UCCRN edu | Urban Climate Change Research Network for Higher Education
Climate-Resilient Design, Planning and Governance of Cities

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UCCRN_edu Climate-Resilient Urban Planning, Design and Governance Handbook

Project Results' Lead Partner: Sorbonne Université

UCCRN_edu — Climate-Resilient Urban Planning, Design and Governance Handbook

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Introduction

UCCRN_edu is launched by world-leading higher education institutions affiliated with the Urban Climate Change Research Network (UCCRN, www.uccrn.org), an international consortium dedicated to fostering multidisciplinary knowledge-based cross-sectoral action on climate change mitigation and adaptation from an urban perspective.

An effective action in these domains requires a focus on the dynamics of environmental, social and economic transformations induced by climate change and their interdependencies; on urban policies and their vertical/horizontal integration with stakeholders and local communities; on technical and communication approaches to streamline existing best practices and innovative concepts; on collaborative design and policymaking methods to overcome the observed "implementation gap" in urban climate resilience.

UCCRN, based on the experience gained in 15 years of research, capacity building and support to cities worldwide in shaping local climate policies and innovating governance, planning and design practices, intends to capitalise on the strength of the network to promote a permanent educational platform with a strong multidisciplinary identity and training towards both research and practice.

UCCRN_edu aims at overcoming existing gaps in education on climate-resilient urban planning, design and governance by establishing synergies with leading research and teaching institutions, as well as EU and international networks with relevant expertise in policy and governance dialogue with local governments and communities to streamline climate action in cities.

This handbook has been drafted to reinforce the role of UCCRN_edu as a catalyst for educational and dissemination activities beyond the 3 years of the project, institutionalising the coordination among participating partners and providing them with a common platform for the continuous improvement of mobility programs and cooperation with EU urban decision makers in tackling specific climate challenges. The

Partnership aims at developing an educational alliance to consolidate approaches, methods and tools developed by the UCCRN_edu community to train the next generation of urban climate leaders able to navigate the complexity of the interconnected knowledge domains to foster urban climate action as hybrid and multidisciplinary new professionals, real factors of change in research, design and policymaking.

UCCRN_edu's educational model bridges climate science, urban design, and community engagement to deliver robust, real-world educational outcomes. Recognising urban resilience as an inherently interdisciplinary domain, UCCRN_edu employs iterative, context-sensitive methods to cultivate interconnected thinking in architecture, planning, and governance disciplines.

The program emphasises experiential learning, immersing students in real-world challenges and equipping them with the tools to navigate the multidimensional landscape of urban resilience. This approach contrasts traditional education by fostering adaptability and critical reflection as integral elements of the learning process.

Table of Contents

1.

Handbook Outline

1.1 Overview

1.1.1 Integration of Adaptive Pathways in Architecture, Urban Planning and Governance Curricula

This section presents an overview of the methodological framework and scientific background for advancing education in urban resilience by integrating urban planning, design, and governance. It focuses on contextualising adaptive pathways within pedagogy, framing how these critical topics can be effectively delivered to students while equipping them with the essential knowledge, tools, and skills to become future practitioners engaged in environmental-resilient urban transformation. By exploring key expertise areas and integrating innovative methods in educational experiences, this chapter aims to foster a new generation of climate-responsive professionals.

Urban environments are increasingly recognised as pivotal arenas for addressing climate change through resilience, adaptation, and mitigation strategies. The Urban Climate Change Research Network (UCCRN) has identified five core pathways for guiding urban transformation, outlined in the ARC3.2 assessment report. These pathways offer a foundational framework for cities to implement climate actions effectively, ensuring progress toward sustainable and resilient futures. The pathways—integrating mitigation and adaptation, coordinating disaster risk reduction, co-generating risk information, focusing on disadvantaged populations, and advancing governance, finance, and knowledge networks—serve as actionable guides for cities of various sizes and income levels. They underscore the need for systemic changes across urban energy, water, transportation, land use, and governance systems to address the challenges of a rapidly urbanising world and a changing climate.

The pathways, which have been systematically addressed within UCCRN_Edu to shape the project activities within a common needs framework, are:

- **Integrate Mitigation and Adaptation**, supporting planning and design solutions that reduce GHG emissions while increasing resilience, taking the local context of each city into account to identify actions that result in the most significant benefits.
- **Coordinate Disaster Risk Reduction and Climate Change Adaptation**, integrating these activities into urban development policies through a new, systems-oriented, multi-timescale approach to risk assessments and planning.
- **Co-generate Risk Information**, triggering processes with the full range of stakeholders and scientists that are inclusive, transparent, participatory, multi-sectoral, multi-jurisdictional, and interdisciplinary.
- **Focus on Disadvantaged Populations**, fostering equity and environmental justice and addressing the needs of the urban poor, the elderly, women, minorities, recent immigrants, and otherwise marginal populations often facing the most significant risks due to climate change.
- **Advance Governance, Finance, and Knowledge Networks**, developing robust city institutions through capacity-building and participating in city networks for climate action, supporting urban climate governance in longer planning horizons and adequate funding and implementation mechanisms and coordination.

Education in architecture and urban planning must adopt responsive and interdisciplinary pedagogical approaches to equip future professionals with the ability to implement these pathways effectively. This integration involves moving beyond conventional teaching models to embrace complexity-driven, experiential, and critical learning practices (Antonini et al., 2021).

The guiding themes for the development of UCCRN_edu learning and educational activities have been the shift toward complexity-driven approaches, innovative learning approaches, critical learning and multi-stakeholder dialogue, addressing equity and climate justice in urban design, planning, and governance for climate resilience, and strategies for applied research and knowledge co-production.

- **Shifting Toward Complexity-Driven Approaches**
  Traditional problem-solving pedagogies, emphasising technological solutions, often overlook urban resil-

ience's social, cultural, and ecological dimensions. By contrast, complexity-driven approaches confront the multifaceted realities of urban environments, addressing local vulnerabilities, socio-political dynamics, and environmental challenges (Grigosono, 2020). Such approaches encourage students to develop design solutions informed by critical reflection on fragilities, conflicting interests, and systemic interconnections.

- **Innovative Learning Approaches: Experiential and Contextual Learning**
  Experiential learning models provide an effective framework for fostering interdisciplinary thinking in architecture and urban planning education (Salama2013). These models emphasise active engagement with real-world contexts, enabling students to grapple with the multidimensional challenges of urban resilience (Altomonte et al., 2017). Students gain hands-on experience and develop a nuanced understanding of urban systems by participating in fieldwork and co-producing knowledge with diverse stakeholders. Integrating data from fieldwork during the design process combines scientific evidence with community knowledge, bridging gaps between technical expertise and local insights. This collaborative approach enhances students' problem-solving capacities and fosters long-term partnerships with public actors and communities, promoting inclusive planning, design, and governance practices.

- **Critical Learning and Multi-Stakeholder Dialogue**
  A critical learning model prioritises context-based education and active knowledge generation through dialogue among academia, communities, policymakers, and practitioners. This approach fosters direct student involvement in real-world projects, motivating them to experiment with diverse forms of engagement and develop the skills necessary for effective collaboration. This model equips students to navigate the complexities of urban transformation processes by facilitating exchanges between scientific and tacit knowledge.

- **Addressing Equity and Climate Justice**
  Embedding equity and justice within the curriculum is essential for preparing students to address the needs of disadvantaged populations—including marginalised groups, recent immigrants, and the urban poor—who are often most vulnerable to climate impacts. Teaching students to consider these perspectives within urban resilience planning enhances their ability to design inclusive and effective solutions.

- **Strategies for Applied Research and Knowledge Co-Production**
  Integrating adaptive pathways in education also involves fostering applied research initiatives that position universities as facilitators within broader networks of public authorities, community organisations, and researchers. Universities can drive meaningful urban practices and governance change by creating hybrid interfaces that bridge education, research, policy, and community engagement.

  - Field Data and Co-Production: Incorporating field data into educational projects allows students to blend scientific information with community insights, creating shared evidence that informs action able outcomes. These outcomes can mobilise community action and inform policymaking, fostering inclusive and evidence-based urban development.
  - University as a Facilitator: Universities play a crucial role in establishing partnerships between territo rial agencies and communities, acting as hubs for knowledge exchange and applied research. By engaging students in public debates and collaborative projects, universities can enhance their capacity to influence policy and practice at the local level.
  - Student Engagement in Public Discourse: Encouraging students to participate in discussions on urban transformation fosters their development as active citizens and strengthens their understanding of architects' and planners' social roles in addressing climate challenges.

- **Towards Climate-Responsive Education**
  Integrating adaptive pathways into architecture and planning curricula represents a transformative shift in educating future practitioners for urban resilience. By adopting experiential, critical, and interdisciplinary approaches, educational institutions can empower students to lead systemic urban transformations prioritising equity, sustainability, and resilience. This approach not only prepares students to address the pressing challenges of climate change but also positions them as key actors in shaping the sustainable cities of the future.

1.2.2 A Needed Evolution of the Educational System to Support Climate Resilient Urban Development, Insights from UCCRN ARC3.3

Conferences, journals, and professional societies that facilitate knowledge-sharing within individual disciplines typically support collaboration between research communities and practitioners. However, this intradisciplinary engagement does not necessarily translate into effective interdisciplinary communication and collaboration, which is essential for rapidly advancing climate action. The fragmentation of disciplines starts early in academic pathways when students specialise in fields such as urban planning, architecture, engineering, and environmental sciences. This division is further reinforced through professional training and certification processes, creating rigid disciplinary boundaries that persist into practice.

The divide is particularly pronounced between professionals in the built environment — such as planners and architects — and researchers in the physical, biophysical, and social sciences. Universities often separate these disciplines into distinct academic units, limiting opportunities for cross-sectoral learning. Moreover, research communities remain largely disconnected from practitioners, making translating scientific findings into practical urban solutions difficult. Climate challenges, such as rising sea levels, extreme heat, and intensified storms, require a convergence of expertise from multiple fields to develop effective, science-based, and implementable solutions.

Despite these challenges, applied research in the built environment is increasingly shaped by the urgency of climate change. Research in building physics and urban climate science is now designed with deployment in mind, integrating insights into real-world applications. Various mechanisms help bridge the gap between research and practice, including interdisciplinary networks, joint conferences, and academic-industry partnerships. Innovation activities such as startups, professional consultations, and capacity-building initiatives also provide pathways for collaboration. However, there remains a need for deeper, sustained communication and structured engagement between researchers and practitioners to ensure climate solutions are developed and implemented effectively.

Enhancing these interactions requires building and strengthening bridges between the research and practice communities. This means establishing two-way communication channels that align the priorities and insights of both groups. While architects and planners increasingly recognise the impacts of climate change on the built environment, they often lack in-depth knowledge of the underlying climate science. Conversely, scientists and engineers working in specialised technical fields may not fully grasp the practical constraints and priorities of urban design and planning professionals. Common areas of interest must be identified to foster meaningful collaboration.

To effectively tackle urban resilience's evolving challenges, research and practice must shift towards new modes of inquiry and action. Cities function as socio-ecological-technological systems (SETS. McPhearson et al., 2022) shaped by intersecting social, environmental, and infrastructural dynamics. Addressing climate change requires integrating mitigation and adaptation strategies at multiple scales — from citywide and district-level planning to individual buildings. Effective climate action demands multi-stakeholder engagement, innovative planning tools, and digital platforms to facilitate knowledge exchange and co-creation of solutions.

Ultimately, expanding collaboration between research and practice is critical for accelerating the deployment of climate solutions. Strengthening interdisciplinary connections, fostering the co-production of knowledge, and leveraging new digital tools will enable cities to become more resilient, adaptive, and sustainable in climate change.

As urban planning and design involve multiple stakeholders, truly integrating research into practice requires research-informed co-design approaches, where scientific insights and community-driven knowledge are combined. The Urban Design Climate Workshops (UDCWs) developed within UCCRN_edu exemplify this methodology by embedding research into practical urban design solutions through participatory, bottom-up approaches. By moving beyond theoretical models and prototypes, UDCWs enable cities to implement tangible, climate-resilient interventions.

1.2 Key Educational Goals for Climate-Resilient Urban Design, Planning, and Governance

As part of the UCCRN_edu Multiplier Event in Rio de Janeiro, a side event for the Rio G20 was organised at the Pontifical Catholic University of Rio de Janeiro, Brazil, on March 27, 2024. Supported by the Columbia Global Center in Rio de Janeiro and UCCRN's Latin American and European Hubs, this Expert Meeting brought together international urban specialists as part of UCCRN's Year of Climate Action, outlining five main educational goals for Climate-Resilient Urban Design, Planning, and Governance.

- **Shift Mindsets Toward Climate Action in Cities**
  The curriculum must emphasise the urgency of transformative change across environmental, social, urban, infrastructure, and governance systems. The educational goal is to nurture professionals who can:
  - envision and drive equitable, resilient, and net-zero urban futures
  - develop strategies to achieve just and inclusive transitions that respect biodiversity, protect ecosystems, and ensure interspecies equity while addressing the needs of vulnerable populations.

- **Foster Multi-Scale and Multi-System Connectivity**
  Learners will explore innovative approaches to integrate urban systems across scales, from neighbourhoods to metropolitan regions. This includes:
  - conducting advanced climate risk assessments to inform new building standards, codes, and land-use planning
  - equipping students with the knowledge to address housing and critical infrastructure challenges (e.g., water, drainage, sanitation, energy, transport) through climate-smart strategies that enhance resilience, reduce emissions, and improve equity and well-being
  - introducing conceptual frameworks like water-energy-food and climate-pollution-biodiversity systems to help understand material flows and interdependencies, enabling dynamic and cross-scalar solutions

- **Align City Actors, Investments, and Regulatory Policies**
  A vital goal is to prepare professionals who can navigate and coordinate across diverse stakeholder groups, including governments, private sectors (finance, insurance, real estate), and civil society. Students will gain expertise in:
  - creating conditions for equitable access to finance, particularly for the Global South
  - strengthening governance structures to align policies, mobilise resources, and mainstream climate adaptation and mitigation
  - developing strategies to integrate regulatory, financial, and social objectives into cohesive city trans formation plans

- **Innovate Indicators, Metrics, and Monitoring Tools**
  The program aims to train students to develop and apply cutting-edge monitoring and evaluation tools, ensuring progress toward resilient net-zero cities. Key focus areas include:
  - designing user-friendly, interoperable data systems to monitor diverse urban issues
  - creating local, context-specific tools to address urban challenges, especially in informal settlements
  - linking short-term forecasting with long-term climate models to inform city planning for drainage, flooding, heat mitigation, air quality, and public health

- **Advance Neighborhood Climate Action**
  Students will learn to co-create and implement neighbourhood-scale climate initiatives that bridge community priorities with scientific insights. This includes:
  - engaging diverse stakeholders while acknowledging existing power dynamics
  - testing innovative concepts that combine community-driven needs with climate science to deliver contextually relevant and socially inclusive solutions.
  - empowering communities to take ownership of climate-resilient development processes

1.3 UCCRN_edu Educational Framework

The UCCRN_edu educational program is designed to equip the next generation of urban professionals with the skills and knowledge needed to address climate challenges in cities. It integrates diverse learning modalities, flexible timelines, collaborative degree pathways, and a strong focus on transferable skills. Below is a description of its general structure:

- **Blended, Asynchronous, and In-Person Learning Modalities**
  The program adopts a hybrid model that combines online and in-person learning to maximise flexibility and accessibility. Blended learning integrates real-time virtual classes with self-paced asynchronous modules, allowing students to balance their studies with professional or personal commitments. In-person workshops and field-based learning are central to the curriculum, offering hands-on experience in climate-resilient urban design and planning through scenario-based exercises, studio work, and case studies in global cities. This mix ensures an engaging and adaptive learning environment, fostering collaboration and practical application.

- **Semester and Intensive Formats**
  Students can follow a traditional semester-based structure or participate in intensive, short-term modules depending on their needs. The semester format offers a steady progression through the program, ideal for students who prefer a comprehensive academic experience. Studio activities (planning and/or design) carried out during the semester are linked to the Urban Design Climate Workshops as intensive modules condense learning into shorter timeframes, enabling working professionals or students with limited availability to complete specific curriculum components efficiently. These intensive modules are structured to maintain depth and rigour, ensuring high-impact learning outcomes.

- **Linked Master's Activities and Students' Mobility**
  The program offers flexible degree pathways to enhance its global relevance and accessibility. Students may choose a linked master's degree, where they specialise in climate-resilient urban design as part of an existing master's program at their home institution. Alternatively, a joint master's degree option enables students to pursue an integrated, interdisciplinary curriculum in partnership with international universities. This joint degree fosters global collaboration and provides students with diverse perspectives and networks, preparing them for leadership in climate action across contexts.

- **Credits and Transferable Skills Recognition**
  The curriculum is structured around a credit-based system, enabling seamless transfer of credits between partner institutions and alignment with international academic standards. Alongside academic credits, the program recognises transferable skills, such as climate risk assessment, data visualisation, systems thinking, policy evaluation, and stakeholder engagement. These skills are explicitly assessed and certified through Digital Credentials, ensuring students graduate with demonstrable competencies relevant to diverse career pathways. In particular, UCCRN_edu has issued Open Badges (Urban Climate Resilience Expert, see https://bestr.cineca.it/badge/show/4040?ln=en) to certify the soft skills acquired during the UDCW activities.

- **Resources for Learning**
  The program provides many resources to support student learning and professional development. This includes digital platforms for asynchronous coursework, urban climate datasets, computational tools for scenario modelling, and simulation software. Field-based resources include site visits to partner cities, workshops with local governments and stakeholders, and opportunities to engage with community-based projects. Students also benefit from mentorship by international experts, access to a global network of researchers and practitioners, and career development resources tailored to the growing demand for climate-resilient urban professionals.

1.4 Urban Design Climate Workshops

Within the UCCRN_edu program, the Urban Design Climate Workshops (UDCWs) are pioneering educational initiatives designed to address the complexities of urban resilience in the face of climate crises.

The name explicitly refers to the need to bridge knowledge from the converging areas of "urban design" and "urban climate" to fully embrace Climate Resilient Development (IPCC, 2022) principles in transforming cities by integrating mitigation and adaptation with the improvement of well-being for people and nature. The term "workshop", other than identifying the short-term collaborative teamwork activities, intends to connect to the context of planning, architecture and engineering firms (e.g. RPBW - Renzo Piano Building Workshop), where the word usually refers to a collaborative, hands-on approach to architectural design and construction. Unlike the more conventional term "studio", commonly used for architecture university classes, "workshop" emphasises a craft-oriented, experimental, and interdisciplinary methodology where architects, engineers, designers, and even artisans work together to develop projects.

In this context, the concept of workshop alludes to:

- A culture of collaboration – The office operates like a collective space where ideas are developed through teamwork and interdisciplinary dialogue.
- Emphasis on craftsmanship and prototyping – The firm engages in detailed model-making, materials research, and hands-on testing rather than just theoretical design.
- Iterative design process – Projects evolve through continuous experimentation, sketching, modelling, and technical refinements.
- Connection to traditional and innovative building techniques – The firm integrates artisanal construction methods and cutting-edge technologies.

The UDCW builds on emerging paradigms of contemporary planning, urban design, and architecture through the lens of a resilient and sustainable built environment. The UDCW process views the city as a body of work made by multiple actors, an indivisible and evolving organism shaped by infrastructure, development, public process, and density. To bridge climate science and climate action, policymakers, researchers, practitioners, and stakeholders need planning and urban design strategies to identify, configure and evaluate urban climate factors at a neighbourhood scale. Using scenario-based prototyping, UDCW participants develop scenarios and urban prototypes aligned with climate-resilient, net-zero carbon principles to strengthen community adaptability to climate change, reduce energy consumption in the built environment and enhance the quality of the public realm. With UDCW sites in diverse global cities, the planning process balances bold visions for the city with marginalised communities' access to services.

The UDCW is conceived as a hands-on, capacity-building process that engages urban designers, climate scientists, policymakers, students, and stakeholders. This cross-sectoral planning process envisions how urban design and planning can shape transformative climate action in urban districts. Scenario modelling illustrates likely climate impacts from development and rezoning alternatives, while climate-sensitive prototyping identifies opportunities for GHG mitigation and climate adaptation. Successful UDCWs configure interconnected microclimates and urban systems within the city to achieve reduced energy loads, cleaner air and enhanced civic life.

Drawing from evidence-based knowledge grounded on urban climate science and community engagement, the UDCW methodology has been introduced by the Urban Planning and Urban Design Chapter of the Second Assessment Report on Climate Change and Cities (Raven et al., 2018) and consolidated by the Third Assessment Report on Climate Change and Cities (ARC3.3), including case studies from UDCWs carried out within UCCRN_edu in Napoli, Paris, Durban and New York City. UDCW outcomes emphasise that delivering mitigation and adaptation through integrated urban transformation reflects a value proposition paradigm shift that includes environmental justice, synergies between research and practice, innovative tools, capacity building and a clear roadmap for climate action.

The UDCW brings together urban designers, urban planners, climatologists, policymakers, stakeholders, and graduate students to build local capacity. Climate benefits based on integrated mitigation and adaptation

strategies go hand in hand with social, economic, and environmental co-benefits. Notwithstanding the effective use of prototyping to demonstrate positive outcomes, the goal is to ultimately go beyond "demonstrator projects" to embed these evidence-based approaches in the standard planning and urban design process.

The expectation is that an educational approach in which research informs practice and practice informs research would foster a rapid evolution in the "business as usual" approach to planning and design, where equity and environmental justice go hand in hand with measurable impacts on climate and environmental goals. UCDW methods and tools identify, configure, and evaluate responses to urban climate factors through multi-scale planning and design strategies and solutions informed by multi-disciplinary expertise. Ultimately, the UDCW process is intended to explore the possible "Climate synergies" that can be activated concerning stakeholder priorities, specificities of urban systems, and planning/design opportunities for the study area and the targeted program. This process combines knowledge-sharing and co-design actions with urban decision-makers and local communities and the development of simulations based on computational design tools to control the main indicators determining the performance of buildings and open spaces about climatic stress conditions.

1.5 Beyond Disciplines: Shaping a Cross-Disciplinary Educational Framework for Climate Action in Cities

In his *Summary for Policymakers of the Nexus Report* (IPBES, 2024), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services tackle together five interlinked global crises in biodiversity, water, food, health and climate change. The report shows how these crises interact, cascade and compound each other in ways that make separate efforts to address them ineffective and counterproductive. Focusing on addressing the challenges in just one sector – such as water, biodiversity or climate change in isolation – seriously limits the chances of meeting other goals. More than ever, there is an urgent need to establish a fertile ground for tackling these challenges through an integrated approach. Environmental dynamics and social and cultural diversity have to be considered to contribute to effectively shaping climate actions in cities.

These global changes and societal trends force academic structures to evolve towards greater flexibility, teaching communities to change their practices and students to change their relationship to roles and knowledge. However, complex objects associated with climate, cities, and nature (such as soil, water, and biodiversity) are at the boundary of several disciplines; understanding them demands interdisciplinary research bringing together, among others, climate, ecology, sociology, geography, planning, law, and governance.

We must move away from 'linear explanation' in terms of cause-and-effect to 'multi-dimensional projection' in terms of alternatives, from one-to-many teaching (in which a teacher tells students what to do) to many-to-many teaching in which teachers and students all interact and learn and teach. At the same time, we must develop education systems that stimulate the acquisition of creativity, diversity, and reflexivity. Even if, in doing so, we are handicapped by the silo structure of our key institutions and by the fact that career structures, evaluations, disciplinary momentum and many other factors and dynamics are stacked against this evolution.

It is increasingly necessary to achieve intellectual articulation between theories and practices in different academic disciplines to gain the 'holistic' perspective necessary to deal with today's challenges in the interactions between our societies and their environments.

The literature on co-production between disciplines and stakeholders is booming, but achieving a co-production setting can be an elusive goal, owing to its dynamics' contextual nature, making it difficult to follow any means of 'best practice'. Co-production comes in many different forms. A common understanding is important to ask comparable questions and explore similar hypotheses, thus enabling us to build on what is already known and advance the practice and scholarship of cross-disciplinarity.

1.5.1 From Pluri- to Transdisciplinarity

The first stage for researchers and practitioners who commit to a cross-disciplinary project is to define and situate the degree of interaction among disciplines involved and reflect on the definition of the kind of cross-disciplinarity they experienced. Complexity is added because the degree of interactions demanded between disciplines depends on the project's purpose.

Cross-disciplinary interactions can be characterised across four different levels of integration (Blanchard and Jean-Paul Vanderlinden, 2010). First, *pluridisciplinarity* encourages several disciplines to coexist within the same entity (e.g., a university) without requiring exchanges. Cross-fertilisation does not exist. *Multidisciplinarity* meets distinct disciplines around a common study theme, although each can retain specific rules, methods and tools. For multidisciplinarity in general, cross-fertilisation is limited. *Interdisciplinarity* allows the exchange of concepts, rules, methods and tools among different disciplines to achieve a global understanding of a common theme. In this case, cross-fertilisation leads to a progressive blurring of disciplinary boundaries. Finally, *transdisciplinarity* is a process of integration that overcomes disciplinary boundaries for a more complete understanding of a complex world. It differs from interdisciplinarity to the extent that a new discipline is created with its codes and tools. In general, in the academic community, the goal is interdisciplinarity.

This leads us to define interdisciplinarity structured around four main dimensions. First, interdisciplinarity aims to structure different sources of knowledge around a common topic that specialised disciplines cannot answer. The second dimension of interdisciplinarity — the sharing of tools, methods, and approaches across disciplines — should be part of an evolving process of knowledge construction. The more distant and divergent the disciplines are, the more time is needed to learn about each other's language and methods. The third dimension relates to the recognition that every discipline brings a valuable perspective and horizontality in the disciplines' participation, contribution and efforts. Finally, the fourth dimension, reflexivity, is related to the capacity of a researcher to recognise his or her personal and environmental influences and adapt his or her relationship to other researchers and other disciplines.

Mechanisms or means to achieve interdisciplinarity strongly depend on the project's structure and design — the project's scope, size, sociopolitical context, and differences in national culture. Two critical values might help researchers and practitioners involved in interdisciplinarity structure their projects in a more systemic way. They are confidence and reflexivity (Vanderlinden et al., 2012). Confidence fosters trust and openness to collaboratively reflect on and discuss the tensions in intercultural and interdisciplinary settings.

Interdisciplinarity must be strongly linked with a process of reflexivity: being involved in a cross-disciplinary dialogue and learning about methods, data, and values of other disciplines helps researchers and practitioners to reflect on their discipline and from the rules that define it and transcend unconscious thinking processes by reflecting on their personal habits, values, interests and representations.

Indeed, the interdisciplinary co-construction of knowledge has repercussions in the various disciplines involved in a project, thus instilling changes in research and practices toward the integration of different kinds of knowledge — a necessary step in responding to social expectations regarding the project of climate-resilient design, planning, and governance of cities.

1.5.2 Putting Interdisciplinarity into Practice through UCCRN_edu

There are many means of accomplishing cooperation between actors and integrating knowledge across disciplines. In UCCRN_edu, the ways to achieve the interfacing of different disciplines have been multidisciplinarity and interdisciplinarity in the broadest sense (the quality of interdisciplinary science is mostly dependent upon the ability to define, collectively and explicitly, common objectives).

It was mainly during the UDCW that a process of "interdisciplinarisation" was developed. Project-based and collective work between students and staff from the participating universities has enabled dialogue between a plurality of knowledge fields and competences, co-construction of actions to be carried out, and choice of common working methodologies, as well as the inter-knowledge between workshop participants.

Senior Academics

First of all, the UDC-W has been a collective experience of and for senior academics themselves, with the aim of' bending' minds around to thinking in new, uncharted ways (not forgetting the fundamental importance of interactions with the "external" stakeholders, such as local authorities, professionals, and associations). In short, academics have been teachers AND experimenters on the journey to interdisciplinarity.

As mentioned above, "interdisciplinarisation" has been implemented by partners hosting a UDCW that conceived a hands-on capacity-building process that engaged urban designers, climate and ecology scientists, policymakers, students, and stakeholders. UDCW reports that the texts (in annex) bear witness to the diversity and richness of the design, organization and implementation of the fields, issues, methodologies and teaching methods. They constitute a catalogue of possible ways of cooperating between disciplines and stakeholders, which can sometimes go as far as incorporating the partners' visions, thus approaching transdisciplinarity. Moreover, the specific tools designed to support the process can be used within educational activities involving teachers, experts and students, both for training and capacity building of city practitioners, local authorities, and so on.

Students' Perspective

Informal discussions with the students show that temporary immersion in interdisciplinary situations, thanks to the UDCWs, is a highly enriching experience, among other things, confronting disciplines with which they were only marginally familiar (as taught in different curricula at university). They move from the student status to that of "expert" (since, within the working group, they bring their disciplinary knowledge outside of their teachers) and must find their place in the group so that their concerns and disciplinary knowledge infuse discussions and decision-making. In short, the UDCWs were a window into their future professional lives, revealing the difficulties and avenues for action.

These discussions also highlighted the need for students to benefit from a learning-to-work-together methodology at the start of the workshop, which will be a valuable asset both in UDCW-type schemes and in their future professional lives.

Student Feedback from Naples UDCW, Collected During the Final Day's Social Networking Event (Oral)

The collective project aimed to build an urban climate resilience plan for the San Giovanni a Teduccio district in the eastern suburbs of Naples. We divided into three working groups. The first was tasked with drawing up a master plan for the city based on an analysis of environmental problems. The second group was tasked with devising solutions for the development of the district's buildings and public spaces to create a city resilient to global warming (based on the models of "green city", "zero-waste city", "15-minute walk city", and so on). The third group's mission was to work with residents to integrate their vision and needs into the resilience plan to protect them against global warming while combating social segregation and economic inequalities.

As part of this third group, we mainly carried out fieldwork. First, we visited the neighbourhood we were studying to understand how it was built and laid out and to observe the daily life of its inhabitants. We had the opportunity to talk to several residents, students and shopkeepers. The aim was to understand their way of life in this neighbourhood and identify the present and future problems linked to global warming they were facing, in addition to living in a socially and economically disadvantaged area where access to education and culture was far from valued. Next, we spent time with representatives of local associations and public decision-makers to co-construct a map highlighting key areas to work on and their visions for the future.

In the end, we were able to identify the environmental and social problems associated with the neighbourhood's layout and construction, put forward a plan for redeveloping the area, and reinvent a new daily life for local residents.

We chose to present our work in the form of a video (https://youtu.be/ilKyMvfJp-A?si=BubD9AmfYSaKBySJ) to reach listeners through sensitive means, image, and sound, as we were able to experience. We had the opportunity to chat with local residents, sample local specialities, and explore the streets up close.

The program enabled us to discover the city of Naples holistically: the bibliographical work we carried out before the project enabled us to start with hypotheses we had to test. We discovered new facets of the city on the spot. One of the most remarkable things was a new vision of the city as an ecosystem that evolves under the constraints of climatic, social and historical pressures. Reflections on adaptability, the relationship between the architecture of the past and the need for modernity, or the climate that changes with human activity are universal questions, valid well beyond the city in the shadow of Mount Vesuvius.

1.6 A feedback from UCCRN_edu UDCWs

Urban Design Climate Workshops (UDCWs) constituted a major part of the effort to innovate educational approaches, methods, and tools in the context of the UCCRN_edu project. Seven UDCWs, organised by different host partners (Table 1), brought together students and staff from the nine participating universities.
In the following subsections, we present the reflections of the UDCW hosts on selected UDCWs focussing on:

- **Preparations**: The time needed to identify a suitable case study, gather appropriate supporting data, and organise relevant talks and event space.
- **Multi- and Interdisciplinary**: The extent to which different disciplines were integrated into the programme (students and staff).
- **Innovation**: What did you add/innovate? Based on other UDCW events, how did this event differ? How did this event build upon previous UDCWs?
- **Community**: An important part of the UUCRN_edu philosophy is the engagement with local communities to include their perspectives on (re)development.
- **Fieldwork**: This is an important element of the UDCW events, allowing the team to see the project in context. How did fieldwork contribute to UDCW objectives?
- **Final Thoughts**: How did the UDCW meet your expectations? What would you have done differently, and what can be done to improve the educational experience?

Urban Design Climate Workshop	Main Goals
Paris Université Gustave Eiffel May 28 to June 3, 2022	To support the climate-resilient transformation of the Porte de Montreuil area. The aim is to produce multi-scale design solutions supported by robust climate, environmental and social analyses with local government, practitioners and communities.
Aalborg Aalborg University November 20 to 26, 2022	To support the climate-resilient transformation of Østervold and Middelalderbyen areas for short to medium-term developments, also considering the long-term development plan of Flodbyen Randers. The aim will be to produce multi-scale design solutions supported by robust climate, environmental and social analyses with local government, practitioners and communities.
Barcelona Universitat Internacional de Catalunya March 18 to 24, 2023	To support a “heatwaves-resilient transformation strategy” for the coastal town of Sitges (Southern Barcelona regional metropolitan area). The goal will be to support the city in designing “heat shelters” and proposing planning and policy schemes to adapt the city to the forthcoming summers. The final aim is to work and push the city to integrate heat-planning with other shocks and stresses (i.e. flooding, water scarcity) responses toward a holistic climate resilience agenda.

Urban Design Climate Workshop	Main Goals
Dublin University College Dublin June 4 to 10, 2023.	To support plans for a zero-carbon neighbourhood in Dublin City. The aim will be to produce multi-scale design solutions supported by robust climate, environmental, and social analyses carried out in collaboration with government officials, design and planning practitioners, and local communities.
Napoli Università degli Studi di Napoli Federico II March 18 to 24, 2024	To support plans for a resilient district in the city of Naples. The workshop will involve representatives from the municipality in developing an update on the Napoli City Plan. Local community associations will be the primary contact to involve citizens, residents and private stakeholders in the knowledge-sharing and co-design activities implemented during the WS.
Rotterdam IHE-Delft Institute for Water Education June 3 to 9, 2024	To support plans to redevelop Merwe-Vierhavens (M4H), a former port area in Rotterdam. An important aspect of the tasks will be to adapt this unbanked area to cope with future climate change-driven water challenges. Each day, a different stakeholder will impose new goals and constraints that will add to the complexity of the task; teams need to be agile and able to change their strategies and proposals. Also, teams are challenged to rethink their education and contribute to a new curriculum focussing on the next urban climate resilience officer. These outcomes will be presented parallel to the workshop at the Urban Future Conference.
Charleroi University of Mons October 26th to November 1st, 2024	To support plans for the 'clean' development of the "Porte Ouest" case study by 2050 based on the master plan by Studio Paola Vigano validated by the city of Charleroi and the Walloon Region in 2021. The aim will be to produce multi-scale design solutions supported by robust climate, environmental, and social analyses carried out in collaboration with government officials, design and planning practitioners, and local communities, such as the Cleantech District. The student will conduct comprehensive urban analyses and propose sustainable and resilient solutions.

1.6.1 Dublin UDCW

The focus of the Dublin UDCW was the planning and design of a zero-carbon neighbourhood. The selected case study site is City Edge, which describes a large (700-hectare) site west of the city centre. The plan for this site is based on public-private partnerships to transform the current land cover from mostly light-industrial and commercial uses to a high-density mixed-use development with high-quality green spaces. The challenge for this UDCW is to plan and design a low-carbon neighbourhood that is integrated (economically and socially) into Dublin.

The first two days were based on fieldwork on microclimates (UCD campus), city-scale land use, land cover, and climate impacts. The UDCW work was completed in the Urban Design Studio on the UCD campus from Tuesday to Friday. In this workshop phase, the students were divided into teams to focus on planning, design

and people. On Saturday, the work of the students was presented. Throughout the Workshop phase, experts presented work on Dublin's plans to become zero-carbon, on models and techniques to support carbon management and on the City Edge project.

UDCW Dublin Schedule
Sunday 4th June. UCD Village
Urban Climate Walk UCD: The walk introduces microclimate types and the physical controls on the climate near the ground. The walk will select specific environments to discuss the relationship between surface cover and climate outcomes.
Monday 5th June. City centre
Dublin City & City Edge field study: Place the case-study area in the context of Dublin's climate change policies and its commitment to achieving zero Carbon. An overview of the geography of the city and its building patterns. The second half of the day examines the neighbourhoods in the west of Dublin, especially the areas of Inchicore and Kylemore. The latter is one of the five districts that comprises the City Edge
Tuesday 6th June. Urban Design Studio
Review of materials: Introduce UDCW and organise the Design/Plan work for the remainder of the week. Talk: Zero Carbon Dublin Sabrina Dekker, Dublin City Council's Climate Officer, who will outline the City's plans to manage carbon in the context of its status of an EU 100 city. These Teams should work in the afternoon on their component of the study. The Govern team: This team will go by public transport to Inchicore to meet with the Community group (Common Ground). We will be introduced to the issues that face residents of the neighbourhood with is adjacent to the Kylemore site, including the provision of green spaces and social housing.
Wednesday 7th June. Urban Design Studio
Talk: Models to support zero-carbon design/planning. Dr. Niall Buckley (IES) will discuss the tools available to evaluate pathways to design and plan zero Carbon neighbourhoods using Urban Building Energy Models (UBEMs). Talk: Bio-solar roofs in cities. Emmanuel Gendreau (Sorbonne) will present on the potential for using roofs in cities as a resource. Each team to give a present short verbal presentation on the status of the work. We will be joined by Francesco Pilla (Professor of Smart Cities at UCD).
Thursday 8th June. Urban Design Studio
Talk: From Edge City to City Edge. Philip Lawton (TCD) and Carla Kayanan (MU). Places the project in an international urban context.
Friday 9th June. Urban Design Studio
This should be a status report from the teams and a discussion of the work for the day. An important part of the workplan should including writing tasks and the development and inclusion of graphics (including maps, figures, and photographs) and tables. As the emphasis in this workshop is on Carbon, the text should place the work in this context. At the end of the day, we should have a first draft of the text and of a presentation of this work
Saturday 10th June. UCD Village
Formal presentation of work. This event will take place in the UCD Village. Each team will present the work, along with an overview to the audience.

- **Preparations**: Gathering the data to support UDCW activities can be very time-consuming, depending on the topic of the workshop, its structure and the required tools. In the case of Dublin, the topic was climate change mitigation (zero-carbon) and the redevelopment of a site (City Edge). However, consideration the topic of the workshop, its structure and the required tools. In the case of Dublin, the topic was climate change mitigation (zero-carbon) and the redevelopment of a site (City Edge). However, consideration was also given to projected climate change to ensure future resilience. The workshop was run from June 4-10th out of the teaching term at UCD. The advantage of the timing is that we could provide campus accommodation and teaching space for the students.
  The materials collated for the UDCW included information on the City Edge project and geographic data on landscape, population and climate. This information was made available through a shared drive and selected printed maps of the study area. The expertise includes GIS, so most of the geographic information can be obtained relatively easily from local sources (including state mapping and environmental and census organisations); this was supplemented by information gathered by the host organisation on trees. Climate information was obtained from Met Eireann, the national meteorological service. In addition to these supporting materials, relevant speakers must be invited, and arrangements should be made with appropriate community groups.

- **Innovation**: The Dublin event was the fourth UDCW, following climate-sensitive redevelopment (Paris), climate change and flooding (Aalborg), and climate change and heat (Barcelona). In terms of scope, the Dublin workshop was closer to Paris than Aalborg and Barcelona, which focused on adaptation strategies for particular hazards.
  The Dublin event was distinguished by its focus on achieving zero Carbon (0C) cities, a stated objective of the Dublin City Council (DCC). Achieving 0C requires a systemic change in how cities function, often expressed as urban metabolism, which describes the range and magnitude of the resources used by the city, including the generation of waste. Rather than take on the challenge of redesigning the existing city, the workshop focused on the (re)development of a large site close to the city (City Edge). Light industrial and commercial facilities currently occupy this site, and the current strategy is to rely on incentives to change the landscape to a mixed-mode urban quarter. The workshop focused on a section of the City Edge site bounded by roads and rail routes and divided by a canal.
  The Dublin event followed the example of the Paris UDCW and divided the students into three groups, each with a specific task.

Team	UDCW Brief
Plan	Focus on the infrastructure and layout of the area to facilitate the people and design teams. This should cover the land use considerations and justify the decision-making in carbon terms.
Design	Consider the type of buildings and layout to accommodate the residents/ workers/visitors identified by people. It should look at a sample of built and natural environments and seek to maximise opportunities for enhancing green spaces. It should also account for existing land cover and residents.
People	Focus on the infrastructure and layout of the area to facilitate the people and design teams. This should cover the land use considerations and justify the decision-making in carbon terms.

- **Multi- and Interdisciplinary**: The Dublin UDCW was organised by the School of Geography at UCD. The organiser's expertise is on the climates of cities, that is, the urban effect on temperature, wind, etc., as a consequence of urban planning and design. The student and staff participants were drawn from architecture, engineering, urban design and the social sciences. Naturally, the composition of the speakers must fit with the workshop's focus. In this case, we included the Climate Officer of Dublin City, who oversees the city's climate mitigation strategy, as a key speaker. In addition, we included speakers on the City Edge project and building energy modelling. In retrospect, the workshop would have been enhanced by including other perspectives, especially those related to private developers who could have provided insights on the financial constraints on redevelopments within the context of 0C.

- **Community**: An important part of the UUCRN_edu philosophy is the engagement with local communities to include their perspectives on (re)development. In the case of the City Edge site, apart from a small site occupied by the Irish traveller community, there are few residents. To compensate, we identified a local community group located nearby that could provide insights into the concerns of residents in the city. These include the availability of affordable housing, access to green spaces and community services. In this respect, the community engagement component of the UDCW was primarily an educational exercise.

- **Fieldwork**: The fieldwork for this UDCW took a full day and included a survey of the City Edge ite. However, as the workshop topic was 0C, participants needed to place the site in the context of the city as a whole. Hence, the field trip used the city's light rail system (LUAS) to complete a cross-section of the city centre. This allowed us to discuss the metabolism of the entire urban area and visit different sections of the city that are distinguished by their land use (commercial, residential, etc.), age and protected status, and land cover. This fieldwork was completed on the first working day of the UDCW and set the context for the discussion. During the week, some groups returned to the site.
  Separately, on Sunday, all the student participants who were in residence on the UCD campus completed an urban climate walk. The focus of this walk was the drivers of micro-climate variation, and it was used as an opportunity to teach and discuss how urban features (buildings, paving, green spaces, trees, and ponds) can be used to create pleasant outdoor spaces.

- **Final Thoughts**: Given the work's scope and the limited time available, the UDCW can be considered a success.
  The structure of the event, especially the integration of lectures and fieldwork, was a success from a course management viewpoint. Moreover, using on-campus accommodation made it easier to develop teams over the available days.
  However, some issues should be improved.
  - The need for preparation before the event. This requires that student attendees be identified well before the event so that the case study can be introduced and work takes place before the workshop. Practically, this is difficult to achieve, and the real issue is how to balance the ambition of the workshop with the abilities of the students.
  - Consideration for how best to balance the needs for teamwork focussed on specific tasks (such as design) and for integration among teams to ensure coherence. This is a challenge as the student body has diverse skills that are not necessarily fitted to the specific UDCW tasks — hence, the course directors need to be aware of the need to act to overcome barriers to collaboration.
  - Improved tools for the zero carbon challenge. During the workshop, it was apparent that there is a lack of consistent tools for assessing the Carbon' price' of various design and planning decisions. For example, the Carbon consequences of local energy generation versus local food production and the use of sustainable building materials need to be evaluated consistently to ensure that the final plan is compatible with the zero carbon objective.

1.6.2 Rotterdam UDCW

The Urban Design Climate Workshop (UDCW) in Rotterdam presented an innovative approach to urban design focused on climate resilience and sustainable urban development. The workshop's primary objective was to equip participants with the necessary skills and interdisciplinary knowledge to address complex challenges such as flood risk, stakeholder engagement, and sustainable infrastructure in the redevelopment of the Merwe-Vierhaven (M4H) district.

Unlike traditional "Waterfall" design methodologies, which emphasized sequential processes, the UDCW adopted a rapid prototyping approach. This process-oriented framework encouraged iterative learning, continuous feedback, and adaptability to evolving challenges. The workshop fostered collaboration between disciplines, communities, and technical experts to co-create solutions that enhanced urban resilience and livability.

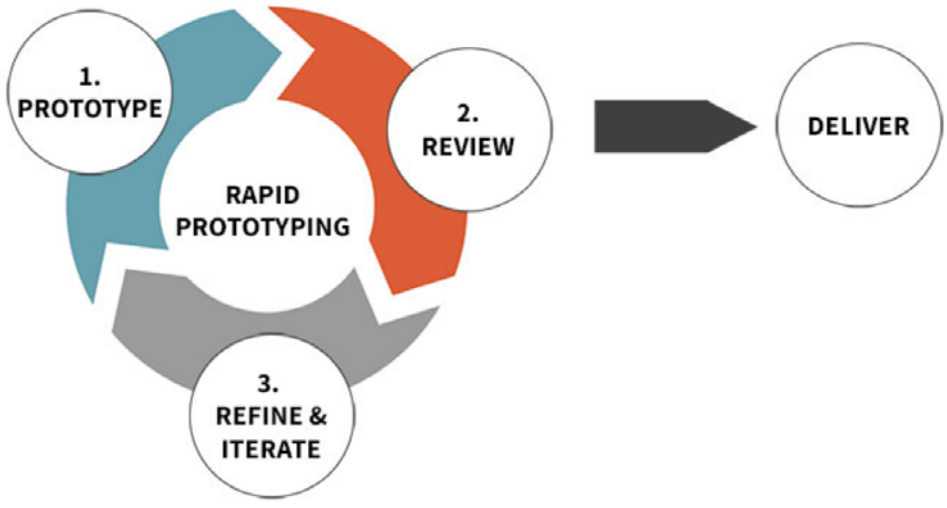
UDCW Rotterdam Schedule
Sunday 2th June 2024. City Centre
Urban Climate Walk UCD: The walk introduces microclimate types and the physical controls on the climate near the ground. The walk will select specific environments to discuss the relationship between surface cover and climate outcomes.
Monday 3th June. Merwe-Vierhavens Analysis
Orientation and Analysis: Participants analyse the existing master plan of the M4H area, assessing its strengths and weaknesses. They explore the area on foot to observe and document site characteristics, using this information as a foundational understanding for future iterations. Talk: DELVA: Merwe Vierhavens. Presentation about the masterplan for the case-study area by the landscape design office responsible for the current masterplan. Mini-lectures on climate change, flood resilience, adaptive planning, by team request
Tuesday 4th June. 1st Iteration
Iteration 1: Stakeholder Interests: Participants integrate the interests of three main stakeholders: the municipality, the port authority, and local residents. Each group's priorities differ, necessitating innovative design solutions that balance commercial goals, municipal interests in multifunctional neighbourhoods, and residents' needs for a liveable environment with common functions. Talk: Buro Sant en Co: A good plan has many fathers - Roof Park Rotterdam. Presentation on the design of the multifunctional levee 'Dakpark', which borders the case-study area. As Europe's largest roof park, the project combines flood defence, retail and recreation/nature. Mini-lectures on climate change, flood resilience, adaptive planning, by team request
Wednesday 5th June. 2nd Iteration
Iteration 2: Balancing Density and Green Space: Drawing on WHO's recommendation of nine square meters of green space per inhabitant, participants calculate the area's population capacity under varying design scenarios. They are tasked with maximizing housing while retaining sufficient green space, using methods such as vertical gardens and roof terraces to accommodate increasing density without compromising green areas. Talk: Frank Lee - NK Tegelwippen. Presentation on the successful campaign for de-paving private and semi-private areas to enhance stormwater infiltration and reduce urban flooding. Mini-lectures on climate change, flood resilience, adaptive planning, by team request
Thursday 6th June. Imagination at Work-Session
Special session: Imagination at work: Role of Creativity in Education. On Thursday, the workshop diverted from standard activities to emphasize creativity's role in design education. Each team prepared a presentation evaluating their university education, highlighting areas that either fostered or inhibited creative problem-solving skills. The presentation focused on whether their academic programs supported creativity—an increasingly vital skill in addressing contemporary "wicked problems." This session encouraged participants to reflect critically on their academic experiences and to consider alternative educational models that prioritized creativity and adaptability in the face of complex urban and climate challenges. The afternoon concluded with a panel discussion, where educators and practitioners exchanged perspectives on fostering creativity in design education, further enriching the learning experience. Talk: Studio Blended – Interdisciplinary curriculum design. Short lecture and workshop on curriculum design, paradigm shifts, transitions

UDCW Rotterdam Schedule
Friday 9th June. 3rd Iteration and Final Presentations
Iteration 3: Adding Value. Building on previously developed climate-adaptive features, participants enhanced these elements by integrating "experience value." This concept involved making climate adaptations functional and aesthetically appealing, creating spaces that served both residents and attracted visitors, blending utility with community enrichment. Mini-lectures on climate change, flood resilience, adaptive planning, by team request
Saturday 10th June. Application on-site
Application. Teams validate their proposals on-site and discuss feasibility with other teams, experts as well as local stakeholders form the area.

- **Preparations**: To maximise their learning experience, participants were encouraged to familiarise themselves with the existing M4H master plan, environmental reports, and urban design frameworks. Preparatory activities included:
  - Reviewing maps and historical data on the M4H area.
  - Understanding local climate risks, particularly flood risk and adaptation measures.
  - Engaging with interdisciplinary literature to better grasp urban sustainability challenges.
  - Exploring case studies of similar redevelopment projects for inspiration.

- **Innovations**: The UDCW Rotterdam introduced an alternative approach to conventional urban design workshops by integrating rapid prototyping and design-driven research (see Figure 1). This format allowed participants to employ an iterative design process to create, test, and refine their ideas through multiple feedback loops. Rapid prototyping enabled the exploration of various urban design concepts under different constraints, fostering adaptability and creativity. For example, participants were encouraged to test multiple approaches to balancing urban density with green space, integrating feedback from peers and stakeholders at each stage.
  The workshop's structure attempted to overcome common issues such as "white paper syndrome" by initiating each project with a default design template, which participants then adapted through multiple iterations. This format supports a dynamic learning environment where design solutions evolve under daily adjustments in response to new requirements and constraints, emulating real-world conditions. The use of iterative prototyping helps foster a design-driven research mindset, encouraging participants to learn through repeated attempts and to embrace mistakes as learning opportunities. This structure builds essential design skills that benefit from hands-on practice, where theory and application continuously intersect.

Figure 1. Schematic representation of rapid prototyping stages in the workshop.



- **Multi- and Interdisciplinary**: The UDCW Rotterdam was structured to unite various disciplines, fostering an interdisciplinary learning environment crucial for addressing complex urban challenges. Participants included students and professionals from various fields, such as:
  - **Urban Planning and Architecture**: Contributed expertise in spatial design, zoning regulations, and urban morphology. Urban planners focused on optimising land use while ensuring compliance with municipal guidelines, whereas architects explored innovative building designs that promoted sustainability and aesthetic coherence.
  - **Environmental Science and Climate Engineering**: Specialists in these fields provided crucial insights into the environmental impacts of urban development. They examined flood risk mitigation, soil quality, and air pollution, ensuring the proposed designs incorporated climate adaptation strategies.
  - **Social Sciences and Community Development**: Sociologists and community engagement specialists brought valuable perspectives on social inclusivity, affordability, and public participation. They inter viewed local stakeholders and analysed socio-economic data to ensure that proposed solutions effectively addressed community needs.
  - **Business and Economics**: Economic experts contributed to the financial feasibility of proposed inter ventions by assessing investment potential, economic viability, and cost-benefit analyses. They provided recommendations on funding strategies and public-private partnerships.

  This multidisciplinary approach enabled participants to break down silos and work collaboratively, leading to more holistic and well-rounded design solutions. For example, during the workshop's stakeholder engagement sessions, urban planners worked closely with social scientists to develop mixed-use spaces that balanced economic goals with social inclusivity.

- **Community**: The Merwe-Vierhaven area, which acted as the case study area, consists largely of an abandoned brownfield sparsely populated by experimental new developments. The workshop attempted to engage with various stakeholders, including artists, design studios, urban farms, retail, and other users in the area.

- **Fieldwork**: Fieldwork was an essential component of the UDCW Rotterdam, offering participants first-hand experience in assessing the M4H district's urban conditions, infrastructure, and environmental challenges. The fieldwork activities were designed to ground participants' theoretical knowledge in practical observations, enabling them to develop site-specific solutions.
  - **Site Analysis**: Participants conducted detailed site visits to document existing conditions, focusing on key aspects such as infrastructure, green spaces, water management systems, and social activity zones. Field observations provided crucial data to inform design decisions.
  - **Photographic and Spatial Documentation**: Extensive photo documentation and spatial mapping exercises were carried out to capture the district's visual and physical characteristics. These records were used for reference during the design iterations.
  - **Stakeholder Engagement in the Field**: Teams engaged directly with local businesses and community representatives, gaining insights into their daily challenges and opportunities for improvement.
  - **Climate Risk Assessments**: Participants identified flood-prone areas using GIS and flood simulation models and explored nature-based interventions, such as elevated pedestrian pathways and green buffer zones, to mitigate these risks.

- **Final Thoughts**: The Urban Design Climate Workshop in Rotterdam exemplifies a shift from traditional, product-focused design workshops to a more process-oriented approach. This model offers an immersive experience that mirrors real-world urban design's complex, often unpredictable demands by emphasising rapid prototyping and iterative adaptation. Including Figure 1 as a reference point throughout the workshop provides participants with a clear understanding of the design stages, fostering a continuous, cyclical approach to learning. This rapid development model builds technical skills and promotes adaptability, interdisciplinary collaboration, and creativity, positioning participants to tackle the evolving challenges of urban climate resilience effectively.

  Unlike many conventional design workshops, this program offered participants multiple avenues for feedback, emphasising the value of reflection and adaptation in the learning process. Daily assessments were conducted through short presentations styled in the PechaKucha format (20 slides, 20 seconds each), where participants presented their revised designs and engaged in discussions with the expert who set the

day's objectives. This iterative feedback loop reinforced the rapid prototyping model, ensuring participants continuously adjusted and refined their designs rather than waiting for final evaluation.
Participants also provided feedback on the workshop in open discussion sessions and anonymously via an online questionnaire. Although responses were predominantly positive, some students reported challenges adapting to the workshop's fast-paced format and forming productive working relationships within their multidisciplinary teams. However, these difficulties were an inherent part of the workshop's design, which aimed to simulate real-world collaborative conditions where flexibility, quick adaptation, and effective communication were key to project success.

1.6.3 Napoli UDCW

The focus of Napoli UDCW was a multi-disciplinary urban planning and design-oriented proposal aimed at supporting plans for the district of San Giovanni a Teduccio in the east suburb of the city of Naples. Students are confronted with an area of exceptional complexity due to the overlapping of social and environmental issues, in which innovative climate-resilient development concepts are needed to propose transformative pathways, integrating multi-hazard resilience linked to climate, volcanic and pollution risks with socio-economic and environmental co-benefits for local communities.
The objective was to identify suitable climate-resilient strategies after interacting with local decision-makers, stakeholders, and communities through knowledge-sharing and co-design exercises. Local community associations were the primary contact for involving citizens, residents, and private stakeholders in the knowledge-sharing and co-design activities implemented during the WS.

UDCW Napoli Schedule
Monday 18 March DiARC & San Giovanni a Teduccio
• Check-in of students and warm-up exercise • Opening conference • San Giovanni a Teduccio Site Visit: The site visit led by local hosts highlighted existing climate and environmental challenges, official plans and policies in the area, socio-economic challenges and community priorities. It included onsite exchanges with local stakeholders and community representatives. The visit closed with a social event at the S. Giovanni a Teduccio beach.
Tuesday 19 March DiARC
• Group exchange ONE #Site impressions • Climate analysis mapping & Preliminary design concepts: Site Opportunities and Constraints, Urban Climate Goals, Climate Scenario Projections, Community features/socio-spatial characteristics.
Wednesday 20 March San Giovanni a Teduccio & Societing LAB
• Session ONE with local stakeholders • Collaborative Mapping, A day in the life, City Visions: The synergies between Community Priorities and Urban Climate Factors were mapped in consideration of key social, economic, and environmental drivers. sustainable and climate-resilient city visions with urban design strategies. Facilitation exercises were proposed by UCCRN team in synergies with students to collect bottom-up inputs. • Session TWO with local stakeholders
Thursday 21 March DiARC
• Group exchanges TWO #Cross fertilization • Students team working: Evaluating Win-Win Synergies: analyzing and configuring interconnected micro-climates and urban systems; bridging climate benefits and social/economic/environmental co-benefits, Multi-scale meta-design strategies; GIS and 3D Simulation and modelling.
Friday 22 March DiARC & RIOTStudio
• Group exchanges THREE #Joint project communication • Students team working: Presentation finalization. • Students' final presentation and closing social event

UDCW Napoli Schedule
Saturday & Sunday
• Debrief and city visit & Free day and leaving of participants.

- **Preparations**: The organization of the workshop has been started two months early in order to: 1. define the case study area and make available background materials; 2. engage local stakeholders and coordinate with them community activities; 3. manage the event spaces; 4. coordinate on-line preparatory activities with students; 5. manage registration of the students, accommodation and workshop agenda. The case study of San Giovanni a Teduccio has been individuated according to ongoing research projects at DiARC (UNINA) and to the expertise of the UNINA UCCRN Team. The background material has been gathered by the UNINA UCCRN Team researchers and made available in a Google Drive repository.

- **Innovation**: The Napoli event is distinguished by the complexity of the Napoli Est area, which refers not only to the multi-hazard condition of the site but also to the socio-spatial challenges related to high poverty, unemployment, illiteracy, and crime, compounded by environmental degradation due to inadequate urban planning following the 1980 earthquake. Post-earthquake residents are among the most vulnerable, primarily due to a lack of services and a long-term economic plan. However, their social vulnerability is mitigated by various grassroots initiatives that promote community participation and cohesion in response to their challenging social-ecological conditions.
  Given this scenario, most of the innovation of the UDCW experience lies in the "innovation from community activities": the innovation of this process lies in the combination of creative and interactive tools that actively engage participants. Activities like the "Character Mix & Match icebreaker" and dynamic tools like the "Derive Bot" introduce playful and immersive elements, fostering collaboration and exploration. This approach bridges theoretical learning with real-world application, providing practical experiences that enhance understanding of the topics. Additionally, actively involving the community and students at every stage of the process strengthens their sense of belonging and transforms the entire journey into an experience of co-creation and shared innovation. Each stage of the process becomes an opportunity to explore, experiment, and learn collectively, transforming the workshop into a space of open and shared innovation where learning is not one-directional but reciprocal and enriching for all participants.
  The Napoli event divided the students into three groups, each with a specific task.

Team	UDCW Brief
Group 1 Masterplan & City/ Neighbourhood Scale	Group 1 worked on developing a concept masterplan considering environmental analyses and strategies based on interactions with local decision-makers, stakeholders, and communities through knowledge-sharing and co-design exercises. Future city visions were considered urban strategies embedding mitigation and adaptation measures (green-blue/15 minutes/zero carbon/ circular city). Planning studies were developed according to current and 2050 climate analysis mapping, with a post-intervention evaluation supported by the UCCRN_edu Toolkit. Detailed analyses deepened ecosystem-based approaches with insights on designing and managing NbS and green-blue-brown infrastructures for sustainability and resilience. *Output*: A concept masterplan highlighting the climate benefits (mitigation and adaptation) and associated co-benefits (environmental, social, and economic) of design strategies, urban sections and 3D schemes highlighting linkages with future city visions.

Team	UDCW Brief
Group 2 Building Scale and Design Solutions	Group 2 focused on the building scale, developing specific solutions to upgrade building envelopes, with insights on solutions for the densification of certain areas while improving the local climate concerning 2050 scenarios and achieving zero-carbon targets. The group also identified design solutions for open spaces, aiming at integrating ecosystem services, social interaction, and environmental awareness, supporting active mobility, and sustainable lifestyles. *Output*: Technical solutions for building envelope/roof and open spaces: plans, sections, details, 3D views, and simulations/environmental analyses.
Group 3 Stakeholder Priorities, Community Engagement and Communication	Group 3 focused on co-design approaches as essential strategies to bridge environmental and socio-economic dimensions. The group developed community-based strategies through interaction with local communities and stakeholders. Group 3 continuously interacted with Groups 1 and 2 to embed community claims (e.g., local needs, ongoing initiatives, and social capital) in the multi-scale climate-resilient principles and technical solutions. Cross-cutting topics such as equity and environmental justice, integration of different data types, and the role of technology, perception, communication, and behaviour were specifically addressed. *Output*: Storytelling of the neighborhood, including the tacit knowledge of local communities, using collaborative mapping (Participatory GIS), videos, and creative tools for engagement, communication, and outreach of UDCW results.

- **Multi- and Interdisciplinary**: The Napoli UDCW was organised by the Department of Architecture of the University of Naples Federico II. The organiser's expertise is in climate-resilient urban planning, design assessment methods, and design support tools. To successfully tackle the multidisciplinary dimension of the urban climate challenge, the UDCW involved an appropriate mix of complementary experience and expertise drawn from architecture, engineering, urban design, urban ecology and the social sciences.

- **Community**: The UDCW Naples was strongly focused on interaction with the local community. The one-day activities have been organised as follows:
  - **Site Analysis Stakeholder Engagement Session at Apple Academy**: On March 20, we held a full-day session at the Apple Academy with local stakeholders, who were invited to share their experiences and perspectives on San Giovanni a Teduccio. The session aimed to deepen our understanding of the area's unique challenges and opportunities from those who know it best. Stakeholders were then involved in a series of collaborative activities, including:
    - **Collaborative Mapping**: The synergies between Community Priorities and urban climate factors are mapped, considering key social, economic, and environmental drivers. Sustainable and climate-re silient city visions are combined with urban design strategies.
    - **Priorities Mapping & Climate Session**: Stakeholders identified and prioritised various issues related to climate risks, local challenges, and opportunities. This session helped align community priorities with sustainable and climate-resilient urban design strategies.
    - **City Visions Context-Based Scenarios**: In this activity, participants developed scenarios based on the current and future visions of San Giovanni a Teduccio. They explored how different urban design strategies could influence the area's development, considering environmental sustainability, social, cultural and spatial opportunities, needs and claims.
    - **A Day in the Life**: This immersive exercise encouraged stakeholders to imagine and describe a typical day in the future life of a resident of San Giovanni a Teduccio. This narrative approach helped to highlight the community's everyday experiences, needs, and aspirations, providing valuable insights into the lived reality of the area's inhabitants.
  - **Immersion and Interviews in San Giovanni a Teduccio**: During their stay in San Giovanni a Teduccio, students had the opportunity to immerse themselves in the neighbourhood and conduct interviews

with residents using a questionnaire they had prepared. This allowed them to gather valuable insights into the lives and experiences of the community members. Below is a summary of the areas investigated:

- **Socio-Economic Situation**: Questions about living arrangements and reasons for choosing their residence.
- **Cultural Access**: Exploration of residents' free time activities, including where and when they go out.
- **Climate Issues**: Inquiry into habitation conditions, use of air conditioning and heating, energy sources, and usage of public facilities such as parks and transport.
- **Local Alternative Solutions (Cooperation)**: Examination of community participation, help from NGOs, food acquisition methods, and presence of community representatives.
- **General Perception**: Residents' views on climate change risks, neighbourhood future, environmental awareness, and pollution-related health issues.

This immersive experience and the interviews provided a deeper understanding of the community's socio-economic conditions, cultural practices, climate-related challenges, and future perceptions. The data collected have been used to tailor urban design and planning solutions that address the specific needs and aspirations of the residents of San Giovanni and Teduccio. The students have released a video to communicate their insights from the field.

- **Fieldwork**: On March 18, 2024, we conducted a site visit to San Giovanni a Teduccio, led by local hosts (NGO representatives). This visit highlighted the existing climate and environmental challenges, official plans and policies in the area, socio-economic challenges, and community priorities. The session included onsite exchanges with local stakeholders and community representatives.

Figure 2. UDCW Napoli.

After the guided tour, the students participated in an urban exploration exercise using the practice of the Derive and the Derive Bot as guiding tools. The Derive Bot provided participants with tasks that guided and helped them immerse themselves in the urban experience. After completing a task, participants could request a new activity, changing the course of their journey. These tasks aimed to enable participants to overlay personal viewpoints with the obligatory perspectives of urban exploration. Each instruction asked them to move in a specific direction and search for something typically hidden or unnoticed in our daily experiences.

Here are some examples of tasks:

- "Find three recurrent elements of the building facades."
- "Observe three people around you and annotate their behaviours."
- "Is there any vegetation? What is its state?"
- "Find any public space different from a street."

- "How old are the three people closest to you?"
- "Take a picture of what you perceive as the 'urban climate' around you."
- "Imagine that there is a storm. Look around. Where would you go to take refuge?"
- "Imagine it is a very hot day; it is 12:00 PM. Look around. Where would you go to take refuge?"
- "Look for water. Is there any public fountain? What kind of water can you find? Saltwater from the sea, rainwater, grey water, black water?"
- "What is the strongest noise around you?"

The visit concluded with a social event at the S. Giovanni a Teduccio beach, providing an opportunity for further informal interactions and reflections on the day's activities.

- **Final Thoughts**: The workshop fixed a complex goal for the area of San Giovanni a Teduccio, namely that of exploring integrated design strategies for creating sustainable and resilient communities that can adapt and thrive in the changing global conditions, meet carbon-reduction goals, provide new public spaces and facilities about community priorities, by configuring or retrofitting compact and mixed-use eco-districts. The input of the different expertise and backgrounds of the students involved turned out to be fundamental in tackling such a complex topic in a context of exceptional complexity due to the overlapping of social and environmental issues. The collaborative approach ensured that various issues were identified and considered, bridging the gap between technical climate data and community-driven priorities and providing a balanced foundation for future urban planning and climate resilience strategies. Briefly, given the limited amount of time available, the UDCW was a success, and the support of the tutors and lecturers involved made it possible to achieve excellent results.

Student Feedback from Charleroi UDCW, Collected as a Post-Workshop Exercise (Written)

The workshop program offered by UCCRN_edu is an enriching experience and an excellent opportunity to collaborate with professionals from fields very different from my initial training in ecology. It is an excellent way to tackle concrete and specific issues. Each workshop focuses on a predefined study area. The week begins with a presentation of the development project related to this area, during which key stakeholders involved in the project are introduced. This introduction is followed by a guided tour, allowing us to understand the scope of the area better, the morphology of the space, the sometimes obvious human challenges, and the history that marks this place (often far more than we might have imagined).

From Charleroi's central station, the hustle and bustle are palpable: the trams, buses speeding by, and the flow of travellers make it a lively area. This contrast becomes even starker as we continue the visit toward the banks of the Sambre, where the atmosphere grows increasingly lifeless. It is not silence that dominates, but rather the deafening sound of cars. Indeed, above the banks rises "the ring," a massive road and highway structure serving numerous surrounding regions. This concrete structure, raised on pylons, looms over the river and the city, casting an overwhelming shadow. This concrete ring creates a fracture, an open separation between the city and the rest of the region, between the city and its industrial past. Beyond these roads was once the heart of Charleroi's activity — the source of its wealth, development, identity, and pride, making it influential in the eyes of the world and its inhabitants. But today, this area is no longer what it once was abandoned, only the steel structures remain, the last visible markers of this past. The river and the soil themselves remember this history, forever marked by pollutants with lifespans exceeding a hundred years: hydrocarbons, heavy metals, plastics, and other residues. How can we breathe life back into this space so filled with history?

Throughout the week, presentations followed one after another. Many local stakeholders came to present their areas of expertise, enriching our understanding of the site and its challenges. Yet, my peers and I were often perplexed, even shocked, by the terms used and the speakers' perspectives, who seemed motivated solely by financial interest and by the fact that pollution issues are not truly addressed. […]

What did we do? Throughout the week, we worked in groups and thematic sub-groups to address key areas relevant to our project. The main themes identified were Energy, Landscape, and Mobility. All students from Sorbonne University chose to join the Landscape group, feeling that our expertise aligned better with this focus area; personally, participating in the other groups was beyond my specialization, a sentiment shared by many of my peers from Sorbonne.

The Landscape group comprised 19 students from several universities, including Sorbonne, Gustave Eiffel, and IHE Delft. We brought together diverse specialists, including urban planners, architects, landscape designers, ecologists, and hydrologists. Within the Landscape group, we divided into three sub-groups — Heritage, Climate Change, and Biodiversity — to tackle a wide range of issues inherent to our study area. Each sub-group focused on identifying key zones or buildings whose functions could be adapted to address specific needs. These included maintaining continuity across various ecological and urban networks, preserving and enhancing landmark buildings, and creating floodable buffer zones to manage heavy rainfall and potential overflow from nearby waterways (such as the Sambre River, Brussels-Charleroi Canal, and Lode d'Heure).

At the end of the first day, we presented our initial ideas, allowing the group to gather valuable feedback from the teaching team and other workshop participants. On the second day, we held a second presentation to expand on the viewpoints and ideas discussed previously [...]

1.6.4 Charleroi UDCW

The focus of the Charleroi UDCW was to develop a multi-disciplinary planning and design-oriented proposal aimed at supporting plans for the 'clean' and green development of the "Porte Ouest" case study by 2050 based on the Masterplan by Studio Paola Vigano validated by the city of Charleroi and the Walloon Region in 2021. The aim was to produce multi-scale design solutions supported by robust climate, environmental and social analyses in collaboration with government officials, design and planning practitioners and local communities, such as the Cleantech District. The students conducted comprehensive urban analyses and proposed sustainable and resilient solutions in line with the problems of the energy crisis and the challenges of the ecological and social transitions of the area.

The first two days were based on fieldwork, a climate walk on-site, and a meeting with local authorities. The UDCW work was completed in the Urban Design Studio on the UMONS campus from Tuesday to Thursday. In this workshop phase, the students were divided into 3 thematic groups based on three specific objectives from the Master Plan, which the students explored: 1 – Enhance landscapes and Ecological environments. 2 - Engage the transition of Mobility. 3- Aim for metabolic and energy exemplarity. On Thursday afternoon, the work of the students was presented and discussed. Throughout the workshop, experts presented works linked to wasteland management, zero-carbon mobility, and energy.

UDCW Charleroi Schedule
Saturday 26/10
• Arrival of participants, welcome meeting.
Sunday 27/10
• Climate walk in Charleroi – Porte Ouest
Monday 28/10
AM: • Meeting with local authorities Arthur HARDY, Charleroi Bouwmeester. « Presentation of Charleroi Metropole and the Paola Vigano Studio Masterplan » • Louis GENEVOIS, IGRETEC. « Missions of IGRETEC and projects related to the Masterplan » • Margaux MONFORTI, CleanTech. « Presentation of the CleanTech District » • Olivier PESTIAUX, Sambre 2030, « Presentation of Sambre 2030 project » PM: • Teamwork on data, diagnostic • Keynote: IGRETEC – Energy. "Water Energy Nexus"

UDCW Charleroi Schedule
Tuesday 29/10
• Teamwork all day on diagnostic and first proposition • Keynote: Yann DUSZA, EPF Hauts-de-France, « Renaturation of urban wastelands in Hauts-de-France » • Presentation of each team accomplishment on the evening, crossing groups results.
Wednesday 30/10
• Teamwork all day on final proposition • Keynote : Frederic JOHN – D-carbonise. « Measure to be sure » • Presentation of each team accomplishment on the evening, crossing groups results.
Thursday 31/10
AM : • Finalisation of the final presentations PM : • Public presentation of the work done

- **Preparations**: Gathering the data to support UDCW activities can be a very time-consuming process, depending on the topic of the workshop, its structure, and the tools required. In the case of Charleroi, the topic was the redevelopment of an industrial site (Porte Ouest) with heavy industries and many wastelands, with or without old buildings. In 2020, Studio Paola Vigano made a master plan, but it has not yet been realised.
  The materials collated for the UDCW included the 2020 Master Plan (from Charleroi Bauwmester Agency), geographic data on QGIS (open-source GIS), and demographics (from StatBel, public stat institute). All this data and related information (e.g., maps) were available through a shared drive. Selected printed maps of the study area were also provided to the students. In addition to these supporting materials, relevant speakers were invited.

- **Innovation**: The Charleroi event complemented the other areas studied in the previous UDCW workshops. It is an industrial wasteland (like Naples UDCW), but only industries were established there. The soil pollution was at the heart of the reflection because of the high contamination levels. Another innovation concerns the distribution of students into thematic groups (mobility, landscapes, energies), while the other workshops had proposed groups following scales of action.
  Concerning the key speakers, an artistic perspective was given to the participants as an innovative approach to the technical aspects of the project compared to previous workshops.

Team	UDCW Brief
Enhance Landscapes and Ecological Environments	This axis aims to strengthen the quality and diversity of landscapes while preserving and revitalizing local ecosystems to strengthen the quality and diversity of landscapes while preserving and revitalizing the local ecosystems specific to the Sambre Valley. It focuses on promoting design and management strategies that integrate biodiversity, restore natural habitats, and foster a sustainable balance between urbanization and the environment in the context of industrialization from the Cleantech district. Emphasis is placed on the importance of creating resilient spaces that can adapt to the impacts of climate change while providing a healthy and attractive living and working environment.
Engage the Transition of Mobility	This axis focuses on transforming mobility systems to address current environmental and societal challenges. It encourages the adoption of more sustainable modes of transport, such as active transportation, public transit, and low-emission vehicles. The goal is to reduce travel's carbon footprint, improve air quality, and create inclusive transport networks that effectively serve the entire population locally and at the scale of the Charleroi Metropole project.

Team	UDCW Brief
Aim for Metabolic and Energy Exemplarity	This aspect aims to position urban projects as models of resource management and energy efficiency. It involves designing infrastructures that minimise energy consumption and greenhouse gas emissions while maximising the use of renewable resources. This axis advocates for a circular approach to the urban economy, where waste is minimised, materials are reused, and energy is managed responsibly to achieve exemplary metabolic and energy resilience while becoming an integrated component in the design of spaces for Charleroi's Porte Ouest.

- **Multi- and Interdisciplinary**: The Charleroi UDCW was organised by the UMONS Faculty of Architecture and Urban Planning. The student and staff participants were drawn from the fields of architecture, engineering, water management, urban design, and ecological sciences. Students with different backgrounds were mixed into the 3 thematic groups as explained previously.
  Key speakers of different disciplines with complementary viewpoints framed the workshop, including:
  - Politicians/City actors
  - Technical public services of the city
  - Future green economy actors
  - An artist who did some video and photo projects on the site view from the river
  - A representative of the Belgian Climate Center
  - A consultant of mobility decarbonization strategies. A researcher on wasteland transformation in North France

- **Community**: An important part of the UCCRN_edu philosophy is the engagement with local communities to include their perspectives on (re)development. In the case of the Charleroi "Porte Ouest" site, there are no residents. To compensate we identified local actors that could provide insights on the concerns of residents to enhance the image of Charleroi and ensure access to green spaces and community services.

- **Fieldwork**: The fieldwork for this UDCW took two and a half days. Sunday, The first one is an on-site walk, crossing a slag heap with a view of the site and its surroundings (the city centre of Charleroi and other small towns). The students observed some industrial legacies scheduled to remain in the master plan as industrial landmarks: industrial chimneys, cooling towers, and blast furnaces. On Monday, we met some local authorities in Charleroi city centre to discuss the context and walked there.

- **Final Thoughts**: The structure of the event, especially the integration of lectures and fieldwork, was a success from a course management viewpoint. However, some issues should be improved in future relevant works:
  - We worked in thematic groups (mobility, energy, landscape) and compared the results each evening. However, the final results remained compartmentalised. Maybe an extra day of work dedicated to comparing results would have been beneficial.
  - More contributions could have been organised with crossing insights for more participant feedback.
  - Other fields of the master plan could have been explored to identify more challenges.
  - More preparatory activities could have been included to provide more technical data to participants.

1.7 Synthesis of Tools Application

The UDCW activity integrates research-based teaching strategies to implement a critical learning model. Through inquiry-based methodologies such as collaborative group discussions, stakeholder roundtables, and expert-led seminars, students engage with current scientific knowledge and apply it to practical, contextually relevant challenges. This pedagogy enhances analytical and critical thinking skills and fosters a research-oriented approach to urban and climate resilience.
The UDCW toolkit exemplifies a robust synthesis of simulation and facilitation tools, providing a comprehensive framework for addressing climate-resilient urban planning and design challenges. This dual approach bridges technical precision and participatory engagement, ensuring that urban interventions are scientifically sound

and socially inclusive.

1.7.1 Simulation Tools: Informing Evidence-Based Design

The simulation tools embedded in the UDCW methodology, such as Geographic Information Systems (GIS) and Algorithm-Aided Design (AAD) tools like Rhinoceros+Grasshopper, empower urban planners and designers to model urban microclimates and analyze the impacts of climate-related stressors. These tools:

- Identify Key Climate Risks: GIS tools map urban heat islands, flood zones, and other climate hazards, providing a spatially detailed understanding of vulnerabilities at city and district scales.
- Evaluate Urban Design Scenarios: AAD tools simulate technical solutions for climate mitigation and adaptation, such as optimizing urban layouts to enhance natural ventilation and reduce heat retention.
- Quantify Co-Benefits: Metrics like the Universal Thermal Climate Index (UTCI), Mean Radiant Temperature (TMRT), and energy consumption indicators help assess proposed interventions' environmental and social impacts.

These simulation tools enhance decision-making by offering real-time visualizations and performance assessments, enabling iterative improvements throughout the design process.

1.7.2 Facilitation Tools: Incorporating Stakeholder and Community Knowledge

The facilitation toolkit complements the simulation approach by engaging diverse stakeholders in co-creating climate-resilient solutions. Key components include:

- Collaborative Mapping: This participatory process geospatialises local knowledge and identifies community priorities, integrating bottom-up insights with top-down data.
- City Visions Workshops: These sessions align local aspirations with broader sustainability frameworks, such as the 15-Minute City or Zero-Carbon City models, ensuring that urban transformations resonate with community needs. "A Day in the Life" tool helps collaboratively envision future scenarios based on community priorities and expectations.
- 3D District Configurator: This tool fosters dynamic co-design by allowing stakeholders to visualize and adjust urban prototypes, facilitating real-time discussions on trade-offs and synergies.

1.7.3 The UDCW Toolkit

Together, these tools create a structured yet flexible methodology for urban design that balances technical expertise with participatory engagement. By linking quantitative simulation outputs with qualitative stakeholder inputs, the UDCW toolkit:

- Ensures that interventions are context-sensitive and aligned with local priorities.
- Bridges the gap between climate science and urban governance, fostering a shared understanding among policymakers, designers, and communities.
- Supports the transition from pilot projects to institutionalized practices, embedding resilience principles into standard urban planning processes.

1.8 Towards a New Student Profile

Cities worldwide face increasing challenges due to climate change, necessitating urgent adaptation and mitigation strategies. The growing consensus acknowledges that urban areas must contribute to reducing greenhouse gas emissions while simultaneously adapting to future climate threats. A paradigm shift is required in urban planning and design to achieve this. Emerging concepts such as water-sensitive cities, sponge cities, low-impact development, blue-green infrastructure, and sustainable urban drainage aim to integrate nature-based solutions (NBS) into urban environments to enhance resilience and sustainability (Kabisch et al., 2017;

Frantzeskaki et al., 2019).

Despite the wide adoption of these concepts within architectural and urban design domains, the actual contribution of such designs to addressing urban environmental challenges remains often unclear. The quantification of impacts related to urban water challenges, heat stress, and other environmental issues is frequently overlooked. Moreover, there is insufficient exploration of the co-benefits these solutions offer, such as enhanced biodiversity, improved public health, social benefits, and economic value (Raymond et al., 2017). Addressing these challenges requires a comprehensive and integrated approach incorporating scientific research, technological advancements, and community engagement.

Furthermore, implementing climate-responsive urban solutions requires strong political will, adequate funding mechanisms, and engagement with local communities to ensure successful adaptation. City planners, designers, and policymakers must work with scientists and stakeholders to develop locally relevant and socially inclusive strategies. Public-private partnerships and community-based initiatives can further accelerate the adoption of climate-adaptive urban solutions by leveraging resources and expertise.

1.8.1 The Need for Quantification and Systematic Integration

While the science behind NBS is increasingly understood, its practical application and integration into urban design remain limited. Many design projects either address these aspects in an early or late stage with external consultations or neglect them altogether. Consequently, cities lack a comprehensive understanding of their contributions to climate adaptation and mitigation, leading to fragmented and opportunistic initiatives rather than systemic transitions (Pauleit et al., 2018).

Quantification tools and methodologies are crucial in assessing the effectiveness of urban climate strategies. Advances in geographic information systems (GIS), remote sensing, and climate modelling provide significant potential to measure the impacts of urban design interventions. Furthermore, comprehensive impact assessments that consider long-term ecological, economic, and social benefits are essential to guide urban development towards resilience and sustainability.

A major factor contributing to this fragmentation is the traditional siloed approach in education. Climate adaptation requires a multidisciplinary approach involving various fields, such as urban design, landscape architecture, drainage engineering, construction engineering, environmental science, ecology, social sciences, health sciences, and urban economics. However, the lack of cross-disciplinary integration in education prevents the development of comprehensive solutions that address the interconnected nature of climate challenges (Bourke & Fox, 2019). Encouraging interdisciplinary collaboration across these fields is imperative to achieve meaningful and sustainable urban transformations.

In addition to interdisciplinary education, the development of standardised assessment frameworks and performance indicators is critical for evaluating the success of urban climate interventions. Universities and research institutions are crucial in advancing these frameworks and disseminating knowledge through collaborative research projects and capacity-building programs.

1.8.2 Towards an Integrated Educational Curriculum

To bridge these gaps, there is a pressing need for an alternative educational curriculum that focuses on integrating diverse fields. This proposed curriculum would replace the traditional designer-centric approach with a more holistic “adaptation and mitigation designer” profile. Such a professional would possess a broad knowledge base and skill set to translate climate adaptation and mitigation needs into actionable design parameters that specialists in different fields can further develop (Foster et al., 2020).

A curriculum addressing urban climate challenges should encompass the following core topics:

- **Core Climate Science and Urban Climate Fundamentals**

- Climate system dynamics and urban climate impacts
- Heat island effects and urban microclimates
- Climate modelling and scenario planning

- **Nature-Based Solutions for Urban Climate Resilience**
  - Green infrastructure planning and implementation
  - Ecosystem services in urban environments
  - Multi-functional landscape design

- **Sustainable Urban Water Management**
  - Stormwater management and flood resilience
  - Water-sensitive urban design principles
  - Blue-green infrastructure applications

- **Urban Planning and Policy for Climate Action**
  - Policy frameworks and regulatory mechanisms
  - Participatory governance and community engagement
  - Climate justice and equity considerations

- **Technical Tools and Methods for Urban Climate Analysis**
  - Geographic Information Systems (GIS) for climate data analysis
  - Remote sensing and urban monitoring technologies
  - Computational fluid dynamics (CFD) modelling

1.8.3 Tailored Approaches Based on Institutional Contexts

The proposed curriculum can be adapted to fit different academic institutions based on their core competencies, enabling institutions to leverage their expertise and infrastructure while effectively addressing climate challenges. Each faculty or department may have distinct strengths that can contribute to developing climate-resilient solutions, making the curriculum adaptable to different educational contexts. This adaptability ensures that students receive a comprehensive education that aligns with their field of study while fostering interdisciplinary collaboration. By integrating climate adaptation and mitigation strategies into their curricula, institutions can produce graduates who are well-equipped to tackle the complex challenges of urban climate change from multiple perspectives. For example:

- **Policy & Management Faculties**: Emphasis on adaptive governance, strategic climate planning, and policy integration.
- **Economic & Finance Faculties**: Focus on climate finance, economic valuation of green infrastructure, and cost-benefit analyses.
- **Environmental Science Faculties**: Strong foundation in ecosystem-based adaptation and climate risk assessment.
- **Engineering Faculties**: Practical training in sustainable construction, infrastructure resilience, and technological innovation.
- **Design-Focused Faculties**: Advanced concepts in resilient urban design, participatory planning, and visual communication.

1.8.4 Implementing Multi- and Interdisciplinary Approaches

The interdisciplinary approach adopted by Urban Design Climate Workshops and the UCCRN_edu programs demonstrates the effectiveness of breaking traditional disciplinary boundaries. These programs have shown the potential to foster the next generation of urban climate change professionals who can effectively integrate knowledge across domains to create comprehensive solutions (Bulkeley et al., 2016). To address the multifaceted challenges posed by climate change in urban environments, education must undergo a transformation that encourages interdisciplinary learning and application. By integrating knowledge from diverse fields and

fostering collaboration, educational institutions can produce professionals capable of developing holistic and effective urban climate solutions. The proposed curriculum serves as a blueprint for cultivating the next generation of urban climate change designers, equipping them with the skills to contribute meaningfully to climate adaptation and mitigation.

1.8.5 Appendix: Overview of Proposed Curriculum

Core Climate Science and Urban Climate Fundamentals

- **Urban Climatology**
  - Urban heat island (UHI) effect
  - Microclimate analysis and modelling
  - Climate variability and extreme weather in cities
- **Climate Change Science**
  - Greenhouse gas emissions and mitigation strategies
  - Climate projections and urban implications
  - IPCC reports and urban resilience
- **Urban Meteorology and Air Quality**
  - Atmospheric pollution and dispersion modelling
  - Impacts of built environment on air flow
  - Monitoring and sensing technologies
- **Climate Adaptation and Mitigation Strategies**
  - Urban decarbonisation pathways
  - Resilient infrastructure planning
  - Climate risk assessment

Nature-Based Solutions (NBS) for Urban Climate Resilience

- **Concepts and Principles of Nature-Based Solutions**
  - Ecosystem services in urban areas
  - Integration of biodiversity in climate adaptation
  - Multi-functional benefits of NBS
- **Urban Green Infrastructure**
  - Green roofs and walls
  - Urban forests and tree canopy management
  - Permeable surfaces and vegetative swales
- **Blue-Green Infrastructure Integration**
  - Hybrid approaches combining water and vegetation
  - Landscape design for climate resilience
  - Social and economic co-benefits of NBS
- **Ecosystem-Based Adaptation for Cities**
  - Coastal and riverine ecosystems for flood mitigation
  - Climate-smart parks and urban wetlands
  - Community engagement in nature-based planning

Sustainable Urban Water Management

- **Sustainable Urban Drainage Systems**
  - Stormwater management techniques
  - Retention, detention, and infiltration solutions
  - Decentralized water management strategies
- **Flood Risk Management in Urban Areas**
  - Flood modelling and hazard assessment
  - Resilient urban design against extreme precipitation
  - Policy frameworks for flood governance
- **Urban Water-Energy Nexus**
  - Circular water systems in cities

    - Energy-efficient wastewater treatment
    - Water conservation strategies
- **Smart Water Systems and Technologies**
    - IoT for urban water monitoring
    - Digital twins for hydrological planning
    - Predictive analytics for water demand management
- **Blue-Green Infrastructure Solutions**
    - Restoring urban rivers and wetlands
    - Water-sensitive urban design
    - Nature-inspired cooling techniques (e.g., water bodies for microclimate control)

Urban Planning and Policy for Climate Action

- **Sustainable Urban Development Strategies**
    - Climate-responsive urban planning
    - Transit-oriented and walkable cities
    - Circular economy principles in urban design
- **Policy Frameworks and Governance**
    - International agreements and local climate policies
    - Financing climate adaptation in cities
    - Public-private partnerships in climate resilience
- **Community Engagement and Climate Justice**
    - Equitable urban adaptation strategies
    - Participatory climate governance
    - Addressing social vulnerability in climate planning

Technical Tools and Methods for Urban Climate Analysis

- **GIS and Remote Sensing for Urban Climate**
    - Spatial analysis of urban heat and water systems
    - Earth observation tools for urban planning
    - Mapping vulnerabilities and risks
- **Climate Modelling and Urban Scenarios**
    - Computational climate modelling for cities
    - Scenario planning and decision-support tools
    - Downscaling global climate models to urban areas
- **Sustainability Assessment Tools**
    - Life-cycle analysis for urban infrastructure
    - Carbon footprint assessment in cities
    - Indicators and metrics for climate resilience

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Annex 1. UDCW Reports

Figure 1. Paris UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_1092/1/

UDCW Report

Paris

Figure 2. Randers UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_7015/1/

UDCW Report

Randers

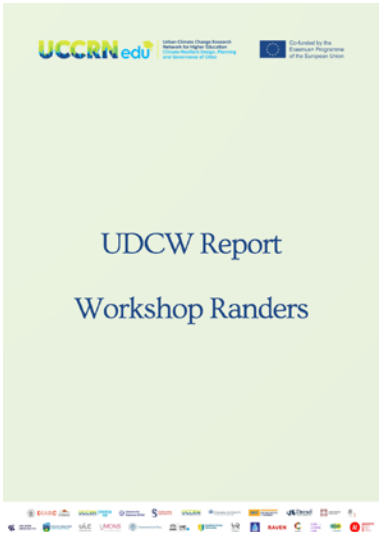

Figure 3. Stiges UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_1237/1/

UDCW Report

Stiges

Figure 4. Dublin UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_6549/1/

UDCW Report

Dublin

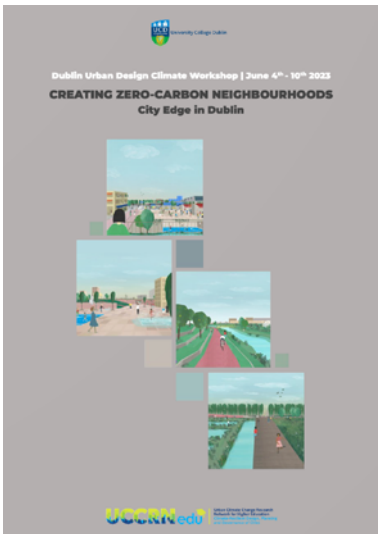

Figure 5. Napoli UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_7012/1/

UDCW Report

Napoli

Figure 6. Rotterdam UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_7018/1/

UDCW Report

Rotterdam

Figure 7. Charleroi UDCW Report: https://www.uccrn.education/udcw-reports/#flipbook-df_7007/1/

UDCW Report

Charleroi

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