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UAUIM | FACULTATEA DE ARHITECTURĂ DE INTERIOR | 20 DE ANI DE ARHITECTURĂ DE INTERIOR ȘI DESIGN

ARCHITECTURAL EXPERIENCES

PROCEEDINGS

INTERNATIONAL CONFERENCE OF ARCHITECTURE AND DESIGN

30-31/10/2023

COORDINATORS/EDITORS:
OANA DIACONESCU
DANIEL N. ARMENCIU
BOGDAN M. IONIȚĂ

PROIECT CO-FINANȚAT DE:
Administrația Fondului Cultural Național
UAUIM
FACULTATEA DE ARHITECTURĂ DE INTERIOR
20 DE ANI DE ARHITECTURĂ DE INTERIOR ȘI DESIGN

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ACCADEMIA ADRIANEA EDIZIONI,
Roma, 2024

20 ARCHITECTURAL EXPERIENCES - Proceedings-
International Conference of Architecture and Design 30-31/10/2023

The publication presents the full paper of the scientific communications from the "20 Architectural Experiences" International Conference, aiming to disseminate architectural and design research studies.

Coordinators/Editors:
Oana DIACONESCU, Daniel N. ARMENCIU, Bogdan M. IONIȚĂ

Editors:
Cristina DUMINICĂ, Alexandra DUNEL, Simina HAIDUC, Oana ILIE, Alexandra STAN

Secretary committee: Cristina Maria Chira, Alexandra DUNEL, Mihaela Lazăr, Roxana Mitarcă, Alexandra STAN

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ARCHITECTURAL EXPERIENCES

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Bogdan IONIȚĂ

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INTERNATIONAL CONFERENCE OF ARCHITECTURE AND DESIGN - "20 ARCHITECTURAL EXPERIENCES"

The Faculty of Interior Architecture is celebrating its 20th anniversary this year. Due to this occasion, we had invited professors, alumni and abroad guests to join us for a special reunion conference.

Over the past two decades, the Faculty has grown and developed, producing some of the brightest design solutions in the interior architecture and product design field in Romania. This conference allows professors and professionals to connect, network, and share their experiences.

The conference was held on the 30th-31st of October at "Ion Mincu" University of Architecture and Urban Planning and featured some prominent figures in the field as keynote speakers. Breakout sessions also covered various topics related to the Faculty's areas of research.

In addition to the conference, the agenda includes five special reunion events, organized as Round tables, which have allowed all the speakers to share their knowledge and provide new perspectives for architectural education.

All these researched areas played a crucial role in shaping the future of our built environment. By bringing together people from diverse cultures, the conference created a platform for sharing ideas and perspectives that enriched the field of architecture. Through research, architects can develop innovative solutions to complex challenges while focusing on new visions, enabling us to push beyond established norms and explore exciting new possibilities. Ultimately, investment in architectural education and research can help create a built environment that is sustainable, equitable and inspiring for all.

The "20 Architectural Experiences" event aimed to help members of universities and professionals find innovative solutions in imagining the entire design process and analyzing its long-term effects and consequences.

Architecture acts as a bridge connecting different aspects of thought processes, ideologies, and perspectives that shape our society. It represents a tangible manifestation of cultures, traditions, and beliefs, giving physical form to the intangible. The structural design, building materials, and overall aesthetics of architecture reflect the values and principles of a specific period or community, presented in the five main conference topics. The event underlined the fusion of art and science to create spaces that serve as a canvas for human interaction and creativity, influencing our behaviour and leaving a lasting impact on future generations.

MAIN COORDINATOR:
Assoc. prof. arch. **Oana DIACONESCU**
Dean of the Faculty of Interior Architecture

The “20 Architectural Experiences” conference has been carefully crafted, encompassing five comprehensive sections that explore crucial facets of modern architecture and design.

Section One: Architectural Education confronts the complexities of architectural education, a domain characterized by its malleability and intricacies. As we embark on this section, we aim to tackle pressing issues, including the evolving roles of curricula, the challenges posed by artificial intelligence (AI), innovative teaching methodologies, emerging trends in the architectural profession, and the importance of interdisciplinary approaches. The overarching objective is to create a global network of strategic significance, fostering the exchange of educational research methodologies and engaging in thoughtful discourse on the future development of academic fields in architecture, urban planning, and design.

Section Two: Perception on Architecture can be decoded through senses emphasizes the profound connections between human beings, their needs, and the built environment. It is our belief that research in this realm is indispensable, and thus, we explore topics such as universal design, healing architecture, the sensory aspects of understanding architecture, and arguments surrounding bio-architecture. Our primary aim is to integrate the human perspective into the narrative of architectural and urban design, emphasizing themes such as well-being, biophilia, eco-design, and the cultural approach to sustainability.

Section Three: Techniques and Technology in Architecture invites extensive discussions on the threats and opportunities associated with the rapid evolution of technology in building design. This section delves into smart cities, urban resilience, the limits of technology in architecture, architectural vulnerabilities, architecture at risk, and the importance of technology in building design, including sustainability, circular economy concepts, BIM technologies, VR, and digitalization. Our mission is to foster a balanced negotiation between the latest technological developments and their seamless integration into the creative architectural design process.

Section Four: Monuments and Historical Traces recognizes the fragility of our built heritage and the pressing need for knowledge, interest, and preservation. With a focus on urban regeneration and the restoration of lost identities, this section explores topics such as archaeological remains, heritage preservation, vanished artifacts, war remnants, reuse, restoration and conservation, urban archaeology, archaeological risk assessments, landscape heritage, and urban transformations. Our purpose is to deepen our understanding of heritage and its integration into the collective knowledge of our cities.

Section Five: Re-Imagining Design unveils the complexity inherent in the world of design, which involves art, engineering, and architecture. We examine topics such as design interdisciplinarity, design history, product and industrial design, graphic design, design methodologies, design thinking, social innovation through design, democratic design, human -centered design, universal design, inclusive design, BIM modeling, and GIS. This section aims to redefine the role of designers and reinvigorate the profession with cutting-edge tools, techniques, and knowledge

Assist. designer **Bogdan IONIȚĂ**

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The forthcoming conference is organized with the principal objective of commemorating the two-decade milestone since the establishment of the Faculty of Interior Architecture. This auspicious event is poised to convene a distinguished assembly of scholars, seasoned practitioners, and prominent institutions, all with the purpose of engaging in a rigorous discourse pertaining to the emerging architectural, urban planning, and design paradigms. The deliberations are anticipated to foster a comprehensive and interconnected outlook, emphasizing the interdisciplinarity that characterizes contemporary endeavors in these domains.

01

SECTIONS:

ARCHITECTURAL EDUCATION

Architectural education is a flexible yet complex field of study, therefore defining its limits and methods represents a challenge for academics and researchers alike.

TOPICS: the roles of curricula, artificial intelligence (AI) challenges, teaching methodologies, tendencies of the architectural profession and interdisciplinarity.

PURPOSES: creating an international strategic network, encouraging the exchange of methodologies and educational research, and debating visions on the further development of the academic field in architecture, urban planning and design.

CONFERENCE MODERATORS:
Lecturer arch. **Daniel N. ARMENCIU**
(**Faculty of Interior Architecture**)

Prof.arch. **Angelica STAN**
(**Faculty of Urban Planning**)

SECRETARY:
Lecturer. arch. **Cristina Maria CHIRA**

02

PERCEPTION ON ARCHITECTURE

Space can be decoded through senses, generating connections between human beings, their needs, uses and the built environment, therefore research on this topic is indispensable.

TOPICS: universal design, healing architecture, the use of senses in understanding architecture, arguments on bio-architecture (wellbeing, biophilia, eco-design, etc.) and a cultural approach to sustainability.

PURPOSES: integrating the human being in the narrative of the architectural and urban design process.

CONFERENCE MODERATORS:
Lecturer arch. **Codruța IANA**
(**Faculty of Interior Architecture**)

Lecturer arch. **Mihaela ZAMFIR**
(**Faculty of Architecture**)

Prof. arch. **Augustin IOAN**
(**Faculty of Architecture**)

SECRETARY:
Assist. arch. **Alexandra STAN**

03

TECHNIQUES AND TECHNOLOGY IN ARCHITECTURE

This section encourages discussions on threats and opportunities arising along with the fast development of technology applied in buildings' design.

TOPICS: smart cities, urban resilience, limits of technology in architecture, architectural vulnerabilities, architecture at risk and the importance of technology applied on buildings' design (sustainability, circular economy concepts, BIM technologies, VR and digitalization, etc.), technical details integration.

PURPOSES: negotiating the balance between the latest technological developments and their integration into the creative architectural design process.

CONFERENCE MODERATORS:

Assoc. Prof. arch. **Codina DUȘOIU**
(**Faculty of Interior Architecture**)

Lecturer arch. **Monica MUREȘANU**
(**Faculty of Architecture**)

Assoc. Prof. arch. **Claudiu RUNCEANU**
(**Faculty of Urban Planning**)

SECRETARY:

Assist. int. arch. **Roxana MITARCĂ**

04

MONUMENTS AND HISTORICAL TRACES

Given the fact that the built heritage is at risk due to a lack of knowledge, interest and preservation, this section wants to highlight studies, research and design projects which are looking not only into the regeneration of the urban tissue but also into regaining the lost identity of the place.

TOPICS: archaeological remains, heritage, disappeared artifacts, traces of war, reuse, restoration and conservation, urban archaeology, archaeological risk charts, landscape heritage, urban transformations.

PURPOSES: understanding and integrating heritage in the collective knowledge of the city, the use of memory in recreating the dialogue between built remains, communities and landscapes.

CONFERENCE MODERATORS:

Assoc. Prof. arch. **Oana DIACONESCU**
(**Faculty of Interior Architecture**)

Assoc. Prof. arch. **Horia MOLDOVAN**
(**Faculty of Architecture**)

Assoc.Prof. arch. **Mihaela HĂRMĂNESCU**
(**Faculty of Urban Planning**)

SECRETARY:

Assist. int. arch. **Mihaela Cecilia LAZĂR**

05

RE-IMAGINING DESIGN

Design has always been a complex phenomenon encompassing not only a diverse intersection of art, engineering, and architecture but also highlighting the need of constantly redefining the profession of the designer.

TOPICS: design interdisciplinarity, design history, product and industrial design, graphic design, design methodologies, design thinking, social innovation through design, democratic design, Human centered design, universal design, inclusive design, BIM modelling, GIS.

PURPOSES: redefine the role of the designer and the way this profession can shape the future through the use tools, techniques and knowledge.

CONFERENCE MODERATORS:

Lecturer arch. **Mihnea SIMIRAȘ**
(**Faculty of Architecture**)

Lecturer urb. **Ana OPRIȘ**
(**Faculty of Urban Planning**)

Assist. designer **Bogdan M. IONIȚĂ**
(**Faculty of Interior Architecture**)

SECRETARY:

Assist. arch. **Alexandra DUNEL**

CONFERENCE KEYNOTE SPEAKERS

Arch. **Lukas BOBOTIS** –
BOBOTIS+BOBOTIS ARCHITECTS, Athens, Greece;

Arch. **Vadim BABIJ** –
DO ARCHITECTS, Vilnius, Lithuania;

Product Designer **Michael SANS** –
SANS, Berlin, Germany.

ROUND TABLE

The panels will be followed by a round table associated to each section, moderated by:

Asoc. Prof. arch. **Oana DIACONESCU**
/ARCHITECTURAL EDUCATION

Prof. arch. **Augustin IOAN**
/PERCEPTION ON ARCHITECTURE

Prof. arch. **Rodica CRIȘAN**
/TECHNIQUES AND TECHNOLOGY IN ARCHITECTURE

Prof. arch. **Mihaela CRITICOS**
/MONUMENTS AND HISTORICAL TRACES

Assoc. Prof. arch. **Ionuț ANTON**
/RE-IMAGINING DESIGN

CONFERENCE GUESTS

Prof. arch. **Marian MOICEANU** –
Rector of ”Ion Mincu” University of Architecture and Urban Planning;

Assoc. Prof. arch. **Mariana CROITORU** –
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PLAYING FOR URBAN CLIMATE RESILIENCE /

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Abstract. Design for Climate Resilience is an academic seminar within the Master of Science for Architectural Sustainability at the Politecnico di Torino. The seminar was set up as an opportunity to join teaching and research experience, tackling significant challenges for cities and buildings affecting climate change. Students are split into groups and participate in a role-play to foster and support an active engagement at the Design for Climate Resilience Seminar. Each group represents prime ministers and mayors of countries, chosen among those facing more climate change effects, particularly the Urban Heat Island (UHI), the extreme weather events and the increase in the heavy rains.

Students are called upon to study the country's climate patterns and to learn more about the progress of emission reduction and adaptation programmes under the implementation of the Paris Agreement (2015). Once the analysis is completed, groups - focusing on some cities - set out climate change mitigation and adaptation strategies based on future climate scenarios (2050). Among the methods suggested and debated during the role-play, Green Infrastructures are prominent because of their attitude toward reducing heat waves and rainwater runoff. They are assumed to be a win-win solution for cities and buildings. More specifically, groups redesign urban spaces and facilities - in selected cities' neighbourhoods - through Sustainable Drainage Systems and Nature-Based Solutions. This paper, therefore, aims to outline some adaptation and mitigation strategies developed by the groups over the last academic years and to show some design proposals.

Introduction. Why it is essential to design climate-resilient cities. Because of the challenges posed by climate change, designing climate-resilient cities is becoming crucial. Some key reasons help demonstrate this approach's relevancy in urban and architectural design and construction:

Climate-resilient cities contribute to mitigation and adaptation efforts and pledges [1,2,3]. They reduce greenhouse gas emissions by fostering sustainable practices and infrastructures, but they also act to adapt to all those changes already occurring due to climate change effects.

Climate-resilient cities are better equipped to protect their citizens and buildings from extreme weather events such as heat waves, floods, storms, and fires [4, 5, 6]. This can lessen victims and property damage, saving lives and communities.

The design of climate-resilient cities encourages the development and implementation of advanced technologies and solutions, which can foster opportunities for new economic growth and create new jobs [7, 8].

Climate-resilient cities are mainly characterised by green buildings [9, 10]. These buildings are powered by renewable energy resources and managed by sustainable water systems; thereby, they reduce the demand for non-renewable and scarcely available resources and, consequently, greenhouse gas emissions.

Climate-resilient cities prioritise social equity [11], ensuring all inhabitants have equal and affordable access to essential services during extreme weather events.

Climate-resilient cities meet national and international commitments, such as the Paris Agreement [12], which provides strategies and plans to mitigate greenhouse gas emissions and to adapt nations to future climate-related events.

The learning seminar project, part of the academic programme of the School of Architecture of the Politecnico di Torino and the Master's programme in Architecture for Sustainability, from the Academic Year 2021/22 onwards, most of the critical aspects outlined above will be deepened by the adoption of an innovative learning model.

Role play as an education and learning strategy. Role-play is a relatively new academic strategy involving students taking on specific roles or characters in a simulated scenario.

About the seminar's educational purposes, students are expected to acquire a growing awareness of climate change effects, the risks of exposure to extreme events that the world's population is exposed to, the construction sector's considerable responsibility, and the mitigation and adaptation strategies that can be developed at the urban scale, the role-playing is being considered as an effective tool.

Role-play actively involves students in the learning process. Instead of passively receiving information, students actively enhance their understanding of the topics.

Role-play allows students to apply theory knowledge to practical situations. It bridges the gap between theory and practice, helping students to understand how concepts work in realistic scenarios. More specifically, role play can define real scenarios, allowing learners to experience situations in which they might find themselves as professionals. This can enable them to handle such problems effectively.

In addition, role-play was chosen because it is suitable for actively motivating participants.

Finally, after role-playing exercises, students were engaged in debriefing sessions in which they focused on their performance and received feedback from their colleagues, professors and academic tutors. Feedback is helpful to encourage performance improvement.

The seminar consists of thematic modules. Each module is organised through lectures and academic activities to maximise student engagement.

The first module is titled Greenhouse Effect and Climate Change. It is an introduction to the climate system and covers the alterations of the carbon cycle and the mechanisms that control the Earth's temperature. This module shows the most relevant facts and figures on carbon dioxide emissions in the past and present, their spatial distribution for different countries, the expected impact of climate change on temperature and water resources, the role of some sectors (e.g. construction), demographic changes and pressures on urban areas. Finally, this part of the seminar is an opportunity to know the main global commitments undertaken at the international level, e.g. from the Kyoto Protocol (1997) to the Glasgow Conference of Parties (COP) to the Paris Agreement (COP 25, 2017).

The second module is titled Urban Climate and Climate Change. The lectures emphasise some urban physical parameters, then study the Urban Heat Island (UHI) and extreme weather events, focusing on urban flooding. This section also includes lectures on general strategies to mitigate the effects of climate change at the urban and building scale and outlines some climate change agendas.

Lastly, the third module is titled Nature-Based Solutions for the Built Environment. This module explores the application of greenery, particularly of Nature-Based Solutions (NBS), as technology and strategy to tackle climate changes in the built environment. A specific focus is the use of NBS for dealing with some environmental features, such as rainwater management, that are particularly impacted by expected climatic and demographic trends. Further benefits referred to the social dimensions and the people's well-being are highlighted.

While addressing the different seminar topics, groups are formed. Each group, through a draw, is assigned a country. The nations have been selected in advance by the professors' team. They are characterised by heterogeneous socio-economic conditions, although they are all affected by a particular climatic vulnerability (e.g. nations and cities frequently exposed to heat waves or rising seas and coastal erosion). Once the country and some cities have been assigned, each person in the group becomes a prime minister, an environment minister, a mayor, an urban planning assessor, etc. To be - even if only in a role-playing game - prime minister of a nation or mayor of a city means making decisions in continuity or rupture with current administrations. It also means questioning and informing oneself about the international and local pledges the countries or cities have signed up for.

Meet your Country. The first challenge (or exercise) given to the groups is quite significant: Meet your country.

Country knowledge is achieved by collecting information to characterise, for instance, the annual mean temperature calculated on the time projection (2100) based on Shared Socioeconomic Pathways (SSP).

A Shared Socioeconomic Pathway is a set of social and economic dynamics that result in a greenhouse gas concentration (not emissions) pathway over a timeline; the Intergovernmental Panel on Climate Change (IPCC) developed the SSP scenarios. Five pathways are used for climate modelling based on the IPCC's Fifth Assessment Report. The pathways describe possible climate circumstances, depending on policies for controlling emissions and the consequent amounts of greenhouse gases emitted over the years. FIGURE 1.

The SSPs are SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5. The IPCC's classification refers to the possible range of radiative forcing values in 2100 (1.9, 2.6, 4.5, 7, and 8.5 W/m^2).

Besides analysing physical quantities, such as temperature and climate-changing gas emissions, the "meeting" with the assigned country takes place by collecting information associated

with the objectives of the Paris Agreement. Students are asked: "What has your country done so far to comply with the Paris Agreements?"; "What does it report the National Determined Contributes document? Do you share the goals?"; etc.

In particular, groups of students are committed to analysing national strategies for mitigating (reducing) greenhouse gas emissions and adapting to the effects of climate change.

The analysis leads to an assessment, which, in a simplified form and based on references provided, allows students to understand the effectiveness of the strategies. For instance, FIGURE 2 shows the insufficient Colombia rating [13]. This means Colombia's climate policies and pledges need significant improvements consistent with the Paris Agreement's 1.5°C temperature threshold. According to 2022 data, Colombia's NDC target is compatible with three °C warming compared to modelled emissions pathways and two °C warming compared to its fair share contribution.

Meet your Cities. The second challenge focuses on the cities. It is dealt with in the second module of the seminar, and it studies some effects of climate change at the urban scale. In detail, the Urban Heat Island (UHI) and stormwater runoff.

The UHI is a feature of cities where the average temperature is higher than in a surrounding rural environment, measured under the same conditions of time and space. The increase in the Earth's average temperature affects the UHI, which in many cities has been particularly marked [14] for a long time. Furthermore, when the UHI effect is significant, continuous use is made of cooling systems to meet people's comfort needs. These systems are often powered by electricity produced from non-renewable energy resources. The consumption of electricity has the consequence of greenhouse gas emissions, which contribute to an earth's average temperature increase and, once again, aggravates the UHI effect. The UHI is not uniform; thanks to some references [15, 16], the groups can identify urban areas of different surface areas where the temperature increase is more pronounced.

The most affected areas are those where the groups most investigate the characteristics of the urban form through specific indexes, notably the Urban Greening Factor – UGF [17]. The UGF studies the aspects of urban space (streets, squares, car parks) and assumes that a natural (or semi-natural) green space has a value of 1. Within the seminar, 0.4 is the minimum benchmark required.

The UGF must be calculated considering all the urban materials featuring a site (asphalt, permeable surfaces, lawns, etc.). In the case of mixed covers, a weighted average UGF can be calculated using proper algorithms; FIGURE 3.

An approach near to the one described for the UHI is also adopted to study stormwater runoff. Using satellite images, areas with large impermeable surfaces and little or no vegetation are identified. In the urban area study, shallow water bodies or proximity to the coast are also considered. Finally, the groups are provided with Intensity-Duration-Frequency (IDF) curves, i.e. graphical representations of the probability that a given average rainfall intensity will occur within a given period [18]. The rainfall IDF curves allow groups to determine the intensity and volume of surface runoff due to a reference extreme rainfall event. Based on some assumptions on the capacity of the ordinary drainage network, a preliminary analytical calculation of the volume of stormwater that can lead to flooding and that should hence be managed.

Design the climate resilience. The third and final challenge is interpreting the outcomes gathered after the analysis and assessment (challenges/exercises 1 and 2). The interpretation concerns the parameters considered, such as the UHI and the stormwater run-off. Besides, groups are tasked to develop adaptation and resilience solutions (or strategies) to be implemented in the urban area investigated within the second challenge. The seminar focuses on Nature-Based Solutions (NBSs) in mitigation and adaptation solutions.

The reasons for this deepening are found in the essence of NBS research. NBSs are engineered vegetation designed to protect, conserve, restore and manage ecosystems and support climate change adaptation and mitigation efforts [19, 20]. NBSs comprise several solutions, from tree planting and vegetated roofing to the latest and most advanced Living Wall Systems. Forests absorb carbon dioxide, allow biodiversity, increase water quality [21] and lessen hydrogeological risk; urban parks, rain gardens, green roofs and façades reduce the effects of UHI and stormwater runoff.

The versatility of NBSs allows them to be used in various climate and microclimate scenarios and socio-economic backgrounds. Finally, NBSs are used in many ways in terrestrial, freshwater, coastal and marine ecosystems.

FIGURE 4 shows an example of possible NBSs integration in an urban area in Cartagena de India. The NBSs selected are rain gardens, bio-retention systems, permeable paving and green roofs. Thanks to those solutions, the stormwater volume captured by NBSs (11.200m2) is about 3.330 m3, and the UGF (under current conditions 0.158) increases to 0.5.

Conclusion. Projects developed by the student groups and the teaching team, joined by tutors and experts invited to report on specific topics, result from an unconventional approach to urban space study. Science and knowledge related to climate change and its effects, from the global to the local scale, lead to redesigning streets, pavements and small squares, where "beauty" can be traced back to its usefulness for human beings. Projects that make future cities still (at least partially) liveable places.

The proposals are many, often with unusual technological solutions. However, each group emphasises a nature-based approach, recognising the crucial role of vegetation in the design of a valuable beauty of urban space.

The role-play ends with a poster session where each group illustrates to their classmates, lecturers and a panel of experts what they intend to do through mitigation and adaptation solutions and projects that are complementary and alternative to those provided in the NDCs of their assigned nations.

The expert panel is asked to award a golden point, considered during the exam. The golden point rewards the groups that have successfully demonstrated the effectiveness of mitigation and adaptation solutions to climate change. In other words, reward the "best" prime ministers, mayors, and top assessors.

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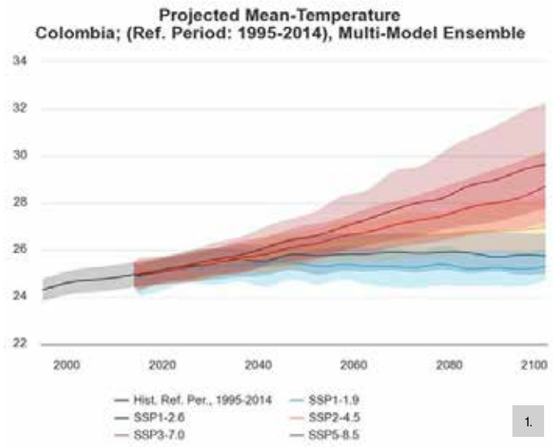
We would also like to thank the experts (Elisa Costamagna, Maicol Negrello and Anacleto Rizzo) who participated in the planned activities through lectures, conferences, guided tours and the poster session.

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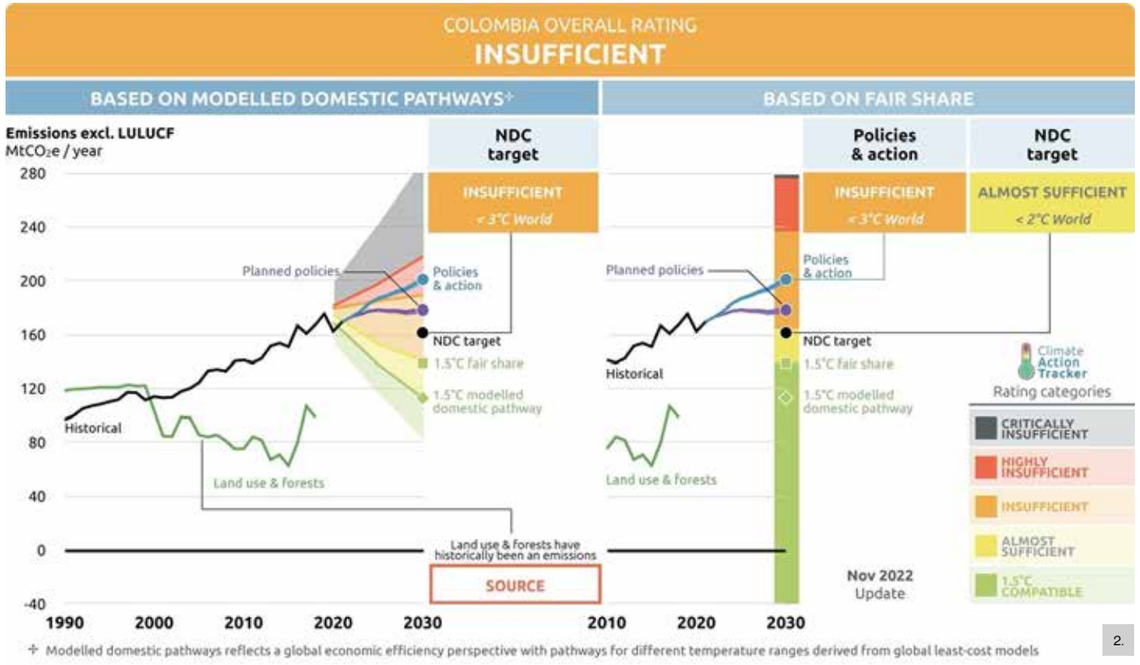
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Figures.
FIGURE 1 - Projected Mean temperature of Colombia (ref. period: 1995-2100, based on data monitored between 1995 and 2014).
FIGURE 2 - Colombia's overall rating summary. On the x-axis are the years considered (1990 2030). On the y-axis, emissions (t) of CO_2 equivalent are shown, excluding LULUCF (emissions from land use, land use change and forestry). The assessment is made by the distance between the NDC target and the planned policies or mitigation actions implemented (2022).
FIGURE 3 - Cartagena de India (Colombia). (a) The highlighted area is one of Cartagena's most exposed neighbourhoods to UHI. (b) The map shows the urban features of the site. According to the different features in the highlighted area, the UGF was calculated. The score is 0.15, which does not comply with the benchmark (0.4).
FIGURE 4 - Cartagena de India (Colombia). (a) Exemplifying pictures of the current situation. (b) Proposed interventions with NBS.

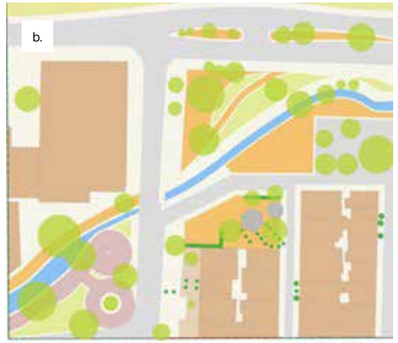


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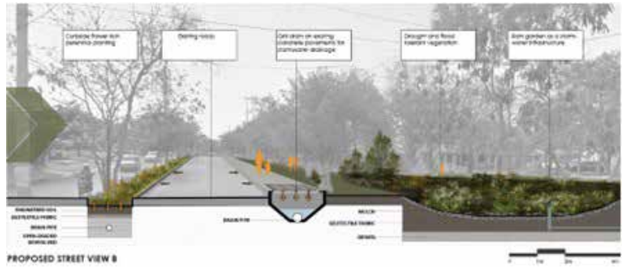
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