EXPLOITATION: INTEGRATION OF EXPLOITED TOOLS INTO THE TEACHER-CE TOOLBOX

Work package T1	Exploitation: concept of CE tools integration
Output T1.1	Concept for integration of exploited tools for climate change adaptation and risk prevention

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1. Introduction

Climate change (CC) has various effects on water management and related sectors. Risks for heavy rain events and flooding increase, while at the same time the risk for extreme dry spells, from which the groundwater level and quality are affected, is rising. Often the events coincide, as for example a drought is often interrupted by extreme thunderstorms which entail heavy rain. The combination of extremes causes problems for all kinds of land-use, such as green spaces and water management, drinking water protection and security, urban water management (sewage systems) as well as agriculture and forestry. Still there are little know-how and instruments at hand for the water management sector to adapt to CC impacts and manage the combined risks in an integrated approach.

The aim of the Interreg project "TEACHER-CE" is to develop an integrated toolbox focusing on a climate-proof management of water related issues. This innovative toolbox is based on the integration of several tools developed within different previously funded EU projects. The purpose of these tools' ranges from guidance documents to intraoperative applications (decision support tools). All relevant tools enable the identification and implementation of measures to make municipalities and regions in CE more resilient to extreme weather events (including CC) and avoid negative impacts on ecosystems and land use. The toolbox is intended to activate synergies between these different already established tools in the context of climate adaptation.

The first phase of the project is drawn up by its partners as a defining process for the elaboration of the TEACHER-CE Toolbox. In order to create the basis for the toolbox development, the work package is split into different deliverables. Five of these deliverables form the basis for this first project output "Concept for integration of exploited tools for climate change adaptation and risk prevention"

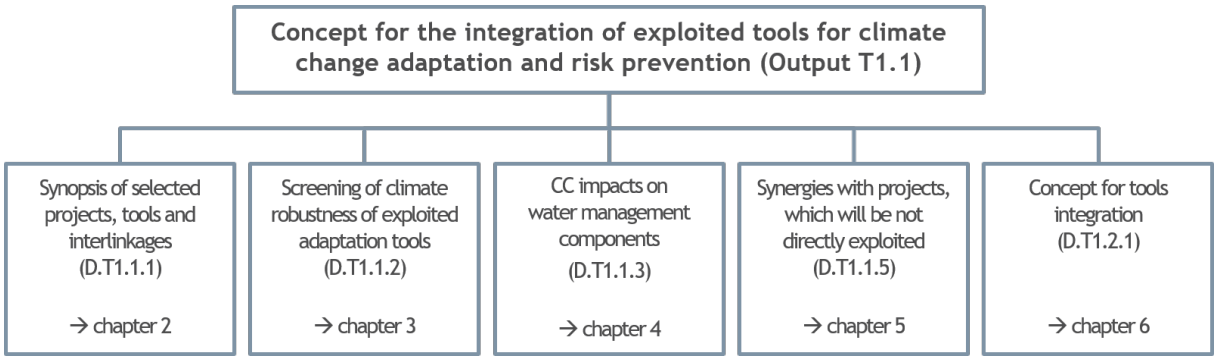

Figure 1: Overview of output report (OT1.1)

The first deliverable, D.T1.1.1, includes a compilation of selected projects, tools and interlinkages. The deliverable creates a common understanding and provides reliable background information, such as a list of similarities and differences between tools. In D.T1.1.2, the "Screening of climate robustness of exploited adaptation tools" aims at verifying the scope of applicability of the tools in the light of changing conditions due to climate change and its impacts. To break down the issue of the relevant aspects which are to be addressed in this context, D.T1.1.3 provides a "Documentation of CC impacts on water management components" like flood, drought and heavy rain. In D.T1.1.5, more input is given by other projects that might be of relevance for the TEACHER-CE Toolbox. Consequently, the aim of D.T1.2.1 is to establish a concept that generates a unified integration of tools into the toolbox.

2. Synopsis of selected projects, tools and interlinkages

The detailed results are available in the report

- D.T1.1.1: Synopsis of selected Interreg CE, DTP, H2020, Life and Copernicus projects, tools and interlinkages (published on TEACHER-CE website)

2.1. Overview of projects and tools exploited in TEACHER-CE

The starting point for the conception phase is the creation of a common overview of existing project tools and their interlinkages. A lot of projects develop (transferable) tools for municipalities and other public administration levels to generate a more sustainable handling of climate change impacts and weather extremes like heavy rain, droughts and floods in water management and to make different kinds of land use more sustainable. These projects use different approaches for the integration and implementation of their outputs and provide best-practice solutions for different geographical and regional settings. The aim of the TEACHER-CE project is to find synergies among these approaches and to integrate particular instruments of these projects in the TEACHER-CE Toolbox and provide an integrated measures database.

Twelve selected EU projects form the base for the development of the toolbox in the TEACHER-CE project. Four of these projects have been focused on: RAINMAN, PROLINE-CE, FRAMWAT and SUSTREE. Table 1 gives an overview of the projects, their tools and the involved TEACHER-CE project partners as well as a description of the respective project's tool. Therefore, a common understanding of each project together with tools and its objective is given.

Table 1: Overview and summary of the four selected Central Europe projects – direct exploitation of results

Tool (project; involved PPs)	Short description and objective of the tool
RAINMAN-Toolbox (RAINMAN – Integrated Heavy Rain Risks; PP2, PP3, PP9, PP11)	The RAINMAN-Toolbox aims at reducing the risks of heavy rain events by capacity-building for local public administration on integrated heavy rain risk management. Therefore, the toolbox includes innovative methods and tools for the integrated management of heavy rain risks by public authorities. An online knowledge platform offers good practice examples and guidance on (1) assessment and mapping, (2) a catalogue of risk reduction measures with additional detailed information on retention, prevention, spatial planning, early warning and emergency response and (3) risk communication.
DSS - Decision Support System (FRAMWAT; PP1, PP4, PP8, PP9)	The application is intended for people involved in the planning of water retention measures to mitigate the effects of drought, flooding and surface contamination by biogenes. The aim of the application is to familiarise the user with the Catalogue of Natural (small-scale) Water Retention Measures (N(S)WRM) and the planning process. An additional function is to help the user to decide on the location and type of measure and to produce a report on the basis of which the user can develop the concept and prepare the necessary permits for implementation. An available collection of data, tools, guidelines and procedures (methodologies) allows the assessment of costs and efficiency of different combinations of N(S)WRM on the catchment scale.
GOWARE Transnational Guide Towards an Optimal WAter REgime	The tool represents a Decision Support Tool (DST) developed for supporting the implementation of innovative Best Management Practices (BMPs) for drinking water protection, also with regard to floods and droughts.

Tool (project; involved PPs)	Short description and objective of the tool
(PROLINE-CE; PP1, PP5, PP6, PP8)	GOWARE-DST was developed to support the decision-making processes of individual users or user groups. The tool contains a catalogue of BMPs for different land uses. The user can individually evaluate the importance of different criteria and thus obtain a selection of BMPs for his specific requirements (Multicriteria Analysis (MCA) Analytic Hierarchy Process). In addition, users can obtain further information on the individual BMPs, for example on the relevant European regulations, on past or current projects/experiences and scientific work dealing with the implementation or design of these BMPs.
SusSelect (SUSTREE; PP7, PP12)	The tool aims to assess the vulnerability of forests to climate change and identify adapted seed sources. SusSelect is a mobile mapping application that displays the current and future vulnerability of 7 European tree species and suggests locations for seed selection. The tool ensures that the genetic material best suited to climate change is used in the forests of a particular region.

Eight selected EU projects complete this analysis. Figure 2 gives an overview about the names of the tools and projects.

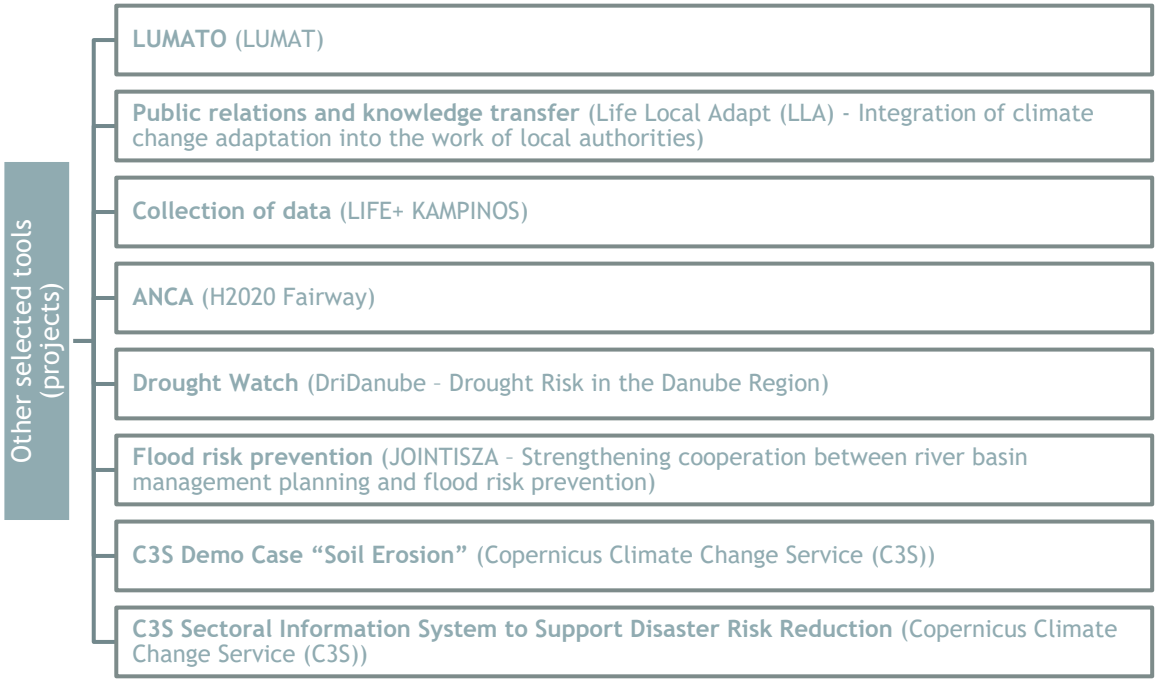

Figure 2: Overview of the other selected projects

2.2. Evaluation, outcome and assessment of exploited projects

A key challenge in the development of the toolbox is the harmonization of the provided tools of exploited projects: the creation of a common understanding and conceptual project framework. Therefore, a comprehensive synopsis of the tools from exploited projects (see above) with regard to their thematic focus and target groups is made. The evaluation of the projects and tools is based on an evaluation sheet that distinguishes different categories and aspects. Functional and spatial

interlinkages of projects outputs are identified. The result of the synopsis in D.T1.1.1 is a common understanding for the further toolbox development process.

By interpreting the evaluation results, the project partners identify aspects for the further tool development that will be considered with higher priority in the subsequent process. Table 2 summarises the main synergies and interlinkages of the twelve projects.

Table 2: Interlinkages of selected projects and starting point for the creation of the toolbox concept

Category	Aspects	
Impacts of climate change addressed	▪ Heavy rain/pluvial ▪ CC-impacts on water supply ▪ CC-impacts on forests	▪ Droughts ▪ CC-impacts on agriculture ▪ CC-impacts on soil
Targeted sectors	▪ Water management ▪ Environmental planning ▪ Forestry ▪ Agriculture	▪ Spatial planning (general) ▪ Urban development / planning ▪ Land-use management ▪ Infrastructure providers
Target group levels and expert level	▪ Municipality / local actors ▪ Politicians / decision makers	▪ Regional administration/actors
Focus of the tool	▪ Hazard & risk assessment ▪ CC impacts / climate proofing ▪ Practical (step by step) guidelines	▪ Risk mitigation measures ▪ Prioritisation / decision support
Spatial application area, characteristics	▪ Urban / built environment ▪ Rural / forest areas ▪ Water environment ▪ Low land, river valleys	▪ Rural / agricultural areas ▪ Rural / natural environment ▪ not spatially fixed (e.g. social ▪ Mountainous areas
Spatial scope	▪ Local / municipal level ▪ River basin level	▪ Regional level
Technical outline/ aspects of the tool	▪ It is a web-application / online-info ▪ It produces maps.	▪ It is a decision support tool ▪ It includes climate modelling.
Stakeholder interaction	▪ Information of stakeholders ▪ Training / capacity building	▪ Exchange
Link to EU Legislation	▪ WFD ▪ Drinking Water Directive	▪ Floods Directive

The completed evaluation sheets are summarised in an evaluation matrix and the detailed results are available in the report of D.T1.1.1.

3. Screening of climate robustness of exploited adaptation tools

The detailed results are available in the report "D.T1.1.2: Screening of climate robustness of exploited adaptation tools" (not published).

A key challenge in the development of the toolbox is verifying the robustness of the provided tools of exploited projects and the potential interaction of different climate change impacts. The question if and how uncertainties regarding climate change scenarios are considered in the tools is especially important for practitioners, stakeholders and decision makers. Therefore, a comprehensive assessment regarding the robustness of the tools was conducted, including both conceptual (target contexts, accounted issues, and main focus) and operational aspects (input data, output typology, and data processing support).

To test the robustness of the tools, it is necessary

- to provide an evaluation of how the aspects related to climate change are managed in the cross-fertilized projects,
- to identify gaps and weaknesses in the tools with regard to their climate robustness and
- to propose suggestions for facilitating the integration of climate-proofing actions.

In order to analyse the climate robustness of exploited adaptation tools, current and future climate data has been gathered, that permit assessments at regional (local) scale. Hazardous events like droughts, floods, and landslides can be characterized by considering several features, e.g. their duration, frequency, and magnitude. The required indices differ in scope and comprehensiveness to cover the most relevant properties of a single hazard. By determining threshold values expressed by either fixed or percentile-based values, a categorized list to relate on can be built up. Nevertheless, it must ne stated, that these indicators do only show changes in climate data (as input data for the tools) but do not assess CC-induced changes of the expected damage level.

In Central Europe, effects of climate change can be already clearly observed and could have a strong impact in the future at the territorial level. From the analysis of the main characteristics of the twelve exploited projects (see chapter 2), it is clear that the already available tools, applications and experiences represent a reliable cornerstone for supporting specific fields the water management sector. But the final picture regarding the tools' robustness against the impacts of climate change is very heterogeneous: some tools nearly disregard the issue of future climate change trends, in other cases complex and reliable climate simulation chains (from concentration scenarios to bias correction approaches and impact models) have been developed.

Based on the assessment of the climate robustness of the exploited adaptation tools, it is proposed to implemented different typologies of data in the Teacher-CE Toolbox:

- General climate indicators and associated maps in the context of water management adaptation to climate change (elaborated in the context of D.T.1.1.3);
- Climate indicators and associated maps tailored to the specific needs of the Toolbox instruments and tools (elaborated under D.T.2.1.1).

Two different ways of integrating climate indicators into the toolbox are identified: First, indicators are used within some of the tools and applications already developed, meaning this information is needed to apply the tools in a local context. Second, potential users of the toolbox could obtain an overview of future climate conditions and expected variation in maps or tables for their region.

4. Documentation of CC impacts on water management components

The detailed results are available in the following report

- D.T1.1.3: Documentation of CC impacts on water management components (published)

4.1. Expected climate change trends and its potential impacts

The comprehensive analysis of "Climate change impacts on water management components" consists of two approaches. The first part aims at providing a general overview of expected climate change and its potential impacts over Central Europe (CE) domain, with a focus on the Pilot Actions (PAs). The definition of the current climate conditions, as well as the evaluation of the future variations of a number of weather/climate-related variables as a consequence of global warming, are supported by the availability of high-resolution climate models that allow obtaining assessment for both recent decades and future periods.

In table 3, the climate change trends and the general impacts regarding water in Central Europe are summarised and the proneness of the TEACHER-CE PAs to the trends and impacts is shown. All PAs have to be considered potentially prone to higher air temperature and increasing frequency of heavy rainfall. Except for PA 5 (Enza basin, Italy), all pilot actions are expected to undergo changing precipitation patterns with an increase in winter season, whereas only three of them experience a seasonal shift of precipitation with a decrease in summer.

Table 3: Expected climate change trends and impacts regarding water in TEACHER-CE pilot actions[1]

CC trend	CC impacts regarding water	Pilot actions potentially prone to impacts								
		1	2	3	4	5	6	7	8	9
Higher temperatures	▪ Higher water temperatures ▪ Increased evapotranspiration ▪ Prolonged vegetation periods ▪ Increased dry periods, frequency and duration of droughts ▪ Increase of incidents of low water ▪ Higher water demand ▪ Increase of transmission of invasive species	●	●	●	●	●	●	●	●	●
Changing precipitation patterns/ seasonal shift in precipitation amounts: increased winter precipitation (rather rain than snow)	▪ Increase of frequency, height and duration of high-water events ▪ Fluctuation of groundwater table ▪ Rising water table	●	●	●	●		●	●	●	●

[1] Pilot actions: (1) Kamniška Bistrica river basin, Slovenia; (2) Upper Lusatia, Germany; (3) Kamienna river basin, Poland; (4) Lusatian Neisse river basin, Poland; (5) Enza river basin, Italy; (6) Vienna Water drinking water sources, Austria; (7) Waidhofen/Ybbs drinking water sources, Austria; (8) Nagykunsági river basin, Hungary; (9) National park Podyjí, Dyje river basin, Czech Republic

CC trend	CC impacts regarding water	Pilot actions potentially prone to impacts								
		1	2	3	4	5	6	7	8	9
Changing precipitation patterns/ seasonal shift in precipitation amounts: decreased precipitation in summer	▪ Increasing dry periods, frequency and duration of drought ▪ Increase of incidents of low water ▪ Higher water demand ▪ Increase of nutrients input in groundwater					●		●	●	
Heavy rainfall - increase in intensity and frequency (small scale)	▪ Increase in flood runoff ▪ Increase of erosion ▪ Increase of nutrients input ▪ Increase of frequency, height and duration of high-water event	●	●	●	●	●	●	●	●	●

4.2. Impacts of climate change on water management in TEACHER-CE

Climate change impacts on water management have been addressed in existing studies and projects. A compilation of this knowledge in the participating countries will examine relevant effects and conflicts in the water management sector. The second part of the analysis "Climate change impacts on water management components" evaluates and structures the main climate change impacts on water management activities and related adaptation options as entry point for the toolbox. Fields of action that are mainly the responsibility of the water industry were considered, but also those that are the joint responsibility of the water industry and other sectors.

Climate change imposes impacts on all aspects of "Water management". The term "water management" comprises many different fields of action on all administrative levels, regarding water quantity as well as water quality and concerning a wide variety of management tasks of freshwater Setting a focus and filtering the wide range of facts and findings is crucial to create a targeted basis for the conception of the TEACHER-CE toolbox. The broad scope has been narrowed with a view to the main aims of the TEACHER-CE Tool to achieve a targeted input:

- Inland river flood management and protection
- Urban drainage and wastewater treatment
- Heavy rainfall and flash floods (management and protection)
- Groundwater protection and groundwater use
- Drinking water supply
- Navigability of water ways
- Dam and reservoir management
- Low water management
- Conservation of aquatic ecosystems
- Agriculture/ forestry: Water for irrigation in agriculture (groundwater) etc.
- Energy/ industrial sector: Cooling water availability; Hydropower generation
- Urban areas: Urban planning and development

Changing climate parameters and their consequences for water availability and water quality lead to increasing adaptation needs in all sectors depending on water resources. Existing synergies and conflicts may be intensified or in some cases even may be balanced, while new conflicts (and synergies) will arise from increasing water resource pressures. The increasing competition on limited water resources and the adaptation needs, options and measures of the different sectors contain a high potential of conflicts.

Climate change impacts for each field of water management and their relevance (prevailing or considerable) is discussed for the pilot action. Most of the discussed impacts on water management have to be considered in at least one pilot action area. The following figure summarizes which fields of action are addressed in the pilot regions and which of these fields of actions are of special importance for the Toolbox (highlighted in blue).

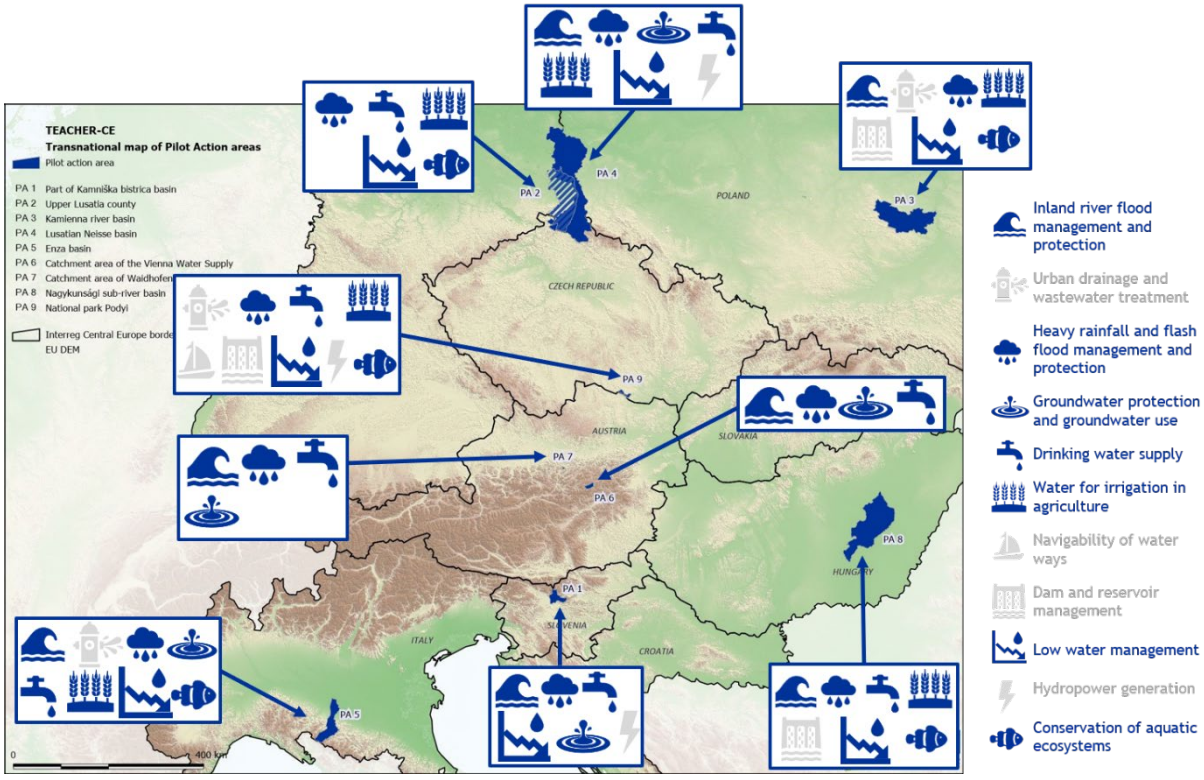

Figure 3: Fields of action of the water management sector addressed in the pilot regions and their importance for the toolbox (highlighted in blue)

5. Synergies with projects not directly exploited in the TEACHER-CE project

The detailed results are available in the report

- D.T1.1.5: Synergies with projects, which will be not directly exploited in the TEACHER-CE project (not published)

5.1. An extrapolation of the selecting process of tools and interlinkages

Generating a unified database by evaluating projects and related tools that are to be exploited in the TEACHER-CE Toolbox is the main focus of D.T1.1.1 (see chapter 2). In D.T1.1.5, the compilation is complemented by identified interlinkages of projects with valuable aspects to be compared with user's requirements.

Figure 5 gives an overview of the respective projects.

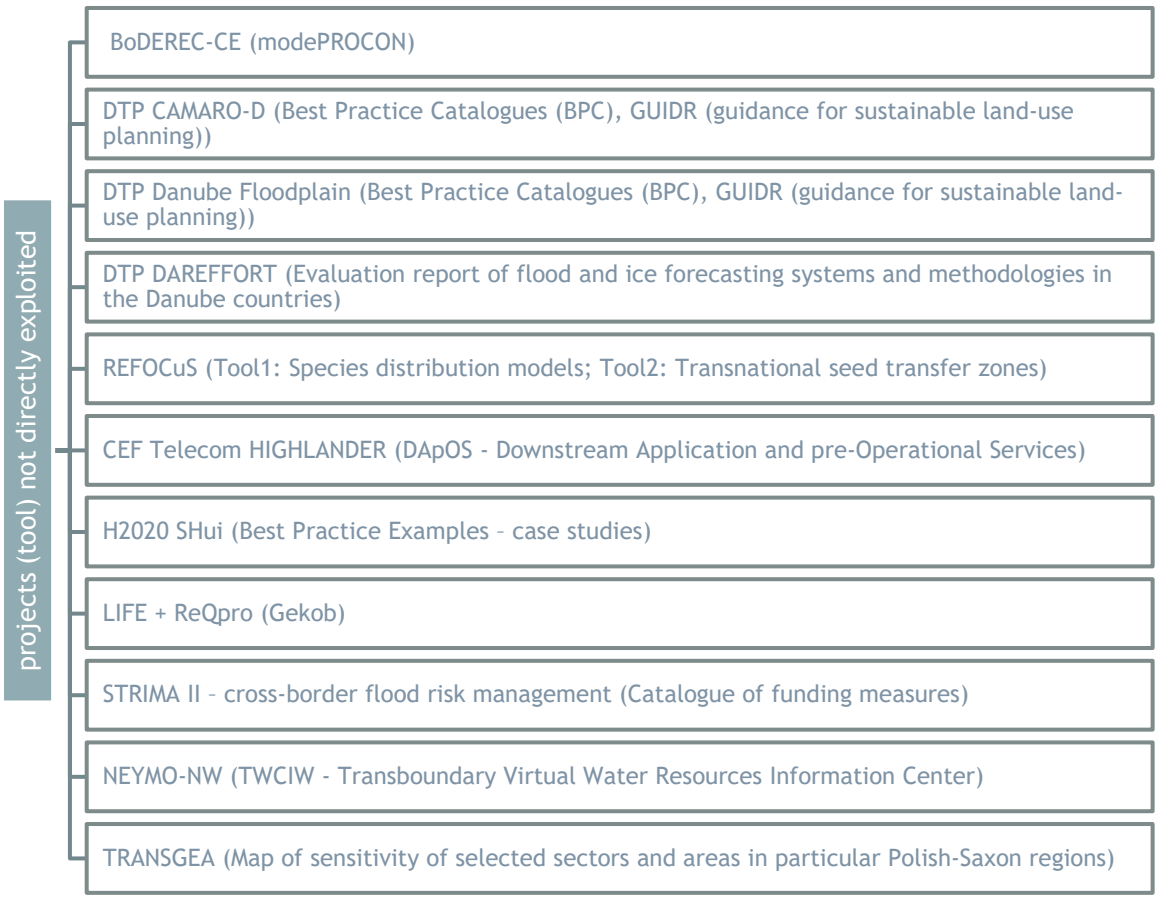

Figure 4: Overview and summary of projects (and name of the corresponding tool) not directly exploited

During the development of the TEACHER-CE Toolbox, it needs to be decided which aspects of these tools are suitable.

5.2. Assessment of not directly exploited projects

The evaluation of these projects is done by using the originated evaluation sheets (see chapter 2). The results of the evaluation of tools for two fundamental categories “impacts of climate change addressed” and “focus of the tools” are summarised here. The aspects which are marked green are defined as mainly important in D.T1.1.1 (see Table 2) and, therefore, are the ones to focus on.

The evaluation delivered the following relevant focusses of the assessed projects regarding the aspects of climate change, addressed by the tools:

Table 4: Overview category “impacts of climate change addressed” in assessed tools

Impacts of climate change addressed (Risks of extreme events, CC-impacts on different sectors)	CE boDEREC	DTP CAMARO-D	DTP Danube Floodplain	DTP DAREFFORT	REFOCuS	CEF Telecom HIGHLANDER	H2020 SHui	LIFE+ ReQpro	STRIMA II	NEYMO-NW	TRANSGEA
Aspects	*Name of tools: see chapter 2*										
River floods / fluvial		x	x	x	x		x		x		o
Heavy rain / pluvial		x					x		x		x
Droughts					x		x	x		x	x
Wind / Storms											x
CC-impacts on water supply		x							o	o	
CC-impacts on agriculture		x	x					x	o	o	x
CC-impacts on forests		x	x		x	x				o	x
CC-impacts on soil		x	x			x	x		o	o	

X = main focus, o = secondary focus / side aspects

The TEACHER-CE toolbox concept focuses especially on the aspects of heavy rain, floods and droughts. The evaluation of projects that will not directly be exploited in the toolbox shows that these projects could add additional value to these aspects as 4/5 of the projects focus on these impacts.

In the category "Focus of the tool" the evaluation regarding synergies of the tools with the TEACHER-CE toolbox is shown in Table 5.

Table 5: Overview category “focus of the tool” in assessed tools

Focus of the tool	CE boDEREC	DTP CAMARO-D	DTP Danube Floodplain	DTP DAREFFORT	REFOCuS	CEF Telecom HIGHLANDER	H2020 SHui	LIFE+ ReQpro	STRIMA II	NEYMO-NW	TRANSGEA
Aspects	*Name of tools: see chapter 2*										
Hazard & Risk assessment	o	o	x		x	o	x			x	o
Impact assessment		o			x		x			o	
Vulnerability assessment		o	x		x		x				x
Climate change impacts		o			x	x	x		x	x	o
Climate proofing of measures		o					x				
Monitoring progress		o	x				x				
Risk mitigation measures		x			x		x	x	x		
(Risk) communication		x	x				x		x	x	x
Prioritisation / decision support	x				x			x		o	x

X = main focus, o = secondary focus / side aspects

In this category the results in D.T1.1.1 (see Table 2) show the greatest synergies in the aspects "Risk Mitigation Measures" and "Prioritisation / decision support". Both aspects can be supported by the projects that will not directly be exploited in the toolbox.

The evaluated additional eleven projects are not directly exploited in the TEACHER-CE project to keep the toolbox concept simple enough regarding the available time and budget but also regarding the targeted users. So, the integration of additional aspects/tools in the toolbox concept should be critically looked at. Nevertheless, these projects can add additional value to the toolbox by the integration of relevant aspects.

6. Toolbox concept for integration of tools

The detailed results are available in the following report

- D.T1.2.1: Concept for tools integration (not published)

6.1. General conditions for the TEACHER-CE Toolbox

Building on the tools from the existing projects, TEACHER-CE aims to develop the decision support tool "CC-ARP-CE" to support Climate Change Adaptation and Risk Prevention in the water management sector in Central Europe.

The toolbox will especially support users to:

- manage the effects of heavy rainfall and floods
- exploit small water retention measures
- protect drinking water through sustainable land use
- and properly manage forests under climate change

All these aspects are included into the current CC-ARP-CE toolbox logo (Figure 1): vertical blue lines present rainfall, inclined yellow lines present sun, rising temperature and climate change, blue curls present runoff and floods and brown horizontal lines soil and drought.

Figure 5: Logo of the CC-ARP-CE (TEACHER-CE) Toolbox

6.2. Concept of the CC-ARP-CE toolbox

The main outcome of the deliverables that are summarized in the previous chapters is a concept for the integration of exploited tools that activates synergies between different tools and meets the needs of users in the context of climate change. In addition, results of national stakeholder meetings in all partner countries are considered (results of the stakeholder meetings are available in the output report O.T1.2). The concept includes the following aspects:

- Vision of the toolbox:
  - The toolbox will be designed as "umbrella Tool" (a "landing page") with a good navigation rather than a completely new tool.
  - The integrated approach is providing links to the tools developed within the past projects, while at the same time upgrading them with selected new integrated features recognized as important by the TEACHER consortium of partners and future users.
- Target group:

- Targeted sectors are especially: water management, spatial planning and land-use management, environmental planning and infrastructure providers (in this context especially drinking water suppliers).
- Target groups and expert levels are especially: municipalities/local actors, regional/national (depending on the organisational structure of the country) administration and actors

- Climate proofing and climate change data:
  - Climate proofing will be integrated (or is already integrated) in the tools of the CE-projects. Climate proofing in this context means to check if solutions / tools are still valid in case of changing climate conditions.
  - A Specific challenge regarding the conceptualization of the toolbox is the selection and integration of climate change indicators in the toolbox. The toolbox could provide data (in form of maps and/or tables) for a rapid overview of the future climate conditions and expected variation in frequency and intensity of weather extreme events under different climate scenarios. The availability of such kind of information could support the climate adaptation challenge at different levels of management.
- Technical outline of the toolbox: The partnership aims at starting the creation of the tool at a low technical level. It can be developed to a higher technical level from there. It needs to be considered that the users of the tool are probably "laymen". So, the use of the tool should be easy. However, the "backend" will have to be on a high level due to the fact that the necessary data and information are not at all simple so that some sophisticated features are necessary to set up a well working tool.

In addition, the TEACHER-CE partnership agreed on the content focus of the toolbox, which builds on the results of the analysis of fields of action described in chapter 4. The terms of the fields were slightly adapted for further processing in the project, as can be seen in the following table.

Table 6: Fields of action as main focus for the TEACHER-CE Toolbox

Fields of action - analysis in D.T1.1.3 (see chapter 4 in this report)	**Fields of Action in Water Management agreed to be focused on in the TEACHER-CE Toolbox**
Inland river flood management and protection	Fluvial flood risk (management)
Low water management	Water Scarcity and Drought risk (management)
Groundwater protection and groundwater use	Groundwater management
Drinking water supply	Drinking water supply (management)
Urban drainage and wastewater treatment	Urban wastewater collection and treatment (management)
Conservation of aquatic ecosystems	Management of water-dependent ecosystems
Heavy rainfall and flash floods (management and protection)	Pluvial flood risk (management)
Water for irrigation in agriculture	Irrigation water (management)

Building on these aspects, the CC-ARP-CE Toolbox aims to support stakeholders of the water management sector and related fields of action to adapt to climate change. the TEACHER-CE CC-ARP-CE "Umbrella" Tool is intended to integrate different components as shown in Figure 6.

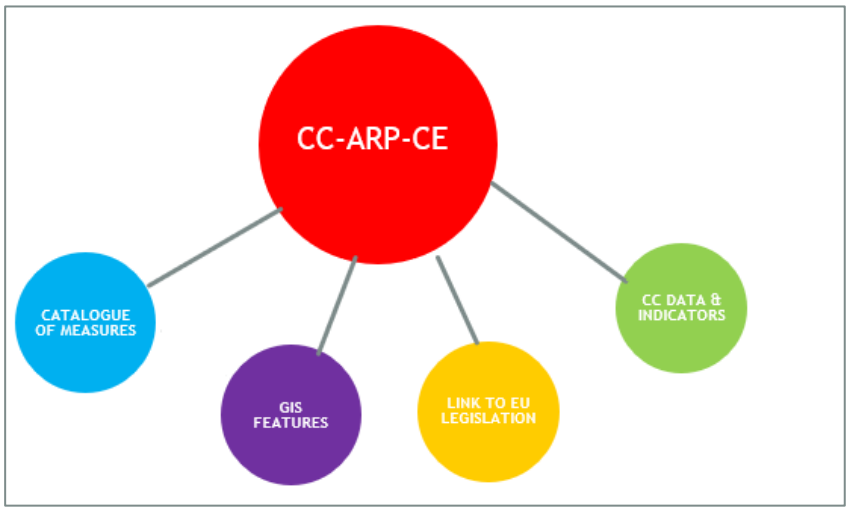

Figure 6: Components of the CC-ARP-CE toolbox

The catalogues of measures from the exploited projects (see chapter 2) will be harmonized and measures will be classified into domains (land use type, water management issue) by an assigned expert group. Following also an assessment of the measures based on selected criteria will be included so that users can rank the measures according to their individual needs.

The feature of an integrated Geographic Information System (GIS) in the toolbox allows the user to see relevant data on digital maps and browse quickly and simply through the tool or even download these data. GIS features in the toolbox include climate indicators for two future time periods (2021-2050 for the short-term analysis and 2071-2100 for the long-term analysis) as well as components of GIS tools of the exploited projects (for example Sustree and Framwat).

Since the TEACHER-CE Toolbox addresses topics that are closely related to the implementation of EU legislation, a link to existing tools on national or EU level (data portals, reports, legislation, etc.) in this context will be integrated. This will guarantee a transparent overview for users.

Climate change data and indicators provide information on the occurrence and severity of weather-related events. The anomalies between future time spans and the current period show the potential impacts of climate change. Users and project partners have identified more than 40 relevant indicators that will be further examined in subsequent work packages. The toolbox will explain and provide interpretation support for the selected indicators.

An outlook of the set-up of these four components in the toolbox is provided in Figure 7.

The CC-ARP-CE aims at the integration of different views. The users provide their ideas/issues/problems within a specific sub-river basin (Figure 7) and communicate via this tool also with the national tools which are already established for the implementation of the WFD. The tool has a simplified GIS function, which provides spatial orientation and provides information on the climate change models and results of climate change for specific sub-river basins analysed. Climate change data and models will provide a climate proof tool, valid for different extreme events (mitigation measures that are relevant for floods but do not negatively influence risk management strategies for droughts) and still valid in case of changing climate conditions.

A specific task is the development of the harmonised catalogue of measures (Figure 7). If the issues are net of specific river basins linked to national water management and to potential infrastructure measures identified in the previous projects, this information goes back to the group of stakeholders, where they can see the issues of other stakeholders (aggregated/integrated issues) and can also see the proposed measures and deposition of other stakeholders' views on how other stakeholders view the proposed measure. This provides an improved platform for communication between stakeholders on the proposed measures.

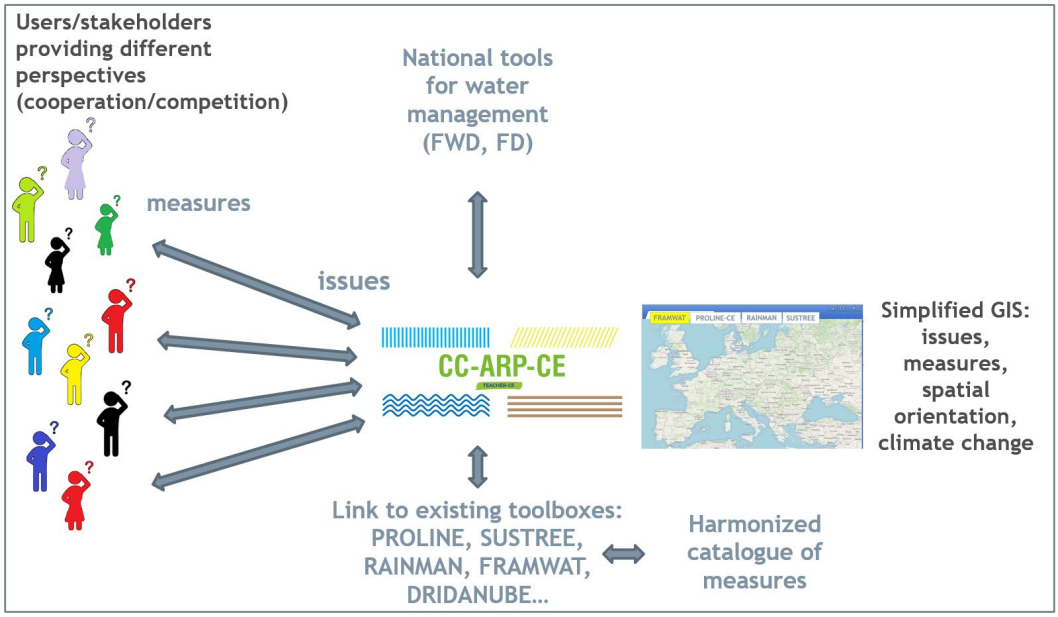

Figure 7: Conceptual scheme of the Toolbox

7. Conclusions and outlook

The goal of the deliverables of work package T1 summarised in this report is to create a common understanding and a basis for the TEACHER-CE Toolbox concept. Relevant established tools will be connected in order to deal with different CC-impacts in the water management sector.

The different steps of the conceptualization of the Toolbox range from collecting exploited project tools to finding synergies, proofing the robustness of adaption, defining how the relevant water management components are affected and finally an integration concept of them all. Finally, the TEACHER-CE partnership agreed on eight fields of action that will be the focus of the TEACHER-CE Toolbox. Moreover, synergies and interlinkages of established tools that deal with specific aspects of climate change have been identified and their climate robustness was tested. Components of the tools will be combined in the TEACHER-CE Toolbox which aims at providing an integrated approach to support CC adaption in different fields of the water management sector.

All these outcomes build one strand for the further development of the TEACHER-CE Toolbox. The second strand “User needs and demands” is available in the second output report “Summary and conclusions of Stakeholder participatory process” (O.T1.2) of this first work package.

The further implementation of the concept and development of the TEACHER-CE toolbox is covered in work package 2 (WPT2) of the project. The following main steps will be applied:

- Integration of selected outputs of the projects presented in chapter 2. Identification of the main gaps relative to the existing tools and positioning of the TEACHER-CE toolbox in the decision-making process.
- Provision of national overviews of existing tools supporting the governance process in the field of water management (national and EU legislation)
- Identification and integration of key climate change indicators: A further identification and calculation of the specific indicators will permit a more complete characterization of the expected impacts for the different areas.
- Merging of the catalogues of measures of different projects for different land uses and fields of action.