

Stakeholder Mapping Summary Report

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Table of Contents

| | | |
|----|--|----|
| 1 | Summary for Publication _____ | 1 |
| 2 | Contribution to the Top-Level Objectives of Impetus4Change _____ | 1 |
| 3 | Background to the work _____ | 2 |
| 4 | Status of Knowledge _____ | 3 |
| 5 | Barcelona (BSC and 300K) _____ | 7 |
| 6 | Bergen (NORCE) _____ | 28 |
| 7 | Paris (CNRS-MF) _____ | 34 |
| 8 | Prague (Charles University) _____ | 42 |
| 9 | Summary of Efforts Undertaken and Main Results Achieved _____ | 50 |
| 10 | Progress Beyond State of the Art _____ | 50 |
| 11 | Discussion and Next Steps _____ | 51 |
| 12 | Links Built _____ | 51 |
| 13 | Communication, Dissemination and Exploitation _____ | 52 |
| 14 | References _____ | 53 |
| 15 | Annexes _____ | 54 |

Abbreviations Used

| | |
|---------|---|
| BSC | Barcelona Supercomputing Center |
| CNRS-MF | Centre National de la Recherche Scientifique – Météo France |
| I4C | Impetus4Change |
| NORCE | Norwegian Research Centre |
| WP | Work Package |

1 Summary for Publication

Generating usable and actionable climate information at the time and geographical scales most needed by decision-makers is at the core of Impetus4Change (I4C). This main objective is addressed on several coordinated fronts in each work package (WP) and is especially present in WP6's demonstrators where we are co-exploring stakeholder and user needs and will co-design science-based products that respond to them.

This deliverable details the efforts of the demonstrators' teams to conduct a purposive stakeholder and user mapping and selection process that will underpin the co-production process foreseen during the project. It summarises recent developments in relevant theory and practice, outlines the methodological framework used and provides detailed mapping results for each of the demonstrators. It also summarises which actors are potential users of the climate services being developed and why, and explores their links to the wider knowledge networks being explored in WP1. The report then briefly illustrates the impact of stakeholder mapping on the co-production to be carried out throughout WP6. Alongside the ongoing and iterative mapping process, it describes the next steps for engaging stakeholders in co-production, for example inviting them to the first I4C Adaptalab (a hackathon-style event where teams from I4C and the demonstrator cities will work in highly interdisciplinary groups to develop ideas about possible climate services).

To reflect the continuous effort of stakeholder mapping in the project demonstrator cities, this deliverable will be treated as a living document. Project partners will continue updating the mapping tools with the summary results from stakeholder mapping and co-exploration of new knowledge and services that will be developed within Impetus4Change.

2 Contribution to the Top-Level Objectives of Impetus4Change

| Objective | Contribution from Deliverable |
|--|-------------------------------|
| <u>Overall Objective:</u> to improve the quality, accessibility and usability of near-term climate information and services at local to regional scales – where impacts are most keenly felt and on-the ground adaptation is implemented – to strengthen and support end-user adaptation planning and action | Yes |
| 1) Improve understanding and flow of climate information through knowledge networks; | Yes |

| | |
|--|-----|
| 2) Address persistent shortcomings to deliver seasonal to decadal predictions of improved quality; | No |
| 3) Develop novel methods to downscale predictions to local scales; | No |
| 4) Improve assessments of hazards and translate this into usable information for local risk assessments; | No |
| 5) Make advances towards the goal of end-to-end seamless climate services; | No |
| 6) Through transdisciplinary co-production approaches develop fit-for-purpose "Adaptation support packs" at municipal scales through our so-called urban Demonstrators; | Yes |
| 7) Ensure high impact and visibility through robust and targeted communication and engagement; | Yes |
| 8) Commit to Open Science through development of open access tools and exploitation of data/model outputs via relevant platforms thereby ensuring improved accessibility and usability of climate knowledge. | No |

3 Background to the work

Generating usable and actionable climate information at the time and geographical scales most needed by decision-makers is at the core of Impetus4Change. This main objective is addressed on several coordinated fronts in each WP and is especially present in WP6's demonstrators where we are co-exploring stakeholder and user needs and will co-design science-based products that respond to them.

The approach presented below and followed for these mapping activities is a response to recognised knowledge gaps and implementation shortfalls in the status quo of knowledge co-production in climate services (see Section 4.1). While the availability and accuracy of climate data have advanced, and despite the "usability gap" of climate information being identified and lamented over a decade ago (Lemos et al., 2012), the usage of climate services in local decision-making continues to lag its potential (Findlater et al., 2021). Attempts to accelerate, proliferate and diversify climate services draw on rich research seams from across the social sciences and adaptation literature. A purposive and systematic mapping approach is followed in attempt to better incorporate these different learnings and understand the variety of barriers that users of climate adaptation services may face.

3.1 Structure of the report

In section 4, we summarise the science and practical knowledge that guided the general methodological steps taken to conduct the mapping in each of the demonstrators. This is followed in sections 5 to 8 by a detailed account of the mapping efforts and outcomes for each demonstrator. Reflections on the mapping process and

next steps as we operationalise the co-production process in each demonstrator are summarised in sections 9 to 11 with the links to other aspects of the Impetus4Change project and outreach activities then covered in sections 12 and 13.

4 Status of Knowledge

4.1 Overcoming known limitations in climate services

The climate services sector, in general, has not yet achieved a universal integration of valuable climate information into evidence-based decision making. When, for example, users such as local governments and agencies take decisions on how to adapt our urban environments to the changing climate, they rarely use the most up-to-date or scientifically robust climate information to support their decisions. Considerable research effort and documentation of positive and negative experiences has led to a rich literature investigating how climate services might fulfil their potential in supporting decision making. Among the broad range of themes treated, key approaches to generating more inclusive and impactful services include:

- better understanding user profiles, needs, motivations, and capacities¹ (Porter et al., [2021](#); Bojovic et al., 2021);
- tailoring climate predictions - from sub-seasonal, over seasonal to multi-annual - and multi-decadal climate projections to the appropriate/fit-for-purpose contexts² (Bremer et al., [2019](#); Mach et al., [2020](#));
- involving marginalized actors, non-expert voices, and valuing alternative forms of knowledge alongside technical climate information (Singh et al., [2017](#); Daly & Dilling, [2019](#); Turnhout et al., [2020](#)); and,
- involving boundary actors (those who straddle climate science and users' worlds) to conduct co-production processes and to use their interstitial position to align scales, generate common understandings and facilitate the incorporation of the latest science into relevant decision-making processes (Briley et al., [2015](#); Kolstad et al., [2019](#); Vincent et al., [2020](#)).

4.2 Co-production of climate services

Knowledge co-production derives from participatory approaches to science and can be defined as, “an iterative, interactive and collaborative process that brings together

¹ Among several other attributes, stakeholder realities are formed in relation to the decision to be supported by climate data, current practices in knowledge access and use, as well as the mandates they must respond to. Scientists' realities differ depending on the roles of boundary actors or data producers, which may or may not overlap but which require both technical and social science skills and eye-level communication.

² The governance system may be formed of multiple and interacting layers that need to be understood for achieving usable and actionable climate data

a plurality of knowledge sources to mutually define problems and develop usable products to address these problems" (Bojovic et al., 2021, p. 2). Co-production involves both the process of developing a climate service – which typically consists of distinct but interrelated co-exploration, co-design and co-evaluation phases – as well as the service/product that results.

Especially relevant for the current deliverable, co-exploration mostly takes place at the beginning of a co-production process when engaging new stakeholders and potential climate service users that may not have been exposed to the service in question before. Co-exploration is consultative, focuses on joint understanding and fact-finding (ibid), with these "facts" formed by contexts marked by several realities: the worlds inhabited by stakeholders, decision makers and scientists, and the governance structures in which the interactions and decisions that the service seeks to inform take place.

Acknowledging and addressing this complexity is why it is essential to involve a plurality of knowledge sources to define problems and develop adequate solutions. Experience has shown that it is not enough to do this in a patchwork fashion; urban climate interventions that manifest the leave no one behind principle that is key to the Sustainable Development Goals³ and the New Urban Agenda⁴ must consistently work to integrate the myriad of perspectives present in our cities on how to adapt to the changing climate.

4.3 Evolution of stakeholder mapping and user engagement

Stakeholder mapping in scientific endeavours originated in the managerial literature. In the 1990s, it was adopted by natural resource managers who recognised that the challenges they faced were shared across governance levels and impacted multiple sectors. The ubiquity of calls for participation and the inclusion of diverse voices in public policy deliberation indicates a consensus that involving a plurality of actors allows complex problems to be better understood and the development of more appropriate solutions. For example, technical solution providers need to account for the complex reality of decision makers who – with finite time, resources, and knowledge – must act in the face of uncertainty.

For climate change adaptation, at a minimum, engaging diverse voices helps avoid maladaptation interventions. Beyond this, the goal of engaging a wider user and stakeholder group is typically to allow these actors to design and propose inclusive, context-specific solutions that are adequate responses to the hazards and risks posed. Despite the premise long being known, a litany of failed projects that lacked a full

³ <https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind>

⁴ <https://data.unhabitat.org/pages/new-urban-agenda>

stakeholder perspective⁵ suggest that active and wide engagement should be a non-negotiable primary activity of attempts to solve these complex problems.

The overall processes involved in the co-production of climate services are different from those related to resolving natural resource management challenges, but the initial steps of framing the problems and outlining possible solutions have similar requirements. The relatively rapid development of co-production of climate services in recent years has therefore seen its praxis increasingly adopt and adapt skills, techniques and approaches piloted in stakeholder mapping and user/consumer selection deployed in other contexts. In a recent peer-reviewed publication (Baulenas et al., 2023), the BSC team leading this task and WP6 overall brought together this patchwork of practices to develop a stakeholder mapping framework that is apt for the realities of climate services, which is described below.

4.4 Summary of the mapping and selection framework

The process of mapping stakeholders and selecting users for climate services essentially involves identifying individuals, groups, and organizations who take climate-related decisions or may be impacted by them and then prioritising which of these individuals and groups to involve in the coproduction process. The stakeholder map and group of prioritised users is specific to the local context in which the affected decisions will be taken and the overarching or high-level goal of the climate service to be developed (e.g., how to reduce the health impacts of heatwaves in the Paris metropolitan area). Figure 1 provides an overview of the framework, which is briefly summarised below. For more details please see the full Baulenas et al., (2023) paper.

- Step 1 involves the ‘why’. This definition of the high-level goal(s) for the service aims to remain open to user demand and break with a tendency of climate services projects to take a supply-driven approach that proposes to potential users an already-defined climate service.
- Step 2 aims to delineate ‘where’ the climate service will be focussed both in terms of where climate change may have an impact (especially where it will increase the frequency and intensity of environmental hazards) and where the climate service may support decision making. By setting the service in the context of a locally taken decision or a locally experienced societal impact, these first two steps seek to avoid designing a service that is scientifically robust but ill-suited for use by decision makers. Initial explorative work by demonstrator leads – all with experience of designing climate services and familiar with their own contexts – saw drafts of these high-level goals and their locations identified for the demonstrators during the proposal stage.
- Step 3, ‘whom’ to include, aims to list any potentially interested or impacted stakeholders related to the high-level goal. This group should represent different categories of society – from policymakers to NGOs, networks and umbrella

⁵ See references in Section 4.1 and citations therein.

organisations – and be sensitive to any overlapping scales (for example, where national and municipal decision makers both have a mandate, or where local NGOs work with international networks on related issues).

- Steps 4 and 5 seek to identify an engagement level for the co-production process of each stakeholder to ensure the service includes attributes such as legitimacy, and balancing power and influence of stakeholder groups; and pragmatic considerations such as whether the stakeholder has the time and willingness to be involved⁶. As a result, some stakeholders will be prioritised and invited to act as key users, and thus hopefully be empowered by the service, while others will be targeted for lower-intensity forms of engagement such as being informed about it.
- Step 6, “iterate”, explicitly recognises that the mapping and selection is ongoing throughout the project and that some of or all the outcomes of the previous steps may be refined as the project progresses.

The Annex displays screenshots from an Excel tool that is based on this methodology, and which was provided to each demonstrator early on in the mapping process.



Figure 1 - Framework for stakeholder mapping and user selection for climate services coproduction processes (Baulenas et al. 2023)

⁶ This is only a short list; for full details see Baulenas et al. (2023). In brief, other important values to consider during knowledge co-production processes include interdisciplinarity, representation, equality and inclusion, deliberation and authenticity of agreements, agency and responding to a multiplicity of demands, as well as transparency of the process (see also Reed et al., 2018).

awareness of – and in some cases contacts with – departments and teams within these groups and listed these separately.

Originally our plan was to carry out the mapping according to each high-level goal that stakeholders requested under the umbrella of summer extreme temperatures (i.e., create individual maps based on the social impacts and decision contexts at different policy/decision timescales). However, as we began engaging with different actors the list of potential goals grew quickly both across thematic areas (e.g., managing public spaces to include parks, pathways, schools and libraries) and across timescales (e.g., changing operating hours in schools in the short term to renovating and redesigning them in the longer term). Carrying out the mapping for each of the growing lists of potential high-level goals would have been repetitive and likely unnecessary at this stage of the process. Thus, instead we created a single map for all high-level goals. 300K then prioritised a first wave of contacts to approach which included several smaller municipalities alongside those actors identified in the proposal.

First engagements

Having decided to collapse the initial mapping process to the level of organisations rather than focusing at this stage on departments or teams, in most cases, the initial contact was with one coordinating agent in the organisation with whom a relationship already existed. However, the first meetings with all contacted stakeholders to date have involved several different teams from the stakeholder side. For example, with the Barcelona City Council, representatives from the climate change and climate shelters teams in the urban ecology department, the city architect's office and from the policy development team (a more political role) attended.

A common theme from our first meetings with potential stakeholders was the agreement of the need for longer and more detailed follow-on meetings with an even more diverse group of representatives. For example, a recommendation from the first meeting with Barcelona City Council was to invite teams working on civil protection, parks and gardens to subsequent meetings that should explain the project and investigate the potential utility of I4C's climate services in more detail. This stakeholder-led snowballing, where stakeholders themselves brought other actors into the discussions, complemented our own mapping efforts.

Separate to the targeted engagement of the prioritised groups, we promoted I4C on an opportunistic and ad hoc basis to other potential stakeholders. In some cases, these actors had been identified in the long-list mentioned above, but not prioritised for the first wave of contact. In other cases, this approach widened and fine-grained the stakeholder map by adding further actors we hadn't considered, and in others still this facilitated or reinforced nascent links with contacts that had been identified. The approaches here varied from participating in tangentially related events (such as workshops led by colleagues on air quality and mosquito control), presenting I4C's aims during other formal events (e.g., in round table discussions led by local governments on citizen science and applying for EU grants), and introducing I4C into informal conversations with actors in our own networks.

Knowledge and stakeholder networks

Alongside mapping stakeholders, we have begun to explore the way that relevant knowledge, data and information is shared amongst different actors, where decisions are taken and what spatial and sectoral areas they affect. In Barcelona's multi-layered governance structure, understanding these relationships is not trivial but these assessments should help us to identify which stakeholders may become direct and indirect users of the information that I4C will produce. As our work continues, we aim to further probe the network to reveal these knowledge pathways more clearly, perhaps exploring Barcelona as a case study in T1.3 (Exploring Other Knowledge Networks).

We also note here that the diversity of the Barcelona demonstrator team (in terms of sector, discipline, interest, seniority etc.) and institutional support has been particularly helpful in the ad hoc attempts to engage different types of stakeholders in I4C. For example, although we recognise parts of the stakeholder map remain uncovered, interests and connections with separate groups and initiatives focused on tangential or unrelated aims – such as mosquitos, feminism, citizen science and air quality – have all facilitated contacts to I4C, as well as those focussed more conventionally on urban climate adaptation. Similarly, many of the ad hoc opportunities arose thanks to the department director and (particularly) group lead at BSC sharing event invitations and working to convene first meetings that may have been difficult for the I4C team to do alone from cold.

As such, it may be that the expansion of the network also strengthens the demonstrator team's links with the local climate network beyond I4C. For example, BSC is now part of the academic support pillar for a small municipality's climate planning strategy. We also see I4C as a mechanism to bring together a network of practitioners and researchers in Barcelona and so often use I4C to springboard onto related, but distinct, topics. For example, although the I4C demonstrator is focussed on summer temperature extremes, our discussions often also include trying to understand what vulnerability to climate change in general means for different groups and different sectors. We are also looking at heat more holistically, exploring the applicability of different thermal indices across diverse geographies. With this we seek to draw out cross overs between vulnerability to heat and to air pollution, and are collaborating with another research institute to hopefully organise a transdisciplinary meeting on heat stress in Barcelona.

Outreach tools and approaches

Engaging stakeholders in diverse ways has required a flexible set of tools and approaches to explain the work we hope to achieve in Barcelona during I4C; here we focus on three.

Pitch slide

For a general audience, we iteratively developed a standalone pitch slide that is available in Catalan, Spanish and English which we tend to send to potential stakeholders in advance of any discussion.

BSC Barcelona Supercomputing Center
Centro Nacional de Supercomputación

300.000 Km/s

IMPETUS 4 CHANGE

- 4 year EU project bringing together expert urban practitioners, social scientists and climate modellers
- It will improve the quality and accessibility of near-term (a few weeks to a few decades) climate information at local to regional scales
- Aim is co-design, co-production, and co-evaluation of climate services **that are used** by decision makers
- Barcelona region is one of four key demonstrators
- Focus: extreme summer temperatures (heatwaves) across various timescales (from the coming months, to decades in the future)

We are seeking collaborators to co-create climate information that could support decisions on:

- How to prepare public buildings for heatwaves
- Growing & coordinating the climate shelters network (e.g. where they can be the most needed)
- Protecting public health by improving disease vector control (e.g. mosquitoes)
- Need and priority for green areas
- Prioritising the adaptation of public and private spaces to adapt to the increasing heat impact
- Urban (re-)development and regeneration planning for more liveable cities
- Improving the resilience and sustainability of the tourism industry

Could you help us tailor climate information for your decisions?
albert.soret@bsc.es
Group Leader,
Earth Systems Services

impetus4change.eu @I4C_eu

This project has received funding from the European Union Horizon Europe research and innovation programme under grant agreement No 101019255

Figure 3 - I4C Pitch Slide

Tailored slide deck

For first engagements with urban decision makers, we create material tailored to the intended audience. Most of this comes from a template slide deck, but we research the stakeholders beforehand and seek to tune any presentation to areas they are interested in (e.g., to discuss vulnerability mapping with the local health agency or potentially relevant aspects from local governments' climate adaptation plans).

During some of these discussions, we focus particularly on the slide shown in Figure 4. This was developed with input from others at BSC and uses different approaches to timescale to explain how we see the I4C Demonstrator as a way of translating between climate information providers and urban planning practitioners.

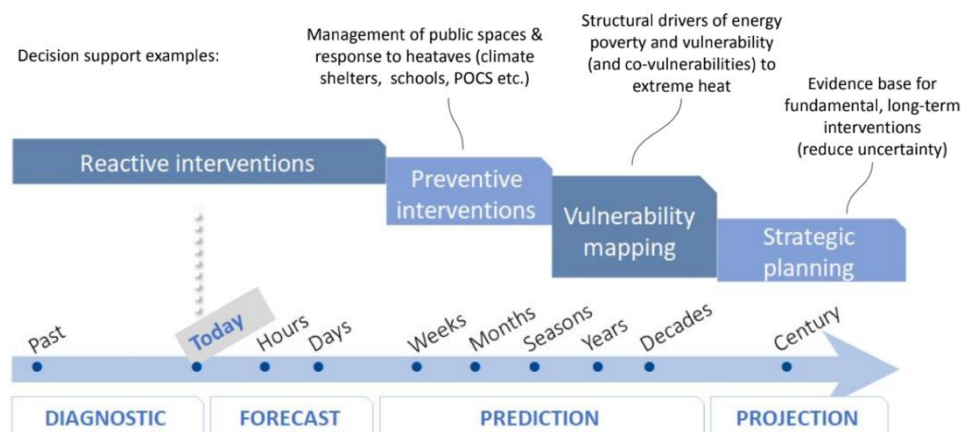


Figure 4 - Slide from introductory presentation that links decision maker and climate model timescales.

Catalogue of potential services

Figure 4 includes examples of actual policies or decisions, but this is only intended to be illustrative during those preliminary discussions. In our follow up engagements with stakeholders and potential users we are now moving to develop a catalogue of options in attempt to refine the social contexts and timescales for which decision makers can see a use for climate data and, next to this, the potential for such climate data to be provided from I4C.

In sending this to potential stakeholders we aim to begin grouping potential users interested in similar themes and then co-produce the services with these focus groups as a hybrid between designing purely retail or purely individualised climate services. We also hope this will allow stakeholders with different capacities to engage in the co-production process.

5.2 Mapping Results

5.2.1 Summary of the stakeholder map

Climatic Hazard: Summer temperature extremes

Social Impacts: Managing public spaces & services during extreme heat episodes; Controlling mosquito populations; Mapping heat—health vulnerability

Noting that it will continue to be updated, we have organised the first iteration of our stakeholder map in a way that groups actors within the map that have existing work that is directly aligned with the demonstrator's different high-level goals.

Table 1: Preliminary grouping of potential users and stakeholders according to high-level goal

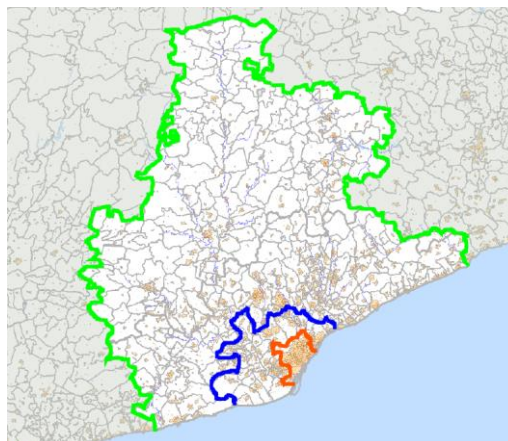
| High-level goal | Potential Users | Potential Key Stakeholders |
|--|---|--|
| Managing public exposure to heat (climate shelters, time-shifting, urban re-design/re-development) | 300K, MeteoCat, AMB, DiBa, Barcelona City Council (all individually) plus clusters of several governments of small municipalities | ASPB, local NGOs, UAB researchers working on NBS |
| Heat—health vulnerability mapping (combining climate and socioeconomic data) | 300K, AMB, ISGlobal, and some smaller municipalities (likely working with coordinating agent like AMB or CCBL) | ASPB, BCNUEJ researchers and members of GECCC |
| Managing mosquito-borne hazards | BSC-GHR colleagues*, ASPB | ISGlobal, UPF researchers, ASPCat |

* BSC colleagues in the Global Health Resilience (GHR) team are working with the local public health agency (ASPB) and other local actors to co-produce sub-seasonal mosquito warning systems for the Barcelona City as part of E4Warning/IDAlert projects.

Our engagement with stakeholders around this theme will aim to support and perhaps expand this work rather than duplicate it.

Note: Our conversations with stakeholders yielded several other potential themes related to summer temperature extremes that were not originally included in the proposal, including drought, forest fire, sudden precipitation, and river flooding. So far, these have only been mentioned by a small number of potential users, though for these actors, the issues represented a demand for key climate information. Thus, we are continuing conversations and may seek to include these themes in the climate services as they are developed.

As we have learned more about the complex, overlapping scales of governance in Barcelona, we have widened our base of potential users from the relatively large-scale local policy makers identified originally to include smaller municipalities. Although many of these municipalities form a contiguous urban area with the City of Barcelona, they are distinct zones of governance that nonetheless fall within the Barcelona Metropolitan Area or within the Barcelona Region. The map below illustrates the different scales of “Barcelona”. Unless noted otherwise, we tend to use “Barcelona” in its broadest sense, i.e., that encompassed by the boundaries of the Barcelona Region.



*Figure 5 - Scales of “Barcelona” (red = city, blue = metropolitan, green = region).
Source: Adapted from <https://sitmun.diba.cat/>*

Our mapping efforts have also added representatives from other stakeholder categories to our group of stakeholders and potential users (Figure 6)⁷. All our direct interactions to date have been with decision makers, local government agencies, and public resources managers. Local decisions relevant to the overarching themes identified for the Barcelona demonstrator are overwhelmingly made by government representatives and Figure 6 shows that our current mapping efforts focus on public sector representatives. Nonetheless, we aim to continue expanding the map when we begin to engage with other social categories as stakeholders — and perhaps potential users — in future efforts.

⁷ For a list of social categories to consider, see Baulenas et al., (2023).
Impetus4Change / Deliverable 6.1 / Stakeholder Mapping Summary Report

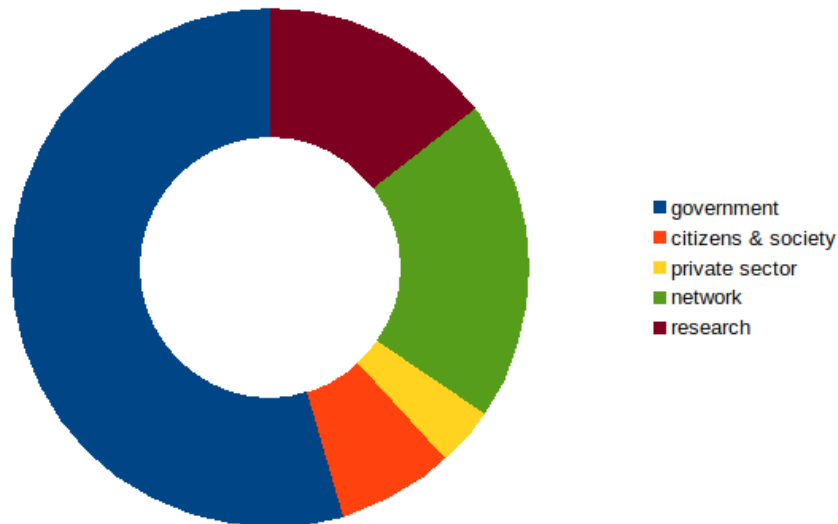


Figure 6 - User categories identified in stakeholder mapping

Within government actors, approximately half of the stakeholders are policy makers with a quarter each resource managers and governmental agencies. Approximately one fifth of the stakeholders mapped are networks, which appear to mainly share thematic knowledge, and one sixth are research entities. The mapping revealed a relatively small number of groups from broader society and the private sector.

Alongside coming to better understand the way in which different entities work on themes related to I4C in general, preliminary discussions have also helped us begin to understand how departments and teams within these entities may be potential users or stakeholders for the I4C project. In general, the policy and local government stakeholders tend to have a dedicated representative or team that is the focal point for integrating all climate-related information into broader decision making. Other stakeholders appear more likely to distribute specific climate themes across other disciplines or areas of work according to the overarching goals. This suggests the need for a tailored approach as different stakeholders – even those within the same organisation – have different capacities, interests and requirements to which the I4C project may contribute. This need for tailoring is further strengthened by initial discussions that have revealed that stakeholders work on a range of timescales depending on the decision context in focus and may not be aware of how climate information varies between these.

5.2.2 Summary of internal and external knowledge networks

Our initial engagement activities have revealed three scales of knowledge networks that could impact the effective use of climate services within Barcelona: those that operate within organisations, those that operate informally between local organisations and those that are structured by more formal (often international) visible networks.

First, regarding internal knowledge networks, we found clear connections within larger entities where climate issues are nominatively the role of a single team but where there are obvious potential users of climate services elsewhere in other departments that

are focussed on other areas. In these cases, it seems the climate office or department plays a key role in facilitating the use of climate information in other departments rather than non-climate departments having dedicated climate officers. This was particularly the case for the larger councils, and there is also often a climate officer for the smaller municipalities who plays a similar role.

However, this structure is not universal, as some entities embed climate across the organisation. For example, the heat impacts of climate are covered in the environmental health in the public health agency while the link between climate and mosquitoes is covered by the pest control team. Equally, in some smaller municipalities and networks, rather than being the responsibility of a single person or team, many disparate groups appear to hold climate as part of their mandate.

Second, we found clear connections between different stakeholders that relate to how climate information is transformed and used in local decision making. In general, the Catalan Meteorological Service (MeteoCat) appears to be the source of almost all climate information used in local decision making in recent years. Our initial exchanges with stakeholders suggest that most policy and decision makers have no in-house capacity to analyse raw data or assess data products and instead depend on external data providers, consultancies and other knowledge brokers.

A key provider of useable climate information appears to be the public-sector agency Barcelona Regional, but academic institutions and private sector consultancies also transform climate data. The heatwaves analysis used to support the City of Barcelona's climate adaptation planning⁸ provides an illustrative example. Here, the Catalan Meteorological Agency provided observations and climate projections to Barcelona Regional which combined this data with socioeconomic data to provide heatwave vulnerability maps for the City of Barcelona that were used to design policies like the climate shelters network.

The use of climate information by smaller municipalities appears less developed, yet where it exists the knowledge chain between climate data provider and decision maker appears to be even longer as most of the studies and analyses are carried out for an aggregating level of government and the results then disseminated to local councils. For example, the Metropolitan Government supported the climate adaptation plans of 22 of the 25 municipalities that have developed them in recent years and has created a climate vulnerability map by overlaying climate and socioeconomic data sets.⁹ Access to other related data also varies between stakeholders. For example, while the City of Barcelona has advanced in-house data collection capacities, socioeconomic data pertaining to smaller municipalities is held by different levels of government, with most held by the Catalan government, which can be time-consuming to access for researchers and practitioners alike.

⁸ See: https://coneixement-eu.bcn.cat/widget/atles-resiliencia/index_calor.html

⁹ See: <https://www.amb.cat/es/web/ecologia/actualitat/publicacions/detall/-/publicacio/la-calor-en-un-futur--index-de-vulnerabilitat-al-canvi-climatic--ivac-/15192912/11818>

Third, Barcelona stakeholders belong to formal knowledge-sharing networks that either focus on or tangentially relate to climate adaptation issues and the sharing of capacities. Related formal networks within Catalonia include those that bring together decision makers at the *comarcal* level (between metropolitan and municipal) and those that are thematically focussed (e.g., on climate change in general, on citizen engagement in public policymaking, or the annual revision of the protocol for how to avoid health impacts from heatwaves). Beyond Catalonia, the larger government actors are active members in several related international networks. For example, the City of Barcelona is a steering member of the C40 Cities Climate Leadership Group and a member of its urban heat working group, and the Metropolitan government is a coordinating member of Local Governments for Sustainability (ICLEI; which both the city and the regional governments also subscribe to) and closely involved with knowledge sharing activities with cities across the Mediterranean. Most, if not all, of the larger governance entities have been, are part of, or are applying for EU projects focused on climate adaptation issues.

5.2.3 Detailed mapping of key potential users

| Actor | Category | Identified via | Contact Established? |
|-------------|----------------|-----------------|----------------------|
| <u>300K</u> | Private Sector | Project partner | Yes |

Role in the network (responsibilities and types of decisions taken)

300,000 Km/s (300K) is a locally focussed urban think tank that has a long list of climate-data-related projects for diverse clients, with particular focus on translating complex data into usable information for decision makers operating at various scales in Barcelona.

Links to other stakeholders and knowledge networks

300K is an integral part of web of urban researchers and policy practitioners in Barcelona with extensive experience working alongside local decision makers.

| Actor | Category | Identified via | Contact Established? |
|-------------------------------|--------------|---|----------------------|
| <u>Barcelona City Council</u> | Policy maker | Document analysis, existing links, SH-led (internal) snowballing. | Yes |

Role in the network (responsibilities and types of decisions taken)

The Barcelona City Council Department of Ecology, Urban Planning, Infrastructures and Mobility (Ajuntament de Barcelona, Departament de Ecologia, Urbanisme, Infraestructures i Mobilitat) is responsible for all municipal-level climate policy within the City of Barcelona. This includes major urban planning projects like the superblocks

scheme and the climate shelters network. The Office of Climate Change and Sustainability appear to hold a wide remit over mitigation and adaptation issues, including (climate) vulnerability. The council can set policy and take budgetary decisions (along with the Generalitat it is the largest budget holder active in the Barcelona area). A preliminary meeting with some of the council team members suggested that other teams that may also be interested in I4C outputs, such as those responsible for housing, public buildings, parks, and green spaces.

Links to other stakeholders and knowledge networks

Connections exist between teams within the Urban Ecology Department on cross-cutting issues, e.g., climate shelters include both public buildings – like libraries and sports centres – and parks, which are managed by different teams. Many links also exist beyond the department/organisation. Much of this seems to branch from the Office of Climate Change and Sustainability which, for example, collaborates and shares information with their counterparts at the AMB. To support the development of the last round of adaptation planning (in 2018), the department's decisions were supported by research that employed climate data analysis carried out by Barcelona Regional. The Department (and the Council more broadly) has deep involvement in international knowledge networks, e.g., as a steering member of C40, and as a member of ICLEI since 1995, and has participated in several EU funded climate adaptation projects.

| Actor | Category | Identified via | Contact Established? |
|-----------------------------------|--------------|----------------|----------------------|
| <u>Vendrell Municipal Council</u> | Policy maker | Existing links | Yes |

Role in the network (responsibilities and types of decisions taken)

The Vendrell Municipal Council (Ajuntament de Vendrell) governs a small municipality of approximately 40,000 people to the WSW of Barcelona. It has a small team that provides advice on urban and environmental aspects, though very little in-house capacity to analyse data, instead relying mainly on analysts from other branches of local government to provide “conclusions” that can then be acted on. The municipality has some authority over local decisions and is particularly concerned with ensuring links between key economic and social points (e.g., to permit people to go for a walk in the shade or arrive at local shops and restaurants). Decisions taken are explicitly local, for example tree planting schemes to ensure natural shading, retrofitting of public buildings to reduce energy cooling costs, and time-shifting services and activities during summer temperature extremes.

Links to other stakeholders and knowledge networks

The municipality has trained some in-house staff on urban scale decision tools (e.g., GIS), but depends on MeteoCat and the Metropolitan and Catalan governmental

teams to provide accessible climate information that they can use to take decisions. The team appears well connected to actors in these other levels of government and to other municipalities within the Barcelona and neighbouring (Tarragona) regions.

| Actor | Category | Identified via | Contact Established? |
|-----------------------------------|--------------|-----------------------------------|----------------------|
| <u>Sant Boi Municipal Council</u> | Policy maker | Ad-hoc/ Snowball (via CCBL event) | Yes |

Role in the network (responsibilities and types of decisions taken)

The Municipal Council of Sant Boi Municipal (Ajuntament de Sant Boi) governs a mid-sized municipality (85k inhabitants) to the southwest of Barcelona City. The environmental team are comfortable using operational air quality information service (Caliopé) but do not have capacity/experience with in-house direct use of climate data. Decisions are highly localised and those within their mandate mainly relate to near-term services (such as irrigating parks, opening times for schools), though they are also interested in data-/evidence-driven redesign/renovation of schools and climate shelters. For longer-term decisions like their adaptation plan (and the resources to finance them) they work with larger-scale government entities.

Links to other stakeholders and knowledge networks

Synthesised climate information is provided via the metropolitan government. Representatives suggested that it may be most beneficial to pool time and resources and work with other local councils under the umbrella of a larger government/network (e.g., Area Metropolitana de Barcelona, Diputació de Barcelona, or Consell Comarcal de Baix Llobregat)

| Actor | Category | Identified via | Contact Established? |
|-------------------------------------|--------------|--|----------------------|
| <u>Viladecans Municipal Council</u> | Policy maker | Ad-hoc (via separate exchange) and existing contacts | Yes |

Role in the network (responsibilities and types of decisions taken)

Viladecans Municipal Council (Ajuntament de Viladecans) governs a municipality of around 67,000 inhabitants located to SW of Barcelona city inland of the Barcelona airport. We were put in contact with the council as part of their search for academic support for the implementation of their 2030 Agenda, one pillar of which was originally the ecological transition (though this has since been refined to sustainability/carbon neutrality). They also have control over a municipal budget and several multi-year sectoral plans. Although they are supported by a climate scientist from the Polytechnic University of Catalonia (UPC) their in-house capacity for direct use of climate data appears limited.

Links to other stakeholders and knowledge networks

Viladecans is an active member of the Consell de Comarcal de Baix Llobregat and also works with the metropolitan and regional governments on climate adaptation issues. It has strong links to local academic institutions.

| Actor | Category | Identified via | Contact Established? |
|---|--|----------------|----------------------|
| <u>Meteorological Service of Catalonia (MeteoCat)</u> | Government body / data-related stakeholder | Snowballing | Pending |

Role in the network (responsibilities and types of decisions taken)

The Meteorological Service of Catalonia (Servei Meteorològic de Catalunya: MeteoCat) is housed within the Catalan Government (Generalitat de Catalunya) and is the main provider of weather information to all levels of government operating in the Barcelona area. Interviews with policy makers operating at different scales (city, metro, province) also revealed how MeteoCat supply the data currently used in climate-informed decision making across different time horizons (from sub-seasonal to multi decadal). It is also an important translator of data into useable policy, for example it is MeteoCat that define "a heatwave". MeteoCat also provides data to researchers, consultants, and the general public via a request form on its website.

Links to other stakeholders and knowledge networks

MeteoCat directly provides data and analysis to local governments, sometimes in coordination with the Spanish meteorological agency (AEMET). Although MeteoCat's expertise mainly lies in meteorological forecasting, it is trusted and well-positioned to also provide longer-scale (i.e., climatological) predictions/projections.

| Actor | Category | Identified via | Contact Established? |
|---------------------------|--------------------------|-------------------------------|----------------------|
| <u>Barcelona Regional</u> | Data-related stakeholder | Snowballing/Document analysis | No |

Role in the network (responsibilities and types of decisions taken)

Barcelona Regional is a publicly owned urban development agency that was formed following the 1992 Barcelona Olympic Games thanks to collaborative efforts by several governments and public agencies, including the Barcelona City and Metropolitan governments. The on-demand consultancy provides data and analysis to local decision makers, foundations and state-owned companies across a range of issues, including climate adaptation. It was responsible for the research underpinning the

City's 2018 Climate plan, which includes detailed assessment of impacts of extreme summer temperatures.

Links to other stakeholders and knowledge networks

A majority of voting rights for Barcelona Regional are held by the City and Metropolitan governments and it is tightly linked and works close with these decisionmakers that form its client's base.

| Actor | Category | Identified via | Contact Established? |
|---|----------|-------------------------------------|----------------------|
| <u>Catalan Climate Change Expert Group</u> | Network | Ad-hoc (unrelated event invitation) | Yes |

Role in the network (responsibilities and types of decisions taken)

The Catalan Climate Change Expert Group (Grup d'Experts en Canvi Climàtic de Catalunya, GECCC) is a loosely organised network of academics, practitioners and policy makers with diverse expertise and experience in climate change matters. The well-respected network arranges public events on climate change issues and shares knowledge between members.

Links to other stakeholders and knowledge networks

Many of the network members deal with climate change issues in their day-to-day work and, as such, it is intrinsically linked to a much broader knowledge network within the broader Barcelona area. Variants/subgroups/members of the network also participate in advisory boards for different government administrations (e.g. at the Catalan or the Barcelona City Council level).

| Actor | Category | Identified via | Contact Established? |
|--|----------|----------------|----------------------|
| <u>Local Council of the Lower Llobregat Region (CCBL)</u> | Network | Related event | Yes |

Role in the network (responsibilities and types of decisions taken)

The Local Council of Lower Llobregat (Consell Comarca de Baix Llobregat; CCBL) appears to mainly act as a convener and knowledge sharing portal. For example, CCBL maintains a data observatory programme that publishes mainly socioeconomic and demographic data and is apparently keen to add environmental – and perhaps climate – aspects too. CCBL does not take policy decisions but appears to have in-house staff that provide some analysis and organisational support to municipalities within the Lower Llobregat area. Recently, CCBL has begun convening local actors

such as councils, research institutions and private sector representatives to pool their knowledge and apply for EU projects.

Links to other stakeholders and knowledge networks

During initial interviews, CCBL offered to act as convener of small group of potential municipalities and are also active at bringing together/working with higher levels of government. Echoing responses from other stakeholders, we heard of the challenges associated with accessing locally-relevant (socioeconomic) data held by higher levels of government and with the lack of standardisation of the data that is collected by different agencies and municipalities.

| Actor | Category | Identified via | Contact Established? |
|---|--------------|----------------|----------------------|
| <u>Provincial Government of Barcelona (DiBa)</u> | Policy maker | Existing links | Yes |

Role in the network (responsibilities and types of decisions taken)

The Provincial Government of Barcelona (Diputació de Barcelona; DiBa) governs the Barcelona region (ES511 at NUTS3 level). Various teams/departments within the government are potential climate service users, including the Urbanism and Civil Protection teams and the cross-department health group. Stakeholders present in our first meeting suggested potential contexts across a range of timescales, and the potential to involved other departments, such as those in charge of indoor and outdoor public spaces. The government takes a range of decisions, some in conjunction with other levels of government and some alone, and because of its large spatial remit and relatively large budget, its decisions can have a wide impact.

Links to other stakeholders and knowledge networks

The Provincial Government is the largest “Barcelona” government entity and as such its mandate overlaps with those of several metropolitan governments and dozens of municipal ones. Examples of collaboration with other stakeholders include collaborating with the Barcelona Metropolitan and Catalan governments to form the council in charge of the Collserola Natural Park, which sits on the northeastern edge of the city of Barcelona. The Government also act as an intermediary, parsing information received from MeteoCat to local governments, particularly the more rural municipalities, and encouraged us to bring local councils into the I4C demonstrator. The provincial government is also active internationally, having been a member of ICLEI since 1999.

| Actor | Category | Identified via | Contact Established? |
|-------|----------|----------------|----------------------|
|-------|----------|----------------|----------------------|

| | | | |
|---|-----------------|-----------------------------------|-----|
| <u>Barcelona Public Health Agency (ASPB)</u> | Government body | Document analysis / Related event | Yes |
|---|-----------------|-----------------------------------|-----|

Role in the network (responsibilities and types of decisions taken)

The ASPB do not take policy decisions but contribute as advisors during policy and protocol development. The team has substantial in-house analysis capacity and access to socioeconomic, demographic and health data, as well as experience with climate services from previous EU projects. In addition, ASPB created an open-access service that maps exposure to heat and mortality for the Barcelona City area (TEMOB). Within the broader frames of work set by the governing body (officially the Metropolitan government but in practice most of the work is in the City of Barcelona), the team appear to have considerable freedom to direct their research. In recent years, ASPB have extended their work to focus on impact assessments and evaluation for urban environmental policy interventions like the superblocks scheme.

Links to other stakeholders and knowledge networks

ASPB mainly work within the city of Barcelona, where they collaborate closely with the city council and the academic community, but they are also involved in cross-boundary networks with links to health, e.g., the Action Plan to Prevent Health Impacts from Heat (POCS) which is led by the Catalan Public Health Agency (ASPCat). ASPB also publish their work regularly in academic journals as well as their own reports.

| Actor | Category | Identified via | Contact Established? |
|---|-----------------|-----------------------|-----------------------------|
| <u>Barcelona Metropolitan Government (AMB)</u> | Policy Maker | Existing links | Yes |

Role in the network (responsibilities and types of decisions taken)

The Metropolitan Government of Barcelona (Àrea Metropolitana de Barcelona; AMB) directly manages some services (water, waste, transport) but most of their climate adaptation work revolves around advising local municipalities to whom they are answerable, i.e., AMB cannot enforce decisions or make policy decisions. AMB has a large budget, some of which comes from transfers from municipal and Catalan governments. AMB plays a key coordinating role in many climate adaptation themes such as a climate shelters network, mapping vulnerability to climate change, and limiting coastal erosion. The in-house team works directly with climate information and collaborates with technical researchers bilaterally through research and consultancy contracts, and as part of EU and other international projects.

Links to other stakeholders and knowledge networks

Within the Barcelona area, AMB is closely connected to local municipalities, comarcal groups and other formal levels of government. AMB also has a dedicated international office that facilitates collaboration within Spain, across the Mediterranean and across

Europe. AMB is a co-ordinating member of ICLEI and is signed up to the EU Mission on Climate Adaptation.

| Actor | Category | Identified via | Contact Established? |
|--|--------------|-----------------------------------|----------------------|
| <u>Catalan Government (Generalitat de Catalunya)</u> | Policy maker | Existing links, document analysis | No |

Role in the network (responsibilities and types of decisions taken)

The Catalan government includes several departments that may be relevant stakeholders for I4C, including environmental, housing, social protection and civil protection departments and an urban agenda task team. It is also the entity that houses MeteoCat and ASPCat and is responsible for collecting and divulging most of the socioeconomic and environmental data gathered outside of the City of Barcelona. For example, it owns and maintains most of the air quality measurement stations and, via MeteoCat, the region's weather stations. Its large size (all of Catalonia) explains its large budget, but although it supports some adaptation initiatives, it appears that many relevant decisions are decentralised to the municipality level, i.e., local governments apply for funding rather than the Generalitat dictating project objectives.

Links to other stakeholders and knowledge networks

Different departments and agencies within the Generalitat are enmeshed in a web of local knowledge networks that has, so far, been difficult to disentangle. Nonetheless, through MeteoCat and its own climate change office the Generalitat is closely linked to all potential key users for the I4C project. This is reinforced via its collaboration on health protocols and socioeconomic data sharing with smaller scales of government.

Other stakeholders

| Actor | Category | Identified via | In Contact? | Roles, decisions & responsibilities | Links to other SHs and KNs |
|--|--------------|-------------------|-------------|---|--|
| Barcelona Citizen Science Promotion Group (Grup Motor de Ciència Ciutadana) | Network | Related events | Yes | The group is established within the Barcelona city council's Science and Universities department and brings together research-focused actors working on citizen science. It undertakes research and provides advice and has recently announced a new initiative looking at heatwaves. | The group includes Barcelona-based academics, public institutions (such as libraries, education and climate) and agencies (e.g. public health and urban innovation). |
| Council of Santa Coloma de Gramenet | Policy maker | Existing contacts | Pending | Medium-sized municipality (118k inhabitants) to the north of Barcelona city within the Barcelonès comarca. The public space and environment, and urban planning and strategy teams are active on climate adaptation issues. | Appears to coordinate with higher levels of government and is well connected in local sustainable urban planning network. |
| Council of Badia de Valles | Policy maker | Existing contacts | No | Small municipality (13k inhabitants) located to the north of Barcelona city within the Vallès Occidental comarca. The planning, environment and health departments are interested in sustainable urban planning. | Unknown |
| Council of Castelldefels | Policy maker | Existing contacts | No | Small coastal municipality (67k inhabitants) to the southwest of Barcelona City in the Baix Llobregat comarca. The urban planning and environment departments are interested in sustainable urban planning. | Unknown |
| Council of Cornella de Llobregat | Policy maker | Existing contacts | No | Small inland municipality (89k inhabitants) to the west of Barcelona City in the Baix Llobregat comarca. The territory and public space; environment; and social action, equality and health departments are interested in sustainable urban planning. | Unknown |

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|---|---------------------------|--------------------------------|-----|--|--|
| Council of l'Hospitalet de Llobregat | Policy maker | Existing contacts | No | Large municipality (262k inhabitants) to the west of Barcelona City in the Baix Llobregat comarca. The department of public space, urban planning and sustainability is interested in sustainable urban planning. | Unknown |
| Council of Montcada i Reixac | Policy maker | Existing contacts | No | Small municipality (37k inhabitants) located to the north of Barcelona city within the Vallès Occidental comarca. The urban planning team is interested in sustainability issues. | Unknown |
| Council of Sant Feliu de Llobregat | Policy maker | Existing contacts | Yes | Small municipality (46k inhabitants) to the west of Barcelona City in the Baix Llobregat comarca. The climate change and environment and urban planning departments are interested in sustainable urban planning. | A representative of the council helps co-ordinate the CCBL and as such is closely integrated in comarcals and metropolitan networks. |
| Council of Terrassa | Policy maker | Existing contacts | No | Large municipality (224k inhabitants) located to the north of Barcelona city within the Vallès Occidental comarca. Through the urban planning and environmental departments, the council has long-standing commitments to sustainable urban environmental efforts. | Experience participating in EU projects. |
| Catalan Health Service (Servei Català de la Salut; CatSalut) | Government body | Document analysis | No | CatSalut and ASPCat coordinate Catalonia-wide health initiatives and may advise on local health policy. | Connections with other health-focused stakeholders. |
| Catalan Institute of safety at work (Institut Català de Seguretat i Salut Laboral) | Government body | Document analysis | No | Unknown | Part of POCS |
| Agència de Salut Pública de Catalunya (ASPCAT) | Government body | Document analysis | No | Broad range of heat/health inputs and health/public space. | Co-ordinates POCS. |
| Barcelona Metropolitan Transport Authority | Resource manager (public) | Document analysis, Snowballing | No | TMB is responsible for all local transport within the Barcelona metropolitan area (both public transport such as metros, buses, trams, | TMB is a wholly owned subsidiary of the Barcelona Metropolitan Government. |

| | | | | | |
|--|---------------------------|---|-----|--|--------------------------------------|
| (Transport Metropolitana Barcelona; TMB) | | | | and active transport such as bikes and e-bikes). | |
| Medical Emergency System (Sistema d'Emergències Mèdiques (SEM)) | Resource manager (public) | Document analysis | No | Unknown | Part of POCS |
| Catalan Union of Hospitals (Unió Catalana d'Hospitals) | Resource manager (public) | Document analysis | No | Unknown | Part of POCS |
| Emergency Services (Bombers) | Government body | | No | Responsible for civil protection, including during extreme weather events. | Unknown |
| Municipal Insitute of Education (Barcelona) | Resource manager (public) | Document analysis | No | One of several quasi-government entities that coordinates schools (and thus climate refuges in schools) | Other education-related stakeholders |
| Barcelona Education Consortium | Resource manager (public) | Document analysis | No | One of several quasi-government entities that coordinates schools (and thus climate refuges in schools) | Other education-related stakeholders |
| Water Barcelona (Aigües Barcelona, also AGBAR?) | Resource manager (public) | Existing contacts, document analysis, snowballing | No | Provide drinking water and irrigation sources to public spaces. Currently acutely focused on drought issues. | |
| Waste and Recycling Barcelona | Resource manager (public) | | | Many urban environmental issues tangentially relate to waste and recycling (e.g. accessibility of public space is degraded if there is lots of rubbish), also an essential public service that must continue in the heat (i.e. prime for time-shifting). | |
| Observatorio Fabra | Data-related stakeholder | | | Maintain one of the long-term sets of weather observations for Barcelona. | |
| Other urban climate projects (DT/DE/Vito?) | Data-related stakeholder | | Yes | Other climate projects working on urban heat in Barcelona. | |
| Red Cross Barcelona (Creu Roja) | NGO | Document analysis | No | Focus on avoiding negative health impacts from heat exposure. Operate volunteer | Part of POCS |

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|---|-----------------|------------------------------------|-----|---|---|
| | | | | telephone check-in network during heatwaves. | |
| Fundació Arrels | NGO | Existing links | No | They have a long history working with people who live on the streets in Barcelona. | Unknown |
| Xarxa de persones sense llar | NGO / Network | Existing links | No | Network of NGOs and service providers working with people living on the streets. | Unknown |
| Anthesis Lavola | Private sector | Existing links | No | Sustainability consultancy. | Unknown |
| ISGlobal | Academia | Existing links, document analysis | Yes | Long-standing work on urban heat health impacts. | Close links to the City Government, ASPB, and academic community. |
| Open University of Catalonia | Academia | Document analysis | No | Running new climate shelters in schools projects | Links to school administrations and academic community. |
| University of Barcelona (UB) | Academia | Existing contacts | No | Wide-range of climate change research and teaching | Run the PF Observatory |
| University Autònoma de Barcelona | Academia | Existing contacts | No | Barcelona Urban Environmental Justice Lab (BCNUEJ) and the Environmental Research Institute (Instituto de Ciencias Ambientales; ICTA) | Strong links to academic community and some urban policy makers. |
| IDAAlert | Related project | Existing contacts | Yes | MosquitoAlertBCN | Links to ASPB and academic community. |
| UPF | Academia | Snowballing | No | Hosted the Urban Mosquitos Conference in Barcelona (2023) | Links to ASPB and academic community (part of IDAAlert). |
| The Blanes Centre for Advanced Studies (CEAB) | Academia | Snowballing | No | Computational ecological dynamics modellers, co-organised Urban mosquitos conference | Links to ASPB and academic community (part of IDAAlert). |
| Xarxa de ciutats i pobles cap a la sostenibilitat | Network | Existing links / Document Analysis | No | Municipal sustainability network. | Links to municipal and comarcal governments |
| Pacte de les alcaldies pel Clima i l'Energia (Diputació Barcelona) | Network | Snowballing / document analysis | No | Local chapter of Mayor's Pact on Climate and Energy. | Links to metropolitan, comarcal and regional governments |
| Assamblea ciutadana pel Clima (Barcelona) | Network | Document analysis | No | Public facing network focused on accelerating action on climate change in Barcelona city. | Hosted by Ayuntamiento de Barcelona |

| | | | | | |
|---|-------------------------------|------------------------------------|-----|--|--|
| More Sustainable Barcelona | Network | Document analysis | No | More Sustainable Schools, More Sustainable City Council | Hosted by Ayuntamiento de Barcelona |
| Federation of Catalan Municipalities (Federació de Municipis de Catalunya (FMC)) | Network | Document analysis | No | Unknown | Links to metropolitan, comarcal and regional governments |
| UN Habitat | Network | Document analysis | No | Source of New Urban Agenda – a clear articulation of need for sustainable and climate-resilient cities. | Barcelona played key role in Habitat III preparation |
| ICLEI | Network | Existing links | Yes | Large, well established network of cities and regions focused on sustainability aims. | Strong international links with many local government members. |
| C40 | Network | Existing links | Yes | Network of large cities that are taking action to fight climate change. Runs thematic working groups (including newly established Urban Heat group). | Barcelona city was a founding member. |
| Consumer protection agency | Other citizen representatives | Unknown | No | Wide remit which includes protection against energy poverty. | Strong links to local citizen solidarity groups. |
| Energy Poverty Advice team | Other citizen representatives | Document analysis | No | Service run by city government that provides advice and facilitates access to other services to reduce burden posed by energy poverty. | Linked to Ayuntamiento de Barcelona |
| Pablo Linde | Media | Document analysis | No | Health journalist that has covered adaptation and heat issues (writes for El País) | Unknown |
| Barcelona Centre for Contemporary Culture (CCCB) | Resource manager (public) | Existing links / Document analysis | No | Experience testing socio/cultural response to public (including adaptation / urban planning) interventions | Unknown |

6 Bergen (NORCE)

6.1 Work Carried Out

6.1.1 Initial connections

The initial connections to stakeholders and relevant users within the municipality of Bergen were identified during the proposal stage and mostly build on previous collaborations between the organisations. The identified actors are the House of Public Safety, the Department for Water and Sewage, and the Department for Climate. During the first months of I4C we organized small meetings with two representatives from each department. These meetings were usually with the department leader and a senior advisor/scientist and had several aims, including:

- to get to know each other;
- to introduce the scientific content and goals of I4C to the project's potential users;
- to hear and learn from the municipality how I4C can be useful for them; and
- to facilitate introductions between key personnel from NORCE working on I4C and key personnel from Bergen municipality.

As well as expanding the stakeholder map, a result of these interactions we have learned:

- about the historical city centre with the dock “Bryggen” which is an area with Hanseatic commercial buildings which has been on the UNESCO list for World Cultural Heritage sites since 1979;
- that the city centre will undergo major infrastructural changes to accommodate a planned new commuter tram line along Bryggen, connecting the suburbs in northern Bergen to the city centre; and
- there are plans to integrate nature-based solutions as part of the transformation of an old logistics harbour and ferry terminal into a 40-hectare zero-emission zone, thereby seeking to fulfil the goals of the Paris Agreement.

6.1.2 Practices and tools used

Stakeholder mapping will be ongoing throughout the period of the project. So far, our focus has been on identifying relevant public sector actors who are likely to be key users for the work being conducted in I4C, i.e., they may directly use data and results produced. We have also identified stakeholders that may indirectly make use of the project's outputs.

We have not yet started detailed mapping of how different stakeholders within the network relate or connect to each other, nor how climate knowledge is shared among this group or with broader knowledge networks.

The stakeholder map has been slightly extended in informal meetings promoting the I4C project, and by engaging in relevant workshops, seminars and events which were occasionally organized by the University of Bergen and Bergen Municipality (e.g., by the World Heritage site coordinator).

6.2 Mapping Results

Climatic Hazard: increase in the amount of extreme precipitation (i.e., mainly focussing on the cumulative impacts of intense precipitation over several days during autumn and winter), and sea level rise (a hazard often mentioned by the municipality's water and climate departments)

Social Impact: Managing public spaces & services during periods of extreme precipitation, mapping critical locations for flooding and impacts on infrastructure (buildings, roads and tram lines)

6.2.1 Detailed stakeholder map

| Actor | Category | Identified via | Contact Established? |
|---|----------------|-------------------|----------------------|
| <u>Bergen municipality: Climate Dept (Klimaetaten)</u> | Decision maker | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

The role of the climate department is to strengthen the municipality in climate matters with respect to both climate mitigation and climate adaptation, and to introduce a circular economy, deal with climate risk, and follow up on the implementation of Bergen's climate and environment plans.

Links to other stakeholders and knowledge networks

This department has strong links within Bergen municipality, the University of Bergen and the Bjerknes Centre for Climate Research, which NORCE is part of.

| Actor | Category | Identified via | Contact Established? |
|--|-----------------|-------------------|----------------------|
| <u>Bergen municipality: Public Safety (Samfunnsikkerhetens hus)</u> | Government body | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

The role of the “House of Public Safety” is to coordinate all work related with public safety such as major accidents, natural disasters, war, or cyber-attacks. The department facilitates planning for coordinated emergency preparedness and disaster management across the municipality.

Links to other stakeholders and knowledge networks

The “House of Public Safety” has strong links to the Directorate for Safety and Preparedness (national level), the military defence, the police, ambulance service, and fire brigade.

| Actor | Category | Identified via | Contact Established? |
|---|----------------|-------------------|----------------------|
| <u>Bergen municipality: Water & sewage (Bergen Vann)</u> | Decision maker | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

The role of the municipality's department for water and sewage is to provide clean water for Bergen's inhabitants and maintain and protect water supply and sewage system.

Links to other stakeholders and knowledge networks

This department has links to the departments of urban planning and urban environment.

| Actor | Category | Identified via | Contact Established? |
|--|-----------------|---------------------|----------------------|
| <u>Bergen municipality: World Heritage site centre (verdensarvsenter)</u> | Government body | Invited to workshop | yes |

Role in the network (responsibilities and types of decisions taken)

The role of the World Heritage site centre is to maintain and secure the cultural heritage site 'Bryggen', and to coordinate all work such as maintenance and restoration related to the site.

Links to other stakeholders and knowledge networks

The centre has strong links to County Vestland, the Bryggen Foundation, the Directorate for Cultural-environmental Administration (Riksantikvaren) and the Norwegian Institute for Cultural Heritage Research.

| Actor | Category | Identified via | Contact Established? |
|--|----------------|----------------|----------------------|
| <u>Bergen municipality: Urban environment (Bymiljøetaten)</u> | Decision maker | Related event | no |

Role in the network (responsibilities and types of decisions taken)

The role of the department for urban environment is to take care of urban development and nature management and to incorporate nature-based solutions.

Links to other stakeholders and knowledge networks

Not yet identified.

| Actor | Category | Identified via | Contact Established? |
|---|--|-------------------|----------------------|
| <u>Meteorological Institute Norway (MET)</u> | Government body / Data-related stakeholder | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

The Meteorological Institute of Norway is responsible for operational weather forecasts and monitoring the climate. The institute also has a strong research unit.

Links to other stakeholders and knowledge networks

The Meteorological Institute of Norway has strong links to the Norwegian Water Resources and Energy Directorate (see below).

| Actor | Category | Identified via | Contact Established? |
|--|-----------------|-------------------|----------------------|
| <u>Norwegian Water Resources and Energy Directorate (NVE)</u> | Government body | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

NVE is a Directorate under the Ministry of Petroleum and Energy that has twin responsibilities: the management of Norway's water and energy resources; and reducing the risk of damages associated with landslides and flooding. The directorate has also a strong research unit in relevant areas, such as hydrological modelling.

Links to other stakeholders and knowledge networks

The Norwegian Water Resources and Energy Directorate has strong links to the Meteorological Institute of Norway (see above).

| Actor | Category | Identified via | Contact Established? |
|--|-----------------|-------------------|----------------------|
| <u>Norwegian Environmental Agency (Miljødirektorat)</u> | Government body | Existing contacts | yes |

Role in the network (responsibilities and types of decisions taken)

As part of the Ministry of Climate and Environment, the Directorate's responsibility is to work for a clean, biodiverse and healthy environment with the main tasks to reduce greenhouse gas emissions, manage Norwegian nature and to prevent pollution.

Links to other stakeholders and knowledge networks

As well as many other national and regional connections this directorate finances and oversees the "Norwegian Centre for Climate Services" which is a collaboration between The Meteorological Institute of Norway, the Norwegian Water Resources and Energy Directorate, NORCE and the Bjerknes Centre for Climate Research.

6.2.2 Other Stakeholders

| Actor | Category | Identified via | In Contact? | Roles, decisions & responsibilities | Links to other SHs and KNs |
|--|-----------------|---|-------------|--|----------------------------|
| County Vestland (Vestland fylkeskommune) | Government body | Existing contacts | yes | Local policy / decision maker. | |
| State administrator in Vestland | Government body | Existing contacts | yes | Local policy / decision maker. | Part of Climate Futures |
| Bryggen Foundation | NGO | Snowballing | yes | Protect the Bryggen World Heritage site. | |
| Red Cross | NGO | Unknown | no | Health-focused NGO | |
| Police | Government body | Document analysis | no | Emergency service – response & planning | |
| Fire Department | Government body | Document analysis | no | Emergency service – response & planning | |
| Ambulance Service | Government body | Document analysis | no | Emergency service – response & planning | |
| Norwegian People's Aid | NGO | Unknown | no | accident prevention, first aid, rescue service, inclusion, anti-racism, asylum reception | |
| NRK | Media | Existing contact (via NORCE communication unit) | Indirect | News broadcaster (national) | |
| TV2 | Media | General awareness | No | News broadcaster (national) | |
| Bergens Tidende | Media | General awareness | No | News broadcaster (regional) | |
| Bergens Avis | Media | General awareness | No | News broadcaster (Local) | |
| SWECO | Private sector | Existing contact | yes | Sustainability consultancy | |
| University of Bergen (Geographical Faculty) | Academia | Existing contact/ Related event | yes | Research interests related to I4C themes | |
| OK Kontor | Private sector | Related event | no | Urban design agency that applies participatory methods | |

7 Paris (CNRS-MF)

7.1 Work Carried Out

7.1.1 Initial connections

The two main actors associated with the I4C Paris demonstrator, Santé Publique France (SPF) and l'Institut Paris Région (IPR) were identified during the proposal stage given existing interests in heat-related health issues and support for urban redevelopment strategies, respectively.

7.1.2 Practices and tools used

Here, we mobilize work carried out in parallel as part of the French H2C research project (for Heat and Health in Cities, ANR-20-CE22-0013), which focuses on improving urban climate services to encourage heat and air pollution prevention measures in the Paris region. The IPR has identified a varied typology of stakeholders from different sectors including local authorities, public health, social action, environmental planning, air quality, energy and climate, urban planning, project design, construction and management of buildings and facilities, and urban open spaces. The IPR has also identified several stakeholders from the health and environment fields.

The identification of players in the Paris region involved in heat and health issues was based on a matrix approach that separately considered the **objects**, **subjects** and **modes** of potential relevant interventions, as explained below.

- The objects of intervention include three different scales: (1) buildings (private, social and community housing; indoor public facilities, including those for vulnerable populations; and tertiary buildings such as offices or shops); (2) public spaces (streets, squares, green areas, open spaces) and the networks; and (3) the neighbourhood (development zones, eco-neighbourhoods, station areas, industrial wasteland, etc.)
- The main subjects of an intervention are the population, the direct users and the beneficiaries of provided human services. More specific categories (referring to different stakeholders) are the general population (all audience), the sensitive population (age, illness, disability, etc.), the fragile population (low income, fuel poverty etc.), the deprived population (homeless, migrants), the working population (tertiary sector) and exposed workers, and finally the population involved in sporting activities.
- The modes of intervention refer to the panel of organizations, trades and skills potentially involved. This includes the competences and capacities of different levels of local authorities (municipal, pairs or groups of municipalities, departmental, and regional). Also included are officials and representatives of public and private sector actors related to health and social interventions, and

urban development and planning. This included certain decentralized state services, institutions, federations, companies, and associations.

At the end of this exhaustive pre-identification of stakeholders, 210 organizations (322 contacts) were targeted by IPR. A questionnaire covering the issues and objectives of the H2C project (which also align with those of I4C) was sent to all contacts. A summary of the stakeholder categories and main themes of interest from the 62 responses (50 organisations) that were received is shown in Figure 7.

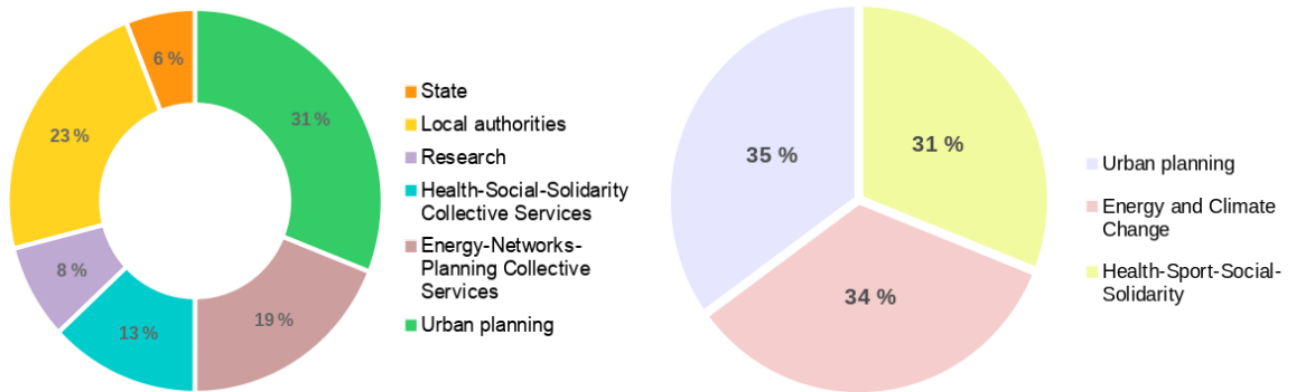


Figure 7 - Distribution of identified stakeholders by category of organization (left) and by major theme (right).

Similar to work in the Bergen demonstrator, we have not yet started detailed mapping of how different stakeholders within the network relate or connect to each other, nor how climate knowledge is shared among this group or with broader knowledge networks, but this will be covered as we continue our stakeholder engagement.

7.2 Mapping Results

Climatic Hazard: Extreme summer temperature and urban heat

Social Impact: Interventions to reduce risk to the population during exceptional and high-risk events, and support for urban planning/development decision making.

7.2.1 Key potential users

| Actor | Category | Identified via | Contact Established? |
|--|-----------------|-------------------|----------------------|
| <u>French Public Health Agency (Santé Publique France; SPF)</u> | Government body | Existing contacts | yes |

The national public health agency (SPF) is a French public administrative body reporting to the Ministry of Health. Its mission is to improve and protect the health of the population. It carries out epidemiological observation and surveillance to monitor

the population's state of health, to adapt health policies and deal with exceptional health situations. It also participates in the fight against health inequalities by implementing health promotion and prevention strategies.

SPF is particularly interested in the impacts of heat on mortality and access to healthcare, and has already conducted epidemiological studies on the relationship between temperature and the relative risk of mortality. For SPF, a big challenge is to better assess the current and future exposure of the population to unfavourable conditions (accounting for spatial variabilities at infra-urban scales) to anticipate risk situations and improve preventative interventions.

| Actor | Category | Identified via | Contact Established? |
|---|-----------------|-------------------|----------------------|
| <u>Paris region urban planning and environment agency (l'Institut Paris Région; IPR)</u> | Government body | Existing contacts | yes |

The Paris region urban planning and environment agency is a key partner in the Île-de-France Region, as its role is to support local authorities (including municipalities, inter-municipality groups and departments) in the development and transformation of their urban and rural territories. It carries out the studies and work required for decision-making by the Île-de-France Region and its partners, in the fields of urban planning, transport and mobility, environment, energy, economy, and social and health issues.

In particular, the IPR hosts the Regional Health Observatory (ORS) and the Regional Energy and Climate Agency (AREC), which are keenly aware of – and mobilized around – the issues of urban heat and health impacts, the link to urban planning, and the expected increase in vulnerability as a result of climate change.

7.2.2 Other stakeholders

Note: For conciseness, the table below omits two columns present in the other demonstrator cities that are of limited use here (this mapping is directly adopted from stakeholder engagement efforts in the H2C project).

| Actor | Category | Roles, decisions & responsibilities | Links to other SHs and KNs |
|--|--|---|--|
| Agence régionale de santé (ARS) | Governmental body (with regional branch) | Implementation and management of health policies (established by the Ministry) at regional and local level. In particular: carries out prevention and crisis management actions and organizes access to care | Disseminating data and expertise to local authorities (municipality and regional levels) |
| Direction régionale et interdépartementale de l'environnement de l'aménagement et des transports d'Île-de-France (DRIEAT) | Governmental body (with regional branch) | Implementation at regional level of government policies on transport, sustainable planning and development, the environment, energy, urban planning, etc. In particular: it prevents and reduces technological, natural and road-related risks. | Disseminating data and expertise to local authorities (municipality and regional levels) |
| Agence de l'environnement et de la maîtrise de l'énergie (ADEME) | Governmental body | Implementation of public policies on energy and environmental protection (funding research and disseminating information to public players and private individuals), with a particular focus on energy efficiency and air pollution and heat-stress prevention. | Disseminating data and expertise to local authorities (municipality and regional levels) and the wider public. |
| National Forests Office (Office national des forêts; ONF) | Government body | Managing France's public forests. Focus on forest fire protection | Yet to be confirmed |
| Municipal councils of municipalities in Île-de-France (Melun, Nanterre, Ville de Paris, Vitry-sur-Seine) | Decision maker | Management of the municipalities with areas of intervention including social action, town planning and housing. Decision-making for the | Yet to be confirmed |

| | | | |
|--|----------------------------------|---|---|
| | | establishment of the PLU (local urban development plan) | |
| Councils of municipal communities (Marne and Goindoire, Paris Saclay, Paris Vallée de la Marne, Saint-Quentin-en-Yvelines, EPT Paris Est Marne & Bois, Plaine Commune) | Decision maker | Grouping of municipalities for joint management of certain local public services | Acts as a bridge between smaller and larger governance sectors. |
| Council of Greater Paris Metropolitan Area | Decision maker | Yet to be confirmed | Strong links to municipalities and regional governments. |
| Paris Regional Council | Decision maker | Yet to be confirmed | Strong links to municipalities and metropolitan governments. |
| CG95 département du Val d'Oise | Local authority – Regional level | Missions in the fields of (1) Solidarity, social action, health; (2) regional planning (including green spaces, departmental roads, regional fire and rescue services); (3) education, culture and sport | Yet to be confirmed (likely links to regional government and specific local initiatives) |
| Research centre specialising in environmental risks, mobility and land planning (Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement; CEREMA) | Data-related stakeholder | A centre of scientific expertise and resources to support the implementation and assessment of public policies in the fields of sustainable development, urban planning, ecological transition (related to mobility, transport and infrastructure, building, natural risk prevention, road safety). | Yet to be confirmed (likely bridge between academic research and real-world policy making / decisions, i.e. applied research) |
| Research center specialising in construction science and practice (Centre scientifique et technique du bâtiment; CSTB) | Data-related stakeholder | Research into the technical, economic, environmental, energy performance, health quality and sociological aspects of construction and housing. Focus on buildings and cities in the face of climate change and building adaptation | Yet to be confirmed (likely bridge between academic research and real-world policy making / decisions, i.e. applied research) |
| National Institute for geographic and forestry | Data-related | Production/dissemination of | Yet to be confirmed (likely bridge |

| | | | |
|---|---------------------------|--|--|
| information (Institut national de l'information géographique et forestière; IGN) | stakeholder | reference data and geovisualisation relating to knowledge of the national territory and French forests as well as their evolution. A major challenge is to map the impacts of human activity on its environment (with the development of certain diagnoses that can be used by actors for decision-making) | between academic research and real-world policy making / decisions, i.e. applied research, especially ONF) |
| Regional Health Observatory (Observatoire régional de santé) | NGO | Observation and documentation of the state of health of populations on a regional (and local) scale, as part of a decision-making support mission. They are consulted as experts in the definition and implementation of regional health policies. | ORS Île-de-France is hosted by the Institut Paris Région, and collaborates actively with Santé Publique France on regional health policies. |
| Essone Public Service for the Elderly (Service public Essonnien du Grand Âge; SEGA) | Government body | Yet to be confirmed (apparent relevant focus is on impact of public policies on health of potentially vulnerable populations) | Yet to be confirmed (likely links to health and social care networks and stakeholders) |
| ENGIE (CRIGEN Research Lab) | Private sector | Production and supply of electricity (natural gas, coal, nuclear, hydro, wind, solar) | Yet to be confirmed (likely bridge between academic research and real-world policy making / decisions, i.e. applied research in energy sector) |
| Local Climate and Energy Agency - Greater Paris West Seine (Agence locale de l'énergie et du climat de Grand Paris Seine Ouest; ALEC GPSO Energie) | Government body / Network | Regional office of GPSO, a foundation seeking to accelerate the energy transition | Yet to be confirmed (likely bridge between different levels of governance and stakeholders in climate/energy sectors) |
| Local Climate and Energy Agency – Seine and Marne (Agence locale de l'énergie et du climat; ALEC Seine-et-Marne) | Government body / Network | Regional office of GPSO, a foundation seeking to accelerate the energy transition | Yet to be confirmed (likely bridge between different levels of governance and stakeholders in climate/energy sectors) |
| Water Agency Seine—Normandy (Agence de | Resource manager | Regional public water agency | Yet to be confirmed |

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|--|---------------------------|--|---|
| l'Eau Seine-Normandie; AESN) | (public) | | |
| Public Railways (Société nationale des chemins de fer français (SNCF) , including Espaces Ferroviaires) | Resource manager (public) | Planning, operation and maintenance of public railways | Yet to be confirmed – links to urban heat and health currently unclear |
| Federation of energy and environment services (Fédération des services énergie environnement; FEDENE) | Network | Network of (mainly private sector?) actors focussed on reducing environmental impact of energy. | Yet to be confirmed – likely links to national energy sector actors as well as local environmental actors |
| Ile-de-France public sanitation service (SIAAP) interdepartmental union (Syndicat interdépartemental de service public de l'assainissement francilien, SIAAP) | Other | Regional public water / sanitation authority that includes four separate government departments. | Yet to be confirmed – links to urban heat and health currently unclear |
| Public utility of gas, electricity and local energies in Île-de-France (Service public du gaz, de l'électricité et des énergies locales en Île-de-France; SIGEIF) | Resource manager (public) | Yet to be confirmed | Yet to be confirmed – links to urban heat and health currently unclear |
| EKOPOLIS | NGO | Long-running NGO focussing on sustainable development and construction with relevant interests in urban rehabilitation/renovation and the mobilisation of relevant actors in the Île-de-France region. | Yet to be confirmed (likely strong links to local and regional urban planning actors) |
| Paris Urbanism Agency (Atelier parisien d'urbanisme; APUR) | NGO / Network | Group of 29 actors that together monitor, analyse and research themes related to sustainable urbanism across the Paris Metropolitan Area | Yet to be confirmed (likely strong links to local and regional urban planning actors) |
| Citallios | Data-related stakeholder | Quasi public land development company that works on behalf of local authorities in urban renewal and the improvement of housing conditions | Yet to be confirmed (likely strong links to local and regional urban planning actors) |
| Grand Paris Aménagement | Data-related stakeholder | Association of planners that support local decision makers to (re)create | Yet to be confirmed (likely strong links to local and regional urban planning) |

| | | | |
|--|--------------------------|--|---|
| | | [improve] the quality of life for urban citizens | actors) |
| E6 Consulting | Private sector | Consultancy focussed on energy and environmental issues | Yet to be confirmed (likely bridge between different levels of governance and stakeholders in climate/energy/environment sectors) |
| Fieldwork Architecture | Private sector | Consultancy of architects and programmers focused on urban design | Yet to be confirmed (likely strong links to local and regional urban planning actors) |
| INGÉROP | Private sector | Long-standing consultancy in energy and transport issues | Yet to be confirmed (likely bridge between different levels of governance and stakeholders in climate/energy/environment sectors) |
| Bouygues Construction | Private sector | Construction company | Yet to be confirmed |
| Organising Committee for Paris 2024 Olympic Games (COJO Paris2024) | Network | Single-focus committee drawing together wide range of actors. Work likely to include understanding and limiting risk to health for participants and attendees. | Yet to be confirmed |
| Olympics Works Delivery Company (Société de Livraison des Ouvrages Olympiques, SOLIDEO) | Network | National project focusing on delivering 2024 Olympic Games | Yet to be confirmed |
| Groupe Verdi | Private sector | Consultancy focused on land use planning, urban renewal, energy transition. | Yet to be confirmed (likely bridge between different levels of governance and stakeholders in climate/energy/environment sectors) |
| Vizea | Private sector | Consultancy focused on sustainable urbanism | Yet to be confirmed (likely strong links to local and regional urban planning actors) |
| IRDS | Data related stakeholder | Regional development planning agency focussed on climate change, urban resilience and sustainable development (among others) | Yet to be confirmed (likely strong links to local and regional urban planning actors) |

8 Prague (Charles University)

8.1 Work Carried Out

8.1.1 Initial connections

The main stakeholders declared in the project proposal were the Prague Municipality, various City Authorities (primarily Environmental Protection, but also Territorial Development and Smart City departments), and the Institute for Planning and Development of the City of Prague, which is controlled by the City and provides expertise and advice in these areas. Together, these groups have been responsible for the two key documents relevant to climate change impacts in the city: the Prague Climate Plan 2030¹⁰ and the Capital City of Prague Climate Change Adaptation Strategy¹¹.



Figure 8 - Key Climate Documents for the City of Prague

Further stakeholders will be discussed and eventually invited. These include actors from within the City of Prague, such as the Operator of Information and Communication Technologies (OICT) Prague; local administrations; independent institutes, such as the Institute for Health and Czech Hydrometeorological Institute; and academic research groups like those at the Institutes of Atmospheric Physics and Computer Science at the Academy of Science of the Czech Republic, and the Department of Environment of the University of Agriculture. Related research efforts can also be leveraged. For example, by coordinating the work carried out as part of I4C with that being undertaken for Destination Earth (where the city of Prague is an example Urban Use Case) may generate other potential stakeholders.

8.1.2 Practices and tools used

One of the strengths of the Prague demonstrator is a strong network of actors in the city that has developed following a long pathway of different projects dealing with air

¹⁰ <https://klima.praha.eu/en/the-climate-plan-at-a-glance.html>

¹¹ https://adaptacepraha.cz/wp-content/uploads/2020/08/adaptation_strategy_eng_web_compressed.pdf

quality, which has long been a major interest of the City of Prague¹². Similarly, work has been ongoing for more than a decade to deal with the urban heat island effect and the impacts of climate change. The links formed through collaborating on these projects facilitated the involvement of the Municipality's Science Advisor in first discussions of the I4C topics and helped map out the City of Prague's needs and potential stakeholders during the proposal stage.

Once I4C was accepted, communication with the Municipality was delayed by the long time needed to establish the City Council following the elections in late autumn 2022. Eventually we managed to hold further meetings and a phone call with the Science Adviser where we presented the I4C project and especially the tasks of WP6. We discussed the potential involvement of other stakeholders from the City Administration, like local authorities of city districts, or other city services (emergency rescue unit, fire departments, transportation, city maintenance), as well as some relevant institutes, e.g. health. We also explored the actual needs of the city authorities with respect to the urban heat island effect, the intensification of heat waves, and air quality, which were confirmed as the main climate-relevant challenges the City faces. We also addressed the potential benefits and coordination needs arising from the opportunity for the City of Prague to become a use case study for the major EU project Destination Earth, which led to the first meeting with the Director of the Environment Protection branch, where further collaboration was agreed and drafted.

In addition to this straightforward line to clearly identifying key stakeholders and potential users, we will also undertake other efforts to continue expanding our understanding of the stakeholder map. A key example actions here is to continue attending the regular relevant meetings organized by the municipality, which provide a platform to present activities and projects in topics aligned with those covered in I4C. Beginning with the urban heat island project, these meetings have evolved into a useful place to present updates and share thoughts with service end-users and Charles University is a regular presenting participant. The hope is that this creates a pool of further potential stakeholders, end-users, and potentially partners for co-production of services useful for the City of Prague.

As the project develops, we also aim to use the opportunities highlighted above to further populate the stakeholder map. We also plan to expand the map by extending our analysis of the city's key climate plans as well as ongoing procedures and activities

¹² Relevant collaboration between actors started in the Operation Programme for Central European Cooperation UHI (Development and application of mitigation and adaptation strategies and measures for counteracting the global phenomenon of urban heat islands) where Charles University, CHMI and the Institute for Planning and Development of the City of Prague collaborated closely. Links were strengthened a few years later when Charles University coordinated Operation Programme Prague – Pole of Growth, URBI PRAGENSI (Urbanization of weather forecast, air quality prediction and climate scenarios for the City of Prague) which also included CHMI, ICS as part of the research team and IPD and the Municipality as the project's major stakeholders and end-users. The former main contact for the above projects at IPD became the Science Adviser at the Environment Protection branch of the Municipality.

to monitor and identify other actors and other potential applications for I4C results (e.g. maintaining urban green spaces or flooding risks).

8.2 Mapping Results

Climatic hazards and social impacts: The main climatic hazards the city faces are the connected phenomena of heat waves and the urban heat island effect. Previous work (Karlicky et al., 2018; Halenka et al., 2019) has shown that on some summer nights the urban heat island can increase temperatures by 4–5°C, significantly increasing risks for vulnerable groups. Health risks also arise from adverse air quality conditions (especially ozone smog) which can compound risks of summer heat and can even develop even in autumn and winter depending on local pollutant levels. A relatively robust water supply means droughts are less of an issue, but limited public irrigation infrastructure could pose challenges for maintaining urban greenery. Floods are less of a priority as the city invested in flood resilience infrastructure during the rebuilding that followed the floods of 2002, limiting future risks.

Overall, preliminary discussions concluded that while floods and poor air quality pose risks, management plans and reactive measures are in place to limit harm. However, risk management (i.e., mitigation measures and reactive procedures) is weaker for heat waves and the urban heat island effect. Indeed, it is currently limited to a public warning system operated by CHMI, see below.

8.2.1 Summary of the stakeholder map

The City Authority and Municipality Administration (both policy makers) are the main stakeholders for the Prague demonstrator and have a direct impact on society within the city and its population. They perform their roles via ownership and supervision of different organizations that cover the city's essential and important services, some of which are relevant for the tasks treated within I4C. Of these organizations, those that are most relevant to I4C tend to be public bodies that manage resources such as waste, public transportation, urban green infrastructure, and emergency (especially health) services. Institutions (government bodies) represent the general framework by which activities are carried out by these organizations, such as preparing the rules and standards that are enforced, and supporting research and implementation activities in their relevant disciplines, e. g. weather and climate, hydrology, water management, health. The academic environment includes universities and the institutes of the Czech Academy of Science. This supports evidence-driven policies and actions by translating scientific knowledge for real-world applications.

8.2.2 Summary of internal and external knowledge networks

CHMI is the authorized provider of meteorological information, and especially of warnings which are issued publicly via the media or negotiated channels. Other stakeholders use this information within the ambit of their responsibilities. Extreme risk situations (typically floods) can trigger the Integrated Rescue System. Representatives of this group of actors – which is headed by the Fire Rescue Service with participation

from the City Authorities, CHMI and other relevant organizations and institutions – gather regularly to devise risk-management plans. Responding to events that do not trigger this group tends involve more ad-hoc cooperation based on potential offers and claims. The above-mentioned workshops are a good platform to exchange this type of information (i.e., who, can provide/use what, where and how). The development of the City's strategic documents can be organized to some extent according to specific projects funded by the City, national or even EU sources.

The City Authority and Municipality Administration and their established organizations have relatively few national connections beyond informal links created through relevant projects (e.g., between academic institutes). Internationally however, the City of Prague is a member of many organizations, initiatives and alliances that aim to share knowledge, practices, interest and experiences in climate change mitigation and adaptation themes. Examples include the Covenant of Mayors, C40 Cities, Race to Zero, Carbon Neutral Cities Alliance, and EC Missions such as 100 Climate-Neutral Cities by 2030 – By and For the Citizens, among others.

8.2.3 Detailed stakeholder map

| Actor | Category | Identified via | In Contact? | Roles, decisions & responsibilities | Links to other SHs and KNs |
|---|-------------------|------------------|--------------------------|--|---|
| Prague Municipality | Policy maker | Clear partner | yes | Major authority responsible for all measures and services applied under mitigation/adaptation measures | User, initiator |
| Prague Districts Municipalities | Policy maker | Clear partner | Not yet | Local authority with wide range of local decision powers | user |
| National Institute of Public Health | Governmental Body | workshops | Yes, but need to refresh | Health promotion and protection, disease prevention, specific interest in (avoiding) negative population health impacts from environmental hazards. Conduct scientific experiments and research. Prepare legislation relevant to health protection, including harmonization of Czech legislation with the norms of the European Union. | Provide methodological advice and expert opinions on the health safety of various products (e. g., cosmetics, food supplements and other day-to-day items). Also carry out and divulge national results of systematic monitoring of environmental impacts on population health. |
| T. G. Masaryk Water Research Institute | Governmental Body | workshops | Yes | Wide range of expertise related to water resources (hydrology, extreme events, climate change, hydraulics, surface water modelling, groundwater protection, water status assessment, protection of aquatic biodiversity, wastewater and water treatment, levels and behaviour of water pollutants, packaging and waste management, water and cultural heritage, geographic information systems, information technology). | Strong links to both academic and policy actors. |
| Czech | Governmental | Collaboration in | yes | Services in the field of meteorology, | Data provider and expert |

| | | | | | |
|---|---------------------------|---|-----|---|---|
| Hydrometeorological Institute | Body | previous and current projects | | climatology, air quality and hydrology, collection of data, observation, measurement, modelling, forecasts, state authority for warnings issuing | opinion provider to national and local decision makers |
| Fire Rescue Service - Integrated Rescue System | Governmental Body | Awareness based on its role in flood response | no | Emergency services focussed on protection of citizens' lives, health and property against fire and environmental hazards. | User. Also is one of the basic bodies of the Integrated Rescue System, established after the experience of the large flooding of 1997 |
| Charles University, Dept. Of Atmospheric Physics | Academia | I4C partner | Yes | Expertise in theoretical and applied research in climate change, regional climate modelling, urban climate, climate impacts | Source and support, initiator |
| Institute of Atmospheric Physics | Academia | Collaboration in previous project | yes | Research in the fields of meteorology and climatology, extreme events analysis and prediction, climate change impacts, heat waves, health effects | Source and support |
| Institute of Computer Science | Academia | Collaboration in previous projects | yes | Research in numerical modelling, atmospheric processes, air quality, urban effects, microscale urban modelling, urban heat island mapping and effects | Source and support |
| Prague Emergency Medical Service | Resource Manager (Public) | Potential stakeholder of previous project | no | Provide specialized pre-hospital emergency medical care. Specialized pre-hospital emergency care is provided by rapid response vehicles (RRV – emergency vehicles carrying a physician) and advanced life support vehicles (ALS – large ambulance vehicles comprising a paramedic and a driver/rescue | User. All activities are managed by the Medical Operations Center. Close coordination with other emergency services. |

| | | | | | |
|--|---------------------------|--|-----------|---|--|
| | | | | person) | |
| Prague Institute of Planning and Development (IPR Prague) | Resource Manager (Public) | Previous collaboration | connected | Main policy-making unit for urban architecture, planning, development, design, and administration | User, source and support |
| Operator of Information and Communication Technologies Prague | Resource Manager (Public) | workshop | connected | A municipal enterprise that primarily secures the agenda for and manages Smart City projects, consultancy in ICT and implementation of ICT projects for municipal districts and other municipal enterprises | User, source and support |
| Prague Public Transit Company | Resource Manager (Public) | workshop | no | Provides public transportation services in the city with relevant work focussed on GHG and pollutant emissions, and predictions related to current events (road conditions, air-conditioning etc.) | User, source and support |
| Prague Renewable Energy Community | Resource Manager (Public) | Awareness, based on documents (Climate Plan) | no | Newly established (planned) enterprise to support the development of alternatives of energy sources | User. Likely to form links to local energy stakeholders. |
| Prague Services | Resource Manager (Public) | Awareness, based on documents (Climate Plan) | no | Public urban works agency with range of roles and interests including waste management, pollutant emissions, greenery maintenance. | User, source |
| Central Wastewater Treatment Plant) | Resource Manager (Public) | Awareness, based on documents (Climate Plan) | no | Public wastewater treatment agency focusing on water, sanitation and energy generation | user |
| Technical Road Administration | Resource Manager (Public) | workshops | yes | Public agency focused on road management | user |

| | | | | | |
|--|-------------------|--|-------------------|--|-----------------------|
| | | | | | |
| Prague Energy Company | Private | workshops | yes | Energy supplier for City of Prague | user |
| Building Authorities | Governmental Body | Awareness, based on documents (Adaptation Strategy) | no | Office charged with approving plans for new and renovated buildings and monitoring their implementation. | user |
| Environmental Education Centres | Non-profit | Awareness, based on documents (Adaptation Strategy), workshops | Previous contacts | Network of sites focused on providing environmental education, supporting in-school education, and promoting learning during free time activities. | User, mediator |
| FŽP ČZU (Faculty of Environment Protection, Czech Agriculture University) | Academia | Workshops, previous co-operation | yes | Research group focused on technical aspects of environmental protection, urban agriculture, greenery, water management and drought. | User, source, support |
| Research Institute for Soil and Water Conservation | Governmental Body | workshops | no | Research institute focused on range of issues including water management and irrigation. | User, support, source |

9 Summary of Efforts Undertaken and Main Results Achieved

The work presented in this deliverable is an overview of the research and engagement efforts carried out in each of the demonstrators to map the actors that we would like to involve in I4C's knowledge and services co-production processes. In each demonstrator, the work presented in this deliverable marks a clear progression from that detailed in Milestone 6.1 (Initial Demonstrator Co-Exploration Meetings). Nonetheless, it is worth noting that the co-exploration process and stakeholder mapping are at different stage in each demonstrator.

Although the context and service in focus is different for each demonstrator, there are some preliminary factors that emerge which help to explain how to advance mapping more quickly. These include the availability of sufficient capacity/resources (person time), appropriate competencies (skills) and existing networks and efforts to directly tap into among the demonstrator teams. For example, the mapping in the Barcelona demonstrator is relatively advanced because a) 300K are a project partner, key user and catalytic interface to the wider Barcelona urban planning community and b) the social scientist team at BSC has direct experience in stakeholder and knowledge mapping and has been able to devote considerable time to this task. This meant that when 300K's local connections helped to kick-start co-exploration with other stakeholders at an early stage of the project, BSC were able to create material to "sell" I4C and co-ordinate the mapping of individual actors and the wider network they form part of.

Some of these factors were less available in other demonstrators and some faced exogenous challenges (e.g., owing to challenges hiring staff, or the uncertainty created by local and national elections). Thus, to ensure that the project moves forward, partners have instead focused on strengthening the relationships with stakeholders with whom the links had been built prior to or during the project preparation stage, while expanding the stakeholder map has progressed more slowly. Despite this, all demonstrators were able to take advantage to some degree of existing relationships between project partners and the decision makers that are the likely end-users of the I4C services. There are also clear examples of allying the co-exploration of I4C themes with other ongoing projects (e.g., with Destination Earth in Prague), learning about emerging initiatives (e.g., a new proposed tram line in Bergen), and building on existing work (e.g., adapting a previous stakeholder mapping activity in Paris).

10 Progress Beyond State of the Art

Although common in other fields, such as environmental management, for decades, purposeful and dedicated stakeholder mapping in climate services to underpin the co-production process and explore the local knowledge network remains relatively

rare. Close linkages with the co-evaluation of the demonstrators (D6.4) will determine whether the approach taken by I4C of enforcing a dedicated task and deliverable among a dedicated demonstrator WP is an effective way to deliver more effective climate services.

The normalising of purposefully searching for actors beyond those who have routinely been involved in climate services previously may also generate spill over benefits that were not foreseen at the beginning of the project, which also mark steps beyond the state of the art. These may be alliances with similar existing and emerging projects, or the generation of new communities of practice (for example, our work on I4C opened up a discussion on the applicability of heat stress indicators with a Barcelona-based health research institute which will hopefully form a springboard to advances both within I4C – with WP4 in particular – and in Barcelona where we are seeking to increase sensitivity to going beyond temperature measurements to understand heat stress).

11 Discussion and Next Steps

Having produced an initial map of actors, we are continuing to engage with potential key users of the data produced in I4C to fill in remaining gaps in the stakeholder map, better understand the flow of climate knowledge into, across and from the network, and strengthen our relationship with these actors. The next steps include developing stratified lists of key users, end users, key stakeholders and interested stakeholders and then refining the high-level goals identified originally and grouping potential users together to reduce the burden of tailoring each service.

Following this, to develop services that are socially inclusive, respond to genuine needs and have a greater chance of producing effective adaptation interventions, we will then evaluate each potential key actor against different dimensions (influence, power, urgency, multiplicity, legitimacy and type of knowledge; see Baulenas et al., 2023). This aims to help ensure our working groups account for existing imbalances in institutional arrangements and works to overcome climate-aggravated injustices as we seek to empower and involve users and to raise awareness among the wider stakeholder group. A key output of these efforts will be identifying the potential users to invite to the 1st Adaptalab in Paris in November 2023.

12 Links Built

Stakeholder mapping and co-exploration of urban climate problems in the four demonstrators has laid the ground for a genuine co-production process to take place in I4C, a key impact of the overall project. Only with opening the discussion and defining the services with stakeholders can we go beyond the much-lamented situation in the climate services literature of pre-defined assumptions and services (Beier et al. 2017; Daniels et al. 2020, Findlater et al. 2021, Steynor et al. 2016). Having these discussions at the very beginning of the project helped strengthen the relationships with stakeholders with whom the links had been built prior to or during the project preparation stage. But even more importantly, the stakeholder mapping

process and opening of the discussion to other stakeholders with whom, sometimes, we have not interacted previously, can help provide a more holistic understanding of the stakeholder community, their perceptions, needs and climate decision-making practices. These new findings can empower climate and social scientists and equip them for the future close collaboration with stakeholders on the new climate knowledge and services coproduction, in I4C and beyond. For example, in each demonstrator there are examples of how the mapping and co-exploration process for I4C has helped situate I4C alongside other projects ongoing in each demonstrator and research partner.

In addition to strengthening links outside of I4C, some of the first activities with stakeholders involved exploring and defining the list of extreme indicators of interest which was then shared with and further analysed with WP4. Similarly, this work provides an initial view of what localised data each demonstrator city might need, which will inform the work in WP3, while the understanding of local and broader knowledge networks may contribute to ongoing and future efforts in WP1.

13 Communication, Dissemination and Exploitation

Some of the demonstrators, such as Barcelona, developed communication material tailored for initial discussions with stakeholders. In the form of a presentation, pitch slide or brochure, these communication pieces helped introduce the project to stakeholders, as well as communicate about the potential of climate services for urban contexts. As the stakeholder mapping work progressed, we provided new content in the presentation to summarise what has already been discussed with stakeholders. Finally, the WP6 team showcased the aims of WP6 and I4C in a poster (see Annex), and ran a workshop on the user selection framework applied in I4C at the ECCA2023 conference in Dublin, Ireland.

13.1 Peer Reviewed Articles

After just nine months into the project, it is too soon to have published any articles directly resulting from our work in I4C and this deliverable. Nonetheless, the methodological article by Baulenas et al., (2023) was developed during the I4C proposal preparation and with the co-production work in the I4C demonstrators in mind. It designed a framework for user and stakeholder selection and engagement in co-production of climate services. I4C proposed this framework for stakeholder selection and, subsequently, is now applying it, as presented in this deliverable. In a similar vein, we expect our ongoing mapping efforts and the experiences gained to contribute to future publications, though there are no fixed plans for these yet.

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15 Annexes

15.1 Screenshot of MS Excel Stakeholder Mapping Tool

| Step 1A | Step 1B | Step 2 | Step 3 | Step 4A | Step 4B | Step 5 | Notes / Extras | direct contact | Links | |
|---|---|--|--|---|---|---|---|-----------------------------------|--------------------------|--|
| What is the climatic phenomenon in focus? | Why are we concerned about it? | Where does it impact and where are decisions made? | Who could be interested in the climate service, and who could be affected by it? | Who brings what to our stakeholder network? | Are there pragmatic aspects to consider? | How should we aim to involve this group? | | | | |
| What is the high-level goal? | Who could be interested in the climate service, and who could be affected by it? | Who could be interested in the climate service, and who could be affected by it? | Who could be interested in the climate service, and who could be affected by it? | To what degree should we involve these stakeholders in the co-production process? | | | | | | |
| Climatic Hazard | Social Impact | Location | Stakeholder category | Organisation | Role in the network (legitimacy, power, influence, urgency) | Pros and cons of involvement (pragmatism) | Level of involvement (cheese) | | | |
| me Summer Temperatures aces & services during extreme heat episodes sitian region and other smaller municipalities in Catalonia | aces & services during extreme heat episodes sitian region and other smaller municipalities in Catalonia | Catalonia | Policy-maker (BN City) | City council (education) | Team here operates climate shelters in schools network. | PRDS: long-term involvement, technical background | Key User | Key contact: Laia Grau (director) | https:// | |
| | | | City council (ecology, urban planning, infrastructure and m... | Team that operates in systemic urban planning. | CONIS: political changes | Key User | Key contact: Xavier Masilla (chief-architect), Anasoa Miquel (director) v | https:// | | |
| | | | City council (ecology, urban planning, infrastructure and m... | Team that operates in public space systemic transform... | CONIS: political changes | Key Stakeholder | Key contact: Jaume Barnada (architect) | v | | |
| | | | City council (ecology, urban planning, infrastructure and m... | Team that operates in climate shelters in schools | PRDS: direct contact with schools | Key Stakeholder | Key contact: Irma Ventayol Cerverino | n | https:// | |
| | | | City council (climate change office) | Team that coordinates the climate shelter project at the | CONIS: the project is already under going | Key User | Key contact: pending | p | | |
| | | | City council (social services) | Team that coordinates emergencies (health, security, etc) | CONIS: direct contact with schools | Key User | Key contact: pending Laia Grau | p | https:// | |
| | | | City council (emergency coordination unit) | Team that coordinates emergencies (health, security, etc) | CONIS: direct contact with schools | Key User | Key contact: pending | p | https:// | |
| | | | City council (social safety, gender justice, feminism and LG... | Responsible for day centres and residences for older peopl... | CONIS: direct contact with schools | Key User | Key contact: Tomás Carrion (advisor) | v | https:// | |
| | | | Municipal Council of Santa Coloma de Gramenet (General) | Team that coordinates climate actions strategies | PRDS: technical background | Key User | Key contact: Rosina Irujo, Mikel Rieg (directors of service) | v | https:// | |
| | | | Santa Coloma de Gramenet (Public space and environment) | Team that coordinates urban planning strategies | PRDS: technical background | Key User | Key contact: Mireia González Sáez (deputy) | v | https:// | |
| | | | Santa Coloma de Gramenet (urban planning and city serv... | Team that coordinates urban planning strategies | PRDS: direct contact with schools | Key User | Key contact: Rafael Moya (housing, planning) and Encarnación Rodri... | n | https:// | |
| | | | Santa Coloma de Gramenet (Education) | Team that operates in climate shelters in schools | CONIS: political changes | Key User | Key contact: Eva López (urban planning) and Jordi Maresma (environment) | n | https:// | |
| | | | Badla del Valls | Departments of planning, environment and health | CONIS: political changes | Key contact: Antonio Martínez Flor (politician), Carlos González (technical dept. territory) | n | https:// | | |
| | | | Castelldefels | Departments of urban planning and environment | CONIS: political changes | Key contact: Claudio Carmona Vargas (politician), David Carabug | n | https:// | | |
| | | | Comerça de Llobregat | Department of territory and public space | CONIS: political changes | Key contact: Joana Fillero Ramera (politician), Eric Termino López (technical dept. social action), Aida Garcia Trillo (health) | n | https:// | | |
| | | | Comerça de Llobregat | Department of environment | CONIS: political changes | Key contact: Blanca Alcenia Gannau (Directora) de Serveis d'Espai | n | https:// | | |
| | | | Comerça de Llobregat | Department of social action, equality and health | CONIS: political changes | | n | https:// | | |
| | | | Hospitalet de Llobregat | Department of Public space, urban planning and sustainability | CONIS: political changes | | n | https:// | | |

15.2 Impetus4Change at ECCA 2023

Bojović et al. (2023) Impetus4Change: Where cities guide the development of novel climate sciences. Poster at ECCA 2023, Dublin.

Where cities guide the development of novel climate sciences

Introduction

Impetus4Change (Improving Near-Term Climate Predictions for Social Transformation) is a research project where urban practitioners, social scientists and climate modellers work together to improve the quality and accessibility of near-term climate information in cities and regions.

Objectives

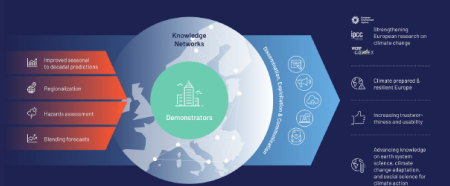
- Provide seamless climate information across timescales ranging from sub(seasonal) to a few decades at local and regional spatial scales
- Enhance accessibility and usability of climate information to strengthen alignment with user adaptation planning needs
- Refine assessments of risk, risk elements and uncertainties due to extremes and associated impacts
- Integrate these advances into a transdisciplinary co-production framework
- Improve understanding of the creation and flow of climate information through knowledge networks, and the potential for scaling out the findings

Methodology

FUNDAMENTAL SCIENCE

KNOWLEDGE CO-PRODUCTION

OUTCOMES > IMPACTS



Impetus4Change has received funding from the European Union's Horizon Research and Innovation programme under grant agreement number 101019745

@I4C_eu impetus4change.eu

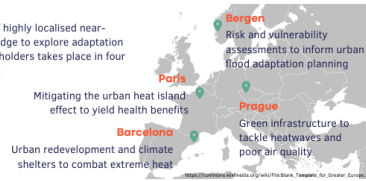
Co-production framework

1. **Engagement.** Co-exploration through stakeholder mapping and discussions between scientists and stakeholders to understand how and what climate services may best fit the local context and raise awareness of climate service potential.
 2. **Involvement.** Co-design of mock-ups of climate services with potential users using existing data. **Adaptalabs** is the platform where scientists and practitioners exchange knowledge in profound discussions related to the structure, data post-processing and delivery formats.
 3. **Empowerment.** Co-development of the final climate services will empower the users to integrate new climate information produced in Impetus 4 Change into their decision making.
- + Co-evaluation runs alongside these steps, focusing on the coproduction process itself as well as the value of the end products.



Demonstrators

The coproduction of highly localised near-term climate knowledge to explore adaptation solutions with stakeholders takes place in four **Demonstrator Cities**



Above: The coproduction framework for climate services

Results, Outputs & Legacy

Alongside climate services implementation and adaptation support guidance packs for each demonstrator, we will synthesise an overall **roadmap of best practices for coproduction of urban climate services**.

More from Impetus 4 Change at ECCA2023:

- POSTER 238 - Upscaling, downscaling and rescaling: how to fit climate services into the real world?
- Weds 21st 12.15: Interactive workshop (Platforms and Services) Selecting stakeholders and users



IMPETUS4CHANGE (I4C)

IMPROVING NEAR-TERM CLIMATE PREDICTIONS
FOR SOCIETAL TRANSFORMATION

Grant agreement ID: 101081555

Call: HORIZON-CL5-2022-D1-02

Type of Action: HORIZON-RIA

Start date: 1 November 2022

Duration: 48 months



Website

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