PROLINE-CE

WORKPACKAGE T2, ACTIVITY T2.3

IMPLEMENTATION OF BEST PRACTICES FOR WATER PROTECTION IN PILOT ACTIONS

D.T2.3.1 EVALUATION REPORTS FOR EACH PILOT ACTION

PILOT ACTION: PA3.1 Po River Basin

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1. Introduction

Best management practices (hereinafter BMPs) for drinking water protection and management derived from T1 were reviewed and relevant BMPs were selected for particular pilot action. Implementation status of BMPs was verified in Pilot Actions (T2); in case of lacks identified, possibilities of improvement and implementation were also assessed. Drinking water protection and management and best practices are strategically implemented in the pilot actions, in order to achieve a function-oriented land-use based spatial management for water protection at the operational level. Measures and actions were analysed and proposed concerning mitigation of extremes and achieving a sustainable drinking water level. PROLINE-CE pilot actions reflect the broad range of possible conflicts regarding drinking water protection, such as: forest ecosystem service function; land-use planning conflicts; flooding and water shortage issues; impact of climate change and land-use changes; demonstration of effectiveness of measures including ecosystem services and economic efficiency.

Review of main land use conflicts and BMPs on Pilot Action level has already been done in Pilot Action BMPs reports, which were a basis for *D.T2.1.2 Transnational case review of best management practices in pilot actions*. Description of natural characteristics of Pilot Site is presented in *D.T.1.4 Descriptive documentation of pilot actions and related issues*.

Activities within Pilot Action are described in *D.T2.2.2 Partner-specific Pilot Action documentation report*.

The Deliverable *D.T2.3.1 Evaluation reports for each pilot action* presents an evaluation of actual implementation and thematic interpretation of tested management practices as well as their acceptance among stakeholders and experts is carried out for pilot action PA3.1 Po river basin.

2. Evaluation of BMPs in Pilot Action

2.1. Implementation of BMPs

BMPs selected in the PA 3.1 Po river basin are:

- the Flood Forecast Center and the Flood Early Warning System (FEWS)
- the Drought Steering Committee and the Drought Early Warning System (DEWS)
- Analysis of the impacts of climate changes on drinking water resources

They are all implemented even if not yet fully implemented, needing for some further steps.

Concerning the first BMP, the Flood Forecast Center and FEWS, implementation was performed according to the following steps:

- inter institutional agreement
- design of the system
- data collection

- implementation and start-up of modelling system
- agreement on operational procedures

In progress activities are:

- new dataset and updating data network
- new implementation and upgrade of implemented models
- continuous hydrological flood monitoring and forecasting
- flood characterization and scenarios
- model performance evaluation and revision

Finally, not yet implemented actions are related to the following issues:

- promote synergic approaches between Disaster Risk Reduction and Climate Change Adaptation
- add other weather, ice/snow cover, ground water information
- support vvulnerability and exposure evaluation
- increase flood awareness

The proposed roadmap for completing not implemented actions includes: improvement of operational procedures and activities, further development of citizen information and assurance of incentives and investments to prevent, mitigate and better manage floods.

Concerning the second BMP, the Drought Steering Committee and DEWS, implementation was performed, starting from the FEWS already completed action according to the following steps:

- inter institutional and stakeholder agreement
- design of the system
- data collection
- implementation and start-up of modelling system
- agreement among institution and stakeholders on operational procedures

In progress activities are:

- new dataset and updating data network
- new implementation and upgrade of implemented models
- continuous hydrological water scarcity and drought monitoring and forecasting
- water scarcity and drought characterization and scenarios
- model performance evaluation and revision

Finally, not yet implemented actions are related to the following issues:

- give more decisional power to the Permanent Observatory on Water Uses
- increase weather, ice/snow cover, ground water and water allocation demand information
- fix water scarcity thresholds
- increase water resources awareness

The proposed roadmap for completing not implemented actions includes the intensification of already started activities and projects, the implementation of economic and environmental methodologies for water resource management, the improvement of operational procedures, further development of citizen information and assurance of incentives and investments to prevent, mitigate and better manage water shortage events and droughts.

Concerning the third and last BMP analysis, i.e. assessing the impacts of climate change on drinking water resources, the implementation was performed according to the following steps:

- literature review on the complex effects of climatic and non-climatic drivers on supply and demand of freshwater ecosystem services (FWES);
- development of a conceptual framework and a set of indicators for assessing the above-mentioned impacts due to global change, i.e. climate change and human activities;
- design of the integrated modelling approach to assess the impacts of climate change and land use change on FWES;
- production of climate change scenarios;
- production of land use simulations;
- data collection for Ecosystem Service model (InVEST);
- calibration and validation of the InVEST model;

In progress activities are:

- simulation of the InVEST model;
- risk assessment of climate change and land use change impacts on ES.

Finally, not yet implemented actions are related to the following issues:

- evaluate the effectiveness of different management options on ES.

The proposed procedure for completing not implemented actions includes:

- develop some scenarios corresponding to the management options such as the change in land use, crop types, water consumption for irrigation and urban;
- implement these scenarios to the InVEST model such as reduction of water consumption for irrigation and/or change of land use/crop types;
- evaluate the effectiveness of these scenarios and propose the best option.

2.2. Acceptance of BMPs among stakeholders

Stakeholders have been the main actors in all phases of BMP implementation and tests. They warmly welcome basic principles and methodologies for flood/drought operational management and for climate change simulation and projections. However, further work is needed for the transition from basic principles acceptance to a shared activities and operational decision making, delivering effective, measurable and balanced benefits.

BMPs have been tested with Stakeholders through thematic events, periodic technical meeting and bilateral events.

In May 2017 in Ca' Vendramin there was the PROLINE-CE National Stakeholders Workshop. The main outcomes of this event were:

- stakeholders involved in water shortage should be not only domain expertise but also communities and not technical
- there is a need to improve available and reliable data collection on water uses
- "Observatory" is a valuable option to address activities and actions in attempting to mitigate the conflicts between upstream and downstream communities; but voluntary actions do not have enough power

- there is a need for an Authority with decision-making power able to manage water crisis to overcome institutional fragmentation and competence with unitary plans

Since summer 2016, periodical meetings of the Po River District Permanent Observatory on Water Uses are taking place, in order to present meteorological, hydrological and water resources situation together with the needs of water users and to discuss possible actions for the optimal management of the water resources. The Observatory meeting is where regional issues are collected and discussed at the whole District scale and in the general framework of integrated water cycle, putting together quality and quantity aspects of water availability and demand. Periodical meetings are generally scheduled to be monthly: the last was on August 2018.

The Observatory meeting delivers an increase of knowledge on activities and issues of stakeholders.

In 2017 the National Government, under request of the Regional Institutions, declared the emergency status for Emilia Romagna region, because of drinking water supply crisis, caused by the severe scarcity of precipitations and the extremely high temperatures.

In response to this situation, a set of contrast action, for short term, was planned and started including:

- maintenance of water abstraction works
- action to increase well abstraction (river bed materials handling, cleaning and substitution of filters)
- use of mobile devices for water treatment
- installation ad empowerment of pumping stations
- tank truck transport of drinking water (especially in the mountain and upper hills areas)
- water networks interconnections (see also conclusion in DT2.2.2)

Moreover, an acceleration was given to medium and long term measures among which those concerning water storage facilities design, implementation and management.

Information and scenarios for the above described plans and actions were generated, shared and approved with the participation of all stakeholders and actors whose decisions were based on information and modeling systems, including DEWS.

In March 2018, within the ceremonies for the UN World Water Day, symbolically held in the Masone Labirinth in Fontanellato (PR), a workshop was held on the theme “The Virtuous Path: from Water Scarcity to Water Efficiency”, devoted to promote awareness on the value of water resources and their protection and use.

In the same March 2018, ARPAE had a bilateral meeting with HERA, the Multiservices –Drinking water Supply Manager selected in our PA, followed in April 2018 by the visit to the Pontelagoscuro (FE) Drinking Water Treatment Plant. These occasions have been an opportunity for each other acquaintance, for exchange of work experiences and for discussion about setting up of future common projects. HERA showed that the Pontelagoscuro Water Treatment Plant serve about 250.000 equivalent inhabitants, 70% pumped form surface water and 30% from river bank ground water. Plant management main BMPs are:

- open air water storage; mainly used to guarantee up to 3-days water supply during emergency stop (pumping problems, low water, pollution and flood events), but also used for sedimentation and natural biodegradation;
- operational programming considering all actions and management scenarios;

- Water Safety Plans, managing drinking-water quality for Public Health
- flood water intensive treatment with multi barrier approach, including pumps stop when the 50 NTU threshold is exceeded, respecting limits for energy costs

At regional level working groups for discussing and planning water resources management exist.
Drinking Water Protection Areas, introduced by the national low (Dlgs 152/2006) and regulated by the Regional Administration, are identified within Municipal and Large Areas planning instruments.
During the technical visit in Pontelagoscuro also emerged the opportunity for further investigation about the relationship between stream flows and river bank ground water levels in the pumping fields, as experienced during the last prolonged low flow period (April 2016-February 2018).

2.3. Overview table about implementation of BMPs in Pilot Action and their acceptance among stakeholders

Table 1: GAPs and proposed BMPs with recommendations for implementation in Pilot Action.

Actual management practice (GAP)		Pressures on water resources management	Flood impact not fully implemented and considered	Climate Change impacts on drinking water resources
Proposed BMP		The Drought Observatory/ Steering Committee and DEWS (Drought Early Warning System)	The Flood Forecast Center and FEWS (Flood Early Warning System)	Analysis of the impacts of climate changes on drinking water resources
Proposed solutions and recommendations	adaptation of existing land use management practices	Improvement of knowledge on links between land use and water resources through: - Periodical updating of the assessment of land use (e.g. agricultural practices) impact on drinking water; -Increase of number, spatial/temporal detail and type of data about land use and environment representation.	Strengthening role and requirements of flood management system in relation to the operational needs in all phases of disaster management (forecast, preparation and response). Increase synergies among land use planning/management and emergency planning/management. Periodical updating of vulnerability and exposure evaluation.	The proposed solution is to carry out detailed studies about the potential impacts of climate changes and partly related land use change. The main goal is to provide probabilistic evaluations of impacts on drinking water resources accounting for multiple constraints. Furthermore, it could increase the awareness of all the stakeholders about the topic.
	Adaptation of existing flood/drought management practices	Increase the use and sharing of drought early warning system among stakeholders. Creation within the DEWS system of drought /water scarcity indicators and indices easier to	Improvement of the monitoring and modelling system, also considering interactions with exposed elements and operational procedures. Investment in flood analysis, operational	Investment in data collection, monitoring, model simulation and analysis, operational platform maintenance education and training. Promote synergic approaches between

		understand for stakeholders. Investment in monitoring, simulation and analysis. Increase weather, ice/snow cover and ground water information. Operational platforms maintenance, education a and training. Consider site specific drought impacts on drinking water. Fix water shortage/drought thresholds.	platform maintenance, education a and training. Consider flood, drought and water management as a unique operational process. Make flood information more understandable to citizens. Consider flood impact on drinking water.	Disaster Risk Reduction and Climate Change Adaptation communities by considering the cross-dependence between droughts and floods periods. The assessments could support systemic evaluations about the management of extreme events (flood and droughts) achieving solutions effective also for preserving drinking water resources. Moreover, the approaches are straightly exploitable also for other test cases.
	Adaptation of policy guidelines	Improvement of potential synergies among stakeholders on water demand and land use. Give more decisional power to the Permanent Observatory on Water Uses.	Integration in policy guidelines of the fundamental role of predictability, uncertainty and communication of extreme events in losses of lives and damages linked to heavy rain and floods, including losses in drinking water supply systems.	Test the implementation of proposed solution by relevant stakeholder's communication in the decision-making process. Improving the decision-making process increasing the awareness of all the stakeholders about the future challenges for effectively preserving drinking water resources.
IMPLEMENTATION		Yes, but not complete	Yes, but not complete	Yes, but not complete
In case of NO:	•possibility of implementation	For the complete implementation it is necessary to: - empower modelling system -increase accessibility and availability of information - further develop stakeholders awareness and engagement -assuring incentives and investments to prevent, mitigate and better manage water scarcity events -improve dialogue and communication	For the complete implementation it is necessary to: - empower modelling system -improve operational procedures and activities considering the whole disaster cycle - further develop citizen information and operation tools for alert dissemination -assuring incentives and investments to prevent, mitigate and better manage floods	The topic about implementation should be differentiated considering the implementation on test case simply requiring the stages above described. In general, to properly account for CC in drinking water protection management, Acts as National Strategy for Adaptation (published in 2014) and next National Adaptation Plan represent key activities; it should be

				integrated with analogues experiences at regional and urban scale
	•proposal of procedure for implementation	Confirm and intensify already started activities and projects. Implement economic and environmental methodologies for water resource	Confirm and intensify already started activities and projects. Implement impact based economic evaluations of flood management	Regional and Urban Adaptation Plans should be performed; moreover, following EU Directive, the updates in Plans should explicitly account for CC issue (f.e. second implementation of actions required by flood Directive)
	•other (please, specify)	Extend the number of stakeholders and stimulate attention to drinking water	Extend the number of stakeholders and stimulate attention to drinking water supply systems protection in case of floods	More quantitative evaluations as those proposed in PA3.1 activities could permit better driving decisions of Administrators also if carried out only on limited domains
ACCEPTANCE AMONG STAKEHOLDERS AND EXPERTS				
	•possibility of implementation	Stakeholders are a bit doubtful about the success of this measure, because their involvement is more recent with respect to flood issues. Although positive trends can be observed, the process is slow and requires persistence. Experts put in evidence the main implementation opportunities underlining the role of funding, multisectoral partnership, interdisciplinary qualitative quantitative approaches, innovation (ICT , humanities, applied research etc.), social awareness, training, and stakeholder involvement.	Stakeholders gave positive feedback, putting in evidence some difficulties and proposing ideas and solutions to complete the implementation. Experts put in evidence the main implementation strategies whose added value rely on funding opportunities, innovation (ICT, humanities, applied research etc.), social awareness, interdisciplinary applications, and stakeholder involvement.	Due to high complexity of investigated issue, several expertise are required to effectively address the topic; the starting point could be represented by Observatories proposed in other BMPs involving also expert in atmospheric sciences or adaptation processes Moreover, awareness about the future potential issues for drinking water should be increased also in general public making the results of research and institutional activities easier for all potential stakeholders (for example, stressing pros and cons or uncertainties in current estimations).
	•proposal of procedure for implementation	Insert easier and more accessible water information, especially drinking water, according to stakeholders needs. Increase the involvement of experts from different	Insert easier and more accessible water information, especially drinking water, according to stakeholders needs. Increase the involvement of experts from different	-favouring the development of participative processes and stakeholder engagement to promote bottom-up approaches -clearly integrate the

		fields (communication, economy, environment, social sciences) to test operational tools and share knowledge. Funding and implementation of interactive systems for hydrological simulation and application.	fields (communication, economy, environment, social sciences) to test operational tools and share knowledge. Funding and implementation of interactive systems for hydrological simulation and application.	activities about adaptation in Observatories, Technical panels and other decision-making bodies in which experts and communities are already involved. -replying the experiences carried out on different contexts favouring the dissemination of the results.
	•other (please, specify)	Increase the knowledge of existing and potential problems and vulnerabilities linked to pressure on water resources. Increase the awareness on benefits of information and scenario (evidence based) based decisions. Share with stakeholders and citizens the main steps and results.	Increase the knowledge of existing and potential problems and vulnerabilities linked to floods. Increase the awareness on benefits deriving from decisions based on full information and specific scenarios. Share with stakeholders and citizens the main steps and results.	

3. Conclusions

In the last years, because of economic growth, social progress and the occurrence of severe weather extremes in Italy, including the Po river basin, we have assisted at the increase of the awareness of pressures on water resources deriving from public and private uses. At the same time and increasing need for safety from extreme events, including floods and droughts, arose especially within the most exposed and vulnerable communities.

The rise of drinking water issues, and generally speaking of the whole water resources theme, was also fostered by the dissemination of the first results deriving from climate change projections and land use change studies.

To face these issues, also thanks to legislation inputs, private enterprise, technology and research, in the Po river Basin a shared process has started with the following main targets:

- improvement of information and knowledge of the basin and sharing of them
- integration of water and land use planning and management
- prioritization of governance actions through the active participation of all actors and stakeholders
- foundation of the actions on decision support system involving experts and the most effective operational simulation tools

Within the Proline Project, the whole water governance process was briefly investigated; deriving from this activity, the main gaps selected and investigated concerned:

- pressures on water resources
- flood impacts
- climate change impacts, especially on drinking waters.

Then, a general overview of management measures and practices have been analyzed and selected evaluating their suitability to fill the detected main gaps above.

The BMP selected within the project to be tested and evaluated in PA31 mainly concerned:

- water resources modeling systems and operational tools
- water and land management participation instrument, also at operational level
- tools and issues concerning impact assessment of projected climate change on good water availability, droughts and floods.

An examination of actual implementation, current activities and ongoing projects concerning the current and potential effectiveness of the selected BMPs has been undertaken in Proline CE. All work has been done with the engagement of stakeholders and suggestions from experts. From the thematic interpretation of tested management practices emerged that work is still needed in order to:

- empower, maintain and integrate modeling system
- increase accessibility and availability of information

- further develop stakeholders and experts engagement and involvement
- improve the understanding of the impacts of climate change and land uses changes on ecosystem services provision.

On the basis of the experience we gained working at Proline project, we can say that in the field of water governance, concerning the acceptance among stakeholders, the decision support tools, the contribution of the experts and the capitalization of transnational, interdisciplinary experience, a great deal of progress has been made, but there is still some way to go.

4. References

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