SUMMARY AND CONCLUSIONS OF STAKEHOLDER PARTICIPATORY PROCESS

WORK PACKAGE T1 – EXPLOITATION: concept of CE tools integration

OUTPUT O.T1.2

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A. Summary

TEACHER-CE partners organized a series of start-up workshops in 8 countries participating in this project during the last three months. The project started in March 2020. The main purpose of the start-up workshops was to involve stakeholders in the work of the project from the very beginning of the project.

Focus of the workshops

In the past few months, the key focus of the partnership was to develop a concept of the TEACHER-CE toolbox and start-up workshops were a great opportunity to exchange views and comments with key stakeholders on the further development of the Toolbox. The workshops programs slightly differed from country to country, but one common objective for all of them was to engage the stakeholders already at the beginning of the project, exchange ideas and expectations, discuss with them the main challenges in their daily operations and involve them in further developments of the project outputs; the concept of the workshops was presented in D.T1.2.3.
In general, two main topics were discussed with stakeholders: a) presentation and discussion of the project concept and the status in the field of water management in adapting to climate change, and b) discussion of views and requirements for the concept of the Toolbox.

Stakeholder engagement

Almost 200 people participated at the workshops, representing all main project target groups, such as public authorities, sectoral agencies, NGOs, private sector, etc. Most of them expressed their interest to be further involved and informed which is one of the ultimate goals of the project. To assure that the design of the Toolbox is regularly supervised and guided by the key end-users, a special Focus Group was established. Key members of the Focus Group (37) in each country are the Associated Partners and other key end users from each partner country; as described in D.T1.2.2. They will help the project partners to obtain actionable insights about the Toolbox users' needs and assure that the ownership for the project outputs is built already from the beginning of the project

Outcomes of the workshops

There is a great awareness among the participants about the necessity to adapt the water management sector towards climate change. This awareness has been rising due to the increased frequency of extreme weather events in recent years.

The status of adaptation in water management to climate change differs by country and region. Several adaptation practices and established tools/instruments addressing the impacts of climate change on the fields of water management, for example water availability, flood protection, heavy rain risk management, and forest management adaptation in water protection zones, were pointed out. Many data and instruments are already available but not known by potential users. The instruments need to be better communicated and promoted. Information should be bundled to make better use of existing planning instruments. Synergies should be identified. This supports the idea to develop an "umbrella tool" that guides through the already developed tools of the exploited projects.

All stakeholders highlighted a contrast between general awareness of climate change impacts on different "fields of water management" and the weak response in terms of measures related to mitigation of and adaptation to climate change.

Among the suggestions to increase climate change awareness and acceptance of adaptation measures, the following was emphasized by stakeholders:

- implement concrete management strategies on both, policy and operative level;
- develop a holistic approach for management planning;
- target functional training to increase knowledge on the impact of climate change on water cycle and bridge the communication gap between academia and land users;
- increase awareness of ecosystem services (e.g., flood protection, water retention) and
- importance of healthy ecosystem for maintenance of ecosystem functions.

The focus of the discussion was to find out about the demands and the needs of stakeholders for the Toolbox.

Stakeholders expressed their views regarding which functionalities should be included in the Toolbox to elaborate it as real support for daily and strategic activities. What was pointed out by many stakeholders is that the tool needs to be functional, easy-to-use with a simplified user interface (web-based). Detailed instructions and links to pilot actions can be added to learn more about the implementation of the tool. Also, a good description of the input data was requested and a necessity for including climate projections as well.

A tool designed to support climate change adaptation should have a cross-sectoral overview of the future projections of goals and measures and it should be developed in a way that it will support the practical side of adaptation tasks as efficiently as possible. For navigation purposes, it would be very good to have included a catalogue of national databases that are currently not interconnected (water, environment, nature, land registers, records, etc.).

The toolbox should contain basic knowledge, a directory of good practices, and dedicated climate change and risk/threat indicators for different administrative units. However, the use of these data and information for daily planning and decision making in water management and urban planning is the most crucial question of the participating stakeholders ("interpretation of data by non-experts"; "conclusion and indications of CC information for planning purposes" etc.). There should be a function of searching (via GIS) for various aspects of a given problem.

Few participants raised an issue that for Toolbox to be used in practice it should be backed-up with legal documents, otherwise (personal and financial) resources will not be allocated.

Next steps

Feedbacks and suggestions for the Toolbox development will be forwarded to the partners who are working on the next phase of the Toolbox development. Meanwhile, communication and meetings with Focus Group members will continue to test and assure that main stakeholders' requirements are integrated into the Toolbox

Further intense communication will take place to support awareness-raising and bring the Toolbox into practice.

In spring 2021 the next round of stakeholder events is planned, focusing on testing the first version of the Toolbox in pilot areas.

B. Stakeholder participatory process

Stakeholder participatory process in the first few months of the project was organized in the following steps:

1. **Roadmap for Stakeholder involvement** (D.T1.2.2) was first prepared and it serves to guide and support partners in engaging stakeholders into integration, development, testing, and implementation of the TEACHER-CE Toolbox through the project. The main objective is to present a synchronized stakeholder engagement process at the project level. In the first few months, roadmap supported partners especially in the mapping exercise (step 2).
2. **Identification of the key stakeholders** (D.T1.2.2 Annexes). The aim of this stage was to identify which stakeholders need to be engaged, to achieve the highest impact for the project. Stakeholder mapping was divided into three stages: identify stakeholders; assess and prioritize; develop an understanding of stakeholders' motivations, interests, expertise and capacity to engage.
3. **Concept note for the Start-up Workshops** (D.T1.2.3). As a first step towards organizing start-up workshops, a special concept note was developed. Main aim of this document was to give general guidance on topics which should be discussed with stakeholders at the national level and to synchronize input from different national events to use them for further development of the outputs.
4. **Start-up Workshops.** Partners organized a series of start-up workshops in 8 countries participating in this project in the period from August till November. You can find more information and conclusions in below chapters.

1. Start-Up stakeholder workshops

National Start-Up workshop (D.T1. 2.4) were organized in all 8 participating countries in different formats: live (2 workshops in Austria and Hungary), online (4 workshops in Italy, Czech Republic, Germany, Poland-Lusatian Neisse), hybrid (2 workshops in Slovenia and Poland-Kamiena basin) and one workshop which was substituted with an online questionnaire in Slovakia.

Key objectives of the workshops were:

- to inform stakeholders about the aims of TEACHER-CE and CC-ARP-CE
- to collect their views and requirements on the concept of the integration of the tools into the TEACHER-CE Toolbox
- to evaluate the potentially relevant existing instruments and tools for CC-adaptation in practical use of stakeholders
- to find out about the demands of the water management sector and other relevant sectors and the needs for the toolbox
- to determine the status of adaption of the water management to Climate Change (CC) impacts
- to explore problems and challenges on the national level related to integrated water management, CC adaptation, etc.

2. Start-Up stakeholder workshops outcomes

2.1. Water Management and Climate Change

2.1.1. Awareness of the water management sector to climate change

There is a great awareness of the necessity to adapt the water management to climate change. This awareness has been rising due to following extreme events/situations occurring more frequently in the recent years, including:

- Flooding in rural areas (e.g. municipalities at mountain foothills in Austria), in urban settlements (e.g. in Graz 2018 and in Kapfenberg 2020 in Austria, and in Starachowice in Poland, in Kamnik, Slovenia). Flash flooding due to heavy rainfall leading to soil erosion and mud flows from agricultural land and pollution of water courses was perceived as a risk by stakeholders in German pilot areas Zittau and Görlitz.
- Increased cost for water infrastructures – building new infrastructure and repairing measures (Hungary).
- Financial losses caused by recent droughts in agriculture and forestry (Poland).
- Water unavailability due to the concentration of precipitation sums into more intense but less frequent rainfall events, which cannot be retained in intensively managed floodplain agricultural areas (e.g., Po River Basin, Italy). Water shortage due to droughts was perceived as serious by German and Slovak stakeholders.
- Increased irrigation demand (Slovenia and Italy), even for crops usually requiring minor water inputs (e.g., vineyards), leading to increased ground water withdrawals. The prohibition of water withdrawal from water bodies during drought periods increased the awareness (Germany).
- Frequent occurrence of heat waves (Germany, Hungary),
- Tree infestation by bark beetles (*Scolytinae*) in Germany and other pests in Slovenia, changes in forest habitats (Poland), invasive plants and impacts of animals (wild ungulates) whose reproduction rates were increased artificially by hunting practices (animal breeding, trophy-hunting focus) and due to the lack of predators (Austria).

Furthermore, the awareness of stakeholders was increased due to their personal involvement in climate adaptation projects. The Slovak stakeholders perceived climate change adaptation as important to their daily work.

2.1.2. Status of adaptation of the water management sector to climate change impacts (build on D.T1.1.3)

The status of adaptation in water management to climate change differed according to country and region. Several adaptation practices address water availability, flood protection, heavy rain risk management and forest management adaptation in water protection zones. Exemplary **measures that were successfully applied** are summarized in Table 1.

Table 1. Already applied adaptation measures according to country and regions (source: partners' reports)

Environment	Land use	Country (Region)	Adaptation needs	Adaptation measures
Karst/ Alpine	Pasture	Austria	Water availability	• multiple small, geographically distributed ponds (decrease cattle concentration and contamination) • water harvesting cisterns on water huts • small spring usage for cattle water supply • transport of water from valley in tank (long-term drought)
Pre-Alpine, Mountain foothills	Settlement	Austria (Rax-Schneeberg-Schneealpe)	Flood protection	• small-scale retention measures protect villages from flash flooding (FramWat) **positive public perception of the measures has increased under climate change*
Water Protection Forests	Water protection zones	Austria (Vienna & Waidhofen /Ybbs)	Forest retention function, water protection function	• tree species are selected according to modelled natural diversity under climate change for each forest type (Forest Hydrotope Model) • SUSTREE App – recommends tree species (selected form 7 main) for whole Austria • Also, non-commercial species are planted or protected (ash, yew, white beam) • oaks are spreading through providing seeds in birds' containers • Water suppliers use hydrologic modelling for planning cycles (CC-WaterS, PROLINE-CE), available for TEACHER-CE
Multiple	River basin management	Czech Republic	Water availability	• calibration of hydrological model according to climate scenarios (HIRHAM, RCAO, and others) • modelling of hydrological balance (outflow, soil water content, seasonality). • HAMR – interdisciplinary cross-sectional platform

				incl. hydrologic, agronomic, climatic aspects, and retention measures.
Mountains-Floodplain	Multiple	Poland (Starachowice)	Water availability	• rainwater harvesting by small farmers (supported by neighbourhood assistance, Agriculture Advisory Centres, http://malaretencja.pL) • national fund to promote and subsidize water retention and encourage "green building", but their funds are only sed little

Other regions (not in the table) developed approaches in certain aspects of climate change adaptation (e.g., heavy rainfall risk management and adaption measures were identified in the district of Görlitz and in Zittau) in Görlitz, while missing a holistic and exhaustive strategy for climate change adaptation. In other regions, such as Kisköre Reservoir (Hungary) holistic plans for water have existed since 1970. They regulated climate adaptation related ecosystem services, such as agricultural water supply, energy production, fish farming and fishing, recreation and tourism. Recently, ecosystem conservation of wildlife has been added. In Slovakia, the practical adaptation to climate change was seen as dissatisfactory by 79% of stakeholders.

The stakeholders suggested a bunch of **activities promoting climate change adaptation** to:

<u>Reduced water availability due to drought:</u>

- Reduce irrigation water demand (e.g., in Po Basin in Italy) by using more adapted crops (sorghum instead of maize), or varieties with shorter growing seasons (early potato varieties, with season from June to July).
- Increase soil organic matter in agriculture (carbon rich amending agents, organic manuring) to promote soil water retention (Italy).
- Reconstruct / build adequate infrastructure to decrease transmission water losses (Italy). New infrastructures should regulate water use in order not to jeopardize natural flows (Slovenia).
- Improve reliability of prediction of water availability and increase efficiency of water use.
- Integrate ground water quantity and quality spatially and temporarily distributed monitoring systems.
- Improve water storage systems on alpine pastures to ensure water availability for humans and live-stock animals (cattle, etc.) (Austria).
- Effectively plan monitoring of surface and groundwater withdrawals, allocation and use (Italy, Slovakia).
- Build irrigation network to allow planting new crops and decrease the workload in agriculture and cattle breeding (Slovenia).

Reduced water quality:

- Increase the resilience of the aquatic and wetland areas by implementing integrated hydro-morphological restoration measures along the streams, drainage channels, and the riparian zone in intensively managed areas with agriculture predominance (e.g., in Po Basin).
- Reforestation as measure to increase retention capacity should be done with caution, because the species which will thrive in the climate of 25 years from now, should be planted today. Thus, it remains open question if to plant non-native species or mixed forests with native tree species. This decision has to be made in each region.

Extreme discharge due to extreme rainfalls:

- Building of water related infrastructures must be aligned with climate predictions and multi-purpose systems need to be implemented.
- Measures for urban drainage are needed, such as enlargement of drainage pipes, construction of overpasses, elimination of underpasses.

Flood management:

- Systematically purchase/exchange alluvial land for the purpose of targeted use of watercourses and flood plains or water retention areas. Restrict purchases for building and facilities to decrease flooding risks.

Furthermore, following suggestions were made **to increase climate change awareness and acceptance of adaptation measures**:

- Implement concrete management strategies on both, policy and operative level.
- Include the trends of ecosystem and climate system as the baseline for planning.
- Develop a holistic approach for management planning.
- Establish relation with national river basin management plans and local communities and link local scale river basin management plans to nature protection.
- Target functional training to increase knowledge on impact of climate change on water cycle and bridge the communication gap between scientists and land users.
- Develop communication strategies which ensure better acceptance of measures (e.g., water re-use).
- Increase awareness of ecosystem services (e.g., flood protection, water retention) and importance of healthy ecosystem for the maintenance of ecosystem functions.
- Decrease interventions into nature in order to protect biodiversity.

2.1.3. Cross-sectoral cooperation (synergies and conflicts between water management sector and other sectors)

The perception on efficiency of cross-sectoral cooperation differed among stakeholders and pilot areas. Following was observed.

Water conflicts were/are reality.
Conflict occurred when the coordination activities aimed at preserving the flow regime and ensuring the water quality in the lower parts of the catchments in Enza and Po River Basins (Italy), where the pollution was thought to origin in upstream areas. Therefore, formation of a higher-level decisional body coordinating all involved sectors was suggested as inevitable. It

was crucial to define specific measures to governing and optimize the demand, to avoid conflicts.

Furthermore, conflicts originated in the tension between maintenance of environmental parameters (inviolable flow, continuity of water courses, water quality) and sewage management, reservoir retention and water tourism or intensification of agricultural production. The reclamation of two large water reservoirs in Poland (Pastewnik, Brody Iłżeckie) created such conflict. Additionally, water conflict occurred by modernization and management of drainage facilities. They were results of inappropriate communication with farmers, and the risk for asking farmers for compensations.

Conflict occurred during periods of hydrological drought, when domestic sewage from small and large treatment plants deteriorates the quality of water in rivers and reservoirs.

Further conflicts were about the damming level. Therefore, it was always controlled prior to the investment was made to avoid protests from residents who feared flooding their fields or houses. On the other hand, water retention facilities located in forests met with a rather positive reaction from the inhabitants.

Adaptation in the water sector needs a holistic approach.

Holistic planning and management (multisector, multilevel, multi-spatial) was recognized as inevitable for success in adaptation (Slovakia, Poland, Slovenia). Stakeholders recognized that sectoral approach to management and decision about the same river basin already existed. In Slovenia stakeholder noted lack of comprehensive development strategy, including in water management. Slovak stakeholders noted that different levels of decision making did not exchange data and information, and often used different climate scenarios for preparing their key documents. Additionally, confusion over property rights were influencing on ground-adaptation measures. The competences on regional and local level to issue and control legally binding documents instead of non-binding guidelines did not exist, and lower administration level lacked capacities (finance, labor) to develop and apply proper measures.

Water management plans were developed in cooperation with other actors or with regards to multiple functions.

Long-term adaptation of the water management sector in Czech Republic was developed in collaboration with other sectors sensitive to water resources (agriculture, natural conservation, hydro-energy, etc.). Middle Tisza District Water Directorate in Hungary considered multi-purpose nature of inland water systems, which should reduce climate change impacts in the future. Coordination and planning of multipurpose management actions for water resources in the upper part of the basin were dominant in Enza Basin and Po Basin in Italy.

Cross-sectoral cooperation was part of daily work in local/regional projects.

In Austrian pilot areas, an exchange between water suppliers and alpine pasture owners on Mount Schneealpe was shown during a field trip. Exchange and cooperation between those sectors were and will be essential and is part of the work of the related stakeholders. It aimed at securing the implementation of best practices for drinking water protection. Solutions were developed in participatory manner, and a subsidy system for farmers by Vienna Water was established. Similar active exchange is given between Vienna Water and the Forest Administration of the city of Vienna. Also, in the pilot area Waidhofen/Ybbs a subsidy system between the municipality (water works) and forest owners will motivate the latter to implement Best Practices for water protection.

In German pilot areas cross sectoral cooperation is part of the daily work and therefore experts from different disciplines working in the respective local/regional administration are involved in the project.

Responsibility to act within a given mandate was the key:

The cross-sectoral cooperation with authorities (both national and regional) was identified as problematic in some cases. Many authorities delegated their responsibilities to other actors and do not act according to their statutory mandate. Inaction of the responsible authorities was identified as obstacle for adaptation, because it caused lack of implementation of existing legislative containing appropriate adaptation measures. Furthermore, personal financial interests or in adherence to previous work routines were recognized to hamper the application of new legislation and / or inter-sectoral, multi-level decision making.

Continuity and reflection were inevitable for adaptation

The stakeholder described that decisions were made often ad hoc. Furthermore, relevant legislative rules have been changed more times in the past twenty years (except for Germany, Austria, and Italy). Many adaptation strategic documents were issued too. Some of them where directly abandoned in next legislation process (e.g., Slovenia spatial planning), while others have never been evaluated for their regional impacts and effectiveness (Czechia, Slovakia). The legal control over the application and maintenance of adaptation measures was missing.

2.2. TEACHER-CE Toolbox

2.2.1. Needs and requirements for the Toolbox

Focus of the discussion was to find out about the demands of stakeholders in the water management sector and other relevant sectors and the needs for the toolbox. Stakeholders expressed their views regarding which features should be included in the Toolbox to make it a real support for day-to-day and strategic activities.

The participating stakeholders communicated following demands for the TEACHER-CE Toolbox:

Best Management Practices

Stakeholders want to see the whole catalogue of Best Management Practices from all integrated projects to have an overview and insight into the Toolbox. The Toolbox should provide a directory of good practices, which would be carefully explained for different stakeholder groups. Background knowledge should be provided.

The Toolbox should maximize the integration between the various measures relating to different systems. Complex interlinkages of different impacts of climate change may not even need to be communicated in detail, but the possible solutions must be shown. Nevertheless, information on conflicts and synergies needs to be available as basis for planning decisions.

Stakeholders are also particularly concerned about considering mitigation measures equally important to adaptation measures. In situation where both conflicted the win-win measures should be clearly distinguished. The functionality of the toolbox should clearly facilitate the understanding about what are the effects of each management choice.

The identification of preventive measures at local level plays an important role for the participants. It is important to provide concrete information on the measures, possible and practical experience of their implementation and funding options for municipalities.

Best practice examples for each region and / or from regions with similar environmental issues were required.

Enable wide use (communicative aspects)

Indicators: The choice of the indicators and the returned information should be carefully evaluated. A valuable strategy could be to use metrics familiar to target groups (e.g., sustainability credits), and provide background knowledge. There should be carefully explained which are the strengths and weaknesses of climate simulation chains (e.g. spatio-, temporal-resolution) in order to provide a clearer understanding about the reliability of the returned indicators and associated uncertainty. The use of these data and information for daily planning and decision making in water management and urban planning is the most crucial question of the participating stakeholders ("interpretation of data by non-experts"; "conclusion and indications of CC information for planning purposes" etc.).

Functionality: Different levels of details (meta-level, national, regional, river basin, river basin from source to mouth, water cadastre, local, and detailed project level) are the key for functionality. On one hand, the toolbox should be general enough to allow everyone to use it in a way that does not require much training. On the other hand, it should be possible for the trained professionals to use advanced functionalities.

The explanation of the functionalities should be done clearly. The interface should be simple and intuitive. The added value of using the tool should be shown and clearly communicated. It should be prepared based on specific needs of target groups and enable easier accomplishment of administrative tasks. There is a particular need for guidance and explanation on small-scale packages of measures because many municipalities do not have the resources to deal with complex tools.

Information detail: Carefully consider the detail of information. Showing risk through examples. A good description of the input data.

Language: simple, understandable, national

Graphical communication: The vast majority of the participants prefer the presentation of data in the form of webGIS. Graphical presentation of information in the form of Box-Whiskers, and tables and graphs would be useful. Level of spatial aggregation depends on the geographic region about which the stakeholder decides. Therefore, it should provide systematic follow-up of plans and measures to dissolve watercourses or sub-basins ("from source to mouth").

2.2.2. Requirements and insights for weather indicators

Main aim of this part of the workshop was to discuss how ongoing or expected climate changes can affect the water management sector, to define the requirements for other indicators to be explored and the time horizon of interest and to collect remarks about the straightest ways to query and return information about indicators (e.g., for querying GIS maps or drop-down menu; for outputs maps or downloadable datasets).

The weather indicators were collected in each country separately, while providing stakeholders different set of parameters (Table 2). After, a review of the stakeholders' requirements has

been performed in order to identify a set properly covering the different aspects of the water-related issues (availability, quality, timing and extreme values) but accounting for the current strengths and weaknesses of climate modelling chains (e.g. low performances in reproducing very localized and short events). The indicators will be included in the Toolbox at native grid resolutions (0.11° for Euro-CORDEX) and as aggregated value at NUTS level.

Table 2. Parameters required by stakeholders (X) in different countries. In each country different set of parameters were asked.

Indicators	AUT	CZ	GER*[3]	HUN	IT	POL4	POL11	SLO*[4]	SVK
Annual mean temperature							X		X
Annual mean diurnal range									X
Isothermallity									X
Temperature Seasonality									X
Max Temperature of Warmest Month						X			X
Summer Days (SU)	x								
HD - Number of heat days: Annual count of days when TX (daily maximum temperature) > 30°C							X		
Number of heat days (Tmax ≥30°C) in summer						X			
Number of heat days (Tmax ≥ 30°C) beyond summer						X			
Number of extremely hot days (Tmax ≥ 35°C) in summer						X			
TR - Number of tropical nights: Annual count of days when TN (daily minimum temperature) > 20 °C							X		
CHD – Heat spell - annual number of days with at least 3 consecutive days when TX> 30°C							X		
TMx - Monthly maximum value of daily maximum temperature							X		
WSDI (days): Warm Spell Duration Index - total number of days per period (annual or seasonal) in which the maximum temperature is greater than the 90th percentile of the maximum temperature in intervals of at least 6 consecutive days for the reference period (1971-2000)							X		
Min Temperature of Coldest Month						X			X
Frost Days (FD)	X					X			
CFD - Consecutive Frost Days - maximum number of consecutive days with minimum temperature < 0°C							X		
ID - Number of icing days: Annual count of days when TX (daily maximum temperature) < 0°C							X		

Monthly minimum value of daily minimum temperature							X		
CSDI (days): Cold Spell Duration Index - total number of days per period (annual or seasonal) in which the minimum temperature is less than the 10th percentile of the minimum temperature in intervals of at least 6 consecutive days for the reference period (1971-2000)							X		
Annual Temperature Range									X
Mean Temperature of Wettest Quarter									X
Mean Temperature of Driest Quarter									X
Seasonal Mean Temperatures (°C) - (Winter/Spring/Summer/Autumn)	x								
Mean Temperature of Warmest Quarter									X
Mean Temperature of Coldest Quarter									X
Annual Precipitation							X		X
Part of heavy rainfall (≥ 10mm) in the annual total						X			
R20mm Number of days with precipitation ≥ 20mm							X		
R30mm Number of days with precipitation ≥ 30mm/day						X			
R90N (days): PR90prctile (mm): 90th percentile of daily precipitation							X		
R95N (days): PR95prctile (mm): 95th percentile of daily precipitation							X		
R99N (days): PR99prctile (mm): 99th percentile of daily precipitation									
Maximum one-day rainfall (RX1Days)	X								
Maximum consecutive 5-day rainfall (RX5Days)							X		
Precipitation of Wettest Month						X			X
Precipitation of Driest Month						X			X
Precipitation Seasonality									X
Precipitation of Wettest Quarter									X
Precipitation of Driest Quarter									X
Precipitation of Warmest Quarter						X			X
99 percentile of precipitation in the warm half year						X			
Precipitation of Coldest Quarter						X			X
99 percentile of precipitation in the warm half year						X			

Seasonal precipitation sums (mm) - (Winter/Spring/Summer/Autumn)	X								
Ratio of total precipitation in the warm to cool half-year									
Consecutive dry days (CDD)	X								
Longest dry period in a warm half-year						X			
Climatic water deficit (CWD)	X								
Heating days per year						X			
Gradual heating days in winter months						X			
Air conditioning days in the year						X			
Degree of air conditioning days in the summer months						X			
Number of days of snowfall with height > = 50 mm						X			
Number of days of snowfall with height > = 500mm						X			
Snow cover duration	X								
Snow pack depth	X								
Extreme wind speed (m /s)						X			
Maximum average daily wind speed (m/s)						X			
GLS (days): Growing season length: Annual count between first span of at least 6 days with daily mean temperature T>5°C and first span with T<5°C							X		
Vegetation period duration	X								
Evapotranspiration									X
Soil moisture data	X	X*1			X				
Soil organic matter					X				
Sunshine duration	X								
Air quality data (fine particle matters)	X								X
Hydroclimatic Balance (BIC)					X*2				
Water quality									X
Groundwater level									
Saltwater intrusion					X				
Irrigation demand / water allocation demand					X				X
Increase/decrease in yields					X				
Hydrological parameters									X
Daily values for specific pilot action	X		X						
Data maintenance and actualization after project end	X		X						
Expected variation in crop cycle in major crops	X								
*1 www.intersucho.cz , *2 https://www.arpae.it/dettaglio_generale.asp?id=2583&idlivello=1867), *3 It can only be decided on a case by case basis what information is still missing. The federal state of Saxony already provides climate indicators for the pilot area in a more detailed resolution.									

https://rekis.hydro.tu-dresden.de/ (indicators for past decades, future projection will be added, *4 only online survey was done;

AUT – Austria, CZ-Czech Republic, GER-Germany HUN – Hungary (no data provided), GER – Germany, IT-Italy, POL4 – Poland (PP4), POL11 – Poland (PP11), SLO – Slovenia, SVK – Slovakia (only online survey)

2.2.3. Concept of the Toolbox development

The concept of the Toolbox was presented and then discussed with participants. The stakeholders wished to use the toolbox as communication tool with other stakeholders. Awareness-raising content should be therefore included (e.g. to help parties with conflicting interests understand each other; thus address their needs and requirements). It is important that the methodology which was used for creating the tools (e.g. forestry modelling in Czech Republic) needs to be acknowledged with relevant stakeholders in the sector/country.

Following thematic gaps were wished to be filled:

- consistent drinking water source protection measures and strategies,
- more focus on green and blue infrastructure measures, small water retention measures, and explain the option for multi-purpose use,
- promote the role of soil in mitigation and adaptation and include it into the toolbox,
- include land use type tourism, focus more on land use type forest and valorisation of ecosystem services,
- include search engine based on number of criteria,
- pay equal attention to adaptation and mitigation strategies,
- connect to existing set of measured data (from different sources, e.g., national), examples:
    - water: links to data on monitoring of groundwater and surface water, water cadaster and water infrastructure (water, water infrastructure and water facilities), records of watercourse maintenance and cumulative impacts (measures/interventions already implemented at the level of comprehensive treatment of individual watercourses and/or river basins)
    - landslides: the selection of landslide data by municipalities, data on natural disasters and damage (like the Ajda reporting system, but more detailed in resolution, including minor damage) and the inclusion of damage to solve the existing problems (e.g., damage on flooded agricultural land).
    - cadaster: up-to-date digital cadaster of ownership, connection to sewage system, detailed data from municipal plans with recent changes.

Stakeholders required to prepare data in way that they are usable in daily planning and decision making (otherwise no added value to existing tools, e.g., in Saxony). They noted that the process of the Toolbox communication to the end users will be of central significance. They strongly suggested that the use of the toolbox should comply with the legal requirements. Otherwise (personal and financial) resources needed for its implementation and necessary capacity building would not be allocated.

Additional feedback to the Toolbox concept:

- Recycling of treated wastewater can be an important water management factor in climate change adaptation.
- Land use proposals to support climate adaptation should be integrated into river basin management planning. Currently, the private sector is not affected by the need for proper land use.
- Improvement of the communication among the different sectors related to water resource management. TEACHER-CE can provide an efficient platform and bring together multiple stakeholders, optimizing water-resource management on a local scale.
- Translation of the Toolbox into national language should be implemented.
- Binding usage of the Toolbox into legislation (not realistic).
- Communication and promotion are very important. Many data and instruments are already available but not known by potential users. The instruments need to be better communicated and promoted.
- Information should be bundled to make better use of existing planning instruments. Synergies should be identified. This supports the idea to develop an "umbrella tool" that guides through the already developed tools of the exploited projects.
- Stakeholders can give a more detailed feedback on gaps in the toolbox concept after the learned more about such a toolbox.

2.3. TEACHER-CE Toolbox Focus Group

The purpose of the Focus Group will be to obtain actionable insights on the Toolbox users' needs. Partners are planning to work closely and more intensively with the Focus Group throughout the project in order to assure that the design of the Toolbox is supervised or/and guided by the key end-users who will, later on, take over the Toolbox and transfer it into operational work on national level.

Key members of the Focus Group in each country are the Associated Partners, additionally 2-4 other end users as well.

In the tables below you can find the list of members that were nominated for the TEACHER-CE Toolbox Focus Groups:

(SLO – LP)

Organization
Municipality of Kamnik (AP13)
Association of Municipalities and Towns of Slovenia (AP14)
Water Utility VOKA SNAGA Ljubljana (AP27)
Ljubljana urban plant - LUZ
Slovenian Water Agency (DRSV) - Department of Sustainable Water Management

(GER – PP2, PP3)

Organization
County Görlitz
City of Zittau
Saxon State Office for Environment, Agriculture and Geology

(PL – PP4)

Organization
Wody Polskie (Polish Water- region) – AP29
Wody Polskie (Polish Water- local) – AP29
Wydział Leśny (Forest Department-WULS_SGGW) – PP4

(IT-PP5, PP10)

Organization
Regione Emilia-Romagna
ARPAE Emilia Romagna- Agenzia regionale per la prevenzione, l´ambiente e l´energia dell´Emilia-Romagna
Regione Piemonte
Consorzio Bonifica dell'Emilia Centrale

(AUT – PP6, PP7)

Organization
City of Vienna, Vienna Water (MA 31)
Water Works, municipality of Waidhofen/Ybbs
Federal Ministry of Agriculture, Regions and Tourism
City of Vienna, Forest Administration (MA 49)

(SVK-PP8)

Organization
Slovenská agentúra životného prostredia
Ministry of Environment of the Slovak republic (Water Directorate)
Ministry of Environment of the Slovak republic (Water Directorate)
Slovenský hydrometeorologický ústav
Slovenský vodohospodársky podnik, š. p.

(HU – PP9)

Organization
Chairman of the Jász-Nagykun-Szolnok County Assembly
PLANTOR Ltd.
National Agricultural Research and Innovation Center - Irrigation and Water Management Research Institute
Tiszamenti Regional Waterworks Ltd.

(CZ – PP12)

Organization
Head of the water resources management unit in Podyjí national park
Technical University in Brno, Department of Landscape Water Management
Czech university of life science, Department of Water Resources
Czech Technical University of Prague, Department of landscape water conservation

3. Conclusions

There is a great awareness among the stakeholders about the necessity to adapt the water management sector towards climate change. This awareness has been rising due to the increased frequency of extreme weather events in recent years.

The status of adaptation in water management to climate change differs by country and region. Several adaptation practices and established tools/instruments addressing the impacts of climate change on the fields of water management, for example water availability, flood protection, heavy rain risk management, and forest management adaptation in water protection zones, were pointed out. Many data and instruments are already available but not known by potential users. The instruments need to be better communicated and promoted. Information should be bundled to make better use of existing planning instruments. Synergies should be identified. This supports the idea to develop an “umbrella tool” that guides through the already developed tools of the exploited projects.

All stakeholders highlighted a contrast between general awareness of climate change impacts on different "fields of water management" and the weak response in terms of measures related to mitigation of and adaptation to climate change.

Among the suggestions to increase climate change awareness and acceptance of adaptation measures, the following was emphasized by stakeholders:

- implement concrete management strategies on both, policy and operative level;
- develop a holistic approach for management planning;
- target functional training to increase knowledge on the impact of climate change on water cycle and bridge the communication gap between academia and land users;
- increase awareness of ecosystem services (e.g., flood protection, water retention) and
- importance of healthy ecosystem for maintenance of ecosystem functions.

The focus of the discussion was also to find out about the demands and the needs of stakeholders for the Toolbox. Stakeholders expressed their views regarding which functionalities should be included in the Toolbox to elaborate it as real support for daily and strategic activities. What was pointed out by most stakeholders is that the tool needs to be functional, easy-to-use with a simplified user interface (web-based). Detailed instructions and links to pilot actions can be added to learn more about the implementation of the tool. Also, a good description of the input data was requested and a necessity for including climate projections as well.

A tool designed to support climate change adaptation should have a cross-sectoral overview of the future projections of goals and measures and it should be developed in a way that it will support the practical side of adaptation tasks as efficiently as possible. For navigation purposes, it would be very good to have included a catalogue of national databases that are currently not interconnected (water, environment, nature, land registers, records, etc.).

The toolbox should contain basic knowledge, a directory of good practices, and dedicated climate change and risk/threat indicators for different administrative units. However, the use of these data and information for daily planning and decision making in water management and urban planning is the most crucial question of the participating stakeholders ("interpretation of data by non-experts"; "conclusion and indications of CC information for planning purposes" etc.). There should be a function of searching (via GIS) for various aspects of a given problem.

Few participants raised an issue that for Toolbox to be used in practice it should be backed-up with legal documents, otherwise (personal and financial) resources will not be allocated.

Next steps

Feedbacks and suggestions for the Toolbox development will be forwarded to the partners who are working on the next phase of the Toolbox development. Meanwhile, communication and meetings with Focus Group members will continue to test and assure that main stakeholders' requirements are integrated into the Toolbox

Further intense communication will take place to support awareness-raising and bring the Toolbox into practice.

In autumn 2021 the next round of stakeholder events is planned, focusing on testing the first version of the Toolbox in pilot areas.