

Editors C. Mileto, F. Vegas, A. Hueto-Escobar, S. Manzano-Fernández

HISTORIC SETTLEMENTS

CONSERVATION, REGENERATION AND MANAGEMENT



Universitat Politècnica de València

ISBN 978-84-1396-363-1



9 788413 963631

ISBN 978-84-1396-360-0



9 788413 963600
Complete Work ISBN



HISTORIC SETTLEMENTS CONSERVATION, REGENERATION AND MANAGEMENT

Editors C. Mileto, F. Vegas, A. Hueto-Escobar, S. Manzano-Fernández

Historic settlements, both urban and rural, are living testimonies of the socio-cultural, economic and spatial evolution of communities throughout history. Shaped by geographical, climatic, and functional factors, these environments reflect the relationship between people, architecture, and landscape through time. Their preservation and regeneration today must transcend mere material conservation, incorporating strategies to promote social cohesion, cultural identity, sustainability, and participatory management.

Historic Settlements: Conservation, Regeneration and Management offers a rich and diverse collection of experiences, research and practices focusing on the challenges and opportunities of conserving historic settings while ensuring their vitality for present and future generations. It constitutes a valuable resource for scholars and practitioners in Urban Planning, Heritage Management, Architecture and Territorial Development.



edUPV

Universitat Politècnica de València

Editors

C. Mileto, F. Vegas, A. Huetto-Escobar, S. Manzano-Fernández

HISTORIC SETTLEMENTS

CONSERVATION, REGENERATION AND MANAGEMENT

Preface

C. Mileto, F. Vegas, A. Hueto-Escobar, S. Manzano-Fernández

Research Centre for Architecture, Heritage and Management for Sustainable Development (PEGASO),
Universitat Politècnica de València, Valencia, Spain

The “HERITAGE2025 International Conference on Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration” has been organized within the framework of three research projects. The first of these, the research project “**Earth4Future** - Sustainable Reuse of Earthen Architecture and its Lessons for Contemporary Architecture”, is funded by the Spanish Ministry for Science and Innovation (PID2022-139154OB-I00) and directed by the Universitat Politècnica de València. The second research project, “**Re-Habitat**– Restoration and sustainable rehabilitation of traditional dwellings in historic contexts”, is funded by the Department of Innovation, Universities, Science and Digital Society of the Generalitat Valenciana (CIAICO/2022/035) and directed by the Universitat Politècnica de Valencia. Finally, the research project “**ENACT 15mc** Envisioning Neighbourhoods and Co-Creating Thriving Communities in the 15-Minute City” is cofunded by the European Union (through Driving Urban Transitions Partnership, DUT, AEI, PCI2023-145946-2) and directed by the Norwegian University of Science and Technology, in collaboration with other associations, bodies, and universities including the Universitat Politècnica de València.

The project “**Earth4Future** Sustainable Reuse of Earthen Architecture and its Lessons for Contemporary Architecture”, with a research team directed by the Universitat Politècnica de València, together with other universities both within and outside Spain, primarily aims to research the energy behaviour and viability of compatible interventions in earthen constructions within Spain. This seeks to identify solutions which increase energy efficiency and reduce emissions without jeopardising cultural, heritage, and social values. This project analyses issues such as respect for heritage values, real economic cost, environmental impact, and energy efficiency based on studies carried out on historic earthen constructions together with contemporary applications of earthen techniques in new constructions.

Furthermore, the project “**Re-Habitat**– Restoration and sustainable rehabilitation of traditional dwellings in historic contexts”, with a research team led by the Universitat Politècnica de València and made up of researchers from universities both within and outside Spain, focuses on the analysis of historic buildings in urban and rural settings. By analysing similar parameters within the Comunidad Valenciana, it seeks to propose guidelines and intervention criteria that are compatible with heritage and are economically viable, environmentally sustainable, and energy efficient.

Conference UPV

HISTORIC SETTLEMENTS. CONSERVATION, REGENERATION AND MANAGEMENT

The contents of this publication have been double-blind peer-reviewed by the program Committee.

The contents of this publication have been evaluated by the Scientific Committee which it relates and the procedure set out

<https://ocs.editorial.upv.es/index.php/Heritage/Heritage2025/about/editorialPolicies>

Scientific Editors

Camilla Mileto
Fernando Vegas
Alicia Hueto-Escobar
Sergio Manzano-Fernández

Publisher

2025, Editorial Universitat Politècnica de València
Cno. de Vera, s/n.
46022 Valencia (SPAIN)
www.lalibreria.upv.es / Ref.: 2029_06_01_01

ISBN: 978-84-1396-363-1

ISBN for the Complete Work: 978-84-1396-360-0

Print on-demand

DOI: <https://doi.org/10.4995/Heritage2025.2025.21179>



HISTORIC SETTLEMENTS. CONSERVATION, REGENERATION AND MANAGEMENT

This book is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike-4.0

International license Editorial Universitat Politècnica de València

<https://ocs.editorial.upv.es/index.php/Heritage/Heritage2025>



2025, Editorial Universitat Politècnica de València

Analysis on a larger scale features the project “ENACT 15mc Envisioning Neighbourhoods and Co-Creating Thriving Communities in the 15-Minute City” directed by the Norwegian University of Science and Technology and different collaborators. This project examines the potential of redesigning historic urban spaces and improving quality of life, active mobility, accessibility and social relations, in order to achieve the concept of “15-minute cities”, through case studies such as Trondheim, Gdańsk, Valencia and Oxford.

The three projects are considered complementary, as they all seek to promote sustainable architecture and urbanism linked to heritage, energy efficiency, and community development, always aiming to strike a balance between tradition and innovation. This is a response to critical challenges such as climate change, population loss, the disappearance of traditional crafts, and the need for vibrant, inclusive, and resilient cities. This further highlights the pressing need to promote research, increasing awareness and action in multiple sectors, actively aiding the transition to more sustainable societies in terms of heritage and urbanism.

Given that these research projects display certain commonalities, particularly in relation to the challenges and perspectives for the future detailed above, and offer the potential for joint discussion, the main themes have been combined in the HERITAGE2025 International Conference. The themes established for the conference are: **1. Vernacular architecture** (study and cataloguing of vernacular architecture; study of traditional materials, techniques and construction crafts; mechanisms of sustainability of vernacular architecture; restoration and conservation of vernacular architecture; energy efficiency and sustainable design projects; management and maintenance); **2. Earthen architecture** (study and cataloguing of earthen architecture; study of traditional materials, techniques and construction crafts; mechanisms of sustainability in earthen architecture; restoration and conservation of earthen architecture; energy efficiency and sustainable design projects; management and maintenance), **3. Urban and rural historical sites** (studies of historic urban and rural areas; intervention and regeneration projects; management and maintenance, threats and opportunities in historic areas: tourism, infrastructure and identity; proximity economy and traditional commerce in historic contexts); **4. From tradition to contemporaneity** (contemporary projects inspired by tradition; traditional sustainability mechanisms applied to contemporary architecture; integration of contemporary projects in historical contexts; reinterpretation of traditional techniques for their application in contemporary architecture).

The Scientific Committee is made up of 89 renowned researchers and specialists in the themes analysed, hailing from 25 different countries from five continents. All the contributions to the conference – abstracts as well as final texts – have been subject to a strict peer review evaluation system by the members of the Scientific Committee. Of the 244 proposals submitted, a total of 150 papers written by 328 authors from 30 countries of five continents has been selected for final publication.

The papers selected have been published in three volumes appearing in print and online format and titled *Vernacular Heritage: Documentation, Conservation and Adaptive Reuse*, *Earthen Heritage: Conservation, Adaptive Reuse and Sustainable Design*, and *Historic Settlements: Conservation, Regeneration and Management*.

The “HERITAGE2025 International Conference on Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration” was held on 10-12 September 2025 at the Universitat Politècnica de València, Spain. The conference was carried out with the sponsorship of: WHITRAP – World Heritage Institute of Training and Research for the Asia and Pacific Region under the auspices of UNESCO; ISCARSAH – International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage, technical committee of ICOMOS; ICOMOS CIAV – International Council on Monuments and Sites; International Committee of Vernacular Architecture; ICOMOS ISCEAH – International Scientific Committee in Earthen Architectural Heritage; and PROTERRA – Ibero-American Network of Architecture and Earthen Construction. The organization, publication and development of the conference was made possible by funding from the Spanish Ministry for Science and Innovation for the research project “Earth4Future - Sustainable Reuse of Earthen Architecture and its Lessons for Contemporary Architecture” (PID2022-139154OB-I00) and the Department of Innovation, Universities, Science and Digital Society of the Generalitat Valenciana for the project “RE-HABITAT – Restoration and sustainable rehabilitation of traditional dwellings in historic contexts” (CIAICO/2022/035). The Higher Technical School of Architecture, PEGASO - Research Centre for Architecture, Heritage and Management for Sustainable Development, and the Department of Architectural Composition of the Universitat Politècnica de Valencia have also contributed to the development of this conference.

Finally, we wish to thank the authors who have contributed to the quality, range, diversity, and richness of the publication with their papers and studies. We are indebted to all the members of the advisory and scientific committees for their work throughout the entire review process for abstracts and papers. And above all, we would like to thank the organizing committee for their invaluable help in setting up the conference, the style and language reviewers for their corrections, and all collaborators for their inestimable work in the management and organization of each and every phase of the process.

Organization and Committees

ORGANIZING COMMITTEE

Camilla Mileto (Chair) – *Universitat Politècnica de València, Spain*
Fernando Vegas López-Manzanares (Chair) – *Universitat Politècnica de València, Spain*
Lidia García Soriano – *Universitat Politècnica de València, Spain*
Valentina Cristini – *Universitat Politècnica de València, Spain*
Alicia Hueto Escobar – *Universitat Politècnica de València, Spain*
Sergio Manzano Fernández – *Universitat Politècnica de València, Spain*
Vincenzina La Spina – *Universidad Politècnica de Cartagena, Spain*
David Eduardo Morocho-Jaramillo – *Universitat Politècnica de València, Spain*
Eva Tortajada Montalva – *Universitat Politècnica de València, Spain*
Francisco Sandoval Gómez – *Universitat Politècnica de València, Spain*
Víctor Manuel Cantero Solís – *Universitat Politècnica de València, Spain*

ORGANIZED BY

UPV – *Universitat Politècnica de València, Spain*
PEGASO – *Research Centre for Architecture, Heritage and Management for Sustainable Development, UPV, Spain*
Departamento de Composición Arquitectónica, UPV, Spain

COFUNDED BY

EARTH 4 FUTURE Research Project (ref. PID2022-139154OB-I00)
RE-HABITAT Research Project (ref. CIAICO/2022/035)
MCIU – *Ministerio de Ciencia, Innovación y Universidades, Spain*
AEI – *Agencia Estatal de Investigación, Spain*
FEDER, UE – *European Regional Development Fund, European Union*
GVA – *Conselleria de Innovación, Universidades, Ciencia y Sociedad Digital, Generalitat Valenciana, Spain*

WITH THE SUPPORT OF

GVA – *Generalitat Valenciana, Conselleria de Educación, Cultura, Universidades y Empleo*
MUCPA – *Máster Universitario en Conservación del Patrimonio Arquitectónico*
EMR-CPA – *Cátedra Estudio Métodos Restauración Conservación del Patrimonio Arquitectónico*

UNDER THE AEGIS OF

WHITRAP – World Heritage Institute of Training and Research for the Asia and Pacific Region under the auspices of UNESCO

ISCARSAH – International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage, technical committee of ICOMOS

ICOMOS CIAV – International Council on Monuments and Sites: International Committee of Vernacular Architecture

ICOMOS ISCEAH – International Scientific Committee in Earthen Architectural Heritage

PROTERRA – Red Iberoamericana de Arquitectura y Construcción con Tierra

SCIENTIFIC COMMITTEE

Alejandro García Hermida – *Universidad Politécnica de Madrid, Fundación Culturas Constructivas Tradicionales, Spain*; Alessandro Merlo – *Università di Firenze, Italy*; Alessandro Pieratini – *Notre Dame University, France*; Alessio Cardaci – *Università di Bergamo, Italy*; Alicia Hueto Escobar – *Universitat Politècnica de València, Spain*; Amanda Rivera – *Universitat Politècnica de Catalunya, Spain*; Amparo Graciani García – *Universidad de Sevilla, Spain*; Andrea Pane – *Università Federico II di Napoli, Italy*; Angela Squassina – *Istituto Universitario di Architettura di Venezia, Italy*; Annick Daneels – *National Autonomous University of Mexico, Mexico*; Antonella Versaci – *Università Kore di Enna, Italy*; Bakonirina Rakotomamonjy – *CRATERRE ENSAG, France*; Birgitte Tanderup Eybye – *Aarhus School of Architecture, Denmark*; Borut Juvanec – *University of Lubiana, Slovenia*; Camilla Mileto – *Universitat Politècnica de València, Spain*; Chaochao Wei – *China Academy of Arts, China*; Chen Lichao – *School of Architecture, China Academy of Art, China*; Chiho Ochiai – *Kyoto National University, Japan*; Claudia Cancino – *The Getty Conservation Institute, USA*; Cristina Lafuente – *Ministry of Culture, Spain*; Daniela Esposito – *Università La Sapienza Roma, Italy*; David Eduardo Morocho-Jaramillo – *Universitat Politècnica de València, Spain*; Donatella Fiorani – *Università La Sapienza Roma, Italy*; Elena Agromayor Navarrete – *IPCE, Spain*; Eva Tortajada Montalva – *Universitat Politècnica de València, Spain*; Fabio Fatiguso – *Politecnico di Bari, Italy*; Fabio Fratini – *CNR-ICVBC Sesto Fiorentino, Italy*; Faissal Cherradi – *Ministry of Culture, Morocco*; Félix Jové Sandoval – *Universidad de Valladolid, Spain*; Fernando Vegas López-Manzanares – *Universitat Politècnica de València, Spain*; Francesco Trovó – *University Iuav of Venice, Italy*; Francisco Javier López Martínez – *Universidad Católica de Murcia, Spain*; Francisco Javier Torrijo Echarri – *Universitat Politècnica de València, Spain*; Francisco Sandoval Gómez – *Universitat Politècnica de València, Spain*; Frank Matero – *University of Pennsylvania, USA*; Gisle Jakhelln – *ICOMOS-CIAV, Norway*; Guillermo Guimaraens Igual – *Universitat Politècnica de València, Spain*; Hirohide Kobayashi – *Kyoto University, Japan*; Hossam Mahdy – *ICOMOS-CIAV, Great Britain*; Humberto Varum – *Universidade de Porto, Portugal*; Ivan Enev – *Architect, ICOMOS-CIAV, Bulgaria*; Javier Orozco Messana – *Universitat Politècnica de València, Spain*; Javier Ors Ausín – *World Monument Fund, USA*; Jorge Luis García Valldecabres – *Universitat Politècnica de València, Spain*; Jorge Tomasi – *CONICET, Instituto Interdisciplinario Tilcara, Argentina*; José Luis Baró Zarzo – *Universitat Politècnica de*

València, Spain; José Manuel López Osorio – *Universidad de Málaga, Spain*; Juana Font Arellano – *Fundación Antonio Font de Bedoya, PROTERRA, Spain*; Juliet Carpenter – *University of Oxford, England*; Julieta Barada – *CONICET-Laboratorio de Arquitecturas Andinas y Construcción con Tierra, Instituto R. Kusch, Universidad Nacional de Jujuy, Argentina*; Letizia Dipasquale – *Università di Firenze, Italy*; Lidia García Soriano – *Universitat Politècnica de València, Spain*; Luis Fernando Guerrero Baca – *Universidad Metropolitana Autónoma, Mexico*; Maddalena Achenza – *Università di Cagliari, ICOMOS-ISCEAH, Italy*; Marcel Vellinga – *Oxford Brookes University, ICOMOS-CIAV, United Kingdom*; María Concepción López González – *Universitat Politècnica de València, Spain*; María José Viñals Blasco – *Universitat Politècnica de València, Spain*; Mariana Correia – *Escola Superior Gallaecia, Vila Nova Cerveira, Portugal*; Marie-Noël Tornoux – *WHITRAP-Shanghai, China*; Marwa Dabaieh – *Lund University, ICOMOS-CIAV, Sweden*; Matilde Caruso – *Universitat Politècnica de València, Spain*; Mikel Landa Esparza – *Architect, ICOMOS-IIWC, Spain*; Min Hall – *Unitec Institute of Technology, New Zealand*; Naima Benkari – *Sultan Qaboos University, Oman*; Natalia Jorquera – *Universidad de Chile, Santiago, Chile*; Ona Vileikis Tamayo – *University Collage London, United Kingdom*; Pablo Rodríguez Navarro – *Universitat Politècnica de València, Spain*; Pamela Jerome – *Columbia University, ICOMOS-ISCEAH, USA*; Paolo Vitti – *University of Notre Dame, USA*; Pasquale De Dato – *Universitat Politècnica de València, Spain*; Paulo B. Lourenço – *Universidade do Minho, ICOMOS-ISCARSAH, Portugal*; Pere Roca Fabregat – *Universitat Politècnica de Catalunya, ICOMOS-ISCARSAH, Spain*; Plácido González Martínez – *University of Seville, Tongji University, Spain / China*; Rohit Jigyasu – *ICROM Roma, Italy*; Sergio Manzano Fernández – *Universitat Politècnica de València, Spain*; Shao Yong – *Tongji University Shanghai, China*; Sofia Rodríguez-Larrain De Grange – *Pontifical Catholic University of Peru, Peru*; Stefan Balici – *Ion Mincu University, Romania*; Stefania Farina – *Universitat Politècnica de València, Spain*; Teresa Cunha Ferreira – *Universidade do Porto, Portugal*; Teresa Gil Piqueras – *Universitat Politècnica de València, Spain*; Thierry Joffroy – *CRATERRE-ENSAG, France*; Valentina Cristini – *Universitat Politècnica de València, Spain*; Valentina Russo – *Università Federico II di Napoli, Italy*; Victor Manuel Cantero Solís – *Universitat Politècnica de València, Spain*; Vincenzina La Spina – *Universidad Politécnica de Cartagena, Spain*; Yolanda Hernández Navarro – *Universitat Politècnica de València, Spain*; Youcef Chennaoui – *École Polytechnique d'Architecture et d'Urbanisme d'Alger, Algeria*; Zuzana Syrová – *National Heritage Institute, Association for the Renewal of the Village and the Small Town (SOVAMM), Czech Republic*

COLLABORATION IN THE PUBLICATION

Alicia Hueto Escobar (Coordinator)

Sergio Manzano Fernández

Eva Tortajada Montalva

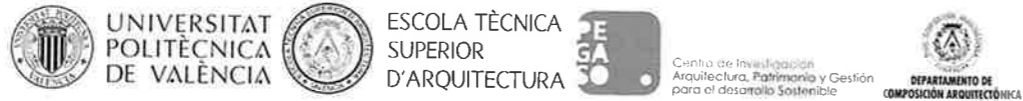
David Eduardo Morocho-Jaramillo

Francisco Sandoval Gómez

Víctor Manuel Cantero Solís

Conference Support

ORGANIZED BY



CO-FUNDED BY



WITH THE SUPPORT OF



UNDER THE AEGIS OF



Table of Contents

Volume I

VERNACULAR HERITAGE. Documentation, conservation and adaptive reuse

Architectural Memory: Créole Houses as Living Monuments in Port Louis, Mauritius <i>K. Jeewa, M. Minguzzi</i>	1
Between Oblivion and Regeneration. A Map of Abandoned Spontaneous Architecture in the Abruzzo Inner Areas (Italy) <i>G. Ciuca, A. Marra, I. Trizio, F. Savini</i>	9
Characterisation of Vernacular Built Heritage in Corvo Island, Azores: Architecture, Construction and Alterations <i>C. P. Mouraz, J. M. Silva, T. M. Ferreira</i>	17
Conflict and transformation: Historic perspectives of architectural heritage in Achuar communities—Ecuador <i>D. E. Morocho Jaramillo, C. Mileto, F. Sandoval-Gómez</i>	25
Conservation of Rural Religious Heritage in the Western Mediterranean Region of Türkiye: Yukarı Kırılı Village <i>S. Akman Güler, D. Mazlum</i>	33
Contribution to the Knowledge of Apennine Rural Architecture. Technical Culture in the Abandoned Historical Villages of the Upper Santerno Valley (Italy) <i>M. Coppola, A. Rosseti</i>	41
Documenting and Studying the First Indigenous Peoples of South Africa's Villages and Dwellings in Baviaanskloof, Applying an Indigenous Methodology <i>M. Minguzzi</i>	49
Exploring Rural Heritage in Central Sicily (Italy). Proposals for Cataloguing, Protection and Valorisation: the case study of Fondaco Cuba <i>A. Versaci, A. Cardaci, L. R. Fauzia, M. Russo</i>	57
José Luis Romany and the Vernacular Architecture of the Former Marquisate of Dénia (Spain) <i>A. Rubio Garrido, J. Caldach Cervera, A. B. Serrano Lanzarote</i>	65
Millars Hydraulic Architecture (Almassora, Spain) <i>C. Burguete</i>	73
Research on the Indigenous Architecture and Its Transformation of the Bahnar Rong Houses in Kon Tum City, Vietnam <i>C. Nguyen, T. Nguyen, H. Kobayashi</i>	81

Rural Architecture in Calabria (Italy): the Example of the Stabilimento degli Insiti <i>F. Tenuta, F. Bilotta</i>	89
Rural Architecture in the Pinerolo Area (Piedmont, Italy): The Search for Evidence of Viticulture <i>A. Vergano, L. Panzani</i>	97
Rural Settlements in the Territory of Alessandria (Italy): Types and Construction Techniques <i>R. Minnucci, F. Castiglione</i>	105
The Architecture of Rural-urban Complexes through Typologies. The case of Maestrazgo (Teruel, Spain) <i>J.-L. Baró Zarzo, A. Almagro Vidal, F.-J. Gómez Patrocinio, R. Eppich</i>	113
The Art of Milling in Calabria - Italy: History, Architecture, Construction Systems of Some Hydraulic Factories <i>B. Canonaco</i>	121
The Calabrian Liquorice in the European Market of the Nineteenth Century: History, Production and Evolution Through the Knowledge of Some Architectures Along the Ionian Sea Coast <i>G. M. Ruffolo, F. Castiglione</i>	129
The Census of Rural Architecture in Italy: a Replicable Model for the Cataloguing <i>F. G. Cavallero, V. Parisi, B. Scala</i>	137
The Census of Rural Buildings in the Italian Region of Friuli-Venezia Giulia <i>E. Rulli, F. G. Cavallero, V. Macovaz</i>	145
Traditional Moken Ethnic Houses in the Surin Islands, Phang Nga Province, Thailand <i>M. Attavanich, A. Fujieda, C. Iba, H. Kobayashi</i>	153
Vernacular and Fertile. The Pantano Masseria di Puglia, Italy <i>F. Cotallo, M. Munafò</i>	161
When the Shapes Unite: Cataloguing and Analysis of Vernacular Architecture in the Valleys of the Provinces of Bergamo and Brescia <i>B. Scala, C. Boniotti</i>	169
Building Techniques and Environmental Stewardship of the First Indigenous Peoples of South Africa <i>L. Vosloo, M. Minguzzi</i>	177
Damage Historical Prevention in Southern Italy's Built Heritage. A Focus on Holed Masonries Through Campania and Molise Regions <i>V. Russo</i>	183
Insights from Past Technological and Intellectual Adaptations in Japanese Traditional Thatch Architecture <i>C. Jamin, H. Kobayashi, A. Fujieda, M. Suginaka</i>	191

Solaque: Examination of a Traditional Construction Technique for Water-repellent Continuous Rendering <i>A. G. Serrano-Gonzales, F. Vegas, A. Hueto-Escobar</i>	199
The Construction Techniques of Vaulted-Stone Buildings in the Taihang Mountains Region of Hebei, China <i>L. Long, L. Gan, G. Semprebon</i>	207
The Jaboncillo Gypsum Plaster in the Traditional Architecture of the Northwest Region of Murcia (Spain): History, Technique and Conservation <i>A. Nezreg Driche</i>	215
Tradition and Didactics. Some Educational Experiences of Intergenerational Transmissions of Artisan Skills for Heritage Preservation <i>A. Squassina</i>	223
Use and Conservation of Alabaster in Traditional Aragonese Architecture <i>J.-L. Baró Zarzo, V. La Spina, A. Pascual Rubio</i>	231
Vernacular Architecture in Disappearing: Unveiling Japan's Mason Work Huts in Shiga Prefecture <i>C. Ochiai, J. Wang</i>	239
Architectural Heritage and Photovoltaic Solar Panels: Regulatory Framework and Action Criteria in Navarra (Spain) <i>J. L. Franchez Apecechea</i>	247
Co-thinking the Language of Vernacular Heritage through a Transdisciplinary Approach: Mapping, Regenerating and Creating <i>R. Lorusso, A. Mazza, A. Guida</i>	255
From Vernacular Wisdom to Contemporary Design: Bridging Traditional Patterns with Modern Sustainability <i>V. Maini</i>	263
Passive Thermal Performance of Glazed Balconies from Northern Portugal Vernacular Architecture and Contribution to a Regenerative Built Environment <i>J. Fernandes, M. Castro, S. M. Silva, R. Mateus</i>	271
Qualities and Values of Rural Vernacular Architecture: by Way of a Decalogue <i>G. Rivero-Lamela</i>	279
The Alfano Ironworks in the Cilento National Park (Italy): An example of Vernacular Architecture <i>G. Vinciguerra</i>	287
The Montalván Hacienda: Traditional Construction and Thermal Strategies in Cañete, Peru (18th-19th centuries) <i>T. Montoya, A. Scaletti, M. Wieser</i>	295
A Holistic Approach to Vernacular Heritage Conservation <i>H. Mahdy</i>	303

Assessment of the Material Fabric Through Non-Invasive Tools, Characterization Process, and Formulating Compatible Repair Material: A Case of Kalidas Jethabhai House, Dharmaj, Gujarat, India <i>S. Ram</i>	311
Comparison of Conservation and Repair Methods for Stone Arch Bridges in Spain and Japan <i>N. Miyamoto, S. Hamada, F. Vegas, C. Mileto</i>	319
Extradados Vaults in the Chartreuse of San Giacomo in Capri, Italy: History, Knowledge and Conservation of a Vernacular Architecture in the Mediterranean Landscape <i>S. Iaccarino</i>	327
Preserving Heritage, Inspiring Revival: Restoring Traditional Japanese Thatch Culture through Transformative Professional and Associative Initiatives <i>C. Jamin, H. Kobayashi</i>	335
Rethinking Local Heritage Through Networked Perspectives: Mylos Project on Imbros (Gökçeada), Turkey <i>A. Dinççağ Kahveci</i>	343
The Farmhouses of the Cuma Archaeological Park in Pozzuoli (Naples, Italy): Between Conservation and New Enhancement Strategies <i>F. Naldi, L. De Riso</i>	351
The Rehabilitation of the Morisco-era House at Calle San Buenaventura 7, Albaicín (Granada): An Over Fifty-Year-Long Project <i>A. Orihuela Uzal</i>	359
The Transformation of Tradition: Restoring original Estonian Vernacular Architecture in a Situation where Traditional Materials are no Longer Available <i>E. Lutsepp</i>	367
The Vernacular Architecture of the Island of Ibiza (Balearic Islands, Spain): a Brief Overview of the Current State of Research <i>M. H. Hermans</i>	375
Traces of Vernacular Architecture in the Royal Palace of Portici (Naples, Italy) between Knowledge and Restoration <i>L. E. Buono</i>	383
Vernacular Rural Architecture with Extradados Vaults. Case Studies from the Inland Areas of Southern Italy <i>M. G. Basilicata</i>	391
Materials and Components for the Sustainable Retrofitting and Climatic Optimization of Etnean Wineries in Sicily, Italy <i>G. Giuffrida, L. Dipasquale, R. M. Pulselli, R. Caponetto</i>	399
Multidimensional Evaluation of the Rehabilitation of Traditional Dwellings: Application to a Protected Dwelling in the Cabanyal-Canyamelar Neighbourhood in Valencia (Spain) <i>F. Vegas, C. Mileto, A. Hueto-Escobar, V. Cristini, S. Manzano-Fernández</i>	407

Passive Heating Strategies and Thermal Characteristics of Vernacular Buildings in Northeastern Portugal: A Case Study of Vernacular Building in the Montesinho Natural Park <i>S. Khei, R. Mateus, J. Ortega, R. Briones-Llorente, J. Fernandes</i>	415
WEDoVer Strategy for Documenting and Enhancing Vernacular Heritage: a Case Study of the Excavated Wine Cellars in Utiel (Spain) <i>Y. Hernández-Navarro, P. de Dato de Gennaro</i>	423
Bourbon Industrial Architecture and Territory: The Recovery of the Vanvitellian Mills in Valle di Maddaloni (Italy) <i>A. Staiano, M. Paradiso</i>	431
Re-envisioning Rural Heritage as a Resource for Regeneration: The Case of Abandoned Farmhouses in Northern Italy <i>A. Psoma</i>	439
The Risks to Vernacular Architecture Associated with Depopulation in the Valencian Community, Spain <i>E. Tortajada Montalvá, F. Vegas, D. E. Morocho Jaramillo</i>	447
Beyond the Surface: Neo-Vernacular Architecture in Sweden and Denmark's Contemporary Landscape <i>B. T. Eybye, M. Dabaieh</i>	455
Integrating Traditional Mechanisms in the Escalà HDU at the Solar Decathlon Europe 21/22 (Valencia, Spain / Wuppertal, Germany) <i>E. Tortajada Montalvá, M. Burgos Martinez</i>	463
Sustaining Traditions, Preserving Forests: Adaptation of Vernacular Woodworking in Rural Japan <i>J. Wang, C. Ochiai</i>	471
The Knowledge Production of Ecovillages and the Issues with Contemporary Regenerative Architecture <i>L. M. B. Jensen, C. Dayer, B. T. Eybye</i>	479
Author Index	487
Volume II	
EARTHEN HERITAGE. Conservation, adaptive reuse and sustainable design	
The Three Great Pioneers of the Art of Building with Raw Earth: from 1789 to the Present Day <i>J. Dethier</i>	489
Earthen Architecture and Landscape: The U-shaped Temples of Pre-Hispanic Lima <i>E. Saez, J. Canziani</i>	497

Earthen Architecture in Costa Rica: Building Typologies in the Historic Centers of Cartago and Santo Domingo de Heredia <i>I. Hernández-Salazar</i>	505
Inventory and Cataloguing of Traditional Houses in the Province of Veraguas, Panama <i>C. Aponte</i>	513
The Footprint of Earthen Architecture: Digital, Open-access Library of Earthen Building Cultures <i>A. R. Olivera, A. González, E. E. Villaseñor</i>	521
The Role of the Terra Conferences in Promoting and Conserving Vernacular Earthen Architecture <i>A. Sprega, C. Cancino, B. Marcus, E. Macchioni</i>	529
Dynamics of Transformation in Earthen Architecture: The Case of the Region of Northwest Murcia, Spain <i>F. Sandoval-Gómez, V. La Spina, S. Manzano-Fernández</i>	537
Tips and Tricks to Study Mudbricks. Experiences from the Protohistoric Site of Casas del Turuñuelo, Spain <i>L. M. Carranza, J. Canivell, B. Cutillas-Victoria, M. Fortea, P. Guerra, M. A. León, M. Lorenzón, A. Medialdea, E. Revert, J. C. Salcedo, E. Rodríguez González, S. Celestino</i>	545
Comparative Study of Yikeyin Adobe Houses of the Han Ethnic Group in Central Yunnan, China and Rammed Earth Houses in Songyang, Zhejiang, China <i>J. L. Xu, W. H. Jiang</i>	553
Earthen Architecture in the Castle of Segart, Valencia (Spain) <i>L. Mantecón, M. Pitarch, P. Herrero, F. Navarro, A. Morro, S. Estruch, F. Piñó, E. García, S. Juanes, J. Alfonso</i>	561
Exploring Earth-Building Techniques with Local Knowledge Holders in Siaya County, Kenya <i>S. Hage, A. Obama, S. Hollerman</i>	569
Hakka Architecture in China: Analysis of Rammed Earth Buildings <i>F. Ye, C. Mileto, F. Vegas</i>	577
Knowing Earthen Architecture in Albania: Investigating some Case Studies in Tirana and Kavaje <i>S. Rescic, L. Luvidi, M. Mattone, F. Fratini, L. Çapeli, J. Meniku, A. Voksh</i>	585
Preliminary Study on Traditional Chinese Cob Buildings and Their Construction Techniques: a Case Study of Yaozhuang Township <i>T. Y. Xie</i>	593
Ancient Solutions for Earthen Architecture in Humid Tropical Environment <i>A. J. E. Daneels</i>	601

Approximation to the Environmental Impact of the House of Gongora, Cehegin (Murcia, Spain): an LCA Perspective <i>A. Quintana-Gallardo, F. Sandoval-Gómez, V. Celina-Sáez, E. Zamora-Marina, J. G. Secondo-Maglia, F. A. Mendiguchia, I. Guillén Guillamón</i>	609
Landscape, Memory, and Sustainability: A study of Troglodytic Architecture in the Canary Islands (Spain) <i>L. Martínez Díaz</i>	617
Rammed Earth as an Alternative to Conventional Construction Methods in Valencia: a Comparative Life Cycle Assessment Perspective <i>A. Quintana-Gallardo, A. Sirera-Cocera, E. Zamora-Marina, V. Sáez, F. A. Mendiguchia, I. Guillén Guillamón</i>	625
Seismic Risk Analysis of the Rammed Earth Residential Buildings in Niebla (Huelva, Spain) <i>A. Guardiola-Villora, L. Basset-Salom</i>	633
Assessing the Performance of Earthen Sites Exposed to the Environment: The Wupatki Pueblo Case in Arizona, USA <i>L. Gambilongo, R. A. Silva, P. B. Lourenço</i>	641
Balancing Sustainable Conservation and Risk in Earthen Archaeological Structures: Insights from a Case Study <i>S. Manzano-Fernández, V. Cristini, D. E. Morocho Jaramillo</i>	649
Between Respect and Innovation. Innovative Recovery and Extension of a Historic Rammed Earth Farmhouse in Novi Ligure, Italy <i>G. Bollini</i>	657
Compatibility between Sustainability and Conservation in Earthen Architecture: Initial Analysis of Restoration Interventions and Contemporary Applications in Spain <i>C. Mileto, F. Vegas, A. Hueto-Escobar, L. García-Soriano, S. Manzano-Fernández</i>	665
Conservation Strategies of Earthen Architecture at the Acropolis of Kaminaljuyu, Guatemala <i>L. Guerrero, B. Arroyo</i>	673
Diverse Approaches from a Participatory Perspective: The Experience of Nuestra Señora de la Purísima Church in Tabladitas (Jujuy, Argentina, Argentina) <i>J. Tomasi, J. Barada, N. Veliz, N. Losa</i>	681
Energy Retrofitting Solutions for Traditional Half-Timbered Walls with earth infill in Spain: Challenges and Technical Recommendations <i>A. Hueto-Escobar, F. Vegas, E. Tortajada Montalvá</i>	689
Experimental Investigation of the Mechanical Behaviour of an Earth Material from an Afghan Architectural Heritage <i>A. Lico, R. Grazzini, A. Boostani, G. Misseri, S. Rescic, L. Rovero</i>	697

Lessons Learnt from Adaptive Reuse of Earthen Heritage in Desert Oases in Hot Arid Climates <i>M. Khalil, O. Pons Valladares, M. Bosch González</i>	705
Memories: Perspective of Intervention for the Safeguarding of Vernacular Earth Architecture <i>A. Weston</i>	713
Organic Stabilizers of Plant Origin in Archaeological Structures: Influence of Cactus Mucilage in the Making of Sacrificial Mortars <i>O. Medina Lorente, B. Carrascosa Moliner, L. Osete Cortina</i>	721
Preservation of Earthen Architecture in Spanish Archaeological Sites: Proposals for a Sustainable Action Diagram <i>S. Manzano-Fernández, V. Cristini, E. Tortajada Montalvá</i>	729
Raw Earth Construction and Restoration Technique: Experimental Protocol and Interventions in the Historic Village of Al Jazeera Al Hamra (United Arab Emirates) <i>R. Liberotti, V. Amer, V. Gusella</i>	737
Research and Comparative Analysis of Earth Mortars for Conservation and Restoration of Archaeological Structures. The Case of the Sant Jaume Site (Alcanar, Catalunya, Spain) <i>M. Roca Cabedo, B. Carrascosa Moliner, L. Osete Cortina</i>	745
Restoration and Conservation of the Earthen Architectural Complex in Tazumal Archaeological Park, El Salvador, Central America <i>S. Shibata</i>	753
Studies of Material Intervention to Conserve the Living Archaeological Site of Shuijingjie Distillery Site in Chengdu, China <i>Y. Wu, YH. Wu, C. Jiang, X. Chen, S. Dai</i>	761
Conservation and Sustainability of an Earth Architectural Heritage located in the Historic Center of Lima (Peru): House Museum, Challenges and Opportunities <i>M. Diaz-Santivañez</i>	769
Compressed Stabilized Earth Blocks for Improving the Durability of an Ancient Technique <i>M. L. Germanà, A. D'Amore</i>	777
Difficulties and Opportunities for the Conservation of the Convent of San Bernardino in Cuenca de Campos, Valladolid. The Task of the 'Rehabitar Tierra de Campos' Foundation <i>J. L. Sainz Guerra, J. M. Sastre, J. Olcese Ortega, J. Garcés Rallo, A. Sainz Esteban, M. A. Garcés Desmaison</i>	785
Status and Protection Strategies for Low-Grade Vernacular Architectural Cultural Relics in Rural Chungking, China <i>Y. Shu</i>	793
UNESCO Management Plans and Community Collaboration: A Comparative Analysis from Lyon, Djenné and Yazd <i>C. Scudellaro, T. Joffroy, M. Mattone, B. Rakotomamonjy</i>	801

The Illusion of Heritage: Critiquing Pseudo-Earthen Vernacular Architecture in Qatar <i>M. Dabaieh, M. Sakr</i>	809
Bioclimatic Enhancement of a Low-cost Earthen Dwelling in Niger Through Comfort Optimisation and Local Skills-based Technologies <i>R. Pennacchio, S. Fantucci, F. De Filippi</i>	817
Earthen Construction, a Question of Permanence <i>J. M. Gentileau, R. Guerrero, A. Nicolas, S. Popot</i>	825
Traditional Architecture and Urbanism of Veraguas, Panama, in a Globalized Reality <i>C. Aponte</i>	833
Author Index	841
Volume III	
HISTORIC SETTLEMENTS. Conservation, regeneration and management	
From Documentation to Strategic Planning: GIS-Based Survey and Assessment of AIUla's Vernacular Wall Paintings <i>S. Whittaker, A. Rava, E. Woolley, L. Alqadi, M. Giangraso</i>	843
From the Inca Ushnu to the Holy Cross Church: Materialities in the Sacred Landscape of Sahuara, Arica and Parinacota, Chile <i>M. Pereira, B. Yuste</i>	851
Stereotomy and Composition in Maya Architecture: The Medial Moulding at the Palace of the Governor at Uxmal (Yucatán, México) <i>A. L. Rosado Torres, L. Gilabert-Sansalvador, G. Muñoz Cosme</i>	859
Restoration Project of Vernacular Architecture. A Case Study: Consolidation-Underpinning Works and Post-Control of Deformations in the Church Juslibol (Zaragoza, Spain) <i>A. Gracia, F. J. Torrijo, A. García</i>	867
The Venice and its Lagoon UNESCO site (Italy): Cultural Heritage and Climate Change <i>F. Trovò, G. Bruschi</i>	875
A 'String Figure' Perspective on Heritage Sites - Examining a Village, a Fishing Harbour and a Former Railway Area in Denmark <i>M. Kirkegaard</i>	883
Aesthetic Qualities and Fragments of History in the Tiburtine Landscape (Italy). Places of the 'Sacred' and Ancient Itineraries <i>V. Montanari</i>	891
Analysis and Strategies for the Conservation and Enhancement of Abandoned Villages in Southern Italy: The Case of Castrum Vayrani <i>E. Coppola</i>	899

Analysis of Rural Settlement in the Czech Republic: A Case Study of Dolní Kounice <i>Z. Sýrová Anýžová, J. Sýrový</i>	907
Circular Villages and Field Systems on a Large Estate of Teplá Abbey in the Czech Republic - Land Arrangement, Settlement Pattern, Surveying and Metrological Analysis <i>M. Cernansky</i>	915
Decision Support Strategies for Urban Resilience: Mediterranean Historical Centres as Living Laboratories for Climate Adaptation <i>F. Armocida, F. Giglio, A. Sarlo</i>	923
Building Archaeology in Support of UNESCO Rural Heritage Projects: The Case of Fortified Church of Viscri (Romania) <i>I. Burnichioiu, M. L. Moldovan</i>	931
Identification and Conservation of Spatial Genes in Traditional Chinese Villages: A Case Study of Sandefan Village <i>X. Shi, B. Wu</i>	939
Interpretations and Sensitive Representations for the Documentation of Matera Vernacular Heritage <i>E. De Santis, E. Chiavoni</i>	947
Mapping the Urban and Rural Character of Historic Sites in Spain through a Digital Database <i>A. Castellón Valderrama</i>	955
Physical and Social Vulnerability to Heat Waves in Rural Communities with Vernacular Architecture: Villages in the Montesinho Natural Park (Portugal) as a Case Study <i>S. Graus, T. M. Ferreira, G. Vasconcelos, J. Ortega</i>	961
Re-naturalizing Minor Centers with Strong Historical Connotations: Strategies and Technologies <i>A. Mami, E. Nicolini</i>	969
Study and Evaluation of the Seismic Features of a Rural Roman Temple: The Case of the Temple of Ain Harcha, Lebanon <i>A. Alonso Durá, H. Bitar</i>	977
The Roman Villas in the Territorial Context of Ancient Pompeii: Conservation of Vernacular Characters and New Forms of Accessibility to the Archaeological Heritage <i>R. Picone</i>	985
The San Antonio Neighbourhood of Valencia and the Church that Gives it its Name <i>P. Blanco</i>	993
Traces and Memories of a Rural Reuse of Roman Amphitheatres: Archaeological Restoration and Landscape <i>L. Cappelli</i>	1001
Traditional Landscape Geography of China's Ou Region: A Perspective from Water and Soil Transformation <i>X. H. Cao</i>	1009

Transformation of an Area with Industrial Buildings in the Ottoman Empire in the 19th Century: İstanbul, Zeytinburnu <i>T. Darendeli, C. Binan</i>	1017
A New Paradigm toward Resilient Morphogenetic Open Processes <i>P. Bracchi, A. Boix, D. Giordanelli, F. J. Torrijo</i>	1025
After the Earthquake: The 'Interrupted' Landscapes <i>S. D'Avino</i>	1033
Forum Novum at Mile X of Via Traiana (Italy) <i>L. Salierno, G. Panarese, R. Bozzella</i>	1041
Hands-on Approach in Dry Stone Architecture and Landscape Heritage Safeguard: The Case of Kato Meropi (Greece) <i>V. Demertzidou Kiouzepe</i>	1049
Holy Spaces, Contemporary Art: Reuse and Conservation in Naples' Churches (Italy) <i>L. Romano, E. Vitagliano</i>	1057
Masonry Walls Restoration and Urban Regeneration in the Clock Tower of Monóvar (Alicante, Spain) <i>V. Fernández-Mora, E. Moya Soriano, C. Boigues</i>	1065
Revealed Spaces. The Hypogeal Churches of Naples Between Improved Knowledge and New Forms of Expanded Fruition <i>V. Cera, S. Pollone</i>	1073
Solar Cadastre for Heritage Sites: A Geoinformation Tool for Balancing Energy Potential and Conservation Needs <i>M. Debevec, T. Bevk, G. Stegnar, D. Gantar</i>	1081
The Historic City of Doha in Qatar; Tourism as a Catalyst for a Sustainable Urban Regeneration <i>D. Boussaa</i>	1089
The Walls of Philippe Auguste in Paris across the Centuries: General Strategy of Conservation and the Case of Jardins Saint-Paul <i>C. Mazzoni, F. Magliacani, A. Pane, E. Polverino, C. Ruggiero, D. Treccozi</i>	1097
Guidelines to Support the Sustainable Conservation of Cultural Heritage Buildings in Slovenia <i>M. Tomšič, N. Goršič, S. Mujkič, M. Šijanec Zavrl, N. Ježič, D. Gantar</i>	1105
Implementation of an Innovative Model of the Comprehensive Energy Renovation Project of a Cultural Heritage Building in Ljubljana, Slovenia <i>N. Ježič, M. Tomšič, M. Šijanec Zavrl</i>	1113
Rural Settlements as Cultural Heritage: Guidelines for Renovating and Building Houses in the Municipality of Cerknica, Slovenia <i>D. Gantar, N. Goršič</i>	1121

Between the Protection of the Urban Landscape and Cultural Tourism: Risks and Opportunities for the Painted Architecture of the Historic Center of Malaga (Spain) <i>L. Royo Naranjo</i>	1129
Cultural Agrarian Landscapes: the case of the Valencian Citrus Fields as a GIAHS candidate (Spain) <i>O. Lozano Muñoz, A. Besó Ros, L. Gilabert-Sansalvador, M. J. Viñals</i>	1137
From Village to Sky: Analysis of the Historical Evolution and Heritage of Benidorm (Alicante, Spain) <i>M. Piqueres Martínez, A. Hueto-Escobar, V. Cantero</i>	1145
Marginality versus Resilience. Opportunities of Inner Areas' Territorial Heritage: The Case of Valle del Giovenco-Valle Roveto <i>C. Salve, A. Tosone, D. Di Ludovico</i>	1153
Transformation of Historic Areas of Spa Towns under Urbanization Pressure: The Case Study of Bukovička Spa (Arandelovac, Serbia) <i>S. Milovanović</i>	1161
Approximation to the Concept of 15mC in the Historic Centre of Valencia (Spain): Demographics, Economy, Housing and Emblematic Establishments <i>J. Orozco-Messana, C. Mileto, F. Vegas, V. Cantero</i>	1169
Vernacular Terraces for Sustainable Urban Ecosystems in Two Cities in the Andes <i>S. Santa-Cruz, M. Vilela, A. Dueñas, C. Zeballos-Velarde, L. Rodriguez, L. Moya, G. Fernández de Córdova, I. Ortiz, G. Romero</i>	1177
The Archaeological Site of Abella Castle (Avella, Campania, Italy): History, Conservation and Accessibility <i>A. Pane, G. Spizuoco, A. Mazzei, A. Polcari</i>	1185
Author Index	1193

To our friends and colleagues in: C.T.A. Consultores Técnicos Asociados, S.A.P., for their collaboration and support.

References

- Jiménez Salas, J.A., Justo, J.L. & Serrano, A. (1981). *Geotecnia y Cimientos II*. Editorial Rueda, Madrid.
- López Julián, P.L., Orte, D., Ramis, J., Pérez, J.A. & Pueyo, O. (2019). Identificación de taumasita asociada a la restauración de la Iglesia de San Andrés de Calatayud (Zaragoza). Condiciones de formación y de preparación de las muestras. *Geogaceta*, 66, pp. 127–130.

The Venice and its Lagoon UNESCO site (Italy): Cultural Heritage and Climate Change

F. Trovò^{1,*}, G. Bruschi²

¹ Università Iuav di Venezia, Venezia, Italia, trovo@iuav.it, ; ² Università Iuav di Venezia, Venezia, Italia, greta.bruschi@iuav.it, 

Topic: T1.5. Energy efficiency and sustainable design projects

How to cite: Trovò, Francesco & Bruschi, Greta (2025). The Venice and its Lagoon UNESCO site (Italy): Cultural Heritage and Climate Change. In C. Mileto, F. Vegas, A. Hueto-Escobar & S. Manzano-Fernández (Eds.) *Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration*. September 10th – 12th, 2025, Valencia (Spain). edUPV. <https://doi.org/10.4995/HERITAGE2025.2025.19512>

Abstract

The contribution illustrates the outcomes of the research “Deepening the Impacts of Climate Change on Venice’s Monumental Heritage”. This activity was carried out to integrate the various studies conducted in recent years by the Iuav University of Venice, the outcomes of the CORILA Venezia2021 research and the general aspects of the Venice Climate Change Adaptation Plan, as well as in coordination with the contents of the UNESCO, ICOMOS International and Europa Nostra documents and with other national (PNIEC, PNAC, PTE) and EU documents. The analysis of impacts and risks to cultural heritage is provided both with regard to the effects of gradual changes in climatic parameters (temperature, precipitation, relative humidity, etc.) and with regard to possible damages caused by extreme events (floods, heavy rain, prolonged drought periods). The effects considered to be potentially more damaging were associated with risks/threats for macro morphological/typological categories of cultural assets identified in the existing cultural heritage, also considering the effects of activating the MOSE system. The analytical campaigns also involved several Iuav laboratories such as Lama, FisTec and Geomatics CIRCE. The conclusion of the research saw the elaboration of a series of actions to prevent and mitigate the effects of climate change, calibrated taking into account the characteristics of the assets belonging to the different macro-categories identified, and referable to both the punctual intervention and the preventive conservation plan, aimed at increasing specific resilience. The proposed actions are aimed at guaranteeing not only the effectiveness of the solutions, but also the material and formal compatibility of the different expressions of historic lagoon buildings.

Keywords: Venice; cultural heritage; climate change; risk; intervention

1. Introduction

This paper presents the findings of the “Detailed Study of the Impacts of Climate Change on the Monumental Heritage of Venice” begun in 2023 (Trovò et al., 2024; Trovò, 2024; Trovò, 2023). As early research on the city of Venice and its lagoon demonstrated (Saetta et al., 2020; Berto et al., 2022), the impacts of climate change—

variations in environmental parameters (rainfall, humidity, temperature), rising sea levels, and the increase of extreme weather events—pose a new threat to the conservation of cultural heritage. The importance of understanding and addressing the impact of these changes on cultural heritage conservation arises from the fact many losses are irreversible and have significant consequences in

terms of the intangible heritage linked to questions of identity and belonging.

The study began with an elaboration of the main risks of Climate Change on Cultural Heritage delineated by UNESCO in 2007 (UNESCO, 2007) and proceeded by identifying specific indicators ETCDI - Extreme Climate and Weather Indicators (EPA, 2025) to show the change, variation, and projection of current climate change impacts in relation to future scenarios. These threats were then distinguished as direct or indirect. The former are climatic conditions that act tangibly on materials, compromising their physical integrity. They can be further distinguished as gradual (variations in environmental parameters) or sudden (extreme weather events). The indirect effects are aggravating factors that can result from the sum or interaction of direct threats (prolonged draught phenomena that can increase the risk of fire) or dynamics that affect not so much the materials as the intangible aspects of the asset, such as the loss of the historical-cultural context, the alteration of the original use, or changing collective perceptions of heritage value.

The research¹, which was coordinated with educational experiences (Gobbi et al., 2024), examined data on temperature, precipitation, and extreme weather events for the Veneto region by analyzing projections developed by ARPAV (the Veneto regional agency for environmental prevention and protection) and considering different emissive scenarios. The Venice lagoon was then examined in its specificity and its historical and recent anthropic transformation, and attention finally focused on the historical city.

¹ *Approfondimento degli impatti dei cambiamenti climatici sul patrimonio monumentale di Venezia (Detailed Study on the Impacts of Climate Change on the Monumental Heritage of Venice)*, City of Venice, Regional Development and Sustainable City, Director Architect D. Gerotto; Environmental Assessment and

2. The approach to the Venetian context: from macro-category to case study

Even though the historical city of Venice is exceptional from an architectural point of view, it is still an extremely significant case study. Every major conservation issue is concentrated here, heightened by the city's extreme environmental conditions and the vulnerability of its historical building fabric. The study investigated the possible actions (from monitoring to specific direct interventions) that can be implemented to strengthen the resilience of the city's built heritage in relation to future risk scenarios. Analyzing the solidity of Venice's built heritage required a morpho-typological macro-categorization through which the specificities of the built environment's vulnerabilities could be examined, prompting an initial distinction between buildings (churches, bell towers, residential/commercial structures, theaters, etc.) and open spaces.

Subdivision into macro-categories makes it possible to identify the risk of climate impacts on the urban scale. It also permits shortlisting specific actions for identified classes and evaluating and comparing assets of classes with similar characteristics. This process made it possible to identify specific building characteristics, such as the materials used and recurring construction nodes, establishing the basis for analyzing the behavior of these elements in relation to certain climatic impacts. In this sense, the risk assessment process begins with in-depth analysis of the intrinsic qualities and proceeds by assessing the various vulnerabilities with respect to the direct threats on the built environment in a given location.

Reclamation, Manager Dr. M. Gattolin - Università Iuav di Venezia, Dipartimento di Culture del Progetto Professor F. Trovò (coordination), Professor G. Bruschi (co-coordination), Architect E. Gobbi (research assistant).

3. Threats & risks for the built environment

A total of 805 buildings were included in this study. Intrinsic factors such as construction and connotative features, the state of conservation, and the extent of restrictions were assessed for each building. Extrinsic factors were then evaluated in relation to location. The specific factors included exposure to sunlight, rain, and wind and average sea level rise. The use of multipliers, which were differentiated on the basis of the building's construction and materials, made it possible to account for vulnerability and resilience on the basis of different climatic factors (higher scores corresponded to greater risk). The first risk indicator was the asset's historical designation², after which its maintenance and conservation status were taken into consideration³.

To assess the asset's exposure in relation to the threats' intensity, the building stock was divided into three categories based on urban location. Buildings located in marginal areas (Fig. 1) that are considered to have greater exposure to the action of winds (bora and sirocco, in particular), rain, and other storm surges were grouped together. Buildings with water frontage (Fig. 2) whose facing walls are threatened by phenomena of water absorption and wave motion came next and, finally, the properties scattered throughout the urban fabric that are considered to be more protected from direct extreme calamitous events.

The impact of sun or shade (Fig. 3) compromises materials in different ways (thermal shocks or the proliferation of biological colonization), which is why multiplicative values were associated to sunlight and shade based on existing materials and their exposure, while rainfall and strong winds can have a greater impact on particularly high buildings, such as bell towers or churches.

² Buildings that are protected by historic preservation provisions were considered higher risk than those that are unregulated.

³ Properties that are abandoned were considered higher risk than those characterized by recent interventions.



Fig. 1 – Buildings located in marginal areas (Elaborated by Enrico Gobbi as part of the activity “Detailed Study of the Impacts of Climate Change on the Monumental Heritage of Venice”, 2024).

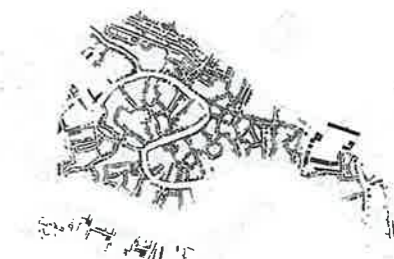


Fig. 2 – Buildings with water frontage (Elaborated by Enrico Gobbi as part of the activity “Detailed Study of the Impacts of Climate Change on the Monumental Heritage of Venice”, 2024).



Fig. 3 – Identification of areas with minimum sunshine 0-4 h and macro-areas subject to Bora and Scirocco winds (Elaborated by Enrico Gobbi as part of the activity “Detailed Study of the Impacts of Climate Change on the Monumental Heritage of Venice”, 2024).

In the case of Venice, in particular, it was also necessary to assess vulnerability to the average sea level rise and to assess phenomena of high tides, making use of the altimetry elevations of the Digital Terrain Models (DTM) of the Metropolitan City of Venice integrated with RAMSES data.⁴

Managing the digital models in a GIS environment made it possible to combine each different building weight with the identification of different critical flooding levels, thereby identifying the vulnerability of the building stock with respect to different scenarios of average sea level rise. The mitigation of the average sea level



Fig. 4 – Palazzo Minotto in Dorsoduro sstiere (Trovò, 2020).

⁴ The RAMSES project (*Rilievo altimetrico, modellazione spaziale e scansione 3D* [Altimetric surveying, spatial modeling, and 3D scanning]) was

rise through the activation of the MOSE system, as well as its effectiveness in future scenarios (2030, 2050, 2100), was taken into account in calibrating the risk scores.

4. Threats and risks for open spaces

With respect to open spaces, the study assessed a total of 566 case studies, including 125 stone-paved squares, 68 gardens, 55 bridges, and 72 wellheads. Open spaces are mainly affected by intense intermittent phenomena, such as winds and heavy rainfall, in which the presence of trees or discontinuous elements increases the risk in relation to the safety of people and the adjacent properties.

promoted by the City of Venice and implemented by Insula spa beginning in 2011.



Fig. 5 – Campo San Lorenzo with the church of the same name in the background (Cappelletti, 2024).

The same methodology used the built environment was used to assess the areas' exposure to sunlight and shade taking into account the surface type. Green areas or permeable surfaces conditions that favor the mitigation of heat waves or water drainage in the event of heavy rainfall—scored better. Wind action was considered in the presence of trees that risked falling. The previously developed digital model was also used to assess the critical elevations for scenarios of average sea level rise for open space.

5. Actions to prevent and counteract

To develop the basis for a flexible programmed conservation plan it was necessary to identify three case studies (Figs. 4-6), each one of which represents a macro-category and specific urban and environmental conditions.

Each case is an example for developing a modus operandi that can be adapted to other contexts in the city, with the goal of establishing a systematic monitoring practice as well as protective measures and/or interventions for cultural heritage that can be extended to other situations. Through an urban scale analysis, this methodology permits the preventive identification of risks and vulnerabilities, making it possible to define targeted measures. The three case studies—a palazzo, a church with a bell tower, and an open space—provide a sufficiently complete framework for developing a methodological approach to planned conservation.

For each case study, it was possible to identify the major building nodes by location, materials, and vulnerability in relation to specific threats correlated to the particular exposure (Bruschi 2020a; Bruschi 2020b).

A shortlist of conservation measures, divided into the major areas of intervention (cleaning, consolidation, integration, protection, and so forth), was identified for each node, made up of specific materials with precise localizations. The measures to prevent and counteract the effects of climate change can then consist of a series of specific interventions to be carried out in the short term to ensure a sufficient level of resistance to known threats, as well as the preparation of programmed conservation plan aimed at increasing resilience over time as threats and their intensity change. The previously identified and “weighted” vulnerabilities and risks determine the frequency of monitoring and, where appropriate, timely interventions making it possible to limit the loss of material and increase the components’ resilience level.



Fig. 6 – Santa Maria Assunta dei Gesuiti church (Trovò, 2021).

6. Conclusions

In a situation in which the variation of predictive data can even significantly alter risk scenarios, the ideal strategy—in a relevant context such as Venice—should consider defining a preventive programmed conservation plan. Alternating monitoring and maintenance measures provides an effective methodology for defending cultural heritage from climatic threats, especially if these actions are integrated into municipal regulations such as master plans and building codes. This proposal stands in contrast with one-time restoration interventions, which are more costly and by their very nature often incapable of adapting to the behavior of cultural heritage in face of rapidly changing climate threats. Digitalizing the collected information in GIS provides an indispensable basis for timely queries regarding an individual building or a single risk factor but must also be continuously updated as scenarios and risks evolve. This research, which focused on historical buildings characterized by traditional materials distinguished by intrinsic resilience, could be further developed for twentieth-century buildings characterized by innovative building materials and construction techniques of poor durability and at even greater risk in extreme weather conditions.

Fundings

The project is part of the MASE–Experimental program on interventions for adaptation to climate change in urban areas (DD 117/2021).

Acknowledgements

Thanks to the other components of the activity: Dr. A. Bonazza (collaborator) with Dr. A. Sardella, (Istituto di Scienze dell’Atmosfera e del Clima, CNR); Laboratorio di Geomatica, (Prof. C. Balletti), Laboratorio LAMA, (Prof. M. Bassani, formerly Professor F. Antonelli), Laboratorio FisTec, (Prof. F. Peron).

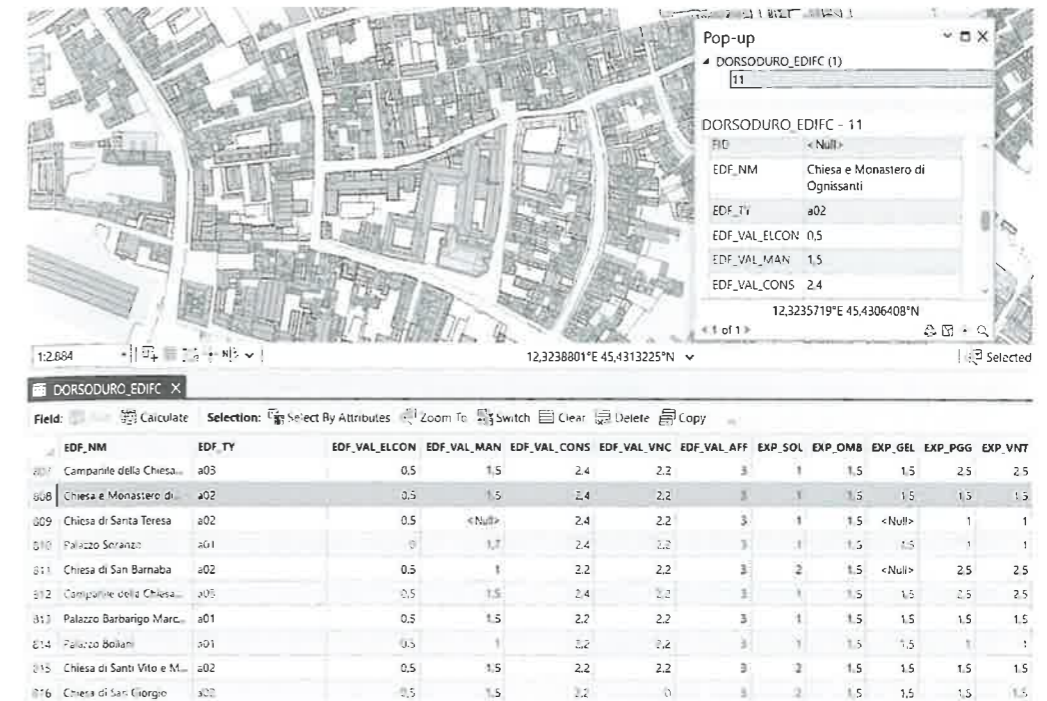


Fig. 7 – Gathers georeferenced and punctual data for the individual building unit in order to define specific interventions with respect to the vulnerability conditions to which the asset is subjected. (Elaborated by E. Gobbi as part of the activity “Detailed Study of the Impacts of Climate Change on the Monumental Heritage of Venice”, 2024).

References

- Berto, L., Talledo, D. A., Bruschi, G., Zamboni, I., Lazzarini, E., Zofrea, C., Faccio, P., & Saetta, A. (2022). A multidisciplinary approach for the vulnerability assessment of a Venetian historic palace: High water phenomena and climate change effects. *Buildings*, 12(4), 431. <https://doi.org/10.3390/buildings12040431>
- Bonazza, A., & Sardella, A. (2023). Climate change and cultural heritage: Methods and approaches for damage and risk assessment addressed to a practical application. *Heritage*, 6, 3578–3589. <https://doi.org/10.3390/heritage6040190>
- Bruschi, G. (2020a). La conservazione dell’architettura nel tempo dei cambiamenti climatici: L’analisi come strumento di progetto. In G. Biscontin & G. Driussi (Eds.), *Gli effetti dell’acqua sui beni culturali: Atti del convegno Scienza e Beni Culturali XXXVI (Venezia, 17–19/11/2020)* (pp. 259–268). Arcadia Ricerche.
- Bruschi, G. (2020b). Global warming e restauro. Adattamento, miglioramento o manutenzione? Note per una possibile conservazione delle architetture storiche. *Officina*, 2020, 42–47.
- Cacciotti, R., Sardella, A., Drdáký, M., & Bonazza, A. (2024). A methodology for vulnerability assessment of cultural heritage in extreme climate changes. *International Journal of Disaster Risk Science*, 15, 404–420. <https://doi.org/10.1007/s13753-024-00564-8>
- EPA (2025). *Climate change indicators: Weather and climate*. United States Environmental Protection Agency. <https://www.epa.gov/climate-indicators/weather-climate>
- Gobbi E., Maimonte M., Tamiello I., Iemma A., Pereira E., Tamiello I., Ivanovic N., Serafin I., Soufian N. (2024). *Cambiamenti climatici e patrimonio costruito a Venezia. Scenari di rischio e azioni di mitigazione: i palazzi, gli spazi aperti, chiese e campanili*. Rapporto prof. Francesco Trovò - co-rapporteur prof. Greta Bruschi - Iuav University of Venice, Architecture Course A.A 2022-2023.

Saetta, A., Antonelli, F., Fabian, L., Faccio, P., Peron, F., Romagnoni, P., Tosi, M. C., ... Zamboni, I. (2020). Venezia 2021. Piano di adattamento al cambiamento climatico e implementazione di strategie di intervento per la salvaguardia del patrimonio architettonico e ambientale. Primi esiti di una ricerca. In G. Biscontin & G. Driussi (Eds.), *Gli effetti dell'acqua sui beni culturali* (pp. 1–10). Arcadia Ricerche.

Trovò F. (2023). Gli effetti dei cambiamenti climatici sul patrimonio culturale di Venezia. Proposta di un metodo per la definizione di misure di contrasto, «Materiali e strutture. Problemi di conservazione», Anno XII, n. 24. Clima che cambia. Beni storici che rimangono, pp. 9-26

Trovò F. (2024). La Venezia del passato, esempio attuale di sostenibilità e resilienza / The Venice of the past, a current example of sustainability and resilience. In R. Tamborrino & A. Longhi (Eds.), *Città che si adattano? Volume 3, Processi urbani di adattamento e resilienza tra permanenza e precarietà / Adaptive cities? Volume 3, Urban Processes of Adaptation and Resilience Between Permanence and Precariousness* (pp. 464–476). AISU International, Collana editoriale.

Trovò, F., Bruschi, G., Umar, N., & Darendelli, T. (2024). Historical cities against climate change: Management conservation plans as a possible strategy? In G. Driussi (Ed.), *La conservazione preventiva e programmata. Venti anni dopo il Codice dei Beni Culturali* (pp. 299–310). Arcadia Ricerche.

UNESCO (2007). *Climate Change and World Heritage*. World Heritage Centre, Centre du Patrimoine Mondial, Paris, Rapport n° 22, WHC-06/30.COM/7.1

A ‘String Figure’ Perspective on Heritage Sites - Examining a Village, a Fishing Harbour and a Former Railway Area in Denmark

M. Kirkegaard^{1,*}

¹ Aarhus School of Architecture, Aarhus, Denmark, maki@aarch.dk, 

Topic: T3.1. Studies of historic urban and rural areas

How to cite: Kirkegaard, Mathilde (2025). A ‘String Figure’ Perspective on Heritage Sites - Examining a Village, a Fishing Harbour and a Former Railway Area in Denmark. In C. Mileto, F. Vegas, A. Huetto-Escobar, & S. Manzano-Fernández (Eds.) *Earthen and Vernacular Heritage: Conservation, Adaptive Reuse and Urban Regeneration*. September 10th – 12th, 2025, Valencia (Spain). edUPV. <https://doi.org/10.4995/HERITAGE2025.2025.19214>

Abstract

This paper will take its departure from research conducted by the author at Aarhus School of Architecture concerning the Danish heritage category ‘cultural environments’. This heritage category concerns heritage sites and incorporates both buildings, structures and landscapes. In other words; ‘cultural environments’ are built wholes. The research has focused on how to manage these sites in a sustainable manner and this has led to new insights into the connection between the intangible and tangible aspects. The paper will be based on this research, but further the discussion and reflection through the so-called ‘string figures’ described by professor Donna Haraway (2016). The paper will analyze three Danish heritage sites; a small village in the countryside, an historic fishing harbor in a small town and a former railway area in the city centre and pair these places with the ‘string figure’ perspective as a method to deepen our understanding of the places. The connections between the different physical elements, natural elements, people and more-than-humans can provide a new understanding of what is important to care for within the historical site. Furthermore, the theory behind the ‘string figures’ outlines an approach to a more detailed narrative of the site which elaborates on the historical relevance and the deep meanings that the site contains. This way of understanding the many layered historical sites creates a direction for how to manage and care for the sites in the future. The historical buildings do not stand alone, and their cultural, historical relevance is often interconnected with the natural surroundings, along with plants and animals, and the people that have cared for the buildings through history and today. Donna Haraway’s ‘string figures’ show the importance of the connections, and not the isolated objects or buildings, which can create a new understanding of our heritage sites.

Keywords: heritage; Haraway; ecology; connections; methods; management

1. Introduction

The paper will analyze three different historical sites by mapping the tangible and intangible components as well as the dynamic and static aspects of the sites. However, the analysis will not focus on these aspects and components as isolated entities, but rather the connections they

form. This is investigated through professor Donna Haraway’s, so-called, “string figures” (Haraway, 2016). The three sites are selected on the basis of an extensive research work conducted at Aarhus School of Architecture from 2015-2022 where over 2300 *cultural environments* in Denmark have been mapped and described (Morgen et al., 2025). The term

Author Index

- Alonso Durá, A.,
Alqadi, L.,
Armocida, F.,

Besó Ros, A.,
Bevk, T.,
Binan, C.,
Blanco, P.,
Boigues, C.,
Boix, A.,
Boussaa, D.,
Bozzella, R.,
Bracchi, P.,
Bruschi, G.,
Burnichioiu, I.,

Cantero, V.,
Cao, X. H.,
Cappelli, L.,
Castellón Valderrama, A.,
Cera, V.,
Cernansky, M.,
Chiavoni, E.,
Coppola, E.,

Darendeli, T.,
D'Avino, S.,
De Santis, E.,
Debevec, M.,
Demertzidou Kiouzepeí, V.,
Di Ludovico, D.,
Dueñas, A.,

Fernández de Córdoba, G.,
Fernández-Mora, V.,
Ferreira, T. M.,

Gantar, D.,
García, A.,
Giangraso, M.,
Giglio, F.,
Gilabert-Sansalvador, L.,
Giordanelli, D.,

Goršič, N.,
Gracia, A.,
Graus, S.,

Hueto-Escobar, A.,

Jejčič, N.,

Kirkegaard, M.,

Lozano Muñoz, O.,

Magliacani, F.,
Mami, A.,
Mazzei, A.,
Mazzoni, C.,
Mileto, C.,
Milovanović, S.,
Moldovan, M. L.,
Montanari, V.,
Moya, L.,
Moya Soriano, E.,
Mujkić, S.,
Muñoz Cosme, G.,

Nicolini, E.,

Orozco-Messana, J.,
Ortega, J.,
Ortiz, I.,

Panarese, G.,
Pane, A.,
Pereira, M.,
Picone, R.,
Piqueres Martínez, M.,
Polcari, A.,
Pollone, S.,
Polverino, E.,

Rava, A.,
Rodríguez, L.,
Romano, L.,

Romero, G.,
Rosado Torres, A. L.,
Royo Naranjo, L.,
Ruggiero, C.,

Salierno, L.,
Salve, C.,
Santa-Cruz, S.,
Sarlo, A.,
Shi, X.,
Šijanec Zavrl, M.,
Spizuoco, G.,
Stegnar, G.,
Srová Anýžová, Z.,
Srový, J.,

Tomšič, M.,
Torrijo, F. J.,
Tosone, A.,
Treccozi, D.,
Trovò, F.,

Vasconcelos, G.,
Vegas, F.,
Vilela, M.,
Viñals, M. J.,
Vitagliano, E.,

Whittaker, S.,
Woolley, E.,
Wu, B.,

Yuste, B.,

Zeballos-Velarde, C.,