CROSSDRO

CROSSDRO ANNUAL REPORT 2020
WP6: Stakeholder engagement, dissemination and capacity building

Research partners:

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1. Introduction

The CROSSDRO project began in September 2019. This project is made up of researchers from different centres and universities in Europe (Spanish National Research Council, University of Zaragoza, Lund University, Potsdam Institute for Climate Impact Research, Maynooth University, Selectia Research Institute of Field Crops), and it has been financed by different European and national institutions.

The main objective of the CROSSDRO project is to develop a multi-sectoral and cross-scale evaluation of drought impacts in complex European basins with contrasting climatic, hydrologic, environmental and socioeconomic conditions. The CROSSDRO project will evaluate the drought impact in different areas such as forestry, land cover, water resources, agriculture, hydroelectric energy, tourism, among others. To achieve this main objective, a series of specific objectives have been proposed, which include:

1. To assess the impact of drought on different sectors.
2. To analyse the connection between biophysical and socioeconomic drought mechanisms between different sectors and different spatial scales.
3. To analyse the capacity of models to reproduce the impact of drought on different sectors.
4. To understand the potential impact of drought under future scenarios of RCP and SSP.
5. To assess how environmental and social resistance to drought can be improved, as well as the adaptive response of society to droughts.

The objectives will be reached by means of experimental studies, both on the field and in the laboratory, remote sensing, historical series and modelling approaches that account for past droughts and future scenarios. In addition, it will be critical to involve key stakeholders to learn about past drought challenges and issues and specifically address their needs. The CROSSDRO project works on different hydrographic basins in Europe, located in Spain, Ireland, Germany and Moldova.

The participation of key stakeholders in the CROSSDRO project will take place in different study locations. The key stakeholders will be composed of people linked to different sectors and in different areas, such as land and water managers, information users, economic agents and farmers, among others. The interaction with the key stakeholders will be carried out through interviews, surveys and roundtable discussions.

This document summarises progress so far in each basin with regards to work package 6: Stakeholder engagement, dissemination and capacity building.

2. DESCRIPTION OF PROGRESS (DEC 19 - DEC 20)

Aragon Basin, Spain

Two stakeholder events have been organized by the Pyrenean Institute of Ecology (IPE, Spain).

Stakeholder workshop in Jaca, Aragón (December 2019)

This workshop took place in December 2019 at the centre of the Pyrenean Institute of Ecology, in Jaca (Aragon). It was attended by representatives from the agricultural, livestock and forestry sector, the local and regional administration, the field of research, environmental associations and civil society.

The objectives of this session were the following:

- To inform about the CROSSDRO project and the actions that are planned to be carried out in it.
- To identify the expectations of the agents involved in the CROSSDRO project.
- To provide an environment for debate to collect contributions to improve the CROSSDRO project.
- To collect the opinions from stakeholders on the impact of drought on different sectors.
- To understand the perception of stakeholders in relation to changes in time and space of the impact of the drought on different sectors.

In general, all the stakeholders showed great concern about the impact of drought on different sectors. In addition, many of the participants highlighted that the problem of drought is increasing in time and space. Another issue that participants highlighted is the lack of prevention policies against agricultural drought, and the lack of communication of this problem to the general public.

Participants highlighted the negative impacts of drought on water resources, which in turn generates negative effects on agricultural production. Participants indicated the need to adjust the water supply to agricultural needs to avoid large economic losses. The loss of agricultural production and land for livestock, with the consequent loss of food, leads to rises in the price of the food in the markets. The participants mentioned that agricultural losses due to lack of water availability have a great impact on the local economy since it affects a series of businesses linked to agricultural products. Stakeholders highlighted the role of agricultural insurance for drought and that it is increasingly available. Another important issue is the indirect effects of the drought in relation to livestock that are reflected in the shortage of feed and affects the health status of the animals and has a great impact on livestock production and the economic value of livestock. A particular problem in this regard is the supply of water to fish farming ponds, where water shortages can cause considerable damage.

Stakeholder conversations also frequently highlighted the negative effects of drought on the environment, especially on the flora and fauna, which indirectly has negative effects on tourism. Prolonged water stress can cause serious damage to the forest ecosystem, such as defoliation and deterioration of tree canopies and, as a consequence, reduction of the thickness of the cortical rings and of wood production. In addition, in relation to drought, special interest

should be paid to forest fires due to the great magnitude of economic and ecological losses that they can cause. One of the most damaging and dangerous effects of drought is reflected in the environment, natural resources, habitats and ecosystems. Studies should be carried out to identify the most vulnerable areas to negative impacts on flora and fauna and develop a series of measures to protect these spaces. Among the main negative effects of drought, the following stand out: reduction and degradation of the habitat of fauna and fish, migration and concentration of fauna, and loss of biodiversity.

The impacts produced by droughts can occur directly and indirectly, some affect large areas and others in isolation, some appear permanently and others semi-presently. In general, these impacts of the drought suppose losses in the economic, social and environmental spheres. It is necessary to take measures that are aimed at the early prevention of drought phenomena that may occur in a certain place. For this, an early warning system must be implemented to anticipate the consequences that this phenomenon may cause. In addition, in-depth studies are required to quantify the negative impacts of drought on each of the sectors in order to know the magnitude of the problem, the possible solutions, and to serve as a tool for land managers.

Finally, participants mentioned the need to better disseminate the impact of the drought, through a language aimed at a general public, informing through different means of communication, and carrying out local activities that allow the population to know the problem of the deep drought.

Stakeholder workshop in Zaragoza, Aragón (February 2020)

This workshop took place in February 2020 at the CSIC center in Zaragoza (Aragon). It was attended by representatives from the agricultural, livestock and forestry sector, the local and regional administration, the field of research, environmental associations and civil society.

The objectives of this session were the following:

- To inform about the CROSSDRO project and the actions that are planned to be carried out in it.
- To identify the expectations of the agents involved in the CROSSDRO project.
- To provide an environment for debate to collect contributions to improve the CROSSDRO project.
- To collect the opinions from stakeholders on the impact of drought on different sectors.
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All workshop participants agreed on the importance of studying the impact of the drought in different sectors, and the need for research projects such as CROSSDRO. They also pointed out that it is important to have the opinion of experts in different sectors (stakeholders), and the importance of disseminating the studies carried out in this regard. According to the statements made by the participants, everyone is aware of the repercussions of the drought on the economy, society and the environment. However, despite the importance of the subject of study, they think that few measures are taken in this regard, and above all, they think that drought is a problem that will increase in time and space.

Some of the statements made by economists highlighted the effect of the drought on the price of food, especially fruit crops. The drought has great effects on the supply of food, which conditions its price. The participants stressed that it is important to take into account that not all crops support the lack of soil moisture in the same way, therefore the aid or insurance associated with them should be in correspondence. In addition, the participants commented that it is necessary to pay special attention to small producers since they are the most affected, and they are the ones who sustain much of the local population.

Another topic that was frequently addressed by the participants is the impacts of drought on livestock. The drought supposes that it decreases the food and water for the cattle, this supposes a decline in income and increase in costs, which often leads to great economic losses, and even that some farmers end up selling the cattle. Livestock is one of the sectors that suffer the most from the impact of the drought, especially due to the large costs it must bear. When available water from major supplies runs out, they often have to turn to groundwater to meet needs.

In relation to the environment, some of the participants, especially from the field of research and environmental associations, highlighted the strong impact that drought has on forests, flora and fauna, and therefore indirectly on tourism. Some of the participants commented that forests are essential to maintain the quantity and quality of water and, therefore, the improvement of existing forests and reforestation should be an indispensable part of any plan to combat drought. In addition, the participants highlighted that as the planet's temperature increases, tree mortality increases. These have major repercussions, as forests store a substantial amount of the world's carbon and the death of trees will increase future global warming.

Finally, the participants emphasized that a greater effort is needed from researchers and the media to report the results obtained from the different studies carried out. Greater communication to the general public will allow for an in-depth understanding of the problem, make politicians aware of the need for policy measures, and alert the different sectors to possible future scenarios. Some participants from civil society even acknowledge that the session held has allowed them to learn about different impacts of the drought that were totally unknown.

Boyne Basin, Ireland

Since the start of the project, the Maynooth University project team have engaged with key intermediaries and stakeholders with an interest in drought impacts in the Boyne catchment. Due to COVID restrictions, we have been restricted to online meetings. This process has also been slowed down to account for extra sensitivity when contacting, chasing and meeting with contacts.

An Irish website aimed at stakeholder engagement in Ireland has been developed and is now live (https://crossdro.maynoothuniversity.ie). We have designed and disseminated an online survey via the website to establish the extent and type of stakeholder interest in drought in the Boyne and connect us with potential project interviewees and future participants. The following table summarizes the survey responses.

Table 1: A summary of stakeholder survey responses.

Sector	**How have they been impacted by drought in the Boyne?**	**Why are they concerned about future drought in the Boyne?**
Forestry	Young broadleaf and native forests were badly damaged by the 2018 drought.	Drought can lead to forest failure / timber degradation. Forests managers will have to adapt.
Agriculture	Reduced water retention / growth / yields / seed return. Increase in irrigation costs. Shallow wells running dry, some for the first time in living memory.	Reduced grass growth, seed production, water availability. Increased pressure on local aquifer from 'development' / quarrying companies interfering with the water table.
Beverage	No impacts as yet.	Water source - Restricted river abstractions could increase costs and reduce product quality.
Horticulture	Low rainfall in April-May 2020 made growing / gardening more challenging. Increase in irrigation costs.	Reduced water retention and less predictable rainfall makes growing / gardening more challenging.

Fisheries	Drought during 2018 and spring 2020 had direct 'on the ground' impacts for state fisheries agency. Reduced fish migration. Increased fish stress/mortality in summer 2018 due to high water temperature / low oxygen levels. Banned from angling on the river. Summer 2018 weed growth choked up the river – impacts on water quality and fish health.	Increased pressure on aquatic/fish ecology due to abstraction / lower water levels. Could see increases in ad hoc abstraction for agricultural. Associated barriers for abstraction effect fish movements. Low river levels reduce fish movement/migration/health.
Ecology / Geology	Damaged hedgerow plants.	Increased pressure / damage to ecological systems, protected plant/wildlife habitats and geological sites. Potential impacts on minimum ecological flows and river abstraction.
Angling	Selling fewer angling 'tickets' during dry periods. The existing management focus on catchment drainage has exacerbated the impacts and frequency of 'low water' events.	Very worried about the future health of catchment due to perceived indifference from state water utility / local gov and an ineffective environment agency. Lack of planning / regulation / enforcement during droughts. Farmers can take water from dry channels without consequence. No incentive for farmers to conserve water. No trust in the national water utility – poorly treated wastewater often leaks into the catchment; drought exacerbates adverse impacts on ecology etc. Pressures from new housing developments could lead to more abstractions and wastewater leaks. Gov agencies seem to disagree on if there's capacity in the system. Ultimately, this will effect fish populations.
Heritage	Historical infrastructures dry out at low water levels.	Drought could damage / compromise integrity of historical canal/river infrastructure.
Boating	Excessive weed growth due to warmer river water effected navigation	Variable water levels may restrict inland navigation.

From these survey responses, we have identified an initial sample of interviewees for the upcoming contextual analysis of cross-sectoral drought impacts in the Boyne catchment (Table 2). We are interviewing stakeholders to gaining a more in depth understanding of sectoral

specific sensitivities/understandings of drought, past drought experiences and challenges and their general priorities, values and decision-making/operational contexts.

Table 2: Initial interviewees for the upcoming contextual analysis in the Boyne catchment

Interviewee	**Organisation type**	**Sectors**
Sustainability policy officer	National Water Utility	Water supply
Inspectorate	National Forest Service	Forestry / Environment
Dublin Director	National Fisheries Authority	Environment / Water / Fisheries
Heritage & Environmental Officer	National Waterways Agency	Recreation / Environment / Water / Fisheries
Community water officer	County Council	Water / Environment
Manager (landowner/farmer/angler)	Rapeseed farm	Agri / Food / Leisure
Managing director (farmer)	Organic farm and ecotourism business	Agri / Food / Tourism
Director (landowner)	Castle estate / farm	Agri / Food / Leisure / Tourism / Environment / Forestry / Fisheries
Owner (farmer)	Farm	Agri / Tourism
Chairman (water manager / user)	Community-run water scheme	Water supply
Secretary (angler)	Local angling group	Environment / Leisure / Tourism / Fisheries
Secretary (angler)	Local angling group	Leisure / Water / Fisheries
Ecology manager	Agri-tech company	Agri / EnvCon / Food / Forestry / Leisure / Water / Fisheries
Volunteer (Chair of Board)	Ecology centre / farm	Agri / Env / Conservation
Business owner	Boating tour company	Tourism / Leisure / Recreation

We have also recently submitted a manuscript to Frontiers in Environmental Science highlighting the strengths of co-production as an engagement approach:

Barriers and opportunities for actionable knowledge production in drought risk management: embracing the frontiers of co-production
Sam Grainger, Conor Murphy, Sergio M. Vicente Serrano
Drought risks pose serious threats to livelihoods and human wellbeing. Managing these risks requires collaboration between diverse groups with different values, interests and forms of knowledge. Funders, researchers and practitioners have increasingly advocated for collaborative models of knowledge production and management in which all participants

recognise the multiple ways of understanding drought risk and strive to co-create knowledge for decision making. This transdisciplinary research approach, involving equitable and meaningful interactions between scientific and societal actors, has been shown to increase knowledge use. In practice, however, collaborations around drought remain largely science-driven and, as a result, can struggle to produce actionable knowledge necessary to better manage drought risk.

This article draws from drought studies and related transdisciplinary fields that share similar epistemic foundations and risk-based decision-making contexts to highlight critical barriers inhibiting actionable knowledge production for drought risk management. We also propose opportunities for improved knowledge production that can guide researchers, practitioners and funders seeking to engage in transdisciplinary research. We argue for the social sciences and humanities to have a more prominent role in planning and facilitating stakeholder interactions, creating an enabling environment that accommodates a diverse understanding of drought, and opening up the cultural, political and institutional dimensions of knowledge-making practices. From this, researchers, practitioners and other stakeholder groups will be better able to develop actionable management plans and policies that reflect the complex and contested socio-ecological contexts in which droughts impact society.

National water planning meeting (June 2020)

Prof Conor Murphy (CROSSDRO co-I) met with national stakeholders in June this year regarding the objectives and early output from the project. These included the Irish Environmental Protection Agency, state-run water utility, Meteorological Agency, Geological Agency, Water Forum and the Federation for community-managed water supply. Arising from the exceptionally dry spring experienced in Ireland this year and concerns about drought, this high-level group was convened to discuss the communication of drought impacts and warnings. Insight from the project was provided in terms of cross sectoral drought impacts and insights derived from initial engagement with stakeholders. The group will continue to meet in the future to discuss a national strategy for managing hydrological droughts.

Prut Basin, Moldova

Meeting with Prime Minister of Moldova (July 2020)

The Prime Minister of Moldova visited partner institution, Selectia Research Institute of Field Crops in Balti city.

The main topics discussed were:

1. The lessons to be learned by farmers from the very severe drought in 2020.
2. Measures to be undertaken in order to revitalize the seed production for field crops, mainly for local varieties which have proven highly resilient to drought.

Meeting participants agreed that challenges faced by modern agriculture, including global warming, can be overcome through the implementation of a new strategy for agriculture intensification based on the principles of agroecology.

Elbe Basin, Germany

Welcome to the club - Ludwigsfelde under palm trees in the Brandenburg sand? (13 January 2020)

As part of an ongoing collaboration with the Ludwigsfelde council, Potsdam meteorologist Peter Hoffmann attended a public meeting at the town hall about rising temperatures and their risks in the state of Brandenburg.
https://www.ludwigsfelde.de/veranstaltung/willkommen-im-klub-ludwigsfelde-unter-palmen-im-maerkischen-streusand-2/

Environmental trends relevant for the energy sector: Briefing of Vattenfall SE (23 April 2020)

Project member Tobias Conradt organized and conducted a virtual meeting of several PIK scientists with the environmental department heads of Vattenfall Germany and Vattenfall SE, Sweden's state-owned electricity provider. In 2019 Vattenfall had withdrawn from operating the giant lignite mining pits and combustion power stations in Eastern Germany, once the basis of the electricity supply of the German Democratic Republic and currently amidst a process of phasing out. The aggravating water scarcity issues associated with the shutdown of mines are however still of concern to the managers, because Vattenfall's gas-driven power plants in the city of Berlin rely on cooling water from the Spree River, a central tributary of the Elbe River system. Streamflow contributions from groundwater extractions at the mining sites are being swapped against water diversions towards a new landscape of lakes emerging from the extensive excavations, and minimum river runoff requirements can hardly be met any more under droght conditions. This was discussed amongst a couple of other environmental questions considering a currently observed climatic trend of increasing evapotranspiration in the Elbe River basin.

Adaptation to climate change in tourism (11-12 May 2020)

Project member Peter Hoffmann gave a presentation introducing a developed climate service portal for 140 tourism destinations in Germany. This tool is end user driven and destination managers are able to learn about the observed and projected evolution of selected climate indicators in form of maps, diagrams, sorted tables and fact sheets.
https://www.umweltbundesamt.de/webinar-anpassung-an-den-klimawandel-die-zukunft-im

The impact of extreme weather events on the technical infrastructure of the Deutsche Bahn (27 July 2020)

The project team presented preliminary results of a risk assessment focusing on long-term changes of weather patterns and extreme weather indicators leading to damages of the technical infrastructure within the administrative areas of the Deutsche Bahn (a German railway company).

A climatic summer even hotter than 2019? A qualitative forecast for 2020 (25 September 2020)

At the "Extremwetterkongress" event, Peter Hoffmann presented a data driven qualitative prediction method of the summer mean temperature valid for eastern Germany. This approach is also able to identify long-term changes in atmosphere circulation over Europe.
https://boettcher.science/ewk2020

Climatic shifts and sugar beets growth in Northern and Central Europe: A basis for regional investment decisions. Roundtable discussions with managers of Nordzucker AG, Germany's second largest sugar producer (26 October and 3 December 2020).

These exchanges were organized on request by the industry representatives who in turn were informed about our CROSSDRO activities. A steadying of cooperation, eventually including additionally commissioned research is intended for the year 2021. The ABSOLUT crop yield model developed in the framework of CROSSDRO caused special interest in that respect.

The future of groundwater recharge in the Potsdam area – a study for the Potsdam water works (17 December 2020)

This presentation held online by PIK's deputy department head Fred F. Hattermann to representants of the Potsdam water works (Stadtwerke Potsdam) summarized the results of a regional water availability assessment conveyed within a framework of regular mutual exchanges with the water works' planning department which were established in the beginning of 2020. Spatially detailed scenario simulations made with the ecohydrological model SWIM focusing on groundwater recharge in the Potsdam area were used to elucidate future drought risks for drinking water supply. According to the climate scenario data, long-term alterations to local water balances are not as pronounced as a recent shift in observed meteorological conditions (apparent for two to three decades) suggests.