“Exchange of experience” minutes report

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Activity Number	3.6
Activity Title	Integrated observational and modelling strategies for filling identified knowledge gaps
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1 Summary

2 Foreword

This document has been produced in the framework of the INTERREG Italy – Croatia CHANGE WE CARE Project. CHANGE WE CARE fosters concerted and coordinated climate adaptation actions at transboundary level, tested in specific and representative pilot sites, exploring climate risks faced by coastal and transitional areas contributing to a better understanding of the impact of climate variability and change on water regimes, salt intrusion, tourism, biodiversity and agroecosystems affecting the cooperation area. The main goal of the Project is to deliver integrated, ecosystem-based and shared planning options for different problems related to climate change (CC), together with adaptation measures for vulnerable areas, to decision makers and coastal communities. Additional information and updates on the CHANGE WE CARE can be found at https://www.italy-croatia.eu/web/changewecare.

3 Introduction

The main goal of activity 3.6 is to make a recap of all the identified knowledge gaps through the exchange of experience meetings and formulate a strategy for filling those knowledge gaps when and where possible. This document, based on the minutes of the exchange of experience meetings, will resume the main results of the interactions on data management and acquisition strategies. Among others, it will contain:

- Identification of knowledge gaps in the different aspects of physical, geomorphological and ecological coastal processes.
- Identification of open issues in data access and use and data management options
- Options for coordinated, interdisciplinary strategies aiming at optimizing the efficiency of field campaigns.
- The definition of a minimum necessary frequency for periodical coordination meetings for data discussions on an interdisciplinary base

The construction of a common framework of integrated observational and modeling procedures will be pursued based on the following actions:

i. Identify necessary and relevant data for an integrated observational and modeling procedure through open discussions and expressed needs of the project participants (ISMAR, IOF);
ii. Establish connections with institutions whose data is accurate and valuable to the research activities (ISPRA);

4 Identification of knowledge gaps

As stated during the exchange of experience meetings, there are two types of information pertaining to CWC pilot sites. Regional information pertinent to all pilot sites, and site-specific information pertinent to each site based on the specific characteristics differentiating each site from the others due to differences in each pilot site specifics.

During the implementation of 3.1 to 3.4 activities, it was determined that, although certain information is pertinent to all pilot sites, that information is not available on all sites due to various reasons (proprietary data not made available to CWC partners; fragmented data; data lacking proper metadata – making it difficult to conduct comparative spatial analysis; data lacking continuity – either because there were no follow up data collections, or collections were too far apart for practical use or conducting proper analysis; a complete absence of data due to either insufficient resources or organizational and/or research strategy shortages of a specific area).

In the activity 3.2 deliverable 3.2.3 a general overview of all the available and missing data both on a regional and pilot sites level is given in both a descriptive and tabular form for each (3.1 to 3.4) activity.

Although A 3.2.3 aimed only at producing a dataset relevant only to A 3.2, during the compilation process, the partners agreed on the fact that the database could be enlarged to include all the categories of data and topics useful to produce the WP 3 outputs. Thus, a part of A 3.6 activity aimed at standardizing and sharing information among the partnership, and identifying existing knowledge and gaps was also conducted. The data set was enlarged to include other categories of the WP 3 (A 3.1, A 3.3, A 3.4). Data was filled in by each of the partners based on a table scheme designed to incorporate all data recognized by the partners as relevant and/or available on either of the pilot sites or on a regional scale.

As stated in deliverable 3.2.3:

- Overall, the data set provides a sufficiently complete overview on the existing cartographic and numerical data, which describe all the proposed topics at different scales, starting from the North Adriatic to the site pilot level. In general, the historical data that can be used to analyze the evolutionary trend covers a quite short and reduced temporal period.

Also,

- The data that potentially can converge into a GIS are even more limited: the identified temporal period ranges from the beginning of the century, with the first orthophotos, to current days, with the recurrent satellite imageries.
- The amount of the material available on the Croatian area appears to be narrower than what is available for the Italian region.

Climate change data and reports, analyzed in activity 3.1, are mostly well documented, freely available, and easily accessible which resulted in a comprehensive analysis that can be found in CWC 3.1.1 report: Assessing different aspects of present state and ongoing climate changes at both Adriatic and local scale. This report contains an overview of present knowledge of climate changes in the Adriatic Sea, both in the atmospheric and in the ocean, by overviewing the scientific literature, analyzing long term in situ observations, and presenting brand new results coming from the 31-year long atmosphere-ocean climate model. The analyses included both the Adriatic-wide climate and well as the climate of the five CHANGE WE CARE pilot sites.

The following activities 3.2-3.4 identified knowledge gaps resulting from lack of available and/or current information that will be listed in the following chapters.

4.1 Neretva River site

4.1.1 Identified knowledge gaps

3.2 Deliverables:

Acquisition of new in-situ geomorphological data for the area of interest needed to complete knowledge.

There were no new in-situ measurements within the ChangeWeCare project. However, the data on the amount of sediment in suspension and the bedload of the Neretva River stream is important for future projections of the trends in sediment accumulation.

There are no available studies on the present day sediment dynamics around the mouth of Neretva River. Especially interesting would be the analyses of sediment dynamics along the circular sandbar Škanj that should be planned for future studies. Thus, sedimentological studies and precise geodetic monitoring along the river mouth is needed in the area for the analyses of the evolutionary trends.

3.3 Deliverables:

There are no new in situ measurements of sediment, water or nutrient fluxes. Many of data sets are still largely lacking, particularly those related to Ploče port sediment quality, composition, and fate (most of the parameters are measured for a short period of time (Nutrient fluxes, Water salinity), or only one for specific research (pesticides, Water flow). Due to the wide sources and general incompatibility of data, analysis of data quality was not performed to date within the Change we Care project.

3.4 Deliverables:

Coastal and aquatic transitional habitats in Neretva River Delta (the wider area of the mouth of Mala Neretva, the mouth of the Neretva River, Parila Lagoon, Vlaška Lake, Neretva River to the city of Opuzen) are scarcely investigated and have to be mapped based on salinity criteria for brachish water from 1 to 25 ppt (30 ppt). Except biodiversity that should be investigated, the ecological status of this transitional habitats should be defined by WFD classification.

4.2 Jadro River site

4.2.1 Identified knowledge gaps

3.2 Deliverables:

There are no available more precise bathymetric data for the Jadro River and the eastern part of Kaštela Bay (Vranjic Bay). Acquisition of modern geodetic methods is suggested (multibeam, photogrametry, laser scanning etc.).

There are no previous analyses of the geomorphological proceses on the pilot-site Jadro River and Vranjic Bay. However, comparision of available historical data, i.e orthophoto images from 1968 and 2017, reveals

that during last 50 years geomorphology along the coast and at the Jadro River mouth has not been changed significantly.

There are no recent geomorphological studies of the pilot-site Jadro River mouth and Vranjic Bay.

Data quality is low and for any further more sophisticated analyses new data aquisition should be performed.

There are no available more precise data on the amount of sediment in suspension of the Jadro River stream. That is why the suspended sediment should be measured.

Recent studies on the present day sediment stocks are not available neither for the riverbed and the seabed nor for Jadro River mouth and the eastern part of Kaštela Bay (Vranjic Bay). Acquisition of new data is needed (sub-bottom profiler, systematic coring of the sediment etc.).

The measurements of the sediment in suspension of the Jadro River lower stream should be done at the entrance to the estuary during the rainy season when the expected erosion of flysch marls is probably the highest.

The recent trends of the sediment supply by Jadro River should be evaluated. Furthermore, various climate change scenarios could significantly affect erosion and sediment supply to the Jadro River mouth, and should be evaluated.

Data quality is low and for any further more sophisticated analyses, new data acquisition should be performed.

3.3 Deliverables:

Permanent monitoring and correlations of precipitation, temperature, discharge and water usage is needed. There are no published data on sediment fluxes by the Jadro river stream. No data for Sediment fluxes, nutrient fluxes (no recent data) water-sediment-nutrient related parameters (pesticides…). There are no new in situ measurements to date.

3.4 Deliverables:

The lower part of the Jadro river is the most vulnerable to the climate change and the sea level rise, as the upper parts of the river are separated from the lower ones with cascade and dam system. Efforts should be directed toward acquiring chemical, physical and biological data for coastal area near and at the Jadro river mouth, as well as the lower part of the Jadro river flow.

4.3 Nature Park Vransko Jezero site

4.3.1 Identified knowledge gaps

3.2 Deliverables:

No new in situ data was acquired to complete the knowledge.

Combination of limnic and karst relief in areas of highly productive agricultural area in combination of ornithological reserve and nature park - many conflicts present in all directions. Particular attention should be paid to monitoring the communication of Vransko Lake and sea water at the locations of coastal springs and hot springs in the lake and the sea. In order to find their location, classical methods of hydrological measurements and sampling, it is necessary to supplement the methods of remote sensing, using infrared satellite or aerial images.ew in situ data was acquired to complete the knowledge.

New data is needed – some maps may be improved; new maps of saline intrusion or so may be produced.

No new in-situ data to complete knowledge for sedimentological data was acquired.

Data quality is sufficient but more interdisciplinary research between geologists, hydrologist, biologist are needed to answer the questions about the influence of climate change the Vransko lake Nature park ecosystem.

3.3 Deliverables:

The quantification of the water inflow and loss in case of the Vransko Lake is still not possible due to the high complexity of its hydrological characteristics, but also irregular or absent hydrological monitoring in the past.

In line with the functioning of the Vransko Lake, described in Deliverable 3.3.1, it is clear that sediment flux in case of Vransko Lake is still unknown, mostly due to the natural complexity of the lake water-sediment system functioning and the superposed human interventions within the Lake drainage area during the last 250 years. Permanent monitoring of the sediment concentration does not exist.

Water quality monitoring has a long tradition within the Vransko Lake area, however, frequent changes of monitoring stations, sampling methodology, analysed water quality parameters etc. resulted in poorly highly dispersed data sets. Even though the Vrana polje is area of intensive agricultural land use, data related to herbicides and pesticides are still largely scarce. Data about grease and oil in the Vrana polje and Vransko Lake are not found in the published literature.

3.4 Deliverables:

A decrease in water quality monitoring (sampling frequency), and partial sampling method change was identified for the site. Such an inconsistent way of quality monitoring within the mentioned state

monitoring program is not appropriate if one wants to monitor the spatio-temporal changes in the state of salinity of the Vransko Lake in a longer time series.

There are no maps of ecological quality elements trend available for the Natura 2000 habitats in the Vransko lake Nature park.

4.4 Banco Mula di Muggia site

4.4.1 Identified knowledge gaps

3.2 Deliverables:

For the study area there is a fair amount of previous data in terms of historical cartography, topo-bathymetric surveys and aerial photos, but the available material is often fragmented, difficult to find and in formats not usable for analysis in digital environment.

The first step of this work was the collection, reordering and critical reading of the available material and the digitization of what was deemed useful and/or appropriate for the purposes. The created database represents a coherent basis, directly usable and upgradable. The analysis has considered the extent and quality of past data, highlighting limits and deficiencies.

For the new surveys the combined use of different survey techniques (topographies with RTK system, Single and Multi Beambathymetrics and drone aerophotogrammetrics) is the only possibility to obtain a wide coverage of the area and to overcome the difficulties imposed by its morphological characteristics.

The construction of the DTM requires particular care and represent a problematic phase in the elaboration process:

- an accurate manual integration of the standard data interpolation procedures offered by GIS geostatistical analysis software is necessary;
- data quality is an essential factor for the model to have a high degree of reliability;
- the density and mesh of the measurements influences the quality of the reconstruction

In order to update the sedimentology dataset of the pilot site, a focused sampling activity was planned but not carried out due to various setbacks (there were problems with authorization because of the stricter rules adopted by the Port Authorities for this type of work at sea; the area is logistically difficult to manage, ideal weather and tidal conditions are necessary; the Covid-19 pandemic conditions).

3.3 Deliverables:

No data for nutrient and sedimet fluxes, Other water-sediment-nutrient related parameters, water flow, flow velocity , chlorides – not available.

The acquisition of an acoustic Doppler current profiler (ADCP) and it set up in the Isonzo mouth was planned in Act. 3.3. The Covid-19 lockdown slowed down the work.

3.4 Deliverables:

Limited information were available, in particular, for the species and distribution of phanerogams, but a preliminary survey was carried out in October 2019 to schedule the following steps for data acquisition. An Operational Plan for acquiring data in situ was prepared and reported on, but whose planning is now affected by the COVID19 emergency and needs to be rescheduled.

4.5 PO River delta site

4.5.1 Identified knowledge gaps

3.2 Deliverables:

Regarding the analysis of the coastline evolution, there are some uncertainties and inhomogeneities regarding the data, such as:

1. The interphase between land and water is not clearly identifiable from the orthophotos and it is affected by the run-up and tide condition at the time of the flight. The uncertainties here is of the order of magnitude of 2 m.
2. The orthophotos gave information of the planar evolution of the coastline, but they cannot say anything regarding the temporal deepening of the seabed and eroded/deposited volumes at the coastline.
3. For the Lidar surveys the coastline is identified as the isoline defined as +0.25 m a.s.l.. Different procedure has been followed to define the coastline from the DTM 2008, considering alternatively the furthest border between land and water. Therefore, this datum has not been considered in the overall analysis.
4. The orthorectification and homogenization of the reference system are crucial elements for the reliability of the analysis.

The bathymetric survey of the Po delta branches, which was an objective of the present project, was planned to provide new information regarding the conformation of the riverbed near the mouth and therefore to identify bottom structures due to sediment transport and any accumulations.

The results of this activity, assigned to AIPO (Agenzia Interregionale per il fiume Po) by the partner Emilia Romagna Region, were not delivered due to several reasons including the covid-19 emergency.

Systematic bathymetric surveys along the entire coast are necessary to assess the sediment stock evolution along the Po delta. However, the available data do not cover the whole delta and they are often inhomogeneous and incomplete.

Overall, the sedimentological and bathymetric data regarding the whole Po Delta area are not spatially and temporally homogeneous. Some areas have received much more attention when compared to others due to their economic and environmental value. Above all, the available bathymetric surveys have not always regarded the same sections along the delta coastline, precluding an appropriate comparison among the profiles taken during the time.

Concerning the Veneto coastline, a proper monitoring network to assess the sedimentological evolution of the Po delta is still missing.

3.3 Deliverables:

No data on total pesticide load, no data on erosion of dryland, short dataset on sediment fluxes (from one year).

For several decades, systematic measures of bedload transport of the Po river have not been carried out. Recent evaluations of the process derive from indirect methodologies based on mass balances or input estimates to the sea deriving from the evolution of the Delta mouths and beaches or the application of experimental correlations.

3.4 Deliverables:

For the Sacca di Goro, to make comparisons between the already available maps and the present situation, the Park had taken the commitment of producing, ex novo, one GIS map for vegetation and one for nesting birds, updated to the present. Monitoring campaigns were planned to be performed in Spring 2020, and maps to be available for the project within the year. However, this activity has not yet started due to the COVID-19 pandemic. For the whole delta area a remote sensing-based approach will be adopted to explore the feasibility of updating the reedbeds maps, given the availability of suitable satellite products. In particular moderate resolution imagery (10-30 m pixel size) from different platforms will be considered.

5 Conclusions

The most prevalent knowledge gap stems from lack of in situ data, predominantly bathymetric and hydrography related data (primarily on the Croatian side), but also other spatial information data (either maps, sampling data or remote sensing data; LiDAR, Photogrammetry, and other high resolution data) that, when available, was often found to be either fragmented, spatially uncorrelated (resolution, scale, georeferencing etc.), lacking adequate metadata or time continuity to provide sufficient information for analysis and decision making.

The analysis of collected data set has revealed that the information regarding the analysis of sediments, with focus on the measurements involving solid transport and sediment stocks, are quite scarce. In this case, dedicated monitoring systems are necessary.

Amount and availability of sediment/ water flux and quality data showed significant differences between Pilot sites. In general, collected data compiled within WP 3 gave an insight into overall picture of sediment and water fluxes within each Pilot site, however, further data should be collected and analyzed for ecological state assessment.

A proposition for filling identified knowledge gaps was, thus, formed during the Exchange of experience meeting to design a questionnaire to be distributed to stakeholders. The questionnaire will be designed in a form that is easily distributed and focusing on the most common data needed for filling knowledge gaps but also on pilot site specific data needed. Another method proposed was introduction of new and emerging remote sensing data (SAR satellite data, LiDAR data etc.) for gaining additional data and insights needed to fill knowledge gaps. Hence, a google form questionnaire (Deliverable 3.6.2) was drafted that pilot site and stakeholder specific questionnaires will be derived from.

Site specific questionnaires need to be derived by CWC partners responsible for type specific data for each pilot sites, and stakeholders that are expected to possess relevant data should be identified in the process. The last step is the distribution of questionnaires, analysis of the responses, gathering of data, and filling knowledge gaps through the following WPs and scheduled partner meetings.