step should be a description of the option that is detailed enough for stakeholders to understand the option.

### Considerations

- The steps outlined above are intended to give structure to the process of identifying options. However, in practice it is possible that not all steps happen in order and that some steps may be combined or even skipped.
- It is important that proposals are formulated in a concrete manner in order to serve as a basis for subsequent steps in developing the river basin adaptation plans. The engagement of public authorities in the participatory process can enable a better harmonisation of the proposals formulated by the stakeholders with existing legislation, plans and programmes.
- The description and characterisation of the water management options needs to be clear and exhaustive. In order to maximise the utility of planned stakeholder interactions (e.g. workshops), relevant information on the water management options can be sent to participants prior to the events to enable them sufficient time for preparation. However, as all individuals may not invest this time prior to attending the workshop, sufficient time should be devoted to explaining each option before beginning the activities.

“The water management options developed for the Rmel river basin are grouped together in bundles according to their synergistic interactions with one another. This bundle provides an overview of information that is specific to [the] implementation pathways of options. This information can be used by decision-makers when determining which single option(s) would be most appropriate to achieve their targeted objectives.”

Hamed Daly, Scientific advisor, Agricultural National Research Institute, Ariana, Tunisia

## Step 5: Assess the impacts of the options through the model

### Objective

To analyse the potential effects of water management options before their adoption.

Aim to answer the question: *'How would the water management options affect the river basin?'*

### Process

To understand the potential impacts of a management option, an ex-ante impact assessment can be carried out. Ex-ante impact assessment is a procedure to analyse the potential effects of new policies or measures before they are adopted or implemented. Within the BeWater project, the fuzzy cognitive maps were used to assess the potential impacts of water management options on river basins.

Within the assessment process, the developed fuzzy cognitive maps can be used as mathematical models to provide information on how the basin responds due to a change in a given driver (e.g. temperature, precipitation, population development, etc.)<sup>12</sup>. As this step aims to see how the water management options could affect the river basin dynamics, the maps can be modified by adjusting the relationships between different factors, introducing new relationships, introducing new factors and relationships, or by a combination of these three possibilities.

### Considerations

- The level of involvement of stakeholders needs careful consideration. Within the BeWater project, options were introduced into the fuzzy cognitive maps by experts and discussed with stakeholders during workshops and consultations. A stronger involvement can enhance understanding of the options, the fuzzy cognitive maps and the results, but this requires more time and resources.

### Alternative Methods for Step 5

**Numerous ex-ante impact assessment tools and methods** have been developed to carry out environmental or sustainability impact assessments. These can be broadly grouped in three classes: monetary, biophysical and indicator-based tools and methods. A full discussion of all tools and methods is beyond the scope of this handbook.

Suggested reading:

- Gasparatos, A., A. Scolobig. 2012
- Singh, R. 2007; 2012



“A profound participatory (bottom-up) approach is a distinctive feature of BeWater. In addition, the project consortium has been highlighting and exposing the possible effects of global change throughout the entire process of searching for proper, effective, realistic and rational solutions for water management.”

Jože Papež, Head of Research and Development at Hidrotehnik, Vipava, Slovenia

## Step 6: Evaluate the options based on multiple decision criteria

### Objective

To examine the different characteristics of the water management options, and their impacts on the water basin and local communities, and consider the specific options that should be included in the river basin adaptation plan.

Aim to answer the question: *'Which options have desirable impacts on the river basin?'*

### Process

To evaluate the water management options, the stakeholders select the criteria on which the options will be evaluated, as well as the relative weight of each criterion during a workshop. The criteria refer to both the design of the water management options (Step 4) and their expected impacts on the river basin, as estimated with the fuzzy cognitive map (Step 5).

The information on the selected criteria and their relative weight is combined with the outcome of the impact assessment on the

options by scientific experts. This is termed “multi-criteria analysis”. The combination of these pieces of information for analysis results in the identification of options that have a desirable impact on the river basin, according to the local stakeholders’ preferences. The evaluation results are presented on a continuous scale.

### Considerations

- The use of multi-criteria analysis has implications for the design of workshops. To avoid bias in the evaluation results, it is important that stakeholders do not see the outcomes of the impact assessment (Step 5) before they are asked to select evaluation criteria and determine their relative importance.
- Within the BeWater project, the multi-criteria analysis was carried out during a stakeholder workshop. It is also possible to select decision criteria and rank their importance through other methods, such as a questionnaire.

## Alternative Methods for Step 6

Numerous methods exist to incorporate preferences in decision-making and a multi-criteria analysis is one that is frequently used. Another commonly used method is cost-benefit analysis.

**Cost-benefit analysis** is an economic decision-making approach, used to assess whether a proposed policy is worth doing, or to choose between several alternative options. Cost-benefit analysis compares the total expected costs of each option against the total expected benefits, to see whether the benefits outweigh the costs, and by how much. Cost-benefit analysis thus uses economic values as a basis for the comparison of the different options. An argument for its use is that the outcomes of a cost-benefit analysis are compatible with market mechanisms and are more comprehensible to decision makers. One difficulty of cost-benefit analysis is to estimate economic values for all potential effects of a management option; non-market effects especially are more complicated and resource-intensive to estimate.

**Cost-effectiveness analysis** is suitable for the assessment of adaptation options if a single objective is focused on, e.g. flood protection or avoiding related health impacts. It is also a helpful tool if significant non-market dimensions are relevant, as the assessment allows for benefits to be valued in non-monetary terms, opting for quantification in physical terms instead.

**Robust Decision Making** is another alternative method which emphasises an option's ability to be effective over a range of possible future conditions. It is especially suitable for large infrastructure investments and can also identify trade-offs and synergies between a variety of options. Robust Decision Making seeks to minimise regret, instead of maximising expected utility.

The most appropriate method depends on the type of decision to be made, or the level of public participation that is required or wanted. A multi-criteria analysis generally (but not always) allows for stronger involvement of stakeholders as compared to cost-benefit analysis. The weighted scoring method tries to link economic cost estimations with benefits, as estimated with multi-criteria analysis. Recent discussions in the field of adaptation have also developed more participatory approaches to using cost-benefit analysis.

Suggested reading:

- Diakoulaki, D., Karangelis, F. 2007
- Department of Finances and Personnel. 2016

“To reach a common vision on what the basin should look like in the future and agree on ways to face the identified changes is a crucial starting point to advance towards societal resilience to climate change.”

Anabel Sanchez, Coordinator of the BeWater project, Research Centre for Ecology and Forestry Applications (CREAF-UAB), Cerdanyola del Valles, Spain

## ○○○ Lessons learnt

This section outlined the steps applied to formulate and evaluate water management options, as implemented in the BeWater project; important lessons learned include:

- **The involvement of stakeholders in the formulation and evaluation of water management options** requires dedicated opportunities for stakeholders and researchers to interact (e.g. workshops, consultations, interviews, etc.). The approach must further allow for iterations to ensure that views and comments are correctly understood and processed.
- Special attention has to be dedicated to **defining the descriptors and characterisations** of the identified options, in such a way the information provided is relevant, sufficient and functional to the subsequent steps.
- **Stakeholder workshops and consultations** are important tools to facilitate interactions with and between stakeholders. These moments of interaction need to be carefully planned in terms of content to ensure that all objectives can be met. The interactions also need to be carefully planned in terms of timing, as improper timing of workshops may hamper certain stakeholder groups from participating or may prevent the objectives from being met.
- A careful **content balance** is needed between providing stakeholders with relevant information and directing the workshops to particular outcomes. It is important to develop a clear process design and to define the roles of scientists and facilitators who are guiding the process to avoid introducing bias in the outcomes of the workshops.
- **Fuzzy cognitive maps** can be constructed with different levels of stakeholder involvement, ranging from desk research to interviews and workshops. Developing a fuzzy cognitive map directly in a workshop setting would enhance the involvement of the stakeholders, enabling them to better understand the role of the maps in the overall analysis. Fuzzy cognitive maps can be created within one- to two-day workshops<sup>13</sup>. However, it takes time to refine the maps to be able to use them for further analysis; their construction and refinement should be carefully planned for when designing the overall process.
- **A dedicated workshop** is ideal in order to adequately brainstorm and formulate the WMOs with stakeholders. It can be a time consuming process, and so such a workshop with a single objective can be helpful.
- It is important to keep in mind that **water management options** developed in a participatory process are not always the most straightforward way to tackle problems. However, a collaborative discussion is a first step towards reducing ambiguity and can serve to increase stakeholder acceptance of the process outcomes.

# River Basin Adaptation Plans – from analysis to implementation pathways

River basin adaptation plans contain a series of basin-specific water management options for enhancing the resilience of the basin's water resources, as well as societal resilience in the face of global change. They can include an analysis of the options' implementation over time and can present a range of further aspects relating to these options, such as implementation opportunities and co-benefits between the options.

- Building on the finalized water management options outlined in the previous section, the following steps move toward implementation and describe the final stages in developing a river basin adaptation plan. More specifically, the chapter covers the following aspects:
- evaluation of synergies and conflicts with existing policies,
  - identification of the potential roles of key stakeholders in the implementation process,
  - co-benefits produced if several options are implemented together and the bundling of options with high co-benefits,
  - assessment of a timeframe for the implementation of the options as an "adaptation pathway".

## ○ ○ ○ Step 7: Evaluate existing policies which support or hinder the implementation of the options

### Objective

To identify policies and policy instruments that are relevant to the water management options.

Aim to answer the question: 'Which policy instruments can support or hinder the implementation of water management options?'

### Process

In this step, policies should be understood in a wide sense to include governmental programmes that use regulatory, financial, or information-based mechanisms and instruments to influence society. The explored instruments should include regulations on different levels and in different sectors as



well as cross-sectoral mechanisms, such as the Water Framework Directive, the Common Agricultural Policy, the EU Adaptation Strategy and national or regional adaptation strategies. More funding oriented instruments should also be covered such as European regional and structural programmes (LIFE, EU Cohesion Policy, etc), national and local programmes (by specific ministries, environmental agencies, local authorities, etc) as well as development investments and programmes (World Bank, European Investment Bank, United Nations, Global Environmental Fund, bilateral assistance, etc).

To assess the feasibility of a water management option in the context of identified policies and instruments, the following aspects should be analysed and noted in a consolidated sheet for each water management option for easy reference:

- 1 **Objectives and target of the policy:** do these align with the objectives of the water management option?

- 2 **Regulatory requirements, eligibility or selection criteria:** can these serve to support or prevent the adoption of the water management option (or part of it)?
- 3 **Funding:** is funding potentially provided for the water management option (or part of it)?
- 4 **Spatial focus and timescales** of the policy and instruments: are these coherent.

### Considerations

- When of developing a river basin adaptation plan a good overview on the variety of regulations, windows of opportunity and available funding mechanisms might be missing. In this case, relevant stakeholders (including e.g. policy makers) should be consulted to either provide the information or to validate gathered information.

“The intense and complicated bureaucratic procedures needed to access funding are currently a great obstacle for farmers to adopt adaptation measures.”

Marta Maynou Vallès, Oriental County Office of the Catalan Agriculture Department, Spain

## Step 8: Identify the potential roles of key stakeholders in implementing the options

### Objective

To identify potential roles, levels of interest, commitments and responsibilities of policy actors.

Aim to answer the question: *'What are the interests of identified policy actors in implementing the different water management options?'*

### Process

The most relevant stakeholders for the adoption of each water management option should be identified, including actors from different sectors, different administrative levels, from private and public bodies (e.g. the agricultural ministry, environment ministry, water agency, municipalities, households, farmers, industry, civil society, including environmental NGOs).

The assessment should include an analysis of the opportunities and barriers due to prevailing stakeholder opinions and positions, and their possible involvement. When looking for opportunities and barriers in stakeholder engagement, a stakeholder's willingness (or lack thereof) to adopt the water management option should be examined.

For example, local farmers may have expressed interest in installing drip irriga-

tion on their farm (e.g. to prevent drought impacts, to save money), but might lack the financial resources to do so.

When evaluating "possible involvement", it is important to examine what stakeholders could do to implement the measure or support its implementation. For example, the assessment here concludes that farmers would adopt drip irrigation voluntarily, but this would require financial incentives to support that adoption. Additionally, local environmental NGOs could be actively engaged in promoting water efficient agriculture amongst farmers and politicians.

### Considerations

- For the inclusion of stakeholder opinions and knowledge in the assessment, e.g. via expert interviews, there is on the one hand a problem of willingness for engagement, and on the other hand the question of commitment if certain institutions have an interest in certain activities. These biases should be taken into consideration.
- In stakeholder group discussions, where researchers are engaging with stakeholders in order to analyse their attitudes, it is possible that the stakeholders will not answer truthfully as some stakeholders might be in a power position.

“ Collaboration with landowners is crucial to implement adaptive forest management. Therefore, the administration needs to consolidate clear agreements and improve the monitoring of the concrete actions developed.”

Daniel Guinart from the Montseny Park Authority, Barcelona, Spain

## Step 9: Assess co-benefits and conflicts arising between options in order to group them in bundles

### Objective

To provide guidance for decision-makers about bundles of water management options which can be implemented together to minimize the degree of conflicts and optimise the benefits arising between the individual options.

Aim to answer the question: *'Which options can work synergistically when implemented together to provide increased benefits?'*

### Process

This step involves conducting an analysis to determine if options have an increased or reduced degree of effectiveness if they are

implemented together in so-called 'bundles'. Bundles combine several water management options and are developed with the aim of increasing the impact of the groups of options through a maximization of synergistic effects. Bundles can be built e.g. for different challenges or for certain regions (up-stream, mid-stream, downstream).

In order to develop the bundles, an assessment of co-benefits between options is necessary. This process should start with an impact assessment that highlights the difference between the effect of (1) the implementation of combinations of water management options and (2) the effect of an



“Bundles of measures with a proposed implementation timeline have been designed and [agreed upon] between stakeholders. A harmonized plan of actions can already be considered as first concrete adaptation measures. Implementing the proposed measures is in the hands of individual stakeholders.”

Matjaž Tratnik, professional associate at Hidrotehnik, Slovenia

individual implementation of options. A qualitative impact assessment can be carried out by comparing higher or lower effects of implementing the groups of options, as opposed to implementing the individual options independently. Next, the options should be grouped in suitable bundles with high co-benefits between each other. Here, it is best to start with an option that has e.g. a high multi-criteria value and add options which show synergies with this option.

Local and regional expert knowledge to support this assessment should be integrated via expert interviews or working group discussions.

#### Considerations

- Bundles can easily include a high number of options that makes combined im-

plementation not feasible. Therefore, it might be necessary to limit the bundles to a certain number of water management options to keep them useful for implementation. Furthermore, in order to implement a bundle of options as such it is necessary to make sure that the nature of the options included is coherent with the implementing responsibilities of the parties that need to be engaged.

- In-depth knowledge of the consulted parties can vary significantly, especially if a large variety of options needs to be analysed. Therefore, the areas of expertise of the consulted parties should be clarified and additional experts should be contacted in cases in which the discussed options are broader than individuals' knowledge.

#### Alternative Methods for Step 9

- If very detailed and geographically determined options should be assessed, further sub-categories can be kept in mind such as an increase or reduction of implementation costs, or overlaps in geographical implementation area in addition to the co-benefits on options' impacts and thereby their effectiveness.
- Quantitative assessment of co-benefits can be used instead of qualitative approaches. This could be done by e.g. using fuzzy cognitive maps or other modeling approaches.
- Scenario development or a prepared participatory vision (as mentioned in Step 2, Chapter 4) could be used to establish bundles of options. A set of scenarios can show different possible developments if different options or bundles are taken into account. The process should include participatory scenario workshop(s).

## Step 10: Assess the optimal timing for implementing the options

### Objective

To identify the timing at which each water management option would best be implemented in a certain bundle, detailing both planning and implementation considerations, such as existing policies and the possible involvement of stakeholders.

Aim to answer the question: *'In which order should the options within each bundle be implemented?'*

### Process

In order to determine the optimal timing for implementing the various water management options within each bundle, a qualitative assessment should be conducted. This involves determining (1) when the implementation of an option is necessary due to the expected climate risk, and (2) the time lag between implementation and effectiveness. Both parameters influence the need for a short-term implementation of a certain option. Additionally, the assessment takes into account planning and implementation-oriented criteria that also influence the implementation in time.

In this exercise, multiple factors can be considered depending on the implementation context. Examples of potentially relevant criteria include: the results of the multi-criteria analysis, the feasibility based on given technical and scientific capacities, acceptability and support or opposition of the option by one or several stakeholders, flexibility for adjustments of the option over time, robustness under different climatic and socio-economic scenarios and the costs of an option. Furthermore, external factors can also be included, such as synergies with existing or upcoming policies and co-benefits with other options. In a specific workshop, expert knowledge is integrated in this qualitative assessment via small group discussions in order to define the optimal timing; working group discussions with actors from different sectors, institutions and backgrounds seem especially suitable to obtain a broad perspective for the assessment.

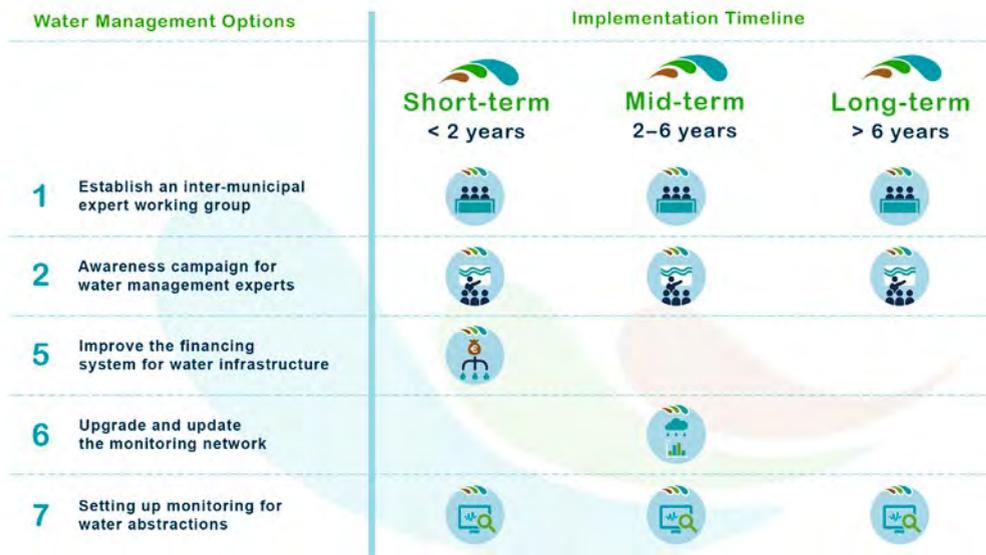
Once these criteria have been explored, the optimal timing of the different options of a bundle is illustrated in the form of an adaptation pathway, as seen below.

“The group of actions oriented to improve the implementation of adaptative forest management put into evidence the multiplying effect of these practices on other environments too, like water cycle conservation and fighting wildfires.”

Josep Maria Tusell, Catalan Forest Landowners Consortium, Santa Coloma de Farners, Spain

## Example of an adaptation pathway from the Vipava case study

### Bundle 1: Organisation of Sustainable Water Management



### Considerations

- There is a tendency to define all options as being important in the short-term, especially if no budget limit for the total set of options' implementation is available. However, it is important to consider the broader assessment criteria for implementation before jumping prematurely to this conclusion.
- It can be problematic for conducting the assessment if knowledge gaps for certain options are present. Here, it can be helpful to contact specific experts after the working group discussion in order to fill in the knowledge gaps and ensure that the adaptation pathway reflects the river basin conditions as accurately as possible.
- The evaluation of co-benefits and conflicts between options is a difficult process, as the effects need to be evaluated very systematically for all options. Different effects might overlap and need to be weighed against each other. Implementation related criteria should be taken into account that information might not be easily available.
- Phasing of the optimal timing for the implementation of options needs an in depth knowledge of the agenda and funding schemes of the responsible public authorities and basin's policies. The BeWater approach delivered an approximation.

### Alternative Methods for Step 10

A **quantitative assessment** can be implemented if the effectiveness of the options and the remaining damage costs can be clearly defined for the climate and socio-economic scenarios. For example, adaptation pathways can also indicate when the effectiveness of an option decreases so much that other options would need to be implemented (Haasnoot 2013).

To develop a timeline for implementation, discussions based on **scenario development or a prepared participatory vision** (as mentioned in Step 2, Chapter 4) can be implemented. For example, a discussion could focus on which options help take steps towards a common vision or target.

### ○ ○ ○ Lessons learnt

This section outlined the steps applied to develop potential implementation strategies for the water management options, as carried out in the BeWater project; important lessons learned include:

- The full **methodological approach** should ideally be prepared upfront in a harmonized process. However, flexibility for adjustments is necessary according to available data, time constraints and regional specifications.
- The **participatory character of the methods** should be taken into account in the development of all methodological steps as it influences the work of the expert teams, the character of the produced data and the level of detail of the analysis.
- For the **evaluation of co-benefits and conflicts** between the different options, a detailed knowledge of the option's characteristic and implementation is needed. The more detailed the options are already elaborated, e.g. where should new water basins or dams are being built, the more beneficial and accurate the analysis of co-benefits. Expert knowledge is essential for this analysis.
- For the **phasing of the optimal timing** of the option's implementation, the important implementation criteria have to be decided. They should be limited to a low number of important criteria to keep a clear target of the assessment.
- The **assessment of policy relevance** of the options requires an in depth analysis of the agenda and funding schemes of the responsible authorities and policies for the water basin. The analysis can only partially build on available material, but needs in depth discussions with the responsible public authorities. For these discussions, sufficient time needs to be included in the planning, e.g. for building up a trustful relationship.

# BEWATER CASE STUDY RIVER BASINS



Pedieos, Cyprus



Rmel, Tunisia



Tordera, Spain



Vipava, Slovenia



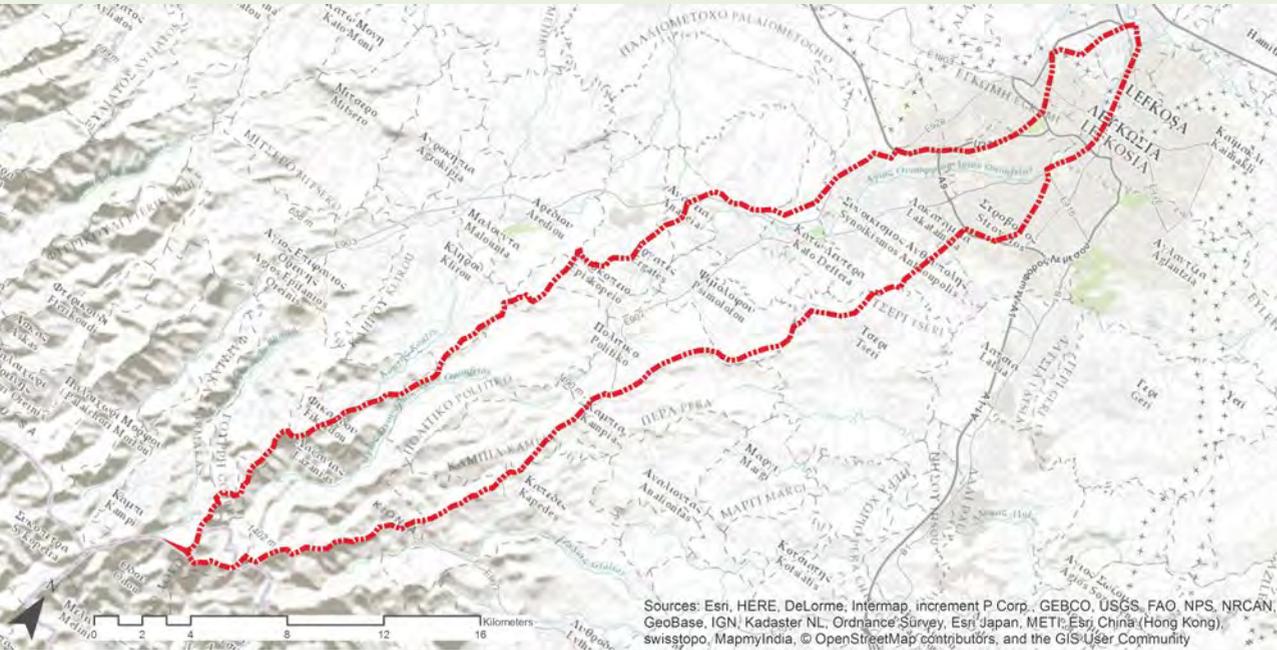
The methodology presented in the previous chapter was applied to four distinct river basins in the Mediterranean region: Pedieos in Cyprus, Rmel in Tunisia, Tordera in Spain and Vipava in Slovenia. For each of these cases, the local context and circumstances are presented in order to convey the important pressures, objectives, needs and stakeholders that were addressed in the BeWater approach.

This section also highlights the respective organisations responsible for managing the development process of each of the four river basin adaptation plans as case study partners. Each river basin also includes sections on the challenges that were faced during the development of the adaptation plans, as well as the main lessons learned from the process. This includes potential strategies to overcome the barriers in the future. Finally, each case study addresses possible approaches to transforming the adaptation plan “from paper to action” – in other words what steps can be foreseen now for supporting the implementation of the outlined water management options in the future.



## Pedieos river basin, Cyprus

Water scarcity and drought are major challenges in Cyprus and in particular in the Pedieos river basin. At the same time, intensive rainfall events and increasing urbanization are causing flooding in downstream areas. Climate change is expected to aggravate these problems.



“Cooperation and coordination between scientists, society, industry, water operators and water producers is necessary to tackle climate change impacts. All of us have to act today and introduce the appropriate water consciousness and culture in our society.”

Giorgos Demetriou, Water Board of Nicosia, Cyprus

## Context of drafting a River Basin Adaptation Plan for the basin

Climate projections indicate higher temperatures, less rain and, most likely, more extreme precipitation events for the Pedieos river basin. These projections imply increased water demand for irrigation and domestic water supply, potential deterioration of water quality and more severe and frequent flooding events in the river basin. Global change is clouded in uncertainties. It is therefore important to develop adaptation strategies that make the basin more resilient to climatic extremes. The knowledge and experience of local stakeholders is an important complement to the data, models and analyses used by scientists.

The development of the Pedieos river basin adaptation plan was led by researchers of the Energy, Environment and Water Research Center of The Cyprus Institute. The Cyprus Institute is a non-profit research and educational institution with a strong scientific and technological orientation. The Institute's Water Research Group is addressing the societal challenge of achieving sustainable, climate-resilient water and land management in the Mediterranean Region, through fundamental and applied, trans-disciplinary research, with stakeholders and collaborators in Cyprus and abroad.

The Pedieos river basin adaptation plan was created on the basis of the vision that the combination of improved awareness, mutual learning processes and shared

responsibility of the society are keys to ensuring successful adaptation strategies to climate change. A wide range of stakeholders shared their knowledge and opinions in a series of BeWater stakeholder meetings, and identified 30 adaptation options that can increase the ability of the river basin to withstand the challenges of the climate change.

The objectives of the river basin adaptation plan in the Pedieos river basin included improved governance for climate change adaptation and water resource management, as well as prioritising adaptation options based on cost effectiveness, their synergies' and stakeholder insight.





## ○○○ Challenges of River Basin Adaptation Plan development

Although droughts and floods are not new for Cyprus, climate change is expected to increase the severity of these extremes. A national adaptation strategy to climate change was developed in 2014. An assessment of the current and future vulnerabilities to climate change was carried out, while adaptation measures were evaluated and prioritized by experts to tackle these vulnerabilities. Many measures were planned and are currently implemented by various government departments. However, a coordination of these actions as well as an overall monitoring and evaluation system is missing.

Another challenge concerned the balanced representation of stakeholders; a diverse

group was engaged to obtain a good understanding of the issues and challenges that river basin is currently facing. A good balance between the information received by the different categories of stakeholders was achieved.

Finally, it was important for stakeholders to recognise and believe in the value of the participatory approach used for developing the adaptation plan. In general, in Cyprus, organisational structures and mechanisms that foster stakeholder involvement in management and decision-making are scarce or don't exist at all, mainly due to the dominance of top-down approaches in planning and decision-making.

“The BeWater approach helped us to improve the communication between scientists and a diverse group of stakeholders and to look at problems and potential solutions from various perspectives.”

Adriana Bruggeman, Hydrologist, The Cyprus Institute, Nicosia, Cyprus

## ○○○ Main lessons learned and strategies for overcoming barriers

- It can be more important to change attitudes towards water resources management approaches than to find optimal technical solutions. This conclusion was also reflected in the preferences of stakeholders for 'soft' (e.g., farm education) and 'green' (e.g., river runoff retention and groundwater recharge systems) adaptation options, instead of 'grey' options (e.g., construction of flood protection works).
- Although solutions to climate change may require specific technical knowledge, stakeholders saw the bigger picture and brought the societal perceptions into the discussion, making the outcome of the participatory process more generic.
- Both stakeholders and scientists recognized that during the process new ideas came up regarding the management of the water resources (e.g. anti-flooding measures and measures for the management of the riverbed).
- The findings of the participatory formulation of the adaptation plan for the Pedieos river basin suggest that implementing bundles of adaptation options could be more effective compared to implementing individual options because of the synergies and co-benefits between the options.
- Considering the small distances in Cyprus, we conducted all stakeholders' meetings in the capital city, which allowed the participation of a wide range of stakeholders. However, it was more difficult for community leaders and farmers to attend. We can conclude afterwards that it may be more effective to conduct stakeholder workshops in both locations.
- The participatory approach improved the collaboration of stakeholders, especially among the governmental departments. More frequent and targeted public consultations and awareness campaigns can further improve such collaborations.

“Water resources management under climate change cannot be optimized only through science and research, but requires the active participation of stakeholders in adaptation processes.”

Stefanos Siligaris, Department of Town Planning and Housing, Nicosia, Cyprus



“The interaction of scientists and stakeholders led to the development of integrated adaptation responses to climate change threats.”

Elias Giannakis, Environmental Economist, The Cyprus Institute, Nicosia, Cyprus

## ○ ○ ○ Approach to transforming the River Basin Adaptation Plan from paper to action

During the development of the adaptation plan we found that the suggested adaptation options have support among stakeholders including governmental authorities. However, the implementation of some adaptation options (e.g., water pricing enforcement) is hampered by lack of political support, while for others (e.g., sustainable urban drainage systems) no financial resources have been allocated.

Dissemination of the proposed adaptation options at various venues has increased climate change awareness of the general

public, including that of the younger generation. This helps to establish popular support for climate change adaptation. We will continue awareness activities at science and environmental festivals, community events and schools, with the help of interactive games such as the mapping of adaptation options on a large size Pedieos river basin map.

We aim to seek competitive research funds to analyse the economic and environmental implications of some of the proposed adaptation options in more detail, in cooperation with the competent authorities and our stakeholder network. We will also pursue the pilot implementation of selected adaptation measures to highlight the effectiveness and importance of this innovative approach.

The adaptation of the river basin to climate and global change is a dynamic process. Therefore, the adaptation plan needs regular reviews and updates. We aim to maintain and enhance the collaboration channels between science and society to continue to improve this mutual learning process.



“Flooding remains an important problem for Lakatameia Municipality and I am happy to have gotten connected with water researchers in Cyprus and abroad through the BeWater project.”

Anna Charalambous, Lakatameia Municipality, Cyprus



## Rmel river basin, Tunisia

Global changes pose major challenges in the Rmel river basin. Water resources in this watershed, as in most parts of Tunisia, are limited, unevenly distributed and annually variable. In light of future climate conditions, the growing demand for water by various sectors will exert acute pressure on these resources in the next years and will therefore bring a confrontation between resource supplies and needs. Consequently, the management of water resources remains a prominent issue whose resolution requires the roll-out of management plans not only on a large-scale (national level) but also on a small scale (watershed level).



“The environmental sector is involved in the creation, implementation and monitoring of these policies. We also have an awareness role. Civil society is involved in the design of these policies by participating in the sensitization campaigns and the integration of associations.”

Bechir Rguez, Regional representative of the Ministry of Environment and Sustainable Development, Zaghouan, Tunisia



## Context of drafting a River Basin Adaptation Plan for the basin

The development of the adaptation plan for the Rmel river basin was led by INRGREF – Institut National de la Recherche en Génie Rural, Eaux et Forêts. This is the national body responsible for research in agricultural engineering, water and forests. In addition to its research, the institute is responsible for contributing to national policies relevant to these sectors.

The Rmel river basin was selected due to the need for increased awareness of challenges facing its citizens and the environment due to global changes. The plan that has been developed over the course of the BeWater project is thus the result of intense team effort, targeted information gathering, scientific analysis, wide stakeholder involvement, critical reflection, and thoughtful planning.

Several workshops were organized during the three last years of the BeWater project aiming to develop an adaptation plan for the Rmel river basin to promote a deeper sense of ownership among actors within the basins for water management. In a first workshop the participants identified challenges related to water management. In a second workshop and a consultation, 19 water management options were refined and evaluated.

During a third workshop, the participants discussed how water management options could be implemented in an adaptation

plan to address the challenges of climate change and other pressures on the Rmel river basin and how they can be combined and whether there are potential synergies and conflicts between them, as well as their implementation in practice.

The objectives of the river basin adaptation plan in the Rmel river basin include: to raise public awareness on sustainable water management; to engage local communities on water use problems and solutions; and to present a range of options and recommendations to increase the capacity of the basin to adapt to the impacts of global changes.

As such, the plan is voluntary and should be seen as a source of inspiration and ideas for the future management of the Rmel river basin and beyond.





## ○○○ Challenges of River Basin Adaptation Plan development

The identification of stakeholders must consider the interests of persons, groups or institutions and their level of involvement in the project. The main challenge is to ensure that the intervention of the project takes place in the best conditions, by harmonising the real conditions with the needs and capacities of stakeholders.

During the stakeholder selection process for the workshops, we tried to respect a balanced representation across various categories (gender, age, membership in organisation, sector, etc.). This despite the constraints related to the duration and the limited number of participants that was possible to include due to the approach of the project.



“Potential challenges relate to the lack of coordination within the administrative authority. It becomes crucial to prevent these issues and to ensure more awareness campaigns.”

Sadok Haj Brahim, Wastewater Treatment Department, Zaghouan, Tunisia

“The Ministry of Agriculture supports all new and participatory efforts in order to better interact with stakeholders. We are hoping that the ‘BeWater’ project could be a source of inspiration at the level of participatory planning in river basins.”

Decision maker at the Ministry of Agriculture, Tunis, Tunisia

## ○○○ Main lessons learned and strategies for overcoming barriers

- Common identification of the key problems and needs at local level through an open and transparent participatory process.
  - Increase of civil society sense of empowerment, having an active role in policy planning at the level they represent.
  - Conduct scientific studies on the estimated impacts of climate change related to water resources availability and hydrological extremes (drought, floods).
  - Research needs to adopt transdisciplinary methods to work together with society in the development of solutions and innovations for sustainable agriculture and sustainable water use. Society
- including farmers, local economy, and communities need to strengthen the market of sustainable agriculture.
  - Increase and improve investment by solving the problems of the land rights and property rights.
  - Policy needs to provide the adequate legal framework to enable education institutions, research, farmers, and community to make use of their capabilities in becoming agents for change toward sustainable water management. Efforts should be made to raise environmental awareness and behaviour among all citizens, including the sustainable use of water.



## ○ ○ ○ Approach to transforming the River Basin Adaptation Plan from paper to action

In order to ensure the successful implementation of individual water management options or bundles of options, the development and execution of a monitoring plan including sound indicators is crucial. This includes finding synergies with existing monitoring schemes regarding the identification of suitable indicators for measuring the output.

A particular focus should be given to prioritized water management options; these options are strongly aligned with community interests and are foreseen to offer large potential in addressing the targeted challenges identified within the basin. In order to assess the best implementation timing, the adaptation pathways should be consulted.

Improving the management of water resources in Tunisia requires coordination between ecosystems, agriculture, and other economic activities. It is important to reduce the number of agencies in charge of water clarifying their roles. To improve collaboration, a forum at river basin level must be created between the different stakeholders (e.g. government agencies, private companies, social groups, research organizations, etc.). This forum should abide to a set of shared principles on the policy to be in line with the new values to take into account (ecosystems, agriculture, and economy).

In addition, strengthening the public participation increases a sense of responsibility within the society concerning water management and adaptation towards these threats. The combination of improved awareness, mutual learning processes and shared responsibility of the civil society and stakeholders are key to ensuring successful adaptation strategies and their implementation. As such, awareness campaigns must continue, as well as activities that engage younger populations such as exhibitions and displays in cultural youth centres. Further action items include:

- Divide the pilot sub-basin into units by territorial sector by prioritization for example: Bundle 4: Forest Resources in the area of Jebel Zaghaouan, Bundle 2: Water Quality in the delegation of Zriba since there is a wastewater treatment station, and Bundle 3: Agriculture in the delegation of Bouachir where most irrigated areas are located.
- Develop a participatory development plan that shows the actions for each territorial sector indicating the objectives, monitoring indicators (budget, time, goal) taking into account the opinion of the population.
- Apply the BeWater approach to other river basins in Tunisia





## Tordera river basin, Spain

The Tordera river basin is a small watershed, rich in natural heritage and of great geostrategic importance for Catalan socioeconomic development. Impacts of global change may have a particular relevance in this territory, affecting the regional as well as the local population due to the crucial role of this basin in the connection between northern and southern Catalonia.



“The main challenge the Tordera river basin has to face to reduce its vulnerability to global change is to ensure a self-sufficiency of water supply and to maintain public control over all stages of water management.”

Gabriel Borràs, Adaptation Unit of the Catalan Office for Climate Change, Barcelona, Spain



## Context of drafting a River Basin Adaptation Plan for the basin

The development of the adaptation plan for the Tordera basin was led by CREAM (Ecological and Forestry Applications Research Centre), a public research centre dedicated to terrestrial ecology and territorial analysis, producing knowledge and methodologies for conservation, management, and adaptation of the environment to global change. The centre's objective is to work as a bridge between academia, administrations, and society, promoting awareness and exchanging knowledge within its scope of activities, at the local, regional, and global levels.

The Tordera basin forms part of the Catalan water basin district and is managed together with 16 other Catalan water basins by a single river basin management plan. Current water planning processes are inspired by an overarching view to reach the requirements of the EU Water Framework Directive, including site specific measures to improve the river's current state and its capacity to satisfy local socio-economic needs. The opportunity offered by the development process of the Tordera river basin adaptation plan was of great value in this context and allowed to complement the implementation agenda of the Water Framework Directive with more in depth, site specific, truly participatory and innovative solutions.

One of the most difficult obstacles for sound adaptive policies to be put in place is the lack of coordination between public authorities at all levels: from municipalities up to the national government, as well as between different departments of the Catalan government. The BeWater project approach offered a great opportunity to engage a broad range of actors, fostering new dialogue and communication channels and setting the basis for innovative governance practices.

The elaboration process of the Tordera river basin adaptation plan contributed to the consolidation of newly developed adaptation policies in Catalonia: the Catalan strategy for climate change adaptation and the proposal of a climate change law presented to the Catalan parliament can be reinforced by these concrete, experience-based actions.

The elaboration process of the Tordera river basin adaptation plan is based on adaptive management principles that need to be mainstreamed when implementing current environmental and sectoral policies. This process requires that involved administrations increase the current level of transparency and accountability, enabling effective societal resilience. In addition, an extra effort is needed to improve control of the implementation processes of adaptation measures and availability of appropriate indicators for local use.



## ○ ○ ○ Challenges of River Basin Adaptation Plan development

The Tordera river basin adaptation plan was produced by a research institute and no public administration is to be held liable for its implementation a priori. On the one hand this facilitated the willingness of the local society to co-produce concrete proposals with a bottom up approach, and the interest to collaborate fostering mainstreaming of the results, and on the other hand, it implied the Tordera case study river basin partners had to put an extra effort on fostering uptake processes and opportunities.

In order to assure the quality of the participation process embedded in the development of the Tordera river basin adaptation plan, a particular effort was needed to build an adequate map of actors making sure all relevant sectors and interests are represented. This process involved personal interviews and different meetings with local stakeholders in order to frame the initiative and awaken commitment to engage in the process.

The high degree of complexity of the issues on the table needs thorough understanding of the interrelation between relevant factors characterising the basin, adopting a multi-disciplinary approach and making relevant information available. The iterative process of developing the Tordera river basin adaptation plan helped to foster knowledge transfer between all actors involved, building a strong basis for informed participatory decision making.

The series of workshops developed to build the Tordera river basin adaptation plan have requested a strong commitment and availability of the participants, who produced much input and feedback during the exercises. Responding to this effort with equal diligence is needed to maintain the information flow and interest high, therefore, sharing intermediate results and producing workshop reports is of particular relevance.

“ The creation of a Permanent Participation Centre for the Tordera basin would allow for the integration of citizen engagement into decision making processes and enhance capacity building through improving access to relevant information.”

Muntsa Niso, head of the participation Unit of the Catalan Water Agency, Barcelona, Spain

## ○ ○ ○ Main lessons learned and strategies for overcoming barriers

The broad diversity of actors involved in the participatory approach and to promote a collaborative environment for different public authorities and key actors helped to enhance mainstreaming global change adaptation principles into different contexts.

- Moreover, the adaptive management framework allows for a focused diagnosis and for specific solutions to be developed with a multi-sectoral view. Therefore it is crucial to make sure the process is developed in line with other processes occurring in the territory, valuing the possibility to fill in existing governance gaps and actively contributing to enhancing societal resilience to global change.
- The innovative participatory approach used to elaborate the river basin adaptation plan may be very useful to build a renovated dialogue between stakeholders and the administration. Given the growing innovation in governance practices, especially those embedded

in EU policy development, it is advisable to explore if participants have previous experiences and what their impressions are. This may help overcoming eventual legacies and manage expectations.

- Furthermore, it is important to invest sufficient resources and apply solid stakeholder identification methods to build an operative map of actors which can make the approach interesting for mutual learning and preparing a multidisciplinary environment needed to design and implement solutions to face global change.
- In order for the water management options included in the plan to be truly adaptive, it is crucial that these are flexible, robust and integrate a multidisciplinary perspective. Particular attention has to be given to analysing and including those aspects embedded into water management options that may multiply and enhance the adaptive effect of the solutions proposed.



## ○ ○ ○ Approach to transforming the River Basin Adaptation Plan from paper to action

As mentioned above, given that the Tordera river basin adaptation plan is developed with EU funding by a local research institute and expert partners, no liable authority was responsible for direct uptake of the whole plan into current policy development processes. In order to ensure the implementation of the proposals included in the plan, different strategies were undertaken to foster take up by liable authorities of the Catalan government.

22 out of 33 water management options were considered totally or partially of competence of the Catalan Water Agency, liable for the WFD implementation for the Catalan River Basin District, including Tordera river basin. These water management options were presented in the participatory process and public consultation for the development of the Catalan River Basin District Management Plan, allowing them to be acknowledged by a broad range of stakeholders and receiving feedback on their viability and coherence with overall water planning. Of the water management options presented, 20 were taken into consideration to be included in to current water management planning procedures and implemented with the corresponding budget.

Furthermore, the participatory design of water management options had a positive influence on the development of local conflicts, such as the choice to install artificial wetlands for wastewater treatment of small buildings located in the natural park areas instead of a traditional system. Dissemination on these issues, combined with increased awareness campaigns, help facilitate discussions within the community.

In other cases, the water management options included in the plan referred to concrete demonstration actions or pilots that were identified for the recovery of the environmental state and reducing impacts of climate change, such as an Integrated Adaptation Strategy for the Tordera Delta Region or the recovery of river morphology for flood risk management. In these cases, the implementation was fostered through the application for EU funded programmes, such as LIFE + or ERA-NET, and implied the creation of specific partnerships to design and development of the project.

As a concluding remark, it is worth mentioning that implementing the Tordera river basin adaptation plan or at least some of its key elements require a strong political will, as the transition to more resilient societies requires that deeply entrenched accommodations be shaken up and socioeconomic inertia be overcome.



“The main challenge for Catalan water management is to improve governance practices to overcome the fact that water demand is higher than what our rivers can supply.”

Francesc Camps, Researcher at the Institute for Agrarian Research and Technology (IRTA) in Mas Badia and Secretary of the Water User Community in Baix Ter region, Spain



## Vipava river basin, Slovenia

The Vipava river basin is located in the south-west of Slovenia and is part of Soca river basin district. According to the trends in the discharges for the Vipava river basin, a decrease in low and mean annual discharge has been observed. Climate change projections show an increase in average annual temperatures and decrease in precipitation. Hence, an additional decrease in low and mean discharges is expected with high probability, creating significant pressure on the region.



*“The results should be presented to an intermunicipal working group, which then communicates with national competent authorities responsible or competent for preparation and implementation of water related directives and objectives.”*

Aleš Vodičar, Technical Assistant for projects at Municipality Miren-Kostanjevica, Slovenia



*“It is important to connect and harmonize the BeWater results with existing sectoral strategic plans.”*

Jože Papež, Head of Research and Development at Hidrotehnik, Slovenia



## Context of drafting a River Basin Adaptation Plan for the basin

The Institute for Water of the Republic of Slovenia, the case study partner, is a lead research and advisory institution in integrated water planning and common EU water policy in the Republic of Slovenia, cooperating with water and regional development agencies and NGOs in the implementation of the Water Framework Directive. The tasks related to the preparation of second River Basin Management Plan were taken over by newly established Slovenian Water Agency.

The Vipava river basin adaptation plan was developed to integrate global changes into river basin management. As a guiding document, the river basin adaptation plan is intended for stakeholders in water use sectors and affiliated policy areas acting in the river basin and aims at the implementation of sustainable water management in the basin for the period until 2030.





“ It is desired to have a list of arrangements on the Vipava River which is as harmonized as possible before the end of the project.”

Anton Harej, Head of Regional Office Štanjel, Government Office for Development and European Cohesion Policy, Slovenia

## ○○○ Challenges of River Basin Adaptation Plan development

When the Vipava case study project team was collaborating with multiple stakeholders with different backgrounds and affiliations, different challenges emerged or were recognized. The main challenge was to engage national level stakeholders (policy and decision makers) and encourage them to participate in workshops. Slovenia is a small country, with a limited number of senior public officers and policy-makers in each field; as such, bringing them together is challenging.

For the development of the river basin adaptation plan, existing projections of average annual air temperatures and precipitation from 2006 and on annual discharges was used. Although with some limitations, a rough estimation of the future development of the river basin was made with the help of a Fuzzy Cognitive Map.

Finally, some challenges arose due to the reorganisation of the Slovenian water sector that was reflected in the change of national level stakeholders. This reduced the transfer of knowledge to some extent and also affected the availability and general mood among national level stakeholders. Key stakeholders were also unable to attend some workshops due to heavy workload and the Vipava case study project team was also affected by reorganisation. In this context, it proved helpful that detailed reports from workshops and other stakeholder interactions were produced. Result documents are crucial for ensuring transparency and traceability of participatory results.

## ○○○ Main lessons learned and strategies for overcoming barriers

- It is important that the project follow a strong methodological approach with some flexibility built in. This can help to avoid deviations the planning processes and is the precondition to ensure that the overall planning objective isn't threatened. This holds especially true if an intensive stakeholder involvement is foreseen.
- In the process of preparing the river basin adaptation plan, the project team must be aware of the importance of good relationships and partnerships with and between key stakeholders (e.g. institutions, competent authorities, policy and decision makers). By participating more actively in the river basin adaptation plan development process, a better management and coordination between key stakeholders can be achieved, as

well as increased understanding of the impacts of global change as a precondition for development of appropriate options to tackle these impacts.

- Taking into consideration that the river basin adaptation plan development, as any other project, has a pre-defined schedule, a project team needs to devote significant energy and time in the initial stage to gather relevant information. This is achieved by involving a wide range of stakeholders with extensive knowledge, experience and expertise to discuss different aspects of water management issues and climate change impacts. By doing so, the project team is less likely to leave out the important issues and consequently options to solve these issues.



“The water cadastre is not managed and updated properly. This should be one of the foundations for all other procedures in relation to water management, including the BeWater project.”

Irena Raspor, Head of the Department for the Environment and Spatial Planning at Municipality of Ajdovščina, Slovenia

## ○ ○ ○ Approach to transforming the River Basin Adaptation Plan from paper to action

Although the original aim to integrate as many developed options or bundles of options as possible in the national River Basin Management Plan was not achieved, many stakeholders showed interest in implementing some of the options or bundles regardless of the national plan. Hence, it was decided to use developed options or bundles for the purpose of applying for calls for different European programmes and funding mechanisms. One such project, through the LIFE+ program has already been funded in the Vipava river basin: the ViVaCCAdapt project.

Dissemination activities will continue to promote and introduce adaptation issues into integrated river management, nature protection, and tourism development, as well as all other issues related to the Vipava river basin. All documents, results from conducted workshops, planned policy forums and policy briefs will also help improve the management of the Vipava River and will certainly enhance spatial planning processes in the Vipava river basin.



# KEY FINDINGS FOR RIVER BASIN ADAPTATION PLANNING

Using an innovative participatory approach, citizens from around the Mediterranean were involved in adaptation planning for the management of their local river basin in light of global change. The participatory approach applied is not only replicable in other Mediterranean river basins, but could be used to apply participatory adaptation planning in river basins across Europe and beyond. There is increasing recognition of the value and importance of co-creation in adaptation planning – the approach developed in the BeWater project, in which stakeholders engage in a collaborative process with scientists and experts to develop river basin adaptation plans, uses co-creation to take up both scientific insight and stakeholder interests in the final plans.

- Participatory adaptation planning for river basins is still a developing concept and could benefit greatly from wider application across a range of basins and the subsequent sharing of best practices and experiences learned.
- The BeWater participatory approach goes beyond methods commonly applied in the implementation of the Water Framework Directive or Floods Directive, which often tend to have a more consultative and one-directional character.
- In line with the concept of Integrated Water Resources Management (IWRM) and as the preferred management unit as defined by the Water Framework Directive, river basins have proven to be an excellent geographical area of scope to analyse and develop water management options for adaptation.
- Building a shared understanding of the key problems and needs at the local level through an open and transparent participatory process is necessary as a starting point to developing adaptive solutions and tackle trade-offs.
- Anchoring adaptation planning on competent political processes and fostering the ownership and leadership of decision makers who are accountable for the

task are key elements in order to move towards implementation. The role of local authorities, such as municipalities, is crucial in the design, implementation and monitoring of adaptation actions.

- The need for improved governance practices is a common pattern for adaptive management to deliver the desired results in Mediterranean river basins. In particular, the flexibility of relevant actions and the coherence and extent of respective instruments could be focus points.
- Society is willing to engage in intense participatory experiences when their involvement in the decision-making process is clear and their role is acknowledged and legitimized.
- Assessment methods need to be adjusted to local contexts, available data, and stages in the adaptation policy cycle. There is no panacea for all problem settings.
- Adaptation actions are by nature cross-cutting and relevant for both existing planning processes and different economic sectors. The planning of adaptation measures at the river basin scale profits greatly from a thorough understanding of existing policy activities and funding streams, from the municipal to the regional level (and sometimes EU funds). Ensuring that adaptation measures are aligned with the planning

requirements and possibilities of other existing instruments greatly furthers the potential for their uptake.

- In a similar vein to the previous point, reaching out and coordinating with the authorities/actors who are in charge of the implementation of local and regional policy (e.g. municipalities, regional authorities responsible for water/agriculture/forestry/nature protection) greatly improves the chances of uptake of the adaptation actions.
- Stakeholder processes have to be managed carefully, as discussions can be unduly influenced, captured, or even 'hijacked' by particular interests. These can have the resources to ensure frequent participation in the workshops and meetings with voluntary and open participation. Attention should be given to the proportional representation of the different relevant actors and stakeholders, possibly by analogy to other structures with fixed stakeholder representation (e.g. the representation of actors in a river basin committee or a water board if there were one in the basin).
- No planning exercise can be of potential use without a strong buy-in from the competent authorities, since it is otherwise doomed to no-implementation. Such ad-hoc planning contributions have value, even as a pressure point for authorities to move and as a solid input to an anticipated formal process.

# REFERENCES

- 1 UN Water. 2010. Climate Change Adaptation: The Pivotal Role of Water.
- 2 O'Brien, K., B. Hayward, F. Berkes. 2009. Rethinking social contracts: building resilience in a changing climate. *Ecology and Society* 14/2.
- 3 Pahl-Wostl, C. 2007a. Transitions towards adaptive management of water facing climate and global change. *Water Resources Management* 21: 49–62.
- 4 Pahl-Wostl, C. et al. 2007b. Managing change toward adaptive water management through social learning. *Ecology and Society* 12: 30.
- 5 Mouratiadou, I., D. Moran. 2007. Mapping public participation in the Water Framework Directive: A case study of the Pinios River Basin, Greece. *Ecological Economics* 62: 66–76.
- 6 Gramberger M., K. Zellmer, K. Kok., M. Metzger. 2015. Stakeholder integrated research (STIR): a new approach tested in climate change adaptation research. *Climatic Change* 128, 3–4: 201–214. doi:10.1007/s10584-014-1225-x. Haasnoot, M., J. H. Kwakkel, W. E. Walker, J. ter Maat. 2013. Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. *Global Environmental Change* 23/2: 485–498.
- 7 Singh, R. 2012. An overview of sustainability assessment methodologies. *Ecological Indicators* 15: 281–299.
- 8 Voinov, A., F. Bousquet. 2010. Modelling with stakeholders. *Environmental Modelling & Software* 25: 1268–1281.
- 9 Verkerk, P., in preparation. Involving society in water management planning to adapt to climate change (manuscript).
- 10 Singh, R. 2007. Categorising tools for sustainability assessment. *Ecological Economics* 60: 498–508.
- 11 Jetter, A. J., K. Kok. 2014. Fuzzy Cognitive Maps for futures studies – A methodological assessment of concepts and methods. *Futures* 61: 45–57.
- 12 Kok, K. 2009. The potential of Fuzzy Cognitive Maps for semi-quantitative scenario development, with an example from Brazil. *Global Environmental Change* 19: 122–133.
- 13 van Vliet, M. 2010. Linking stakeholders and modellers in scenario studies: The use of Fuzzy Cognitive Maps as a communication and learning tool. *Futures* 42: 1–14.
- o Bizikova L., D. S. Rothman, S. Boardley, S. Mead, A. T. Kuriakose. 2014. Participatory Scenario Development and Future Visioning in Adaptation Planning: Lessons from experience: Part I. [www.iisd.org/sites/default/files/publications/participatory-scenario-development-future-visioning-adaptation-lessons-part-i.pdf](http://www.iisd.org/sites/default/files/publications/participatory-scenario-development-future-visioning-adaptation-lessons-part-i.pdf) (accessed November 09, 2016).
- o Davis, M., J. Rouillard, E. Lukat, U. Stein, J. Tröltzsch, R. Vidaurre. (2014). Compilation of best practice examples and experiences of adaptation plans. Deliverable D4.1, BeWater, FP7 project no. 612385 -SIS.2013.1.2-1 European Commission, 67 pp.
- o Department of Finances and Personnel. 2016. The weighted scoring method. [www.finance-ni.gov.uk/sites/default/files/publications/dfp/The%20weighted%20scoring%20method\\_0.docx](http://www.finance-ni.gov.uk/sites/default/files/publications/dfp/The%20weighted%20scoring%20method_0.docx) (accessed November 09, 2016).
- o Diakoulaki, D., F. Karangelis. 2007. Multi-criteria decision analysis and cost-benefit analysis of alternative scenarios for the power generation sector in Greece. *Renewable and Sustainable Energy Reviews* 11: 716–727.
- o European Environment Agency. 2014. Public participation: contributing to better water management: Experiences from eight case studies across Europe. [www.ecologic.eu/sites/files/publication/2014/eea\\_03\\_2014\\_public\\_participation.pdf](http://www.ecologic.eu/sites/files/publication/2014/eea_03_2014_public_participation.pdf) (accessed November 09, 2016).
- o Gasparatos, A., A. Scolobig. 2012. Choosing the most appropriate sustainability assessment tool. *Ecological Economics* 80: 1–7.

# PROJECT PARTNERS



# COLOPHON

## Developing participatory adaptation plans for river basins – a handbook

### Authors

- Ulf Stein, McKenna Davis, Jenny Tröltzsch, John Tarpey, Evelyn Lukat, Josselin Rouillard, Rodrigo Vidaurre | *Ecologic Institute*;
- Annelies Broekman, Anabel Sánchez | *CREAF – Tordera River Basin*;
- Hans Verkerk | *EFI*;
- Steven Libbrecht | *PROSPEX*;
- Manca Magjar, Peter Suhadolnik | *IzvRS – Vipava River Basin*;
- Elias Giannakis, Adriana Bruggeman, Christos Zoumides | *CYI – Pedieos River Basin*;
- Sihem Jebari | *INRGREF – Rmel River Basin*;

Peer Review by: Sarah Adams (*EFI*), Georgia Angelopoulou and Vangelis Constantianos (*GWP-MED*), Nicola Tucci, Leonardo Piccinetti and Donatella Santoro (*Europe for Business Ltd*)

### Originally published as

Stein, U.; Davis, M.; Tröltzsch, J.; Sánchez, A.; Verkerk, H.; Libbrecht, S.; Broekman, A.; Magjar, M.; Giannakis, E.; Jebari, S.; Tarpey, J.; Lukat, E.; Bruggeman, A.; Zoumides, C.; Suhadolnik, P.; Vidaurre, R.; Rouillard, J. (2016). Handbook for drafting participatory adaptation plans. Deliverable D4.4, BeWater, FP7 project no. 612385 -SIS.2013.1.2-1 European Commission, 48 pp.

**ISBN** 978-3-937085-30-2

**Layout** Beáta Vargová | *Ecologic Institute*

### Photos

P.3: © shutterstock/oticki; P.4, 7: © Ulf Stein; P.10: © Elias Giannakis; P.13: © Sihem Jebari; P.14–15: © Ulf Stein; P.16: © Sabina Blumauer; P.19: © Sihem Jebari; P.24: © Manca Magjar; P.29: © Manca Magjar; P.31: © Ulf Stein; P.36, from left to right: © Elias Giannakis, Sihem Jebari, Anabel Sánchez, Danica Magjar; P.38, 39: © Elias Giannakis; P.41: © Ulf Stein; P.42, 43: © Elias Giannakis; P.44–49: © Sihem Jebari; P.50–55: © Anabel Sánchez; P.56: © Danica Magjar; P.58–61: © Manca Magjar



