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Editors

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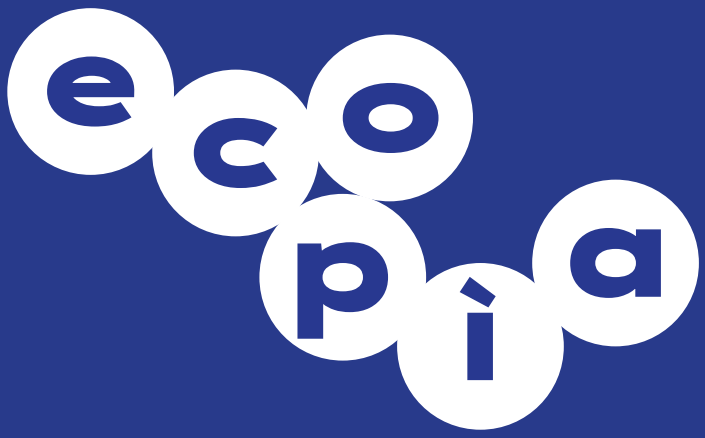

ECO PARTNERSHIP FOR INTERDISCIPLINARY ACTION

UNIVERSITÀ DELLA CALABRIA
DIPARTIMENTO DI **INGEGNERIA DELL'AMBIENTE**

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ECOPÌA

ECO PARTNERSHIP FOR INTERDISCIPLINARY ACTION

International Symposium
Book of Abstract

Editors
Paola Cannavò, Pierfrancesco Celani, Massimo Zupi

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INTRODUCTION TO THE CONFERENCE

Paola Cannavò, Pierfrancesco Celani, Massimo Zupi

ECOPÌA

The era we live in, as many of the past times, is marked by multiple and interconnected crises (humanitarian, environmental, social, political, and epistemic) as well as by growing inequalities, the erosion of common goods (Ostrom, 2008), biodiversity loss and, finally, the climate crisis (IPCC, 2023).
Despite thirty years of sustainability rhetoric, launched with the Earth Summit in Rio in 1992, the tangible impact of the many good practices implemented has remained limited. The concept of "sustainable development," which was consolidated too quickly, has failed to deeply transform collective behaviors, production systems, and power structures (Franz, 2020, 2022).
The 2030 Agenda and its 17 Sustainable Development Goals (Ferrara, 2016) marked an important step, but have not been able to trigger the necessary structural, cross-sectoral, and multilevel change.

Since 2012, the international academic network "Routes Towards Sustainability – Routes" promotes academic cooperation among more than twenty universities across five continents, through a multidisciplinary approach to sustainability.
But the conditions described above, have led the Routes network to evolve and renew itself, reaffirming its decade-long commitment while updating and expanding its scope.

Thus, ECOPIA – Eco Partnership for Interdisciplinary Action was born: an open and dynamic alliance uniting universities, research centers, public institutions, non-profit organizations, grassroots movements, and private actors. What binds these diverse actors is a shared vision: to co-construct, inclusive, generative, and sustainable futures through dialogue between knowledge systems, territories, and transformative practices. This vision is in constant evolution, able to adapt to different contexts and changing circumstances, and aims to offer a positive interpretation of sustainability, one that reintegrates humanistic, cultural, and artistic knowledge, as a counterpoint to traditional apocalyptic or guilt-based narratives.
These narratives have produced international policies that, too often, were based on an unconscious subtext: the end users, the citizens, had to atone for years of bad behavior, give up part of their well-being, and accept a backward step to survive. It's clear that this approach was inevitably doomed not only to failure, but also to rejection, repulsion, and ultimately a reactionary attitude that, especially in recent times, has significantly regressed the culture of sustainability.

No discipline, territory, or community can face the complexity of today's challenges alone. What is needed is a choral convergence, capable of weaving together knowledge, practices, and visions across geographical, institutional, and epistemic boundaries (Morin, 2005).
But such convergence, such sharing, cannot be based on fear (a new Noah's Flood that will reduce living species to the bare minimum, so that we can start over). We must have the courage, strength, and ability to show and demonstrate that a better future is possible, that humanity can cooperate to overcome current crises and meet contemporary challenges.

In this spirit, ECOPIA presents itself as a generative and inclusive space, where partners might co-construct shared imaginaries and pathways of transformation.
Failures, setbacks, and unsatisfactory results should not lead to resignation but instead drive renewed commitment and action toward more just, relational, and desirable ways of living. ECOPIA was born from this tension: as a collective space of thought, action, and imagination, where diverse actors can build real alternatives, starting from the territories and the relationships that inhabit them.
At the heart of this vision lies the idea of a common home to be inhabited and regenerated together. The reference to the Greek term oikos, understood not only as a physical space but

as a living web of relationships, evokes a collective responsibility to care for the conditions that make life possible. From this also arises a tension toward a concrete utopia: an ever-shifting horizon that doesn't promise certainty but invites movement, construction, and collaboration.

As Eduardo Galeano reminds us:
"Utopia is on the horizon. I walk two steps, and it moves two steps away. I walk ten steps, and the horizon runs ten steps further. No matter how far I walk, I'll never reach it. So what's the point of utopia? The point is: it keeps us walking." (Galeano, 1993).

ECOPIA aims to be exactly that: a shared, open, pluriversal community where knowledge, practices, and visions come together to shape futures that do not yet exist,

SYMPOSIUM

The "Ecopìa – Eco partnership for interdisciplinary action" Symposium represents the founding event of the new network, offering a space for reflection and interaction through a series of activities, including plenary lectures, parallel sessions, round tables, and other formats aimed at promoting direct dialogue between the various stakeholders involved.

In seeking to embody the mission of Ecopìa, the Symposium takes shape as a space of collective elaboration that does not limit itself to gathering and sharing research findings, but aspires to build common ground for epistemological, methodological and political reflection around several key questions widely debated in the literature.

Plural, Situated and Shared Knowledge
The starting point is a radical epistemological assumption: knowledge is neither neutral, nor universally locatable in a single center of production. Drawing on the perspective of *situated knowledges* (Haraway, 1988) and subsequently systematized in the epistemologies of the South (Boaventura de Sousa Santos, 2018), the Symposium holds that all knowledge is produced by a subject positioned within a specific historical, cultural and territorial context. This positionality does not constitute a limitation to be overcome, but a resource to be valued: it is in the plurality of perspectives that the conditions for a deeper and more just understanding of socio-territorial phenomena are generated.

This orientation draws inspiration from a particularly lively period of contemporary research on decolonial and plural epistemologies, which have articulated the concept of decoloniality as an epistemic, aesthetic, and political project (Mignolo and Walsh, 2018). Subsequently, the implications for knowledge production in post-socialist and peripheral contexts have been examined, demonstrating how situated epistemologies are not a privilege of the global South, but a necessity for any context that has undergone processes of cognitive marginalization. In the Italian and Mediterranean context, an analysis of the forms of patrimonial and territorial knowledge that resist globalizing standardization has developed, recovering the notion of biocultural heritage as an epistemic tool that intertwines scientific knowledge, practical knowledge, and collective memory.

In this direction, the concept of the *pluriverse* (Kothari et al., 2022) offers a programmatic horizon for thinking research processes that do not colonize local worlds but rather valorize their own ontologies and rationalities.

Trans-disciplinarity: Crossing Boundaries to Build Knowledge with Communities
The scientific framework of the Symposium embraces trans-disciplinarity not as a simple integration of different disciplines, but as a radically different mode of knowledge production — one that implies the active involvement of non-academic subjects throughout the entire research cycle, from the definition of problems to the evaluation of results. This conception is clearly distinct both from multidisciplinarity, which juxtaposes disciplines without making them interact, and from interdisciplinarity, which generates syntheses internal to the academic field

without opening up to communities.

Recent literature has considerably refined the conceptual and methodological tools for transdisciplinary research. Some authors propose a typology of forms of *co-production of knowledge* in transformation-oriented research contexts, distinguishing between levels of non-academic partner involvement and discussing the institutional conditions that make them possible (Schäpke et al, 2022). In this context, the reflexive dimension of transformative research is explored, introducing the concept of positionality as a methodological requirement that obliges researchers to explicitly state their values, assumptions, and power relations in the field. This leads to an updated systematization of available methodologies, with particular attention to the processes of mutual learning between science and society.

In Italy, this perspective has found significant expressions within territorial studies, where some authors (Alberto Magnaghi, 2020) have theorized processes of *territorial autopoiesis* founded on the protagonism of local communities as knowing and designing subjects.

The Symposium explicitly situates itself within this tradition: not as a container of already-produced knowledge, but as a *hybrid forum* (Callon et al. 2009) in which experts, practitioners and citizens jointly construct interpretations and proposals for addressing the challenges of contemporary territorial life.

Territorial Regeneration: A Relational Ecology

Territory is assumed as a fundamental category of the Symposium's scientific framework, but in a sense profoundly different from the reductively spatial or patrimonialist one that has often characterized public policies. Following the territorialist tradition (Dematteis and Governa, 2005), territory is understood as the *historical product* of relations between settled communities and the biotic and abiotic environment: a social and cultural construction that sediments values, identities and practices of care.

In these approaches, the territory is not thought of as a surface on which separate actors operate, but as a network of lifelines in continuous evolution, in which humans, non-humans and environments co-constitute each other (Ingold, 2011). The analysis of friction ecologies (Tsing, 2015), shows how relations between the local and the global, between nature and culture, are always mediated by situated actors and negotiation processes that produce both vulnerability and possibilities for regeneration.

In the context of territorial planning and policies in Italy, the implications of this paradigm shift for territorial governance practices are discussed, highlighting the need for design tools capable of integrating ecological, cultural, and economic dimensions without reducing them to mere optimization variables. The concept of integral regeneration within the UN-Habitat program offers an international benchmark for practices that transcend the sectoral approach and promote systemic visions of urban and territorial development.

In this perspective, regenerating a territory does not mean applying technical solutions to externally defined problems, but activating processes of care that involve multiple subjects, long temporal horizons and dimensions that are at once material, affective and symbolic. Regeneration thus becomes a *relational process* that interweaves nature, culture, economy and affectivity, escaping the extractive logic that has dominated twentieth-century development models.

Universities as Platforms for Collective Learning

Within this framework, the role of the university is called upon to undergo a profound redefinition. The academic institution can no longer limit itself to being a place for the conservation and transmission of codified knowledge, nor can it content itself with transferring technologies and expertise to a productive system that remains external and dominant. *The Triple Helix model* (Etzkowitz and Leydesdorff, 2000), while stimulating, tends to relegate the university to a functional role in economic innovation, without problematizing the power

asymmetries among the actors involved. More recent reflections point instead towards a university understood as a *civic institution* (Goddard and Vallance, 2013), capable of anchoring itself to its territory through processes of knowledge co-production that valorize local knowledge and strengthen the collective capacities of communities.

Reflections on the engaged university (Benneworth et al, 2022) show how universities that succeed in building lasting relationships with local communities produce not only social impact but also more robust and more relevant scientific innovation. The concept of co-creation in higher education proposes a methodological systematization of community-engaged scholarship practices that goes beyond service learning, taking shape as genuine knowledge co-production in which community partners are full epistemic subjects rather than mere recipients of academic expertise.

In the European context, the *European Universities* program promoted by the European Commission has generated growing reflection on forms of university-territory partnership, who critically analyze the tensions between the orientation towards global competition and the local responsibility of university institutions, proposing alternative models founded on the principle of *territorial justice*.

Participatory Democracy: Inclusive and Transformative Processes
A transversal thread running through all dimensions of the Symposium is democracy as a constitutive practice, not merely a procedural form. The Symposium holds that decision-making processes can and must be made more inclusive, more transparent and, above all, more transformative: capable not only of incorporating diverse voices, but of effectively redistributing power and resources, thereby modifying the underlying structures that produce exclusion.

Recent literature on participatory democracy has undergone a significant revival, thanks in part to the experimentation with new deliberative tools such as citizens' assemblies and strategic co-planning processes. Studies on open democracy, which combines representation and direct participation through mechanisms based on lottery and deliberation, demonstrate how randomizing access to decision-making processes can produce epistemologically superior results to those of purely electoral systems (Landemore, 2022). Deliberative democracy laboratories, scalable to complex institutional contexts, are analyzed, discussing the conditions for the transferability of results and the guarantees of inclusiveness necessary to prevent these tools from becoming participatory simulacra.

In the context of territorial planning and policies, the conflictual dimension of participation is explored, revisiting and updating the agonistic perspective for urban governance contexts: the goal is not to neutralize conflict, but to create arenas where it can develop productively, generating solutions that no single actor could have conceived alone (Miessen, 2022). On the dimension of collective capacity, the capabilities framework reworked in community terms, moving beyond the purely individual decline proposed by Sen, offers analytical tools for assessing the impact of participatory processes not only in terms of decision-making outcomes but also in terms of transforming collective capacities for action.

Finally, recent literature on territorial commons offers a robust institutional foundation for thinking forms of governance that transcend the false dichotomy between State and market. The notion of commons as social systems show how communing practices produce not only management solutions for shared resources but genuine alternative imaginaries, capable of collectively orienting territorial transformation towards horizons of justice and sustainability.

THEMATIC SESSIONS

In light of this approach, the Symposium includes four thematic sections, within which the contributions received have been classified.

COLLABORATION FOR JUST AND EQUITABLE FUTURE
Collaboration among people, communities, social movements, institutions, and public and private sectors is essential for building a just and equitable future. It involves not only cooperation between individuals and collectives but also the creation of transversal, multilevel, and cross-sector governance frameworks that enable shared decision-making and the co-construction of collective visions across territories.

This perspective unfolds in multiple domains where justice, sustainability, and daily life converge. Food systems reveal how equity, ecological balance, and cultural identity can be aligned through participatory and context-based approaches. Energy communities demonstrate how citizens and institutions can work together to manage resources, promoting autonomy and ecological transition. Inclusive housing initiatives, meanwhile, highlight the potential of inter-institutional collaboration to guarantee the right to dignified and sustainable living spaces.

These and other experiences, from local mobility and education to cultural and environmental cooperation, demonstrate that collaboration operates at many scales: from everyday practices to policy design, from grassroots innovation to institutional transformation. Together, they challenge extractive logics and open pathways toward just and equitable futures.

The contributions received within this session have provided significant insights into numerous specific topics. In particular, five macro-themes can be identified.

Local Food Systems, Agroecology and Territorial Justice
A first, substantial thematic cluster concerns food systems as a privileged terrain for experimenting with alternative forms of territorial governance. The contributions range from the co-production of local food atlases to alternative food distribution networks, from agroecological transitions in Mediterranean and Latin American contexts to social agriculture as a practice of community regeneration. Food emerges not as a mere economic variable but as a relational infrastructure through which territorial identities, rights and development models are negotiated.

Collaborative Governance, Deliberative Democracy and Participatory Processes
The second theme, arguably the most transversal across the entire collection, concerns the institutional architectures and methodological devices through which more inclusive and transformative decision-making processes are built. The contributions touch on citizens' climate assemblies, community bodies for water and land management, frameworks for solidarity economy governance and processes of systemic inclusion. Collaborative governance is treated not as a neutral technique but as a situated political practice.

Climate Justice, Ecological Transition and Territorial Governance
A third axis gathers contributions that address the challenges of the climate crisis across very different scales and contexts: from adaptation in South Asia to coastal management in Colombia, from energy communities in the Southern Apennines to indigenous-led ecosystem governance. The common thread is a critique of technocratic models of response to climate change and a search for community-rooted approaches attentive to the dimensions of gender, ethnicity and social vulnerability.

Knowledge Co-Production and the Role of Universities in Territories
The fourth theme brings together contributions that explicitly reflect on the relationship

between academic knowledge production and territorial transformation: universities as platforms for territorial activation in Latin America, collaborative frameworks for landscape governance in Mexico, university-led food networks between Argentina and Italy. A productive tension emerges between the institutional logic of the academy and the demands of territorial rootedness and social responsibility in research.

Commons, Care and Endogenous Territorial Capacities
The fifth theme, the most transversal and perhaps the most innovative, groups together contributions that work around the concept of the endogenous capacity of territories: from the measurement of multidimensional well-being in the solidarity economy to the conceptualization of endogenous territorial forces, from expanded care systems that include commons and situated artificial intelligence, to the governance of genetic resources as a common good. What emerges here is a reflection on territorial subjectivity as a condition for just and equitable imaginaries of the future.

ECOSYSTEM MANAGEMENT FOR A SUSTAINABLE FUTURE
Ecosystem management must go beyond conservation to embrace systemic transformation. This approach brings about a paradigm shift by challenging anthropocentric perspectives and emphasizing coexistence, reciprocity, and societies' duty to safeguard the ecological integrity of natural systems and, where possible, restore ecosystems.

Central to this transformation is the recognition of the Rights of Nature, a legal and philosophical framework that repositions ecosystems not as mere resources to be exploited or managed, but as entities possessing intrinsic value and legal standing. This ontological shift enables more effective responses to environmental risks while opening pathways for ecosystem restoration that simultaneously protects biodiversity and enhances human well-being. Achieving meaningful climate change adaptation requires innovative governance models that integrate cutting-edge scientific research with traditional and Indigenous knowledge systems.

Key components for achieving these goals include the development of circular systems, which propose regenerative frameworks aimed at reducing resource extraction, minimizing waste, and closing material cycles. These systems offer the possibility of aligning economic activities with ecological boundaries.

Equally important is the One Health perspective, which underscores the interdependence between ecological integrity, animal health, and human health. This approach calls for transdisciplinary collaboration and reinforces the urgency of treating environmental sustainability and public health as inseparable concerns.

This session too yields at least five macro-themes to which the contributions received can be traced.

One Health, Integral Ecology and Territorial Health
A first thematic cluster runs through the contributions that adopt the One Health perspective as an integrative framework for reading the relationships between human health, animal health and ecosystem health. This perspective — today recognized by the WHO, FAO and UNEP as the reference approach for global health policies — breaks with the disciplinary compartmentalization that has long separated medicine, ecology and the social sciences, proposing instead a systemic vision in which human well-being is inseparable from the integrity of living environments. The theoretical framework of One Health has recently been updated to explicitly include the dimensions of social equity and environmental justice, showing how the most vulnerable populations are systematically exposed to health risks amplified by ecosystem degradation. On the methodological level, citizen science emerges as a privileged device for participatory environmental monitoring, capable of connecting scientific data production and community activation. Within the broader framework of Planetary Health, a redefinition of biomedical research priorities is proposed, one that places

ecosystem regeneration at the centre of prevention and health promotion strategies.

Nature-Based Solutions, Green Infrastructure and Ecosystem Regeneration
The second theme gathers contributions that explore Nature-Based Solutions (NbS) and ecological infrastructures as tools for the regeneration of degraded landscapes, water resource management and the planning of multifunctional green solutions at urban and territorial scale. The IUCN taxonomy of NbS distinguishes between solutions that protect, restore and manage ecosystems, discussing the conditions of effectiveness across different climatic and socio-institutional contexts. At the urban level, the design of green infrastructures produces significant co-benefits in terms of mental health, social cohesion and climate resilience. Particular relevance attaches to contributions addressing the restoration of small water cycles as a lever for the regeneration of climatically vulnerable landscapes, with positive effects on both biodiversity and the water security of settled communities.

Governance of Water Resources and Biocultural Landscapes
The third theme gathers contributions that address the management of shared natural resources — lakes, wetlands, river basins, coastal systems — as a terrain for experimenting with new forms of collaborative governance. Water emerges as the common good par excellence, whose management requires institutional devices capable of holding together ecological, economic, cultural and distributive justice dimensions. The resilience of social-ecological systems depends on the capacity of institutions to learn and adapt in real time to environmental changes, in accordance with the principles of adaptive water governance. Local knowledge and traditional management practices constitute indispensable epistemic resources for sustainable governance of aquatic biocultural landscapes, while approaches founded on the valorization of cultural ecosystem services produce greater social legitimacy and better conservation outcomes than top-down models.

Biodiversity, Agroecology and Climate Resilience
The fourth theme groups together contributions that explore the relationship between biodiversity — cultivated and wild — territorial food systems and resilience to climate change. The agroecological approach emerges as a unifying paradigm, integrating the productive dimension with the ecological and social ones, and proposing systemic alternatives to industrial agriculture models. Varietal diversity and ecosystem complexity are the main sources of resilience for agricultural systems in contexts of climate crisis, while the management of biotic diversity at landscape scale produces benefits that extend well beyond the individual farm. The valorization of peasant knowledge emerges as a necessary condition — and not merely an ethically desirable one — for the success of agroecological transitions, through dynamics of co-learning between researchers and farming communities.

Circular Economy, Bioeconomy and Ecological Transition in Territories
The fifth theme gathers contributions concerned with the material and technological dimensions of ecological transition: from the management of photovoltaic waste within a circular economy framework, to the production of biofuels from microorganisms, through to the institutional and urban planning implications of the urban bioregion as a model for resource governance. These contributions share an attention to the territorialization of transition policies, that is, to the necessity of grounding the grand narratives of global sustainability within specific institutional, ecological and social contexts. Strategies for valorizing local biomass produce positive socio-economic impacts only when they are designed with and for settled communities; circular economy policies, in turn, risk generating new asymmetries if not accompanied by inclusive governance mechanisms. The concept of the urban bioregion offers in this sense a promising institutional framework for overcoming the legal and administrative fragmentation that hinders local ecological transitions, proposing the metropolitan scale as the unit of governance for the integrated management of natural, energy and food resources.

FACING CRISES FOR LIVEABLE CITIES & RESILIENT TERRITORIES

Contemporary cities and regions are at the frontline of multiple, overlapping crises that challenge their livability and resilience. Societies in general, and governments in particular, are facing the multifaceted challenges posed by the impacts emerging of these crises. The environmental challenges, mainly associated with the climate crisis, are deeply entangled with social, cultural, and economic pressures, creating a complex web of risks that threaten the cohesion of communities and the sustainability of territories.

Responding to these crises requires more than technical fixes — it demands a reimagining of how cities function as social and ecological systems. Building truly resilient, livable cities calls for strengthening the social fabric and empowering collective capacities for adaptation and transformation. This means cultivating solidarity, shared responsibility, and inclusive governance, so that communities are not just protected from harm but actively engaged in shaping just and regenerative futures. This entails a need to move beyond extractive logics — whether material, cultural, or symbolic — that erode ecosystems and undermine social trust. Alternative development models must place care, reciprocity, and territorial justice at their core.

Urban planning decisions are pivotal in this transition, determining whether cities will reinforce exclusion and ecological degradation or foster equitable access to resources, cultural vitality, and ecological integrity. Multiple social and economic fragilities emerge in this landscape: dealing with housing dynamics and new forms of exclusion, access to adequate services, infrastructure and quality redesigned public spaces attending at new societal needs; addressing socio-spatial inequalities as well as demographic and territorial patterns shifts such as aging populations and the depopulation of rural and inland areas; the tourism pressures in an increasing commodification of urban environments, or the changing market dynamics requiring transformation of local economies. Addressing these issues requires cities and regions - in a whole-of-a-society approach- to foster diversified, circular, and community-centered economies that sustain both livelihoods and ecosystems in a resilient manner.

The contributions received in this session can be traced back to four themes of particular interest.

Hydrogeological Risk, Territorial Vulnerability and Flood Resilience

A first thematic cluster gathers contributions that address the management of hydrogeological risk and the vulnerability of territories to extreme events, with particular attention to flooding as a growing challenge for territorial planning in contexts of climate crisis. The contributions range from predictive risk modelling through machine learning techniques and neural networks, to the analysis of the vulnerability of hydraulic protection infrastructures, through to a critical reassessment of existing planning instruments in light of the soil-vegetation nexus as a dynamic factor of resilience. The stochastic approach to evaluating the efficiency of Italian municipalities in the face of natural risks opens a comparative perspective of great interest for prevention policies. Common to all contributions is the awareness that risk management cannot be reduced to a technical matter, but requires governance tools capable of integrating scientific knowledge, local knowledge and inclusive decision-making processes.

Urban Climate Adaptation, Environmental Comfort and Territorial Value

The second theme aggregates contributions that address the physical and performance dimensions of climate adaptation in cities and inhabited territories, with particular attention to low-technology solutions and green infrastructures as tools for countering urban heat islands and improving the quality of living environments. Living walls, evaporative cooling and building energy management emerge as situated and scalable responses to urban heat islands, while contributions on housing adaptation and property values in contexts of climate risk introduce a critical perspective on the inequalities that adaptation processes can produce or amplify. The theme of housing thus interweaves with that of territorial justice, raising fundamental questions about who bears the costs of adaptation and who benefits from it.

Digital Tools, Participatory GIS and Territorial Heritage Mapping
The third theme gathers contributions that explore the potential of digital tools (GIS, participatory cartography, interactive digital heritage) as knowledge infrastructures for the multilevel governance of territories and for the valorization of local identities in contexts of crisis. Participatory GIS emerges not only as a data collection technique, but as an epistemic device capable of making visible collective knowledge and memories that would otherwise remain invisible to public policies. The mapping of the intangible heritage of the Arbëreshë communities in Calabria and the processes of cultural mapping for new territorial legacies show how digital technologies can be placed at the service of practices of cultural recognition and identity regeneration. Participatory coastal governance mediated by GIS infrastructures opens finally promising perspectives for the integrated management of complex, multi-stakeholder territories.

Planning in Crisis Contexts, Territorial Justice and Marginal Areas
The fourth theme gathers contributions that address the challenges of urban and territorial planning in contexts marked by multiple crises (environmental, social, demographic) with particular attention to marginal areas and the most vulnerable populations. Flood risk in the peri-urban areas of Puebla, the rigidity of the housing stock in the face of the diversity of household types in Guadalajara, urban planning under uncertainty in the Mexican case, and the experimentation of Living Labs in the Naples metropolitan area all share a critical perspective that does not limit itself to describing the dysfunctions of existing territorial systems, but seeks to identify design and participatory devices capable of producing justice-oriented transformations. The generation of individual micro-scenarios in marginal territories introduces moreover an unprecedented scale of analysis that productively complicates aggregate readings of vulnerability processes.

READING THE CLIMATE CRISIS: HUMANITIES AND ACTION IN THE ANTHROPOCENE ERA
One of the main epistemological ruptures introduced by the Anthropocene, from within and so called hard sciences in debates on the environment, life, and nature, is the disjunction between the experience of local climate and the understanding of global climate. Although various theorists have pointed out the challenges posed by this fracture between experience and knowledge, literary and cultural artifacts produced globally addresses this issue by means of various creative and aesthetic strategies, vindicating a cultural geology that cannot be reduced to a universalized climate science of the Anthropocene. Thus, culture, climate, experience, and knowledge are placed in a disjunctive relationship. However, these fractures in narrative and knowledge do not operate as clear divisions, but rather constitute a field of tensions where literary representations and cultural artifacts play a key role.

In this sense, a fundamental question arises: what kind of narratives allow us to navigate an ecological crisis that is at once local and planetary, historical and anticipatory, cultural and behavioral? The question of narrative and representation is crucial to understanding the Anthropocene, since, by marking a radical break with the past, it poses specific epistemological and ontological challenges. While the Anthropocene is a material phenomenon, measurable and experiential, it is also a representational construct that challenges the way we conceive the planet as a system in crisis.

Leveraging the Environmental Humanities, encompassing disciplines such as literature, history, philosophy, and art, to facilitate a deeper comprehension of our current planetary moment within the Anthropocene. The Humanities provide critical analytical frameworks necessary for navigating the climate crisis, specifically by addressing foundational issues of environmental ethics, justice, and the politics of cultural memory.

The contributions received within this session share a fundamental epistemological wager: that the humanities, understood in a broad sense, as a field encompassing literature, anthropology, history, pedagogy and critical theory, are not an ornament of scientific knowledge about the Anthropocene, but one of its conditions of possibility. In the face of the

planetary ecological crisis, the production of imaginaries, the care of collective memory and the critique of dominant narratives are not activities accessory to action: they are its indispensable premise.

A first thread runs through the contributions that work on the level of epistemological critique and narrative deconstruction. The reading of Jamaica Kincaid's "A Small Place" as a site of epistemological rupture of the Anthropocene, the analysis of resilience narratives at the intersection of community epistemologies and hyper-technological futures, and the denunciation of the climate injustices concealed behind energy transition discourses — with the emblematic case of rare earth extraction — share a common critical gesture: dismantling the rhetorics of sustainability and resilience in order to reveal the power relations, geopolitical asymmetries and silencing they produce. Alongside these stands the contribution on the Wunderkammer as a device of more-than-human governance, which proposes an epistemology of composting and collage as an alternative to the linearity of dominant crisis models.

A second thread gathers the contributions oriented towards the construction and transmission of situated knowledge through narrative, pedagogical and archival practices. The local narratives of rural communities in central Chile as acts of resistance, the digital topographic archive of stories and natural heritage of Rapa Nui, the work on biocultural memory as an educational pathway of territorial belonging in Brazil and Chile, and the contribution on agroecological education as a fundamental component of counter-hegemonic digital mechanisms, all converge on an idea of knowledge that is always rooted, embodied and transmitted through concrete community practices. In these contributions, action in the Anthropocene does not pass through large technological infrastructures or top-down policies, but through the recovery and reactivation of memories, practices and bonds with territory that extractive modernity has systematically eroded.

One contribution occupies a partially autonomous position with respect to these two threads: the multilevel analysis of environmental patents and the role of gender equality and international mobility introduces a quantitative and institutional perspective that productively complicates the picture, interrogating the structural conditions that determine who produces ecological innovation and with what resources. Its presence in the session is a reminder that the humanities do not exhaust their task in critique and memory, but must engage with the institutional and political-economic dynamics that shape the transition.

Taken together, these contributions suggest that acting in the Anthropocene requires not only technical or institutional solutions, but a profound transformation of the collective imaginaries through which communities narrate themselves, remember themselves and project themselves into the future. It is in this sense that the humanities cease to be a luxury and become a political necessity.

NUMBERS

The 70 contributions received from scholars coming from across the world (Belgium, Brazil, Chile, Colombia, Germany, Japan, Mexico, New Zealand, Slovakia, the United States, the Netherlands, Portugal, Spain) have provided insights, ideas and fundamental food for thought for the development of the new Ecopìa network. The first attempt at synthesis with respect to these inputs is contained in the preceding section; it represents an initial schematization that is fully aware of the fact that all the themes identified are closely intertwined, cutting across practices, knowledge and technical expertise. Trans-disciplinarity, a non-negotiable objective of the Ecopìa network, is one of the defining features of the Symposium, and finds concrete expression in the participation (in different roles) of scholars from 9 of the 14 Departments of the University of Calabria, ranging from the Engineering Departments to the Department of Humanities, and from the Department of Biology, Ecology and Earth Sciences to the Department of Economics, Statistics and Finance.

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CONFERENCE PROGRAMME

PROGRAMME DAY 1: 22TH APRIL

8:30 · PARTICIPANT REGISTRATION

9:00–9:30 · OPENING PLENARY SESSION

Welcome:
Paola Cannavò, DIAm- Università della Calabria

Institutional greetings:
Gianluigi Greco, Rector of Università della Calabria
Salvatore Straface, Director of DIAm – Università della Calabria

Opening remarks:
Massimo Zupi, DIAm – Università della Calabria

9:30–11:00 · PLENARY SESSION TALK
COLLABORATION FOR JUST AND EQUITABLE FUTURE

Chair:
Pierfrancesco Celani, DIAm – Università della Calabria

Keynote lecture:
Marcela Ibarra Mateos, Universidad Iberoamericana Puebla

Discussants:
Caterina Rondoni, Università degli Studi di Ferrara
Daniel Enrique Sardo, ITESO Universidad Jesuita de Guadalajara
Gonzalo Valdivieso, Pontificia Universidad Católica de Chile

11:00–11:30 · COFFEE BREAK

11:30–13:30 · PLENARY DIALOGUE
FAIR AGRICULTURE AND SUSTAINABLE RURAL AREAS

Chair:
Alessandra Corrado, DISPeS – Università della Calabria

Participants:
Alberto Mossino, PIAM – Progetto Integrazione Accoglienza Migranti
Francesco Piobbichi, Mediterranean Hope – Federazione Chiese Evangeliche Italiane
Franco Aceto, Coldiretti Calabria
Alberto Statti, Confagricoltura
Grazia Valentino, CREA Bari
Letizia Palumbo, Università Ca' Foscari di Venezia
Delegato Organizzazione di Produttori Carpe Naturam
Delegato Organizzazione di Produttori Pianagri
Delegato Dipartimento Agricoltura Regione Calabria

13:30–15:00 · LUNCH BREAK

15:00–16:30 · PLENARY SESSION TALK
ECOSYSTEM MANAGEMENT FOR A SUSTAINABLE FUTURE

Chair:
Paola Cannavò, DIAm – Università della Calabria

Keynote lecture:
Warner Jeroen, Wageningen University

Discussants:
Fabio Teodoro De Souza, Pontifícia Universidade Católica do Paraná
Gianfranco Franz, Università degli Studi di Ferrara

16:30–18:30 · PARALLEL SESSIONS

PROGRAMME DAY 2: 23TH APRIL

9:00–9:30 · AWARD CEREMONY: Routes Award
Matias Barberis Rami, European Future Innovation System Centre

9:30–11:00 · PLENARY SESSION TALK
FACING CRISES FOR LIVEABLE CITIES & RESILIENT TERRITORIES

Chair:
Massimo Zupi, DIAm – Università della Calabria

Keynote lecture:
Shigeru Satoh, Waseda University

Discussants:
Matias Barberis Rami, European Future Innovation System Centre
E.R. Morales García de Alba, ITESO Universidad Jesuita de Guadalajara

11:00–11:30 · COFFEE BREAK

11:30–13:30 · PLENARY DIALOGUE
INNOVATION POLICIES IN CALABRIA

Chair:
Graziella Bonanno, DIAm – Università della Calabria

Participants:
Maria Carmela Passarelli, DiScAG – Università della Calabria Delegata del Rettore all'Innovazione e all'Imprenditorialità
Luigi Aldieri, Unisa – coordinatore commissione terza missione SIE
Francesco Aiello, DESF – Università della Calabria
Alessandro Zanfino, Fincalabra
Vincenzo D'Agostino, Omnia Energia
Albino Carli, Consorzio della patata della Sila
Antonio Padovano, DIMEG – Università della Calabria
Monica Filice, Università della Calabria / Progetto COI

13:30–15:00 · LUNCH BREAK

15:00–16:30 · PLENARY SESSION TALK
READING THE CLIMATE CRISIS, HUMANITIES AND ACTION IN THE ANTHROPOCENE

Chair:
Renato Sanza, DiSU – Università della Calabria

Keynote lecture:
Marco Armiero*,* University of Santiago de Compostela, Spain

Discussants:
Ana Elena Builes Vélez, Universidad Pontificia Bolivariana de Medellín
Andrea Casals Hill, Universidad Finis Terrae
Ingrid Molderez, KU Leuven

16:30–18:30 · PARALLEL SESSIONS

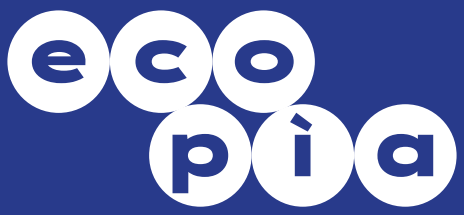
PROGRAMME DAY 3: 23TH APRIL

10:00–12:00 · CLOSING PLENARY SESSION

Chairs:
Paola Cannavò, DIAm – Università della Calabria
Salvatore Straface, DIAm – Università della Calabria
Massimo Zupi, DIAm – Università della Calabria

Participants:
Graziella Bonanno, DIAm – Università della Calabria
Ana Elena Builes Vélez, Universidad Pontificia Bolivariana de Medellín
Alessandra Corrado, DISPeS – Università della Calabria
Gianfranco Franz, Università degli Studi di Ferrara
E.R. Morales García de Alba, ITESO Universidad Jesuita de Guadalajara
Caterina Rondoni, Università degli Studi di Ferrara
Fabio Teodoro De Souza, Pontifícia Universidade Católica do Paraná
Gonzalo Valdivieso, Pontificia Universidad Católica de Chile

CONFERENCE SESSIONS



COLLABORATION FOR **JUST**
AND **EQUITABLE FUTURE**

COLLABORATION FOR JUST AND EQUITABLE FUTURE

SESSION A - Wednesday 22nd – 16:30/18:30

Chair:
Caterina Rondoni, Università degli Studi di Ferrara

Discussants:
Walter Nocito, DISPeS – Università della Calabria
Daniel Enrique Sardo, ITESO Universidad Jesuita de Guadalajara
Gonzalo Valdivieso, Pontificia Universidad Católica de Chile
Giovanna Vingelli, DISPeS – Università della Calabria

Riccardo Giovanni Bruno, Veronica Allegretti, Egidio Dansero, Tommaso Tonet
Mapping toward sustainable governance: methodological pathways for the co-production of Local Food Atlases

Lucia Miglietti
The local perspective as a form of resistance: urban movements and alternative food networks for a fair future

Chiara Caterina Razzano
Studying Local Food Systems as Opportunities for Just and Equitable Futures: Collaboration and Empowerment in The Unión de Trabajadores de la Tierra (Argentina) case study

Nouman Saleem, Janna Smirnova
Climate Variability and Food Security in South Asia: Policy Mechanisms for Climate Adaptation

Eva Sander
Expanded care systems: food, commons, and situated AI for everyday justice

Mario Coscarello, Chiara Spadaro
Collaborative Governance for Just Food Transitions: Lessons from University-Led Food Networks in Argentina and Italy

Marinés de la Peña-Domene, Natalia Mesa Sierra, Juan Fernando Escobar Ibáñez, Luz María Ayestaran Hernández
From Knowledge Co-Production to Social Incidence: Nature-Based Solutions and University-Community Landscape Governance in Mexico

Giovanna Vingelli
Gender Equality, Sustainability and Armed Conflict: Rethinking Environmental Justice in War-Affected Contexts

SESSION B - Thursday 23nd – 16:30/18:30

Chair:
Caterina Rondoni, Università degli Studi di Ferrara

Discussants:
Ana Elena Builes Vélez, Universidad Pontificia Bolivariana de Medellín

Mario Pullano, Alessandra Corrado
Collaborative governance and agroecological transition in Mediterranean inner areas: analysis of the "Biodistretto Agroecologico Monti Erei" (Sicily, Italy) case study

Sonia Vivona, Alessandra Patitucci, Paola Sdao, Alessandro Colonnese, Angela Magariello
Life quality and environmental sustainability in south Italy: a case study on social agriculture farms

Claudia Mazzanti, Rainer Maria Baratti, Domenico Vito
Deliberative Climate Governance at the Urban Scale: Lessons from the Permanent Citizens' Climate Assembly of Milan

Merata Kawharu
From Community Climate Plans to Digital Environmental Stewardship: Indigenous-Led Decision-Making for Ecosystem Governance

Ana Elena Builes, Juliana Restrepo Jaramillo
Bridging Knowledge Gaps: Collaborative Frameworks for Assertive Climate Communication and Social Justice in Urabá's Shorelines

Francesca Paradisi, Piero Bevilacqua, Natale Arcuri
Implementation of an Energy Community within a public residential housing complex in a mountainous area of Southern Italy, aimed at addressing energy poverty and promoting the ecological transition

Natalia Alejandra Salinas Bravo
Program for Economic Development and Territorial Competitiveness for Micro, Small, and Medium Enterprises in the Western Basin of the Lerma River, Mexico (PRODECOL)

SESSION C - Thursday 23nd – 16:30/18:30

Chair:
Gonzalo Valdivieso, Pontificia Universidad Católica de Chile

Discussants:
Enrico Caterini, DiScAG – Università della Calabria
Daniel Enrique Sardo, ITESO Universidad Jesuita de Guadalajara

Gonzalo Valdivieso
Regional Chair for Dialogue: A Case Study of Collaborative Action for Social Transformation

Cristina Fachini, Maria Paula Domene, Thâmara Figueiredo Menezes Cavalcanti
Collaborative Governance for the Conservation and Sustainable Use of Genetic Resources – São Paulo, Brazil

Gianluca Gherardi, Rossella Romano
From integration to participation: a systemic view of inclusion paradigms

Raul Gonzalez Meyer
Conceptualizacion, cualificacion y medicion de las fuerzas y capacidades endogenas de un territorio

Francesca Librandi, Federico De Francesca, Michele Leonetti
"Collaborative Governance and Territorial Justice in the Ecological Transition: towards an integrated framework for just and equitable futures"

Johan José Merchán Navarro, Heliodoro Ochoa-García
Towards sustainable water and land management from the local level: The potential of Community Action Boards (JAC- by its Spanish acronym) in the face of institutional fragmentation in Colombia.

Luca Mollo
Multidimensional Well-being and Collaborative Governance: a Framework for Measuring the Impact of the Social and Solidarity Economy

Daniel Sardo, Nora María Samayoa Aguilar
Academia y activación territorial: desafíos éticos y políticos en ecosistemas participativos latinoamericanos

Mapping toward sustainable governance: methodological pathways forthe co-production of Local Food Atlases

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This research explores Local Food Atlases as collaborative and transformative infrastructures for just and reflexive food governance. By integrating participatory mapping, collective research, and open data practices, these atlases operate as socio-technical devices that enable communities to co-produce shared knowledge on food systems. Reinterpreting the atlas not as a static representation but as a living infrastructure of collaboration, the work investigates how cartographic and participatory tools can sustain transversal, multilevel, and solidarity-based food governance arrangements.

Local food systems embody the entanglement of environmental, economic, and cultural dimensions where questions of justice, access, and recognition converge. Conventional technocratic approaches often reduce this complexity to data management or territorial planning, overlooking its relational and political character. Local Food Atlases aim to overcome this gap by connecting diverse actors through participatory processes of visualization and deliberation that bring together civic initiatives, local administrations, and research organizations. Through accessible, evolving forms of spatial representation, these atlases make visible the plural and situated perspectives that lie before food systems, enabling new forms of cooperation, awareness, and collective decision-making.

Building on experiences such as the Metropolitan Turin Food Atlas, considered in this work, the study conceptualizes these initiatives as boundary infrastructures linking grassroots innovations with institutional frameworks. They operate as platforms where different understandings of food justice, sustainability, and community well-being can be articulated and negotiated. Methodologically, the research adopts iterative cycles of co-production, aggregation of multi-source data to sustain continuity between scientific and community-based knowledge. In this process, participation becomes not an ancillary activity but a defining feature of the atlas itself, shaping both its epistemic architecture and its political relevance.

The guiding research question asks how Local Food Atlases can function simultaneously as analytical devices and as catalysts of inclusive transformation. Two interrelated dimensions frame this inquiry. The first concerns the conditions under which collaborative mapping and civic engagement activate equitable power relations across local food governance networks.

The second investigates how different epistemic forms and practices, quantitative data, experiential narratives, institutional knowledge, can be aligned within shared infrastructures of interpretation and policy deliberation. Together, these dimensions address the ways in which participatory methodologies redistribute visibility, legitimacy, and agency within the food system, contributing to more democratic forms of territorial governance.
Empirical insights are drawn from the co-development of Turin Food Atlas addressed by the urban–rural fragmentation, marginalization of peri-urban territories, and tension between agricultural preservation and industrial expansion. Comparative analysis demonstrates that the durability and impact of these initiatives depend on sustained collaboration and relational continuity beyond project-based funding structures. It highlights the importance of inclusive facilitation, institutional ownership, and the embedding of shared learning loops across policy, civil, and research domains. Conversely, where governance frameworks remain fragmented or technocratic, participatory atlases risk becoming symbolic artefacts without tangible influence.
The results suggest that Local Food Atlases can strengthen collective capacities for deliberation and cross-sector coordination, fostering alternative policy imaginaries anchored in reciprocity and shared responsibility. Universities and civic actors often act as knowledge brokers within these processes, translating between technical and experiential languages and mediating among institutions and communities. Yet the sustainability of such collaborations requires long-term infrastructures of care and reflexivity capable of bridging academic, administrative, and civic timescales.
Theoretically, this work contributes to debates on collaborative governance, participatory knowledge infrastructures, and solidarity economies, advancing a situated and procedural understanding of innovation in food policy. Conceived as processual ecologies of practice, Local Food Atlases embody the political potential of mapping as a collective act of inquiry and imagination. They foreground how spatial representation can support deliberative forms of multilevel governance, where justice, sustainability, and cultural identity are negotiated through participation rather than prescribed by expertise.
Ultimately, the study contends that the co-production of Food Atlases exemplifies how collaboration can become a material and epistemic driver for just and equitable food futures. By assembling communities, administrations, and researchers around shared cartographic infrastructures, these initiatives enact the principles of participatory change and solidarity governance across territories. They demonstrate that mapping, when conceived as a collaborative, reflexive, and justice-oriented practice, can nurture both institutional transformation and community empowerment, contributing to the plural and interdependent futures that this session seeks to imagine.

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The Local Perspective as a Practice of Resistance: Urban Movements and Alternative Food Networks for an Equitable Future

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Introduction and Background: The Crisis of the Global Model In recent decades, the global food system has been hit by a profound crisis of legitimacy, stemming from the intrinsic unsustainability of the neoliberal production model. This model, characterized by profit maximization and the standardization of agri-food processes, has produced a growing alienation between the moments of production and consumption. In this scenario, the localist push does not emerge merely as a market trend, but as a critical response and a form of cultural and political resistance (Allen, 2010). The physical and cognitive distancing imposed by global commodity chains has generated a "metabolic rift" that urban movements are now attempting to mend. The rediscovery of the local dimension thus becomes the privileged ground for contesting food homogenization and reclaiming sovereignty rooted in territories. This is not just about shortening "food miles," but about operating a profound "re-spatialization" of food (Feenstra, 1997), where geographic space once again coincides with social and relational space.

Re-spatialization and the Role of Alternative Food Networks (AFNs): The transition toward sustainable food systems requires the reconstruction of a social fabric around the act of nourishment. Alternative Food Networks (AFNs)—ranging from Solidarity Purchasing Groups (GAS) to Community Supported Agriculture (CSA) experiences—represent the most advanced expression of this civic participation. In these contexts, the reflexive "prosumer" exercises a political agency capable of transforming the market into a space of sub-politics and value-based claims. Food ceases to be a mere commodity and returns to being a common good, charged with meanings related to labor dignity and biodiversity protection. However, as highlighted in recent action plans for local governments co-funded by the European Union, the crucial challenge is ensuring that these networks do not remain elite niches. Building inclusive food systems requires that the resistance of AFNs not be limited to an "escape" from the global market, but becomes an engine for democratizing access to healthy food for all segments of the population, overcoming barriers of economic and cultural capital.

The Urban Scale: A Laboratory for Urban Food Planning In this scenario, the urban scale emerges as the core of the "new food equation" (Morgan & Sonnino, 2010). Cities, historically perceived as places of pure consumption separated from rural areas, are assuming a proactive role in food governance. Urban Food Planning now attempts to recompose the fractures between public health, ecological integrity, and social justice. As highlighted by Giorgio Giovanelli in his analysis of Italian pathways, urban food policies are configured as necessary adaptation strategies to face climatic and social uncertainty. The emergence of tools such as city Food Policies and Food Councils demonstrates an attempt to institutionalize the demands of grassroots movements. Food governance thus becomes a hybrid process, capable of integrating urban planning with food resource management, transforming urban metabolism into a more circular and resilient system. An emblematic example of this trend is the Milan Food Policy, which has successfully translated sustainability goals into concrete actions, such as reducing food waste through "Neighborhood Hubs" and revising school catering tenders to favor short supply chains. Similarly, the experience of Food Councils in cities like Turin or Rome demonstrates how governance can become truly participatory: in these forums, third-sector actors, local producers, and citizens collaborate to map the territory's nutritional needs and influence urban planning decisions. These case studies highlight that planning is no longer a top-down act, but a negotiated process aimed at fixing

distributive gaps and enhancing local excellence.
Beyond the "Local Trap" and Food Deserts: However, it is necessary to warn against the risks of a "local trap" (Born & Purcell, 2006). The uncritical assumption that the local scale is inherently more democratic or ecological than the global scale can be misleading. Localization is not an end in itself, but a tool to achieve real equity. An excessively defensive vision of localism risks fueling forms of exclusion or ignoring inequalities within territories. A clear example is represented by fragmented urban food landscapes, where areas of abundance coexist with so-called "food deserts"—urban zones where physical and economic access to fresh, nutritious food is practically non-existent. To prevent localism from becoming a privilege for the few, planning strategies must adopt a holistic and redistributive approach, intervening in logistical and social infrastructures to ensure widespread coverage of the right to food.
Conclusions: For Participatory and Inclusive Governance In conclusion, the transition from an extractive food system to an equitable one requires a synthesis between grassroots energy and institutional regulatory capacity. Only participatory governance, which views citizens not as mere users but as co-producers of policies, can address the structural inequalities that characterize our cities. Integrating the drive of urban movements with action plans for food inclusion means recognizing that sustainability cannot be separated from social justice. To be truly equitable, the food future must be based on a territorial alliance capable of regenerating soils, protecting small producers, and guaranteeing every urban inhabitant, regardless of income, the possibility of actively participating in the construction of a healthy, safe, and democratic nutritional system.

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Studying Local Food Systems as Opportunities for Just and Equitable Futures: Collaboration and Empowerment in The Unión de Trabajadores de la Tierra (Argentina) case study

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Local food systems (LFS) have emerged as a prominent framework for food system transformation toward sustainability, yet dominant conceptualizations remain deeply rooted in Global North perspectives developed within post-industrial contexts (Faegan, 2007). This contribution argues that mainstream LFS discourse—centered on place and territorial embeddedness, consumer-producer reconnection, quality turn, and short supply chains—only partially grasps the transformative potential of food system relocalization in those Global South contexts affected by structural inequalities, colonial legacies, and power asymmetries, requiring explicitly politicized approaches. Through the analysis of the Unión de Trabajadores de la Tierra (UTT) case in Argentina, this paper demonstrates how bridging radical agroecology and food sovereignty frameworks with LFS scholarship offers critical analytical tools for understanding grassroots collaboration as a pathway toward just, equitable, and ecologically sound futures.

The analysis positions itself at the intersection of Global North LFS scholarship about quality and place-turn (Feenstra, 1997; Whatmore et al, 2003; Goodman, 2003; Faegan, 2007; Sonnino, 2013, 2022), the agroecology-food sovereignty alliance (Altieri, 1995; Holt-Giménez & Altieri, 2013; Van der Ploeg, 2012; Declaration of Nyélény, 2007; Choplin, 2013), adopting a decolonial and political ecology perspective for interpretation of the food sustainability question. While Global North LFS discourse emerged within specific contexts—post-industrialization, crises of productivist models, disconnection between food and place—these frameworks risk imposing top-down categorizations (shortened chains, consumer-producers re-connection, local(ity) food, quality food) that inadequately capture Global South realities where food systems face distinct challenges of food insecurity, land tenure insecurity, racism, coloniality, climate vulnerability, and structural marginalization of small-scale producers.

The agroecology-food sovereignty alliance provides a fundamentally different epistemological approach, one that centers political struggles for self-determination, control over productive resources, and resistance to hegemonic food regimes. As Holt-Giménez and Altieri (2013) articulate, in radical agroecology, local networks for agroecological practice merge with transnational agrarian movements for food sovereignty to generate massive social pressure, thus dismantling power relations within the globalized food system. This alliance offers critical frameworks for analyzing food system transformation as an inherently political terrain requiring collective action, social movement organization, and explicit challenges to existing power structures rather than technocratic or market-based solutions.

The UTT case study exemplifies how this alliance manifests in practice. Founded in 2010 in the Cordón Hortícola Platense region, supplying Buenos Aires, UTT emerged from the struggle of Bolivian migrant families working under precarious and exploitative arrangements in Argentinian farms—facing exorbitant land rental costs, inadequate access to secure land, and unfair prices imposed by intermediaries. These migrant workers, constituting the backbone of Argentina's horticultural labor force, endured systemic discrimination portrayed through xenophobic narratives depicting them as "illegal," "stealing jobs," and "overburdening public services," while their labor filled gaps left by previous generations and performed the most demanding agricultural work under normalized precarious conditions.

UTT distinguished itself through emphasis on collective action, bringing together more than 500 farming families by 2015. Following months of stalled negotiations over public land

allocation, UTT occupied a 90-hectare disused state-owned lot in Jáuregui-Luján, leading to formalization under a loan-for-use agreement and establishment of the first UTT Agroecological Colony: "20 de Abril - Darío Santillán." The colony model represents territorial re-embedding, grassroots cooperation, mobilization, and empowerment to an extent well beyond conventionally conceptualized as LFS, supply chain shortening, or consumer-producer re-connection. Nearly a decade later, the Luján colony houses 50 families, providing services to the community, where households farm one hectare of vegetables without agrochemicals, and services comprise an adult school, a health clinic, a local shop, an apiary, a plant nursery, and permanent housing—all self-managed by the community.

UTT's leadership made agroecology a guiding principle, recognizing that only by freeing themselves from exploitative rental arrangements could families gain autonomy to adopt agroecological farming practices. This strategic alliance between local territorial land access struggles (inspired by transnational peasant struggles for food sovereignty) and agroecological production methods demonstrates how food system re-localization operates as a multidimensional transformation: from labor exploitation to self-determination, from agrochemical dependency to ecological autonomy, from individualized precarity to collective empowerment, from marginalization to political protagonism.

At national scale, UTT has grown into a nationwide organization active in 18 Argentine provinces, uniting approximately 20,000 producers, managing multiple agroecological colonies across Buenos Aires Province and Misiones, and developing complementary strategies including the *Consultorio Técnico Popular* (COTEPO)—a grassroots training program grounded in "farmer-to-farmer" methodology supporting agroecological transition; community-run bio factories producing inputs and seedling nurseries reducing costs and commercial dependency; and self-managed marketing and distribution circuits connecting regional collection hubs, UTT-owned trucks, and hundreds of collaboratively organized consumer nodes and *Almacenes Soberanos* (sovereign stores) across Greater Buenos Aires and other cities.

Methodologically, this paper draws from interviews conducted with UTT representatives[1] as part of the Resilient Local Food Supply Chains (RLFSC) Alliance's[2] global mapping initiative, which aims to showcase successful local food systems experiences. The analytical framework integrates different geographical perspectives and case studies of food system re-localization to reflect on Local Food System scholarship, integrating critical perspectives such as radical agroecology, food sovereignty, and decolonial and political ecology approaches, allowing transformative aspects of local food systems to emerge, moving beyond conventional LFS frameworks.

The analysis reveals that mainstream LFS conceptualizations face fundamental limitations when applied to non-North contexts, without critical adaptation. Market-based approaches (quality turns, geographical indicators, short supply chains as niche opportunities) and even more progressive frameworks (alternative food networks, civic agriculture) risk reproducing power asymmetries when divorced from explicit attention to land control, colonial legacies, and structural inequalities. As demonstrated by UTT's trajectory, genuine food system transformation in contexts marked by accumulation by dispossession, neoliberal rural development, and land commodification requires approaches that center collective land access and tenure security as prerequisite for autonomy, beyond shortened supply chains or direct marketing opportunities; agroecological production systems rooted in local ecological knowledge and farmer-based innovation, rather than certification schemes designed elsewhere imposing external standards; self-managed distribution networks controlled by producers and their communities, preferable to integration into existing value chains offering "market access" on terms dictated by intermediaries; political organization and social movement building capable of challenging structural marginalization beyond empty participatory governance mechanisms; and solidarity economy principles prioritizing collective wellbeing over market competitiveness.

The UTT experience demonstrates that grassroots collaboration becomes transformative when it simultaneously operates at multiple scales and dimensions: creating material alternatives (agroecological colonies providing housing, production, infrastructure, education to marginalized, previously disempowered communities), building organizational capacity (national movement uniting 20,000 producers), forging political consciousness (from

marginalized migrants to political protagonists), and proposing systemic alternatives (legislative proposals for public credit mechanisms enabling landless farmers to become landowners). This multidimensional approach embodies the "collaboration for just and equitable future" framework envisioned by Ecopia, showing how local initiatives become transformative through territorial embeddedness, ecological integrity, social justice, and democratic governance operating in mutually reinforcing ways.

We wish to make an interconnected and multidimensional contribution of this abstract to ECOPIA: theoretically, it advances a bridging framework connecting LFS scholarship with agroecology and food sovereignty perspectives, offering analytical tools for understanding how re-localization operates differently across contexts and why explicitly politicized, decolonial approaches become necessary for addressing food system transformation in contexts marked by colonial legacies and ongoing structural marginalization. This framework responds to the documented fragmentation and North-centrism in food systems discourse, hopefully contributing to meta-theory development that honors epistemological diversity and geographic specificity. Methodologically, the abstract draws on a participatory mapping and documentation of grassroots experiences conducted by the Resilient Local Food Supply Chain Alliance, through its collaborative knowledge co-production process that aims to enable marginalized voices and practices to enter academic and political debates. This approach, formalized in the Alliance's Collaborative Discussion Paper "Towards the Handbook of Resilient and Sustainable Local Food Systems and Supply Chains" (RLFSC Alliance, 2025), represents an attempt to challenge corporate capture and institutional co-optation of food systems transformation discourse and practices within political, advocacy, and scientific fora. Politically, the abstract addresses ECOPIA and similar multi-stakeholder alliances as privileged interlocutors for testing and refining these analytical frameworks through dialogue that bridges academic research, grassroots movements, and policy spaces.

The RLFSC Alliance's work demonstrates both the necessity and challenges of bringing marginalized perspectives to UN Food Systems Summit processes, and other UN advocacy spaces, where coalitions of action struggle for recognition, resources, and meaningful participation despite their potential role as mechanisms rebalancing power asymmetries. Platforms like ECOPIA offer essential spaces for developing solidaristic approaches and strategic alliances to foster food systems just transformation, convinced that genuine sustainability requires not technical fixes but structural re-evaluation, valorization of existing practices and knowledge systems, and political commitment to justice, equity, and self-determination.

The UTT case ultimately reveals that food system re-localization, when approached through decolonial, agroecology, and food sovereignty frameworks, operates as a struggle for liberation from unbalanced power dynamics toward food and collective self-determination. It demonstrates that just and equitable futures emerge not from implementing pre-designed solutions but from supporting communities' own transformative processes, providing land access, recognizing knowledge systems, protecting organizational autonomy, and enabling democratic control over food provisioning. This understanding positions collaboration not as mere cooperation or stakeholder engagement but as political solidarity with grassroots movements building concrete alternatives while simultaneously challenging the structural conditions that necessitate those alternatives.

[1] Credit to Caterina Rondini (UNIFE- Interviewer) and Luis Caballero (UTT- Interviewee)

[2] One of the UN Food System Summit Coalitions of Action – multi-stakeholder alliances with a mandate to boost the adoption of game-changing solutions for food system transition to sustainability.

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Climate Variability and Food Security in South Asia: Policy Mechanisms for Climate Adaptation

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Despite significant improvements in sustainable development in recent times, climatic factors continue to threaten food security. posing a significant risk to agriculture in regions characterized by high climate exposure, fragile agroecosystems, strong dependence on climate-sensitive livelihoods, such as South Asia (Pörtner et al., 2022). Recent empirical evidence further highlights this vulnerability, showing that rising temperatures are associated with significant declines in agricultural production per capita across developing regions, with the strongest effects observed in South Asia, where the negative impact is approximately one and a half times larger than in Southern Africa and more than three times greater than in South America (Saleem & Smirnova, 2026). These findings highlight South Asia as a global hotspot of climate-induced agricultural risk, reinforcing the urgency of identifying policy-relevant adaptation mechanisms to buffer agricultural food systems against increasing climate variability.

At the same time, the literature provides considerable evidence that some incentive mechanisms, such as access to agricultural credit and climate-resilient seeds, can mitigate the effects of climate variability-induced agricultural disruptions (Rehman et al., 2024; Elkhalfi et al., 2025). However, among these incentives, very little attention has been given to the roles of agricultural R&D and renewable energy (Rehman et al., 2024; Ullah et al., 2025), which could be important policy tools for sustainable development in emerging economies.

Thus, to address these gaps, this study examines the impact of climate variability on food security in South Asia by focusing on climate change factors such as temperature and precipitation variability, and evaluates the extent to which agricultural R&D and renewable energy consumption act as effective policy instruments for mitigating climate-induced food insecurity. Using evidence from the most climate-vulnerable South Asian countries, Bangladesh, India, Nepal, and Pakistan, the analysis assesses both short- and long-run effects of climate variability, investigating whether investments in agricultural R&D and increased renewable energy consumption can moderate these effects over time.

To achieve these purposes, we employed the CS-ARDL model using country-level panel data from four South Asian countries for the period 1991-2022. The results indicate that climate variability significantly reduces food security in both the short and long run by undermining agricultural production, while targeted policy tools, such as investment in agricultural R&D and increased renewable energy consumption, help mitigate these effects. Furthermore, the results demonstrate that the mitigating roles of agricultural R&D and renewable energy consumption are even more substantial and statistically significant in the long run. The results also suggest that having more agricultural land and irrigation infrastructure is insufficient without proper climate mitigation tools.

Additionally, since the mitigating effects of the policy tools grow over time, this study argues that consistent and long-term support for agricultural R&D and renewable energy consumption is essential to achieving sustainable food security under climate change. Thus, for policymakers, it is essential to prioritize innovation-driven agricultural R&D policies, renewable energy consumption, proper management, and investment in climate-resilient infrastructure, particularly in climate-vulnerable regions such as South Asia.

Overall, the investigation makes a contribution to the existing literature on climate variability and food security in South Asia in four ways. First, it addresses methodological shortcomings by employing the CS-ARDL approach to model the relationship between climate change and food security. Second, it considers the impacts of both temperature and precipitation variability, as indicators of climate change, on food security. Third, it explicitly examines the role of agricultural R&D as a policy tool for climate change mitigation and adaptation in South Asia. Fourth, the study offers a more comprehensive assessment of the agricultural sector in South Asia by moving beyond single-crop analyses to
evaluate the buffering effects of agricultural research and development on overall agricultural production and food security. Finally, the analysis contributes to the literature by showing that agricultural R&D and renewable energy consumption not only lead to greater long-term gains in agricultural production and, consequently, more food security, but also provide greater short-term resilience to climate variability.
Thus, by providing robust empirical evidence from a highly climate-exposed region, this study generates meaningful insights into the interconnections between economic development, climate change, and sustainability. It offers an integrated and interdisciplinary perspective, while advancing actionable pathways to address climate risks and promote inclusive, resilient, and sustainable long-term development.

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Expanded Care Systems: Food, Commons, and Situated AI for Everyday Justice

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This paper argues that contemporary care systems must be understood as expanded socio-ecological infrastructures, where food practices constitute the central terrain through which justice, dignity, and collective well-being are produced in everyday life. Addressing the theme Collaboration for a Just and Equitable Future, the paper proposes that food — as a daily, embodied practice of care — functions as a shared common, while artificial intelligence (AI) is approached as a situated, limited, and auxiliary technology. Drawing on feminist epistemologies of situated knowledge (Haraway, 1988), AI is not framed as a mediator or driver of care, but as a companion tool whose role is deliberately constrained to supporting collective reflection, coordination, and learning within community-governed care infrastructures.

Theoretical Foundations: Care as Infrastructure
Building on Latin American feminist political economy and care studies, particularly CEPAL's (2022) work on care systems and the economy of care, the paper situates care as a foundational economic and social infrastructure rather than a residual or supplementary activity. Feminist critiques of the capital–life conflict — notably developed within the tradition of social reproduction theory (Federici, 2012, 2013) — reveal how food provisioning and care labor are systematically feminized, invisibilized, and territorialized, reinforcing structural inequalities that operate across household, community, and institutional scales. This analysis insists that care is not merely a social support function but a constitutive dimension of economic life, whose devaluation is structurally connected to the extraction of unpaid and underpaid labor from women and feminized bodies. Recognizing care as infrastructure means demanding its visibility, valuation, and collective governance as a political priority. Addati et al. (2018) have demonstrated through international comparative data the scale and economic significance of care work globally, and the urgency of creating decent conditions for those who perform it.

Food as a Common Good
From this theoretical foundation, food systems are approached as commons: collectively produced, culturally embedded, and sustained through everyday cooperation and shared responsibility (Ostrom, 1990). Food is not merely a commodity to be optimized or a nutritional input to be managed; it is a practice of care, a medium of cultural transmission, a site of political contestation, and a dimension of territorial belonging. The paper draws on urban food theory (Steel, 2013) to illuminate how food shapes the physical and social organization of cities, and how the breakdown of local food cultures is inseparable from broader processes of dispossession and infrastructural neglect. Insights from urban commons theory emphasize the role of local knowledge, informal networks, and proximity in sustaining food practices that are both ecologically grounded and socially just. Community food practices — from school meals to neighborhood food networks — are understood here not as marginal or compensatory, but as experiments in building alternative economic imaginaries that put life at the center.
Raworth's (2017) doughnut economics framework provides a complementary lens: food justice is simultaneously a question of social foundations (ensuring that everyone has enough to thrive) and ecological ceilings (ensuring that food systems do not exceed planetary boundaries). This double commitment — to sufficiency and to limits — is central to the paper's argument and informs its approach to technology.

Situated AI: Limits as Design Principles

Within this expanded understanding of care and food commons, AI is examined through feminist and justice-oriented approaches to technology (D'Ignazio & Klein, 2020) that reject claims to neutrality, universalism, and optimization. Rather than replacing human judgment or automating care relationships, AI is understood here as a bounded and accountable tool. Its role is explicitly constrained: to support — not substitute — the relational, affective, and political dimensions of care work. This means that the design of any digital tool introduced into care

infrastructures must be governed by explicit principles of limitation, transparency, accountability, and community ownership.

The paper is critical of dominant framings in which AI is presented as a solution to the care crisis — a crisis that is fundamentally structural and political, not technical. Automation cannot resolve the systemic devaluation of care labor; it may, in fact, deepen it by further rendering human care workers invisible and disposable. Instead, the paper advocates for a model in which digital tools are co-designed with communities, subject to collective governance, and evaluated not by metrics of efficiency but by their contribution to dignity, autonomy, and shared well-being.

Situated Experiences: La Combi Rosa and Colmena Bot Escolar

The paper draws on concrete situated experiences from urban and peri-urban Latin American contexts, particularly the work of La Combi Rosa and its development of Colmena Bot Escolar, a tool for ecosystemic social innovation designed to strengthen school food systems in the Mexican states of Hidalgo, Tlaxcala, and Puebla. At the heart of this initiative is NadIA (Nutrition, Food, and Data with Artificial Intelligence), a digital assistant that draws inspiration from the milpa-based food system — the Dieta de la Milpa — and from the German Agency for International Cooperation's Framework for the Transformation of Food Systems, linking personal, community, and planetary health within a single integrated approach.

NadIA integrates a corpus of scientific and practical knowledge built over more than two years of research using social design methodologies. This includes official nutritional guidelines, traditional local and seasonal recipes, balanced school menus, food safety protocols, zero-waste strategies, and community training materials. Critically, NadIA supports multilingual communication — in Spanish, Nahuatl, English, and German — in order to engage the full range of actors involved in school food systems: food producers, cooks, canteen administrators, teachers, health and hygiene personnel, families, and researchers. It fosters collective decision-making through gender and intersectional lenses, and promotes food autonomy, socio-environmental resilience, and cultural rootedness through biodiversity protection in food practices.

These experiences are discussed not as scalable models or replicable solutions, but as grounded experiments in commoning food and care. They illustrate both the possibilities and the limits of introducing digital tools into community life, and they highlight the importance of trust, process, and political intentionality in any such endeavor. The emphasis throughout is on learning from situated practice: on what works, what creates friction, and what questions remain open.

Methodology

Methodologically, the paper is grounded in research-action and co-design approaches (Tummers & MacGregor, 2019), combining qualitative analysis with participatory engagement across school communities in central Mexico. Knowledge is produced collaboratively with community actors — including educators, families, cooks, and local food producers — privileging situated expertise, everyday practices, and collective sense-making over extractive or top-down research logics. The design of NadIA itself emerged from this process: its knowledge corpus, its multilingual architecture, and its governance principles were all shaped through iterative dialogue with the communities it serves. The paper critically examines the ethical and political implications of introducing digital tools into care infrastructures, including questions of data sovereignty, power asymmetries, and the risks of techno-solutionism. It approaches methodology itself as a care practice — one that attends to relationships, contexts, and the conditions under which knowledge is produced and shared.

Contribution to ECOPÌA

The paper contributes to the ECOPÌA network by offering a shared conceptual and methodological framework that bridges care economics, food commons, urban theory, and responsible technology. By positioning food as a common good and AI as an accompanying infrastructure with explicit limits, it opens space for interdisciplinary collaboration and comparative research across diverse urban and peri-urban territories. It aligns with ECOPÌA's commitment to just, equitable, and life-centered futures by insisting that the technologies we build and the systems we design must always be answerable to the people and communities whose lives they shape.

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Collaborative Governance for Just Food Transitions: Lessons from University-Led Food Networks in Argentina and in Italy

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In the context of multiple interconnected crises – environmental, social, economic, and epistemic – food systems have emerged as a crucial arena where issues of justice, sustainability, and territorial governance intersect. Despite decades of sustainability-oriented policies, dominant agri-food models remain largely extractive, unequal, and environmentally unsustainable.

This paper argues that university-led social incubators (Coscarello, 2025) and cooperative food networks can operate as key platforms of collaborative governance, enabling just and territorially grounded food transitions.

Adopting a territorial and ecosystemic approach to social innovation, we explore the role of these social spaces in reconfiguring local food systems through practices rooted in the Social and Solidarity Economy (SSE) and Civic Food Networks (CFN).

The analysis draws on comparative research into innovation ecosystems, focusing on two cases: the University Incubator for the Solidarity Economy, Market and Finance (IUEMFS) at the National University of Quilmes in Argentina, and the Italian Network for Local Food Policies. We have engaged directly with both initiatives through first-hand experience and active involvement as researchers in processes aimed at advancing just food transitions.

Our central thesis is that university-supported social incubators and local networks not only provide support to social enterprises operating within territories, but also act as platforms for coordination, co-creation, and institutional innovation. These experiences illustrate how collaborative and multilevel governance frameworks can emerge from the interaction between universities, local institutions, and grassroots food actors. In doing so, they connect academic research, public policies, and grassroots practices related to food systems, thereby fostering more effective pathways toward just food transitions (Coscarello et al., 2025).

The Argentine case study – the University Incubator for the Solidarity Economy, Market and Finance at the National University of Quilmes – illustrates this role clearly. Through participatory action-research methodologies, the incubator has facilitated the emergence of agroecological markets, solidarity finance mechanisms, and collaborative food circuits, strengthening food sovereignty, economic justice, and environmental sustainability at the territorial level. Taken together, these two cases represent complementary models of university engagement in food governance: one territorially embedded and practice-oriented, the other network-based and policy-oriented.

In comparison, the Italian Network for Local Food Policies, founded in 2019 and comprising nearly 600 academics, researchers, public administrators, and activists engaged in the planning of sustainable local food systems, has established a distinctive national platform for open dialogue and collaborative action among diverse stakeholders on food-related issues (Dansero et al., 2019; Marino, 2024).

We present ongoing exploratory research into the characteristics of these cooperative spaces and the actors involved – particularly within universities – with the aim of generating concrete impacts on local foodscapes and supporting agroecological practices. Methodologically, our approach combines quantitative and qualitative methods, including the mapping of local

experiences, semi-structured interviews, participant observation, active personal involvement, and document analysis. This mixed-methods and participatory research design allows for a situated understanding of governance dynamics, knowledge co-production, and institutional learning within local food systems.

Empirical findings highlight three main contributions of social incubators and networks to fairer food futures. First, they promote inclusive governance models that enable producers, consumers, cooperatives, and institutions to actively participate in decision-making processes. Second, they advance economic democracy by redistributing value along food supply chains and reinforcing local autonomy. Third, they act as knowledge brokers, translating academic research into actionable practices and policy-relevant insights.

By framing universities as boundary spaces for collaboration between research, policy, and territorial practices, this paper contributes to the ECOPÌA network by offering a situated yet replicable model for the co-construction of shared cultural and methodological horizons.

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From Knowledge Co-Production to Social Incidence: Nature-Based Solutions and University-Community Landscape Governance in Mexico

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The San Juan Sustentable initiative in San Juan de Abajo, Nayarit (Mexico) exemplifies an integrated approach to climate adaptation and territorial justice through sustained knowledge co-production, applied socio-environmental research, and landscape-scale management based on Nature-based Solutions (NbS) co-designed and co-managed with local communities. This contribution is explicitly framed to engage with the ECOPÌA – ECO Partnership for Interdisciplinary Action network, particularly within the thematic line Collaboration for a Just and Equitable Future, by offering an empirically grounded and methodologically explicit model of collaborative, justice-oriented territorial transformation. Rather than treating sustainability as a technical outcome or a collection of isolated interventions, San Juan Sustentable adopts a co-productive socio-environmental research framework that links ecological processes, social dynamics, and governance arrangements to concrete mechanisms of social incidence and collective decision-making. The project is grounded in knowledge co-production theory, which understands sustainability transitions as the result of iterative, reflexive, and power-aware interactions between scientific knowledge, local experience, and institutional practice (Jasanoff, 2004; Nowotny, Scott & Gibbons, 2003). From this perspective, environmental degradation, climate risk, and social inequality are not independent variables but co-produced outcomes of historical land-use patterns, infrastructural decisions, and asymmetric governance regimes (Berkes, 2007; Schlosberg, 2007, Escobar, 2018). Methodologically, the initiative operates through a mixed-methods socio-environmental research design explicitly oriented toward incidence, integrating participatory territorial diagnostics, landscape and ecological analysis, and socio-institutional assessment. Participatory mapping, community timelines, and collective identification of risks and assets are combined with hydrological reading, ecosystem degradation indicators, and governance analysis. These methods are applied iteratively, allowing research findings to be discussed, contested, and reinterpreted with community and institutional actors, and translated into shared priorities for climate adaptation and ecological restoration. In this way, research outputs function as boundary objects that connect knowledge production with planning processes, community agreements, and public action.

A defining feature of San Juan Sustentable, and a central contribution to the ECOPÌA. network, is the structural integration of ITESO's Professional Application Projects (PAPs) and graduate

programs (including Master's and Doctoral levels) as long-term socio-environmental research and governance infrastructures embedded in the territory. PAPs operate as applied co-production platforms where undergraduate students, faculty, and community actors jointly generate data, define problems, and co-design NbS interventions. Graduate programs provide epistemic depth, methodology recognitional, and distributive dimensions of environmental justice. The initiative is supported by international cooperation funding, which acts as an enabling condition for sustained experimentation in collaborative governance rather than as a top-down driver of predefined solutions. Faculty members play a key role as epistemic and institutional mediators, aligning co-produced knowledge with municipal and regional planning frameworks and ensuring reflexivity, learning, and adaptive governance, in line with adaptive co-management approaches (Armitage, Berkes & Doubleday, 2007). In terms of social incidence, the project's research design is explicitly oriented toward influencing concrete decision-making processes. Co-produced outputs, such as landscape management criteria, NbS prioritization maps, socio-environmental vulnerability assessments, and community-agreed intervention portfolios, are systematically used to support community assemblies, inform municipal planning discussions, and guide negotiations with public and non-governmental institutions. This incidence-oriented approach positions socio-environmental research not as an external evaluative tool but as an active component of territorial governance, reinforcing accountability, transparency, and collective ownership of climate adaptation strategies.

This paper contributes to the construction of the ECOPÌA network in four explicit ways. First, it offers a methodologically explicit example of knowledge co-production that operationalizes collaboration as a driver of justice-oriented territorial transformation. Second, it demonstrates how universities, through undergraduate, Master's, and Doctoral programs, can function as long-term governance infrastructures, ensuring continuity, institutional memory, and accountability. Third, it provides an integrated landscape management model based on community-centred NbS, linking ecosystem restoration with social equity and climate adaptation. Fourth, it illustrates how internationally funded initiatives can be reoriented toward locally grounded, co-produced, and incidence-driven outcomes, avoiding technocratic and extractive approaches. San Juan Sustentable shows that socio-environmental research, when explicitly designed for knowledge co-production, social incidence, and collaborative governance, can contribute meaningfully to the just and equitable futures envisioned by the ECOPÌA network. By linking research, education, community action, and Nature-based Solutions within an integrated landscape framework, the project offers a robust and transferable contribution to ECOPÌA's collective effort to build plural, inclusive, and transformative responses to contemporary socio-environmental crises.

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Gender Equality, Sustainability and Armed Conflict: Rethinking Environmental Justice in War-Affected Contexts

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The convergence of three global crises—armed conflict, climate breakdown, and gender inequality—demands analytical frameworks capable of holding their interactions in view simultaneously. Yet mainstream sustainability discourse has been slow to incorporate the insights of feminist political ecology, and peacebuilding practice has frequently treated environmental restoration and gender justice as parallel, rather than constitutive, agendas. The result is a double invisibility: women's environmental vulnerabilities are obscured in conflict analysis, while their indispensable roles as resource managers and community sustainers are routinely excluded from post-conflict reconstruction planning.
This paper proceeds in four stages. Section 2 establishes the theoretical foundations, drawing on feminist political ecology and intersectionality theory. Section 3 examines the gender-differentiated environmental impacts of armed conflict across key domains: resource access, food security, water management, displacement, and care work. Section 4 analyses the limitations of existing peacebuilding and sustainability frameworks, offering empirical examples from conflict-affected regions. Section 5 proposes an integrative conceptual framework and concludes with reflections on the structural conditions for just and durable peace.

Theoretical Foundations: Feminist Political Ecology and Intersectionality
Feminist political ecology (FPE) emerged in the 1990s as a response to the gender-blindness of mainstream political ecology and the class-blindness of earlier ecofeminist thought. Scholars such as Rocheleau, Thomas-Slayter, and Wangari argued that access to, knowledge of, and struggles over natural resources are profoundly gendered, and that these gendered dynamics are always also shaped by class, race, ethnicity, and location. FPE insists that environmental knowledge is situated and that women's resource management practices constitute a form of expertise frequently devalued by formal institutions.
Intersectionality, as theorised by Kimberlé Crenshaw and subsequently elaborated within feminist scholarship, provides the methodological complement to FPE's political-ecological insights. It directs attention to the ways in which multiple axes of identity and structural power—gender, class, race, age, disability, displacement status—interact to produce differentiated vulnerabilities and capacities. In conflict settings, intersectionality is not a theoretical luxury but an analytical necessity: a woman who is also a refugee, an ethnic minority, and a subsistence farmer faces configurations of risk that no single-axis analysis can adequately capture. Together, FPE and intersectionality provide the conceptual architecture for what this paper calls a gender-sensitive environmental justice framework for conflict contexts. This framework insists that environmental degradation and gender inequality are co-produced in war, that their mutual reinforcement generates specific forms of suffering that are often unrecognised in humanitarian and development responses, and that sustainable peace requires the simultaneous transformation of both environmental and gender power relations.

Gender-Differentiated Environmental Impacts of Armed Conflict
Access to Natural Resources and Food Security
Armed conflict disrupts the social and institutional arrangements through which communities access land, water, forests, and other natural resources. These disruptions are seldom neutral in gender terms. In many conflict-affected societies, women's land rights are customary rather

than formal, making them more precarious and easier to dispossess when legal institutions collapse or armed actors impose new territorial orders. The looting and destruction of agricultural inputs, the contamination of soils with heavy metals from munitions, and the militarisation of rural spaces all converge to undermine the conditions of smallholder farming in which women's labour is disproportionately concentrated. Food insecurity is both a cause and consequence of gendered conflict dynamics. Women and girls typically eat last and least within households under food stress, and conflict-induced disruptions to markets, supply chains, and agricultural calendars fall most heavily on female-headed households—a category that expands dramatically in war contexts as men are killed, conscripted, or displaced. In South Sudan, research conducted in the wake of the 2013–2018 civil war documented how women who had previously maintained diversified food production strategies were forced into dependency on humanitarian food aid as conflict destroyed both their resource base and the social networks through which they had managed environmental risk.

Water, Sanitation, and Hygiene

Water is among the most immediate environmental casualties of armed conflict. Infrastructure is deliberately targeted as a tactic of war; aquifers are contaminated by military activity; and the breakdown of governance makes maintenance and repair impossible. The gendered implications are severe. In most conflict-affected contexts, water collection is primarily a female responsibility, and the destruction or contamination of proximate water sources forces women and girls to travel longer distances—exposing them to violence, including sexual violence—or to use unsafe water with attendant health consequences. The 2011–2021 conflict in Yemen provides a stark illustration. The targeting of water and sanitation infrastructure contributed to what the United Nations described as one of the world's worst cholera outbreaks, with women and girls bearing disproportionate burdens both as caregivers for the sick and as those most exposed to unsafe water through their household roles. The destruction of sanitation facilities also undermined menstrual hygiene management, with cascading effects on girls' school attendance and women's participation in public life during periods of partial stabilisation.

Displacement and Environmental Exposure

Conflict-induced displacement creates distinctive environmental vulnerabilities. Internally displaced persons and refugees frequently settle in ecologically marginal areas—steep hillsides, floodplains, arid zones—where the risk of environmental hazard is high and where competition for natural resources generates secondary conflicts. Within displaced populations, women face compounded risks: gender-based violence in camps and settlements, reduced access to legal protection, and exclusion from the collective decision-making processes through which displaced communities negotiate resource access. The interaction between conflict-induced displacement and climate change is increasingly significant. In the Sahel region, where desertification and irregular rainfall have long strained livelihoods, conflict has accelerated outmigration while simultaneously making return more difficult by destroying the environmental and social infrastructure of origin communities. Women displaced from agricultural livelihoods often find themselves confined to domestic roles in urban or peri-urban settings, losing both their economic autonomy and their environmental knowledge—a loss that has long-term consequences for household resilience and community food security.

Care Work and Social Reproduction

Perhaps the most systematically invisible dimension of the gender-environment nexus in conflict settings is the intensification of care work that environmental degradation imposes on women. When forests are destroyed and firewood becomes scarce, women spend more time collecting fuel. When water sources are contaminated, women spend more time treating water and caring for the sick. When agricultural systems collapse, women spend more time managing hunger within households. This invisible labour—what feminist economists have termed social reproduction—is the shock absorber of humanitarian crisis, and it is overwhelmingly performed by women. The recognition of care work as environmental labour is essential to any serious framework for sustainable recovery. Post-conflict reconstruction

programmes that prioritise physical infrastructure—roads, buildings, water systems—without attending to the social infrastructure of care and community sustenance reproduce the gender inequalities that made women so vulnerable in the first place. As Elson and others have argued, economies and ecosystems alike depend on reproductive labour that markets and states routinely fail to value or support.

Limitations of Mainstream Frameworks and Empirical Evidence

Mainstream peacebuilding and sustainability frameworks have made significant advances in recent decades, yet they continue to exhibit structural limitations when confronted with the gender-environment nexus in conflict contexts. United Nations Security Council Resolution 1325, adopted in 2000, recognised the importance of women's participation in peace processes and post-conflict reconstruction. However, implementation has been uneven, and the environmental dimensions of women's peacebuilding roles have received scant attention in National Action Plans developed under the Women, Peace and Security agenda. Similarly, the Sustainable Development Goals (SDGs) include commitments to both gender equality (SDG 5) and environmental sustainability (SDGs 13–15), as well as to peace and strong institutions (SDG 16). Yet the architecture of the SDGs treats these as largely parallel objectives, failing to articulate the structural linkages that make progress on one conditional on progress on others. Environmental sustainability assessments conducted in post-conflict settings rarely include gender analysis; gender-responsive programming in humanitarian and development contexts rarely incorporates environmental dimensions. The post-conflict reconstruction of Rwanda illustrates both the potential and the limits of gender-sensitive approaches. Rwanda's post-genocide government adopted ambitious gender quotas in political institutions and developed innovative community-based approaches to land reform that strengthened women's tenure security. These measures contributed to significant improvements in women's formal political representation and agricultural productivity. However, critics have noted that environmental restoration efforts—including reforestation and wetland protection—were implemented in ways that sometimes increased women's unpaid labour burdens without compensating economic or legal benefits, and that formal gender equity did not automatically translate into substantive changes in the gender division of environmental labour. Post-conflict Colombia offers a different set of lessons. The 2016 peace agreement between the Colombian government and the FARC-EP included provisions for land restitution and rural development that acknowledged gendered land rights, and civil society organisations—including women-led environmental groups in the Pacific coastal region—played a central role in negotiating these provisions. Yet implementation has been hampered by the persistence of armed actors, the assassination of environmental and social leaders (disproportionately from Indigenous and Afro-Colombian communities), and inadequate resourcing of the institutional mechanisms required to enforce the agreement's environmental and gender commitments.

Toward an Integrative Framework: Gender Justice, Environmental Sustainability, and Conflict Transformation

The empirical evidence reviewed in the preceding sections points toward the need for a conceptual framework that integrates gender justice, environmental sustainability, and conflict transformation as mutually constitutive rather than parallel objectives. This section outlines the key elements of such a framework. First, the framework must be grounded in a recognition of gendered environmental knowledge. Women in conflict-affected settings are not simply victims of environmental degradation; they are also sophisticated managers of ecosystems and natural resources, whose knowledge has often been developed and transmitted across generations in contexts of scarcity and insecurity. Post-conflict environmental governance that excludes women from decision-making processes not only violates principles of democratic inclusion but actively impoverishes the epistemic resources available for ecological restoration. Second, the framework must centre the political economy of care. Social reproduction—the labour of sustaining human life and community—is both environmentally embedded and gender-divided. Any sustainability framework that fails to account for care work reproduces the fiction that economies and ecosystems can function without the unpaid labour predominantly performed by women. Concretely, this means that post-conflict reconstruction programmes must assess the care implications of their

environmental interventions, and that environmental restoration must be accompanied by investments in social infrastructure—childcare, healthcare, community support systems—that redistribute care burdens more equitably. Third, the framework must insist on inclusive governance as a structural condition, not an add-on. The evidence from Rwanda, Colombia, South Sudan, and Yemen consistently shows that technical interventions in environmental management—however well-designed—fail to achieve sustainable outcomes when governance institutions exclude the communities most affected by environmental degradation. Women's meaningful participation in peace negotiations, land reform processes, resource management institutions, and post-conflict environmental governance is not merely an ethical imperative; it is a structural condition for the durability of environmental agreements and the sustainability of recovery. Fourth, the framework must embrace an intersectional approach to vulnerability and agency. Not all women in conflict settings experience environmental harm in the same way, nor do all women possess the same capacities for environmental agency. Age, ethnicity, displacement status, class, and disability intersect with gender to produce differentiated experiences that homogenising categories of 'women' obscure. Programmes and policies must be disaggregated to respond to these differences, and the organisations of women from marginalised communities—Indigenous women, refugee women, women with disabilities—must be recognised as legitimate interlocutors in environmental and peacebuilding governance.

Conclusion

Armed conflict does not simply destroy environments; it restructures the gender relations through which communities access, manage, and reproduce natural resources. The environmental costs of war are not gender-neutral, and neither are the opportunities for ecological restoration. This paper has argued that feminist political ecology and intersectionality together provide the analytical foundations for a framework capable of holding these complexities in view, and that the empirical record from conflict-affected regions offers both sobering evidence of the costs of gender-blind environmental programming and promising examples of what gender-sensitive approaches can achieve. The integration of gender equality into sustainability and peace agendas is not a matter of adding women to existing frameworks. It requires the transformation of those frameworks—their analytical assumptions, their governance architectures, and their metrics of success—to recognise care work as environmental labour, to value women's ecological knowledge, and to treat women's meaningful participation in decision-making as a structural condition for sustainable outcomes. This is, in the deepest sense, not merely an ethical imperative but a condition of possibility for durable peace and environmentally just recovery.

Much remains to be done, theoretically and practically. Future research must develop more robust methodologies for quantifying the gendered environmental costs of conflict, for tracking the care implications of post-conflict environmental interventions, and for documenting the contributions of women-led organisations to ecological restoration. Policymakers must develop accountability mechanisms that ensure gender commitments in peace agreements are matched by adequate resourcing and institutional capacity. And the organisations of women from conflict-affected regions—who have long been theorising these connections from the ground up—must be recognised not merely as beneficiaries of frameworks designed elsewhere, but as their authors.

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Collaborative governance and agroecological transition in Mediterranean inner areas: analysis of the “Biodistretto Agroecologico Monti Erei” (Sicily, Italy) case study

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The transformation of agri-food systems has become a central challenge in the context of intertwined socio-ecological crises, territorial inequalities, and the marginalization of inner rural areas. In this framework, dominant global agro-industrial food regimes continue to generate environmental degradation, economic dependency, and social exclusion, while weakening local capacities to govern natural resources and food systems democratically. Within this context, agroecology has emerged as a multidimensional and transdisciplinary paradigm – at once scientific, practical, and political – that integrates ecological management, participatory governance and socio-political mobilization with the aim of challenging and reconfiguring dominant food regimes (Altieri & Toledo, 2011). Fostering institutional and social innovation through the interaction between local actors and public policies, agroecological transition emerges as an alternative capable of reducing agriculture’s dependency on global agro-industrial circuits, strengthening territorial connections, and enhancing the ecological, social, and cultural specificities of local systems (Anderson et al., 2019). The aim of this contribution is to investigate and analyze agroecological transition processes within the broader dynamics of re-localization and re-territorialization of agri-food systems, focusing on place-based, multi-actor and participatory models, strategies, and approaches developed at the territorial level in the context of Mediterranean Europe. A specific focus was placed on the model of Biodistricts (or organic districts) and the analytical-interpretative framework of Local Agroecological-Based Agri-food Systems (SALBAs): in this regard, particular attention was given to the potentials and limitations of the initiative in enabling territorial transformation processes in an agroecological key, assessing both opportunities for building spaces of autonomy and the presence of political, institutional, and organizational lock-ins that hinder the scaling-up of agroecological practices and strategies (Van der Ploeg, 2018).
Biodistricts – formalized multi-actor platforms involving farmers, municipalities, civil society organizations, research institutions and consumers – have increasingly been promoted across Europe as policy instruments for re-localizing agri-food systems, supporting rural development strategies and strengthening local economies. However, existing research highlights substantial differences in their ability to promote transformative change, especially in peripheral contexts characterized by persistent power asymmetries, fragmented governance structures, limited infrastructure, and demographic decline. Building on debates in rural sociology, political ecology and agrarian political economy, this paper conceptualizes biodistricts as contested governance spaces in which divergent visions of sustainability, social and rural justice and territorial development are negotiated (Van der Ploeg, 2018). The analysis also engages with critical agrarian studies on the risks of institutional co-optation and depoliticization affecting alternative and localized agri-food networks when grassroots initiatives are incorporated into policy frameworks (Guthman, 2007). Together, these perspectives underpin an examination of whether the analyzed biodistrict model functions

primarily
as an adaptive arrangement within existing policy regimes or instead constitutes a potential lever for more structural socio-ecological transformations.
The empirical analysis was based on the "Biodistretto Agroecologico Monti Erei" experience, located in the inner areas of central Sicily (Italy) in the province of Enna, identified as an emerging territorial configuration of collaborative governance oriented towards agroecological transition and socio ecological regeneration. Empirically, the study relies on a qualitative research design, based on a microsociological and interpretative paradigm and developed over multiple fieldwork phases. Methodology tools included semi-structured interviews with farmers, processors, public officials, activists and technical advisors; participant observation during assemblies, training activities and public events; and analysis of policy documents, development plans and internal governance materials. Prioritizing the analysis of local social dynamics and everyday practices through which agroecological agri-food systems are constructed, the empirical corpus is interpreted through the combined analytical lenses of Territorialised Agri-food Systems and the "domains of agroecological transformation" framework proposed by Anderson et al. (2019), which allows for systematic attention to interactions between discursive, institutional, ecological, economic and political dimensions of transition processes at a territorial level.
The findings – although partial given the evolving and changing nature of the initiatives – show that the observed experience operates as a platform for inter-municipal coordination and multi-actor collaboration, enabling farmers, local administrations, civil society organizations and technical advisors to co-produce shared territorial strategies for agroecological transformation. Within this context, the agroecological biodistrict model can act primarily as a participatory governance arena in which the actors involved engage in sustained processes of deliberation and collective decision making. Through formal assemblies, thematic working groups and informal coordination practices, participants co-define shared territorial priorities for agroecological transition, including soil regeneration strategies, biodiversity conservation, crop diversification and the reorganization of local food chains resilient to the climate crisis. These collaborative processes foster the circulation of situated knowledge and technical expertise, while also opening spaces to negotiate distributive issues such as access to public support, market opportunities and infrastructural resources, thereby linking ecosystem management to concerns for social equity and territorial justice (Van der Ploeg, 2018).
At the same time, the analysis points to the ambivalent effects of institutionalization and bureaucratization on participatory dynamics. While official recognition and integration into public funding schemes contribute to stabilizing the Biodistretto and increasing its visibility within regional policy arenas, they also introduce new administrative requirements and pressures towards agenda alignment (Guthman, 2007). Moreover, asymmetries in actors' resources and capacities, uneven levels of engagement across social groups, and persistent bottlenecks in processing and logistics continue to shape the inclusiveness of collaborative arrangements and to limit the consolidation and scaling of agroecological practices over time. By foregrounding these ambivalences, the paper contributes to current debates on just transitions in rural contexts and on ecosystem management through participatory governance, arguing that biodistricts may operate as laboratories of socio-ecological transformation only when deliberative mechanisms remain robust and inclusive, and when public intervention prioritizes long-term territorial capacity-building over short-term project cycles. The contribution thus offers empirically grounded insights for interdisciplinary research on collaborative sustainability governance and for the collective agenda of the ECOPÌA network.

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LIFE QUALITY AND ENVIRONMENTAL SUSTAINABILITY IN SOUTH ITALY: A CASE STUDY ON SOCIAL AGRICULTURE FARMS.

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Population aging represents one of the most significant demographic transformations of the 21st century and poses new challenges for welfare systems, local communities, and disciplines concerned with public health, well-being, and quality of life. Prevention and active aging, as well as innovation in services for vulnerable individuals, represent crucial challenges given also the population aging process. According to the World Health Organization definition, the concept of active aging emphasizes the importance of creating environmental, social, and cultural conditions that foster the participation, autonomy, and health of older people.
Providing healthy environments for people well-being corresponds to World Health Organization (WHO) strategic priority “Ensure healthy lives and well-being for all at all ages”, creating resilient communities and supportive environments for health.
The environment, both in the physical and relational sense, has a strong impact on the level of personal and collective well-being and therefore does not play a role of neutral space, a background to interpersonal behavior. The influence of natural environments on human well-being began to be explored in the 1980s, when researchers observed that elements such as light, noise, greenery, and the overall design of spaces could reduce stress and support psychophysical recovery, especially in hospitalized or elderly patients.
These effects are now framed within the concept of ecosystem services, defined by the Millennium Ecosystem Assessment as the multiple benefits that ecosystems provide to humans.
Within this context, the idea of Green Care has emerged, referring to activities that promote physical and mental health through contact with nature, in line with the WHO definition of health as complete physical, mental, and social well-being.
Social Agriculture, a multifunctional agriculture model regulated in Italy by the Law n. 141/2015, is part of a welfare model in which environmental protection, enhancement, as well

as people well-being and social integration, can find their maximum expression. It is an innovative approach that combines agricultural production and social purposes, offering ecosystem services, inclusion, rehabilitation and well-being paths to vulnerable categories: an approach that integrates various functions and benefits within the agricultural context, going beyond simple food production, emphasizing the importance of sustainable practices that contribute to the local and environmental development of rural communities, providing also social services. A practice that is increasingly spreading, especially as response to the needs of an aging population.

For older people, the experience in Social Farms is an opportunity for aggregation and improvement of life quality and psychophysical well-being, according to the WHO's definition of active aging as a "process of optimizing health opportunities, participation and safety to improve people's quality of life".

In the frame of the CNR "Nutrage" Project, in 2024, we conducted a preliminary desk analysis to size number, sectors of specialization and recipients of companies operating in Social Agriculture in Italy. For the data selection, we used the ISTAT 2020 National Census, the CREA 2020-2023 Regional Registers, various search engines and comparisons with trade associations as well as direct telephone contact.

From the desk analysis carried out, emerged an ever-increasing presence and legislative protection of Social Agriculture, but also the necessity to improve the knowledge of the phenomenon, since the information on operators, activities, recipients and above all effects of these practices on people and territorial contexts are poor.

In 2025 we conducted a case study through the administration of online questionnaires (Google Forms) and face to face interviews on a sample of 19 companies located in Calabria and Sicilia Regions (Italy) to analyze their activities and the psychophysical well-being parameters linked to the stay in natural environments by the over65 people attending them.

In particular, the case study involved a sample of 14 over65 people attending on regular basis/residential mode two social farms located in Calabria Region: "Don Milani Cooperative", Acri (CS) and "Arca di Noè Cooperative", Carolei (CS). The survey has been conducted through the administration of a face-to-face interviews. The questionnaire administered was structured with open, closed and multiple-choice questions and was composed of two sections: section I concerning the general data of the interviewees and section II concerning the data relating to health, eating habits, lifestyles, attendance and care of green areas and well-being The data analysis was conducted through the software IBM SPSS statistics and Microsoft Excel.

The case study confirmed the importance of the Green Care sector and services related to the natural environment, especially for the people most socially vulnerable. The environment quality in Social Agriculture farms, frequented not only for potential nutritional purposes (horticultural therapy) but also as a provider of ecosystem services related to health (e.g., air quality) or as an aesthetic-spiritual landscape element, is an important element of psycho-physical-cognitive well-being by the subjects interviewed, along with a Mediterranean Diet and healthy lifestyle and social activities. Nutritional assessments and adequate hydration and a personalized dietary recommendation, particularly regarding protein intake, supported the maintenance of functional status.

According to the 14 interviewees (8 female, 6 male, mean age 76,93±12,344), the ecosystem services contribute significantly to psycho-physical and cognitive well-being, alongside the Mediterranean diet, healthy lifestyle habits, and social engagement. Respondents reported experiencing enhanced well-being from spending time in green spaces. They view their connection with nature as a fundamental part of their lives and feel a deep bond with other living beings.

The combination of nature activities (contact with nature, green space maintenance, physical exercise), social interaction (workshop and creative activities), and structured routines appears to foster psychological resilience, motivation, and a renewed sense of purpose. These findings are consistent with international evidence on social farming, which highlights its ability to reduce stress and depressive symptoms, strengthen social connection, and promote autonomy and self-esteem.

Although the sample size limits, the results case highlights the potential of social farming as a complementary approach within community-based welfare systems.

Social Agriculture can lead to a welfare model in which environmental protection and enhancement, well-being, and social integration can find their full expression within an ethical commitment to sustainable development and healthy lifestyles, with a positive response to loneliness and degenerative diseases affecting older adults.
The study can help public policy decisions and choices towards new age-friendly and active aging models to promote increasingly participatory and inclusive processes.

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Collaborative Climate Governance and Democratic Justice: The Permanent Citizens' Climate Assembly of Milan as an Infrastructure for Equitable Futures

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Contemporary climate governance is increasingly confronted with a dual crisis: the escalation of climate risks and the erosion of democratic legitimacy in public decision-making. Addressing these intertwined challenges requires governance models capable of fostering collaboration across institutional levels, social actors, and knowledge systems, while ensuring justice, inclusiveness, and accountability. In this context, deliberative democratic innovations—such as citizens' climate assemblies—are gaining relevance as mechanisms for co-constructing shared visions and collective responsibility.

This contribution examines the Permanent Citizens' Climate Assembly of Milan (APCCMI) as a case study of collaborative governance oriented toward a just and equitable urban transition. The paper draws on the results of an independent monitoring and evaluation process conducted during the Assembly's 2024 cycle, which combined document analysis, direct observation, participatory evaluation sessions with assembly members, and internationally recognized criteria for assessing deliberative quality.

The analysis highlights how the APCCMI functions as a space of structured collaboration between randomly selected citizens, public institutions, experts, and civil society actors. The Assembly has contributed to enhancing the inclusiveness of climate policymaking, amplifying marginalized perspectives, and strengthening citizens' capabilities to engage with complex climate issues. Its deliberative outputs—recommendations addressing mitigation, adaptation, and social justice—demonstrate the potential of participatory processes to challenge technocratic and extractive governance logics, re-centering care, equity, and the commons within urban climate strategies.

At the same time, the evaluation identifies critical tensions inherent to collaborative governance, including uneven institutional uptake of citizens' recommendations, power asymmetries between administrative actors and deliberative bodies, and the risk of participation remaining consultative rather than transformative. These findings underscore the need to embed deliberative assemblies more firmly within policy cycles and accountability frameworks, ensuring continuity, transparency, and mutual responsibility.

By situating the Milan experience within broader debates on participatory change, multilevel justice, and democratic innovation, this paper argues that permanent citizens' assemblies can operate as infrastructures of collaboration, enabling the co-production of climate policies that are not only effective, but also socially legitimate and just. The contribution aims to inform the ECOPÌA network by offering transferable insights on how collaborative, citizen-centered governance can support equitable climate transitions across diverse territorial contexts

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From Community Climate Plans to Digital Environmental Stewardship: Indigenous-Led Decision-Making for Ecosystem Governance

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Across the world, societies face intersecting crises of biodiversity loss, deforestation, and freshwater degradation. Indigenous peoples confront these environmental challenges alongside enduring legacies of land dispossession and community depopulation. For many communities, social, economic, and ecological pressures have intensified across generations, leaving limited on-site capacity and constrained resources to address complex, multi-dimensional problems simultaneously.

Despite these constraints, Indigenous leaders seek to exercise trustee leadership that advances environmental sustainability not only for their own communities, but also for wider society and future generations. In Aotearoa New Zealand, Māori who are pursuing effective trusteeship typically share two core objectives:

1. Strengthening connections with dispersed community members to enable collective action; and
2. Securing the best available knowledge—combining locally held ecological knowledge, wider community experience, and western science—supported by appropriate technology to improve environmental health.

This paper draws on Project Kāinga, a five-year, community-led research programme working with rural Māori communities across Aotearoa New Zealand to respond to climate change, biodiversity loss, freshwater degradation, and social vulnerability. Project Kāinga began by understanding community challenges and aspirations relating to climate resilience, prioritising the long-term health of people, lands, and waters, and then supporting communities by developing Kāinga (community) climate adaptation plans. These plans are values-based, economically realistic, and context-specific, addressing interconnected challenges including food security, water quality, energy affordability, forest restoration, and community wellbeing.

While these plans provide strategic direction, a critical next step lies in translating aspirations into sustained action. This requires bringing together fragmented data, observations, and expertise into usable monitoring and decision support systems. The paper therefore introduces a community-driven goal to develop a cloud-based, AI-enabled platform designed to support Indigenous environmental decision-making.

Recent advances in environmental artificial intelligence provide an important foundation for this work. New Zealand is internationally recognised for “predict and prevent” approaches to environmental management, particularly in biodiversity protection, where AI is used to anticipate ecological threats—such as from invasive predators (including possums, stoats, rats, feral cats, and dogs)—and guides early intervention. From Māori community perspectives, further progress involves advancing current models toward systems that integrate highly localised ecological knowledge held within their communities alongside temporal indicators into analytical frameworks. Incorporating place-based understandings of ecosystems, species interactions, and seasonal cycles into machine-learning models has the potential to improve predictive accuracy while remaining aligned with community-defined stewardship goals.

The platform is therefore conceived as adaptable across multiple environmental governance contexts, including invasive predator control, biodiversity monitoring, freshwater and water-quality assessment, wetland restoration, forest health, and community-based food and land-use systems. It is configurable to enable communities in different regions to tailor the tool using their own community-generated and externally held data, to elicit information on local

leadership, skills, and capacity, and to deploy it in relation to the specific environmental systems and priorities they seek to steward.

The key to success is embedding tools within local leadership. It is about empowering this leadership to act collaboratively from informed perspectives where data is nuanced, specific and relevant. Many existing international environmental tools rely on high-level or standardised datasets that lack the granularity required for effective, community-led action. A critical gap remains in the development of user-friendly, adaptable decision-support systems that can be customised to local priorities, values, and environmental conditions. While a growing ecosystem of digital tools seeks to empower local sustainability efforts, the next challenge lies in integrating nuanced community knowledge—reflecting distinct social, cultural, and ecological contexts—with larger environmental datasets. Doing so enables more targeted, actionable interventions and shifts AI from a passive monitoring function toward an active enabler of collective environmental decision-making.

The proposed platform aims to integrate multiple forms of knowledge—community observations, locally held ecological knowledge, seasonal indicators, sensor-based monitoring, and national or local environmental datasets—within a shared decision-support tool. The approach supports regenerative ecosystem management by linking environmental monitoring, community stewardship, and adaptive decision-making across freshwater, biodiversity, forest, and food systems. Rather than treating data as an extractive or purely technical resource, the platform is conceived as a collective governance instrument, enabling communities to define their own environmental priorities, track change over time, evaluate interventions, and coordinate action. It supports locally defined indicators of environmental health, decision prompts aligned with community goals, and feedback mechanisms that strengthen participation, accountability, and intergenerational knowledge transfer.

Methodologically, the research combines participatory design with Indigenous governance theory, environmental science, and applied artificial intelligence. Communities and their researchers have completed the first five years of work identifying opportunities, risks and challenges for community resilience in a changing climate and now want to guide data curation, platform design, testing and deployment. Centring community leadership in this work ensures that technological development remains aligned with local values, leadership structures, and social realities. This approach reframes digital tools not as neutral infrastructures, but as governance instruments that can either reproduce or reshape power relations in environmental management.

The paper contributes three insights to the ECOPÌA network. First, sustainability efforts are more effective when decision-making tools are co-designed with communities and grounded in place-based values. Second, Indigenous governance approaches offer practical alternatives to technocratic sustainability models by foregrounding collective responsibility, long-term stewardship, and relational accountability. Third, the Project Kāinga model demonstrates how Indigenous-led environmental governance can be scaled without standardising or diluting local values, by coupling place-based planning with adaptable digital infrastructure. In doing so, it offers a transferable model that enables collaboration across communities, institutions, and territories while preserving Indigenous authority over priorities, data, and decision-making. The approach is intentionally interdisciplinary and internationally legible, creating opportunities for collaboration within the ECOPÌA network to work in contexts of Indigenous stewardship, environmental injustice, and long-term territorial resilience.

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Bridging Knowledge Gaps: Collaborative Frameworks for Assertive Climate Communication and Social Justice in Urabá's Shorelines

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This paper argues that climate adaptation is only equitable when communities are co-creators of the risk narrative. By analyzing the case of Urabá, Colombia, we demonstrate how pedagogical communication acts as a tool for social justice, ensuring that marginalized coastal populations have the agency to shape their own resilient futures through collaborative knowledge. To operationalize this vision, we present the design of a specialized pedagogical tool for climate change communication, specifically tailored for diverse coastal contexts. This tool facilitates the translation of complex climate data into accessible, place-based narratives, utilizing visual analysis and social mapping to bridge the gap between scientific expertise and local lived experiences.

Furthermore, we explore how a framework of collaborative and multilevel governance is essential for systemic transformation. By engaging diverse communities—including children, youth, settlers, and women's grassroots organizations—this study highlights the importance of horizontal knowledge exchange across different scales of decision-making. We argue that integrating local ecological knowledge with institutional climate governance not only addresses structural inequities but also fosters a shared sense of responsibility. The pedagogical tool serves as a boundary object in this process, enabling inclusive dialogue and aligning community priorities with regional adaptation policies.

By centering the design process on the voices of those most affected by environmental precarity, we challenge top-down technocratic approaches that often overlook cultural nuances and relational well-being. Ultimately, this participatory approach and the implementation of assertive communication tools serve as a catalyst for a just socio-ecological transition. The case of Urabá illustrates how design and pedagogy can transform passive residents into active stakeholders, empowering them to navigate the uncertainties of climate change through collective action, territorial solidarity, and renewed hope for a just and equitable future.

Case Study: Urabá

The municipality of Necoclí is located in the subregion of Urabá in the department of Antioquia, Colombia. It is bordered on the north by the Caribbean Sea and the municipality of San Juan de Urabá, on the east by the municipality of Arboletes, on the south by the municipality of Turbo, and on the west by the Caribbean Sea. It has an area of 1361 square kilometers. It is located in the Gulf of Urabá, where the Fort of San Sebastián was, the first Spanish settlement in America. The Gulf of Urabá is a dynamic and multifaceted coastal landscape that extended over length of 4.291 Km2, located in the southern Caribbean, bordering Panama, is the largest sea inlet on the Colombian coast, being an elongated body of water, in a north-south direction, with a U-shaped morphology (80 km long and 25 km wide on average). It is the largest estuary in the Colombian Caribbean because the Atrato River (4,155 m3/s, the second largest flow after the Magdalena River) flows into the middle part of its western coast. This forms an extensive fingered delta that contrasts with the acuminate

micro-deltas of the south-eastern side at the mouth of several rivers of lesser flow, which constitutes a very dynamic landscape.

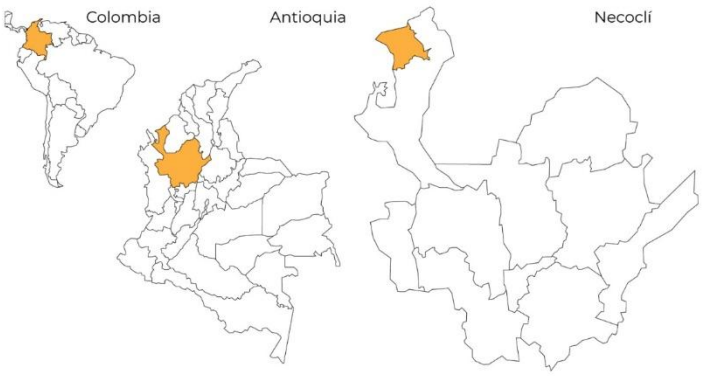

Figure 1. Location of Necoclí in the Gulf of Uraba, Colombia.

The municipality is located in a warm zone, which, like the entire Urabá region, is characterized by the same climatic conditions. The average annual temperature is above 24° C, with maximum humidity between March and June and minimum humid-ity in February, August and October. The bimodal rainy season occurs in the months of February and March, with an increase in humidity that favors fishing and planting. Necoclí's landscape is quite diverse, as the Image 2 shows. This landscape reveals a contrast between the coastal and riverine landscape, mangroves, and tropical rainforests that favor diverse socio-cultural, environmental, and commercial activities based on flora and fauna.

Pedagogical communication as a tool for social justice

When designing educational strategies to address climate change, there is a risk of overlooking the prior knowledge held by local communities. Although technical terminology related to climate science may be unfamiliar to certain groups, this should not be interpreted as evidence that these communities lack meaningful insights into the issue. On the contrary, it is essential to recognize their empirical knowledge of environmental changes and the practical strategies they have developed to respond to mitigation and adaptation challenges. Understanding the communities with whom climate change initiatives are developed also requires examining the specific ways in which they contribute to the problems associated with climate change, as well as the barriers and motivations that shape the adoption of substantial and sustained changes. These factors vary across contexts and are strongly influenced by cultural practices, livelihood systems, and territorial characteristics. An illustrative example can be found in Necoclí, Antioquia, where the increasing frequency of flooding and coastal erosion—associated with global warming—has led residents to develop a practical and experience-based understanding of these phenomena. even though this problem is far from being solved, recognizing local expertise is -in this and in other cases- not merely a gesture of inclusivity, but a functional necessity for ensuring that adaptation strategies are culturally relevant, sustainable, and technically grounded in the specificities of the territory.

The involvement of external actors in climate change education can generate pedagogical and ethical tensions, especially when there is asymmetry in environmental responsibility (Bryan, A., 2022). In the context of this project, it would be paradoxical, to say the least, for coastal communities to receive mitigation guidelines from actors in inland cities, given that a significant part of environmental impact in Necoclí—such as the accumulation of marine debris—comes from rivers that flow through the territory and collect debris along the way. While the precise percentage of solid waste and microplastics transported by rivers such as the Atrato to the coast of Necoclí remains undetermined, coastal ecosystems in the Gulf of Urabá exhibit significant impairment due to plastic pollution (Hoyos Ibargüen, 2020). Rivers serve as primary conduits for terrestrial pollutants to the sea; consequently, given that the Atrato drains an expansive basin with substantial human activity, it is reasonable to conclude

that fluvial discharges contribute significantly to the observed coastal contamination (Franco-Herrera et al., 2022; Arregocés-Garcés et al., 2024). Likewise, a significant portion of pollution in coastal areas of the Caribbean is attributable to tourism. Studies conducted on nearby Colombian beaches such as Santa Marta, Cartagena, and San Andrés have documented that periods of high tourist influx coincide with significant increases in coastal waste, particularly single-use plastics, cigarette butts, and food packaging (González-Fernández & Hanke, 2020; Valdelamar et al., 2018; Castellón-Mena et al., 2024). This disparity underscores a structural contradiction: the burden of implementing corrective actions falls disproportionately on populations that are not the sole generators of the environmental damage.

In addition to recognizing shared responsibility in climate change education, educational models must move beyond one-way knowledge transfer, to avoid reproducing colonial assumptions of epistemic superiority (Ajaps, S. O., 2021), (Filosofía de la liberación Enrique Dusell, Antonio Quijano, Beatriz Sarlo.), which normalize the universality of Western paradigms, such top-down pedagogy inherently sidelines and invalidates indigenous and localized knowledge systems (Mbah & Ezegwu, 2024). The implementation of decolonial pedagogical models in Necoclí is fundamentally justified by the territory's demographic and ethnic complexity. According to data from the National Administrative Department of Statistics (DANE, 2018), the municipality exhibits a robust ethnic identity: approximately 57.4% to 59.0% of the population self-identifies as Afro-Colombian, while indigenous communities—primarily the Zenú and Emberá peoples—constitute between 3.5% and 4.0% of the total inhabitants. Consequently, any environmental education strategy that fails to integrate these local epistemologies risks perpetuating a 'pedagogical verticality' that marginalizes the lived experiences of a majority ethnic population. Recognizing these ancestral and empirical knowledge systems is not merely a methodological choice but a requirement for social and climate justice in the Urabá region. Therefore, environmental education must be addressed as an exercise in co-creation that reveals the systemic connectivity between diverse human groups, their particular circumstances, and possibilities for transformation, towards an understanding of climate as a cross-border common good that links dissimilar geographical realities under a framework of shared responsibility and collaborative ethics.

Tool and methodological approach

The methodology employed was grounded in the concept of ontological design (Escobar, 2018), which seeks to position communities as co-producers of meanings and narratives while transforming the designer into a co-researcher and co-creator of future-oriented strategies. This perspective moves beyond the functionalist and rationalist traditions of design, opening a framework in which design can facilitate the articulation between technical-scientific knowledge about climate change and the situated knowledge of communities that directly experience its impacts within their territories. Such a facilitative role is particularly relevant because it acknowledges the coexistence of multiple ways of knowing and inhabiting the world—the pluriverse—rather than imposing a universalist and external vision of environmental problems and their solutions. Within this framework, designers contribute to strengthening capacities for community autonomy while fostering relationships of radical interdependence.

Based on these premises, the project developed a series of workshops aimed at identifying and documenting local knowledge about climate change in Necoclí. The knowledge generated through these activities was subsequently synthesized into a visual tool designed to communicate the findings both to residents of Necoclí and to young people in urban contexts such as Medellín, with the aim of fostering shared responsibility and encouraging collective action. This process was implemented through existing community-based social structures composed of participants of diverse ages (children, youth, adults, and elders), educational backgrounds, and life trajectories, including both long-standing residents and individuals who have migrated more recently from inland regions to the Caribbean coast. Working within these established networks allowed the project to engage participants in spaces of trust and collaboration that were already meaningful within the local social fabric. These social

structures included several community groups. First, a bullerengue training group for children and youth—centered on the traditional Afro-Caribbean musical practice of bullerengue—comprising approximately 30 children and young participants and 10 facilitators. Second, a women's collective located in La Ciénaga de la Marimonda, a rural settlement about thirty minutes from Necoclí, where women collaborate in activities such as small-scale cultivation, childcare, and communal cooking. Third, an adult and elder bullerengue ensemble composed of local musicians dedicated to the preservation and performance of this musical tradition. Finally, the project also engaged the administrative staff of a family-run eco-hostel that promotes educational and environmental initiatives in the region. The existence of these forms of community organization already reflects a strong social fabric oriented toward cultural preservation, cooperation, and mutual support—dynamics that contrast with the fragmentation and individualization often observed in highly digitized urban environments. The workshops conducted during the research process are described below.

Women from La Ciénaga de la Marimonda. A workshop known as the "gossip workshop" (taller del chisme) was organized as a facilitated conversation in which researchers prompted participants to reflect collectively on how the region has changed in recent years. The discussion focused on transformations in their daily lives, livelihoods, and relationships with the surrounding environment and with other members of the community. The format intentionally drew on the culturally familiar practice of informal storytelling and communal conversation to encourage open participation.

Children from La Ciénaga de la Marimonda. With children, a creative workshop was conducted in which participants represented local plants and animals through drawing and simple paper-folding exercises. The activity encouraged them to describe the species they recognized in their surroundings and to explain why they liked them or how they were useful in everyday life. This exercise served as a visual elicitation method to explore children's perceptions of local biodiversity.

Adult bullerengue group. A conversational session was held during one of the group's regular music rehearsals. Participants were invited to reflect on how music has shaped their personal trajectories and how bullerengue expresses aspects of the social and environmental realities surrounding them, including concerns related to territory, community life, and local ecosystems.

Children and youth learning bullerengue. A workshop was conducted with younger members of the bullerengue training group. Researchers introduced basic concepts related to climate change and global warming through an accessible pedagogical format. This was complemented by a participatory activity in which children identified and discussed the trees they recognized in the area and explained why they considered them important.

Members of the eco-hostel. Finally, semi-structured conversations were held with members of a family-run eco-hostel located in the region. These discussions explored their personal histories in Necoclí, the community initiatives they have promoted, and their perspectives on regional development and environmental change.

Collaborative and multilevel governance is essential for systemic transformation

The workshops conducted in Necoclí generated a series of situated narratives that illustrate how environmental change, social dynamics, and cultural practices intersect in everyday life. Taken together, these stories reveal that sustainability challenges cannot be addressed through isolated interventions but require forms of collaborative and multi-level governance capable of integrating community knowledge, cultural practices, and institutional action. Some of these narratives are discussed ahead.

One young member of a local bullerengue group recounted that during his youth he spent much of his time drinking rum and attending parties, partly because employment opportunities in the area were scarce and physically demanding. During one such gathering he became involved in a fight with a violent man who, in the middle of the confrontation, drew

a machete and struck his arm. The impact produced a sound that reminded him of the beat of a bullerengue drum, and in that moment, he realized that he preferred to preserve his arm for music rather than for violence. In this story, the machete symbolizes both threat and livelihood: an everyday tool associated with rural subsistence that can also become an instrument of harm. The turning point in the young man's trajectory was not simply an individual decision but his connection to a cultural collective that provided an alternative form of belonging and expression. This example highlights how cultural institutions and community networks can redirect personal trajectories, suggesting that governance strategies aimed at social and environmental transformation must engage and strengthen local cultural infrastructures.

Another young man described leaving early one morning to fish because he was extremely hungry. After failing to catch any fish, he captured two blue crabs despite knowing that the species is legally protected. On his way home he was stopped by the police and taken into custody. From the station he called a friend who had studied in the city and possessed greater social influence; she helped resolve the situation despite being vegan herself. This account reveals the tensions that arise when environmental regulations intersect with conditions of scarcity and inequality. What appears as a simple violation of conservation rules is, in practice, embedded in a web of survival strategies, legal frameworks, and social networks. The episode illustrates that effective sustainability policies require governance arrangements that bridge institutional regulation with the lived realities of local communities, integrating social justice considerations into conservation efforts.

A third story was shared by a young woman who works at a family-run eco-hostel in the area. The house where the hostel now operates belonged to her father and had long served as a vacation home for the family, who lived inland. After their father's death, she and her sister decided to return to Necoclí in search of a simpler life and with the intention of contributing to the community where they had spent many happy childhood years. However, the coastal environment surrounding the property has changed dramatically. The wide beach that once extended in front of the house has gradually disappeared due to coastal erosion, and during the rainy season seawater now reaches the building's foundations. The case illustrates how climate change directly threatens local livelihoods, particularly those connected to tourism economies that depend on the stability of coastal landscapes. Addressing such vulnerabilities requires coordination across multiple governance levels—from local community initiatives to regional planning and national climate adaptation policies—demonstrating the need for integrated, multi-scalar approaches.

A woman from the nearby Ciénaga community offered a longer historical perspective on environmental transformation in the region. When she was a child, the area was surrounded by monte—dense, relatively undisturbed vegetation that served as habitat for diverse wildlife. Families frequently hunted small mammals such as monkeys, opossums, and other forest animals as part of their diet, and turtles were also commonly consumed. Over time, however, these landscapes have been replaced by cattle pastures, large-scale teak plantations, and other agricultural developments. Territories that were once collectively used have increasingly become privately exploited. The disappearance of wildlife has therefore entailed not only ecological loss but also the erosion of cultural knowledge linked to hunting, cooking, and local ecological understanding. This account underscores how land-use transformations reshape both ecosystems and cultural practices, reinforcing the importance of governance frameworks that consider environmental conservation, economic activity, and cultural heritage as interconnected dimensions of territorial management.

Finally, an activity conducted with young children revealed how these environmental transformations are also reshaping ecological perception among the youngest generations. When asked to draw plants and animals from their surroundings, one child produced a drawing filled with horizontal lines covering the entire page, with only a small oval shape in the middle. When asked to explain the image, she stated that it represented a cow. The drawing suggests that cattle—introduced through the expansion of ranching—have become the dominant reference point in the landscape, while the biodiversity that once characterized the region has become increasingly absent from children's everyday experience. As a result, the loss of biodiversity becomes difficult to recognize, as younger generations grow up within already transformed ecosystems.

Together, these narratives reveal that environmental change in Necoclí operates simultaneously at cultural, economic, ecological, and generational levels. They also demonstrate that meaningful responses cannot emerge from isolated policy instruments or community actions alone. Instead, the stories collectively support the argument that collaborative and multi-level governance is essential for systemic transformation, as it enables the articulation of local cultural practices, social networks, regulatory frameworks, and environmental management strategies in ways that acknowledge the complexity of lived territorial realities.

Systemic transformation in climate adaptation requires moving beyond siloed decision-making toward a model of multilevel governance that mirrors the complexity of the ecosystems it seeks to protect. In the context of Urabá, this means that the risk narratives co-created by coastal communities are not merely local anecdotes but essential data points that must inform regional and national policy. By integrating children, youth, and grassroots women's organizations into the governance structure, we create a horizontal knowledge exchange that disrupts traditional hierarchies. This approach ensures that adaptation strategies are not just technically sound, but socially resonant, grounding high-level policy in the territorial solidarity necessary for long-term resilience.

The implementation of specialized pedagogical tools serves as the operational glue for this governance framework, acting as a boundary object that translates abstract scientific data into actionable local wisdom. When marginalized populations utilize visual analysis and social mapping, they transition from passive recipients of climate aid to active stakeholders who can negotiate with institutional powers on equal footing. This alignment of community priorities with formal adaptation policies is what ultimately facilitates a just socio-ecological transition. By centering the design process on those most affected by environmental precarity, we replace top-down technocratic failures with a collaborative model that fosters shared responsibility and a renewed, equitable vision for the future.

Policy Recommendations for Just Climate Adaptation

To ensure that the systemic transformation described in Urabá can be institutionalized and replicated, the following actions are recommended for regional and national decision-makers:

- Institutionalize Boundary Objects in Planning: formally integrate pedagogical tools—such as social mapping and visual risk narratives—into the standard requirements for regional climate adaptation plans. This ensures that community-led data is given the same weight as traditional meteorological or geological data
- Establish Multi-Scalar Feedback Loops: Create permanent Territorial Dialogue Tables where grassroots organizations (particularly youth and women's groups) have a seat alongside institutional actor. This moves governance from a one-way notification system to a horizontal exchange of knowledge and priorities.
- Fund Community-Led Technical Training: shift climate budgets toward pedagogical communication programs. Rather than hiring external consultants to explain risk, invest in training local leaders to facilitate the translation of scientific data into place-based narratives, fostering long-term territorial solidarity.
- Mandate Equitable Co-Creation in Risk Assessment: update environmental regulations to require that climate risk assessments be co-created with local populations. Policy should specify that a project is not equitable unless marginalized coastal populations have influenced its design through their lived experience.
- Adopt Relational Well-being as a Success Metric: move beyond purely economic or infrastructural metrics (e.g., height of sea walls) to measure the success of adaptation projects. Include indicators of social justice, agency, and the active stakeholder status of residents as key performance indicators for socio-ecological transitions.

Conclusion: Toward a Just Socio-Ecological Transition

The case of Urabá, Colombia, serves as a profound testament to the idea that climate adaptation is not merely a technical challenge of infrastructure, but a moral imperative of social justice. By positioning marginalized coastal populations as co-creators of their own risk narratives, we move beyond the limitations of top-down technocracy. The integration of a

specialized pedagogical tool does more than just simplify data; it serves as a bridge across epistemic divides, allowing local ecological knowledge to sit as an equal partner to scientific expertise. This horizontal exchange is the cornerstone of a truly multilevel governance framework, one where the agency of children, youth, and grassroots organizations is the primary engine of systemic transformation.

Ultimately, the path to a resilient future lies in the transition from residents as passive observers to active stakeholders invested in territorial solidarity. When we center the voices of those most affected by environmental precarity, we do more than mitigate physical risk; we foster a shared sense of responsibility and institutionalize equity. This participatory approach ensures that the uncertainties of a changing climate are met not with paralysis, but with collective action and renewed hope. Through the intersection of design, pedagogy, and collaborative governance, we can cultivate a socio-ecological transition that is as durable as it is just.

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Implementation of an Energy Community within a social housing complex in a mountainous area of Southern Italy, aimed at addressing energy poverty and promoting the ecological transition

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The EU building sector accounts for ~40% of total energy consumption, with ~75% of the building stock exhibiting poor energy performance. Energy transition represents both a technological and social challenge, as the urban contexts requiring the most significant intervention are disadvantaged residential neighbourhoods, as social housing, affected by low efficiency and high operating costs. In this context, Renewable Energy Communities (RECs) offer an innovative approach, providing environmental, social and economic benefits, including reduced energy costs and mitigation of energy poverty.
This study analyses a social housing complex in Southern Italy to assess its transition toward a Renewable Energy Community model through simulations carried out in the TRNSYS environment. After evaluating energy demand, an air-to-water heat pump and a photovoltaic system with battery storage are integrated, considering multiple power and storage configurations. A parallel set of simulations examines a building envelope retrofit scenario. The analysis quantifies self-consumption and grid exchange, followed by a 20-year economic assessment based on Net Present Value (NPV) for both scenarios.
The selected building stock is located in the municipality of Soveria Mannelli, Calabria, and consists of two south-west oriented linear block buildings, each composed of three adjacent four-storey sections, with a total footprint of 910 m2. The complex comprises 48 apartments, with a total gross area of 2976 m2 (Figure 1). The building complex, dating back to the 1970s, exhibits a low thermal performance envelope.

Figure 1. Aerial view of the building complex.

The annual heating demand was assessed through hourly dynamic simulations using the TRNSYS software and occupancy schedules are developed assuming one to three occupants per zone, to estimate electricity consumption. The study assumes that the existing heating system will be replaced with a centralized cascade air-to-water heat pump system. A parametric analysis evaluates the performance of a centralized photovoltaic system with integrated storage batteries, varying both the PV power and storage capacity. The parametric analysis is performed for both baseline and retrofitted scenario, the latter including external wall insulation and high-performance window replacement.
Based on the heat pumps characteristics and the buildings' thermal demand, the hourly heat pump electricity needs are evaluated. Photovoltaic generation is also simulated to determine the self-consumed share, the portion drawn from the grid, and the surplus energy exported to the grid. Based on technical feasibility assessments, polycrystalline PV modules rated at 435 Wp are selected. Installed PV capacity ranges from 30 to 210 kWp in 30 kWp increments. Battery storage capacity varies between 40 and 200 kWh, with 20 kWh steps.
A cost–revenue analysis is performed over the system's lifetime for both scenarios using the NPV method, calculated as the sum of discounted net cash flows minus the initial investment, following Cirone et al. The assessment includes initial capital costs, assumed equal to 1500 €/kW for the PV system and 500 €/kWh for the battery storage system, annual operation and maintenance costs (1% of the initial investment per year), and battery replacement in year 10. Actual annual revenues are estimated by accounting for energy price inflation, general inflation, and the customer discount rate, set equal to 0.05, 0.02, and 0.025, respectively. The economic parameters are based on 10-year average values to capture long-term trends while accounting for geopolitical and economic fluctuations.
The analysed configurations benefit from national incentives for self-consumed energy within Renewable Energy Communities: 100 €/MWh is applied for energy shared in the REC, and an additional 11.89 €/MWh is included to enhance system benefits, both for 20 years. Additional revenues include 46.8 €/MWh from surplus energy fed into the national grid and 0.35 €/kWh from savings due to self-consumed electricity. Initial investment subsidies are not considered.
In the baseline scenario, the annual heating demand is ~169 MWh, supplied by two heat pumps (59.7 kW each, COP 3.51), with the total electric consumption of ~80 MWh, including other electrical end-users associated with occupancy. Following the retrofit, heating demand decreases to ~60.8 MWh, met by two smaller heat pumps (26.8 kW, COP 3.27), and total electricity use drops to ~57 MWh.
Figure 2 illustrates the percentage of self-consumed electricity and electricity imported from the grid required to meet the annual electrical energy demand of the complex under the two scenarios, for selected power-storage configurations analyzed.

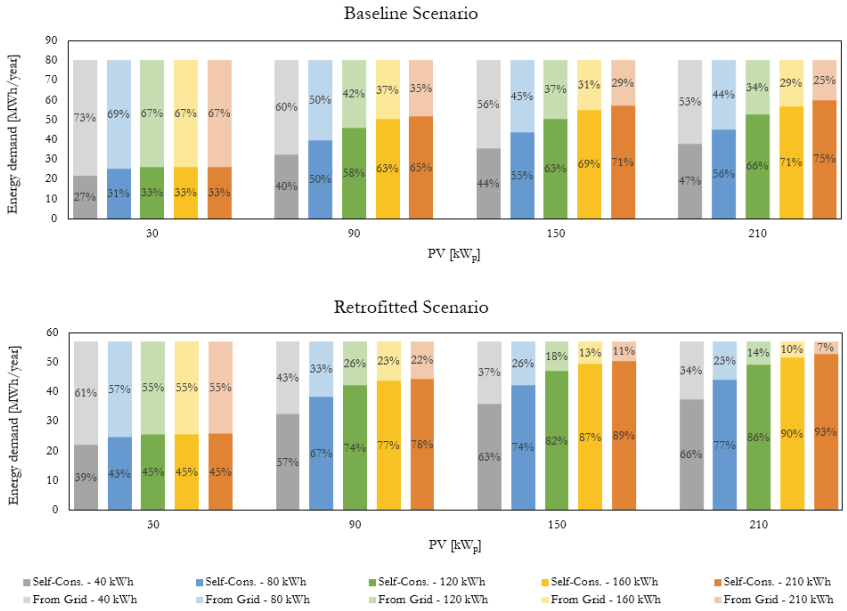

Figure 2. Self-consumption and grid energy by battery capacity for each scenario.

The total energy demand is defined as the sum of self-consumed energy and electricity imported from the grid. Self-consumed energy is determined from the gross photovoltaic production, after accounting for system losses and surplus energy exported to the grid, including the net energy exchanged with the storage system.
In the baseline scenario, the higher overall energy demand results in a lower fraction of self-consumed electricity compared to the retrofitted scenario, leading to increased reliance on the grid. For low PV capacity, increasing battery storage yields only a marginal improvement in self-consumption, as the PV generation remains limited relative to the load demand and storage exchange capacity. Conversely, at higher PV capacities, the role of storage becomes more significant, with the impact of battery capacity on self-consumption more pronounced and saturation (flattening) of energy performance indicators occurring at higher storage capacities.
NPV results for both scenarios are reported in Table 1, in which the baseline scenario exhibits higher NPV values compared to the retrofitted case, driven by the greater amount of energy shared. The lower envelope efficiency in the baseline configuration leads to higher energy demand, which consequently increases the share of self-consumed PV
energy relative to total production. Since self-consumed energy benefits from higher incentive schemes compared to surplus electricity exported to the grid, the baseline scenario achieves superior economic performance under the regulatory framework.

Battery\PV	NPV [k€] - Baseline scenario						NPV [k€] - Retrofitted scenario					
	30 kW_p	60 kW_p	90 kW_p	120 kW_p	150 kW_p	210 kW_p	30 kW_p	60 kW_p	90 kW_p	120 kW_p	150 kW_p	210 kW_p
40 kWh	175	238	257	230	219	210	179	242	260	229	221	204
60kWh	179	259	283	248	241	224	176	253	265	243	239	219
80 kWh	172	272	301	264	262	237	168	257	284	246	247	227
100 kWh	162	296	333	297	290	274	156	259	297	266	264	249
120 kWh	142	289	329	289	288	275	137	243	286	252	253	237
140 kWh	121	278	325	288	289	267	116	224	271	239	243	223
160 kWh	100	269	331	293	290	272	96	207	259	232	233	216
180 kWh	79	251	317	282	279	266	74	187	241	213	215	204
200 kWh	57	233	305	268	268	260	53	167	222	195	201	185

Table 1. Net Present Value (NPV) for each evaluated configuration.

In both scenarios, the most economically advantageous configurations correspond to intermediate PV capacity coupled with medium-size battery storage systems. Configurations characterized by higher PV power and larger storage capacities exhibit lower NPV values due to the substantial increase in investment costs, which is not compensated by a proportional increase in self-consumption. Beyond a certain threshold, the incremental gains in self-consumed energy become progressively smaller, leading to diminishing economic returns. Conversely, configurations with low PV power and limited storage capacity also result in reduced NPV values. In these cases, the total amount of self-consumed energy is insufficient to generate significant economic benefits.
The economic analysis highlights that building envelope retrofitting does not necessarily correspond to an increase in economic returns, despite the reduction in energy demand and the improvement in overall energy efficiency observed in this configuration. More generally, the results suggest that retrofitting interventions combined with renewable energy generation and storage systems can effectively reduce households' energy costs and mitigate energy poverty, thereby contributing to enhanced social sustainability and improved energy efficiency.

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Program for Economic Development and Territorial Competitiveness for Micro, Small, and Medium Enterprises in the Western Basin of the Lerma River, Mexico (PRODECOL)

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Program Objective
Promote sustainable economic development in the Western Basin of the Lerma River in Mexico, through the competitive improvement of productive actors and business support entities, developing a territorial articulation model for micro, small, and medium enterprises (MSMEs) in the pork, horticultural, and artisanal sectors that integrates public-private partnerships, collaborative innovation, and the strengthening of institutional capacities within a framework of effective governance.

Actors Involved
PRODECOL is operated by the University of the Valley of Atemajac, UNIVA La Piedad Campus, with cofinancing from the Multilateral Investment Fund (MIF) of the Inter-American Development Bank (IDB). 313 producers from the municipalities of La Piedad, Michoacán; Penjamo, Guanajuato; and Degollado, Jalisco participated, positioning this sustainable territorial development program with a tri-state impact.
During PRODECOL's operation, public and private institutions, as well as local, state, and federal research centers with proven experience working with the participating productive sectors, joined the program. International solidarity was also present through the Senior Experten Service (SES Germany) and the Japan International Cooperation Agency (JICA), which collaborated on various program components. More than 50 institutions have supported PRODECOL's operations, and a network of 60 national and international consultants has carried out various consulting and capacity-building activities for participating producers, businesses, and productive sectors.

Governance
PRODECOL's governance involves two complementary and closely linked aspects: the governance structure from a strategic and operational perspective; and the coordination among stakeholders in the region. For PRODECOL's operation, public-private collegiate bodies were established, such as the Board of Directors (JD), the strategic management body; the Implementing Unit; and the Sectoral Strategic Committees (COES), composed of representatives of producers from the three municipalities and the Directors of Economic Development from the three local governments.

Impact
PRODECOL's results demonstrate significant progress in technological and associative innovation. Six public-private partnership projects focused on innovation and environmental sustainability were generated, and two public policies for territorial development were successfully influenced through participatory processes: the approval of tax incentives for the formalization of businesses at the local level and the creation of a budget allocation for access to development funds for the agro-industrial sector through the Michoacán State Innovation Agenda, with the aim of promoting technological innovation as a driver of social and economic development.
In the *Pork meat sector*, the experimentation with swine health systems now allows for continuous monitoring of farms to strengthen sanitary control. The Regional Health Committee

regulates various programs related to the control of swine diseases and the implementation of good production practices that include cross-cutting sustainability elements. Of note is the strategic alliance with the National Institute of Forestry, Agricultural and Livestock Research (INIFAP), which has worked alongside the Food and Agriculture Organization of the United Nations (FAO) on the implementation of the Livestock and Environment Development Initiative in Mexico. This initiative serves as a strategy to address the pollution problem caused by intensive animal production. The model was applied in the PRODECOL program, considering the integration of livestock farming with agriculture through an integrated livestock waste management system. This system increases farm profitability by adding value to waste, allowing for diversification of production and income, and mitigating the polluting potential of residual products. Innovations in swine feed through automation and modernization are also incorporated.

In the *Horticultural sector*, learning related to the implementation of protected agriculture for strawberry production in macro tunnels and greenhouses, efficient water resource management through drip irrigation, the incorporation of organic fertilizers, national and international certification processes, quality, food safety and biosecurity schemes, global market demands, and traceability systems has also contributed significantly to innovation. Soil analysis has motivated horticulturalists to engage in dialogue with scientific research institutions to combine their knowledge with scientific and technological resources and move towards an eco-efficient production transformation. At the economic and social level, the impact of PRODECOL is reflected in the generation of temporary and permanent jobs, including those for women and senior citizens, reducing migration and improving the quality of life for individuals and their communities.

Artisan sector. The innovation efforts undertaken by artisans, specifically those producing rebozos (shawls), are reflected in their integration into the national and international fashion consortium. Rebozo fabrics and weaves are used to create original, high-quality products such as formal dresses, handbags, fine shoes, and jewelry. In the quarrying subsector, the formation of a producers' cooperative strengthens not only product sales but also the purchase of supplies and financing for production activities. The Quarrying Design Center, unique in the country, is a collaborative and innovative space focused on the creation and development of new products. It fosters creativity and business strategy, generating innovative products and access to new market niches. Furthermore, a registered collective brand ensures compliance with common quality standards, strengthening the identity and competitiveness of this group of quarrying artisans, facilitating access to higher-value markets, and protecting their cultural heritage.

PRODECOL actively participates as a founding partner of the La Piedad Innovation and Competitiveness Center, A.C. (CINCOM) is a public-private partnership organization whose objective is to improve local competitiveness and promote innovation through entrepreneurial projects that add value to the region.

Collective Goods and Services

The territorial coordination model implemented with the participation of 313 companies in the region has generated new dynamics of inclusive development, a solidarity economy, process and service innovation, as well as a new awareness of environmental stewardship. The territorial development strategy focused on three pillars: the technological pillar, to bring new knowledge to producers, supporting them in expanding their skills, developing their human capacities, and managing the territory in an eco-efficient manner; the institutional pillar, which helped to connect society for governance by integrating research centers and higher education institutions with local governments; and the economic-business pillar, through which it was possible to improve competitiveness and the quality of life of the families involved.

Final Comments

The financial resources mobilized for the PRODECOL operation totaled US$2,830,000.00, of which the IDB-FOMIN contributed 48% through a non-reimbursable technical contribution, and 52% was provided as local counterpart funding managed by UNIVA La Piedad as the Implementing Agency through federal, state, and municipal programs, as well as valuable in-kind contributions from producers. Through the development dynamics promoted by

PRODECOL, relationships of trust and cooperation have been fostered between companies and institutions, encouraging leadership in the public and private sectors, and expanding the capacity to mobilize resources in the region to advance the design of innovative collective initiatives for the region that are economically, environmentally, and socially sustainable.

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Quarry Artisan Sector https://www.youtube.com/watch?v=bkGV3s3_hHY&t=1s
Rebozo Artisan Sector https://www.youtube.com/watch?v=yE9COJrgBC8&t=1s"

Regional Chair for Dialogue: A Case Study of Collaborative Action for Social Transformation

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Collective action is widely recognized as a key driver of social transformation; however, its effectiveness in contexts marked by long-standing territorial conflict remains deeply contested. In such contexts, institutional cooperation—particularly among universities—raises critical questions about legitimacy, trust, and the capacity to foster meaningful dialogue. This paper presents a case study of the Regional Chair for Dialogue, an inter-university initiative developed in the Araucanía region of southern Chile to strengthen dialogue capacities as a strategy for conflict transformation. This experience has been developed since 2021 by seven regional universities and the Nansen Center for Peace and Dialogue of Norway.

Various approaches exist for understanding the concept of dialogue. The Nansen Center's 2024 publication "Public Dialogue" cites Harold Saunders with the following definition: "Dialogue is a process of genuine interaction through which human beings listen to each other deeply enough to be change by what they learn. Each makes a serious effort to take other's concerns into her or his own picture, even when disagreement persist. No participant gives up her or his identity, but each recognizes enough of the other's valid human claims that he or she will act differently toward the other."

The Nansen manual for dialogue facilitators and conflict transformation indicates: "Dialogue is a way of communicating that focuses on understanding the other." "In dialogue, we invest in creating safe and supportive spaces where participants can share their experiences, feelings, and thoughts." The prerequisite for all dialogue is the intention to listen to the other, not to convince them.

Chile's Araucanía region has historically experienced social and political conflict stemming from the territory's occupation by the national army, dispossessing the Mapuche people, and the subsequent distribution of lands to European colonists and Chilean families. This history, marking its beginning in 1883 with the Parliament of Putue (end of the "pacification process"), constitutes an open wound in regional society, with violent expressions including machinery destruction, property burnings, land usurpation, and murders. Since the late 1990s, these actions have radicalized within certain organizations, with sabotage actions against individuals and companies present in the region.

In 2021, the highest authorities of seven universities with regional presence—Universidad de La Frontera, Universidad Católica de Temuco, Universidad Arturo Prat Victoria campus, Universidad Mayor Temuco campus, Universidad Santo Tomás Temuco campus, Universidad Autónoma, and the Villarrica Campus of Pontificia Universidad Católica de Chile—together with the Bishop of the Temuco diocese, Monsignor Héctor Vargas, convened to issue a call for generating a new regional transformation process based on dialogue to repair the profound fractures evident in the south-central territory of the country. In this call, we invited the State and regional society to conceive and propose a process enabling trust reconstruction among diverse actors, including the Mapuche people, through dialogue. In that same declaration, we invited the Nansen Center for Peace and Dialogue of Norway, possessing extensive experience with conflict processes in various parts of the world, to accompany this path.

Together, we designed a pathway for generating dialogue capacities in the region. Eighty workshops have been conducted with participation from over 1,400 individuals regionally. This initial phase included participants from universities, civil society, social organizations, public institutions, Mapuche communities, among others.

The second phase consisted of creating a formal collaboration instance among the universities, denominated the Regional Chair for Dialogue. This Chair is defined as a system whose purpose is to transform individuals who contribute to recovering and strengthening a

culture of intercultural dialogue. Its principal attributes are: reflection, promotion of a diverse community, and sustainability.
The Chair defines four main lines of action: Training activities, including undergraduate students, graduate students, and continuing education; Development of societal engagement instances such as seminars, workshops, dissemination through digital media, among others; Promotion of research and publications on this theme; Implementation of local, regional, and international initiatives for dialogue as a process of personal and social transformation.
For governance, three organizational levels are defined: Steering Committee, as the Chair's highest authority, composed of the rectors or highest authorities of each regional university; Advisory Council, composed of members from universities and public and private entities, social organizations, Mapuche communities, and other regional, national, or international entities, including the Nansen Center for Peace and Dialogue; Executive Secretariat, composed of an individual and work team, whose mission will be to implement the Chair's various areas in conjunction with the universities and territorial organizations.
This initiative seeks to continue building dialogue capacities in the region, impacting schools and the training of professionals across all areas regionally, with a long-term vision for regional society transformation.

Collaborative Governance for the Conservation and Sustainable Use of Genetic Resources: A Territorial Approach in the State of São Paulo, Brazil

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The erosion of agrobiodiversity, driven by the expansion of industrial agriculture, agricultural policy frameworks, and the progressive loss of traditional territories, poses significant risks to food security, ecosystem resilience, and cultural heritage, particularly in regions characterized as hotspots of genetic diversity. Addressing this complex challenge requires governance approaches that go beyond sectoral policies and top-down conservation models. Conventional conservation strategies historically centered on ex situ approaches and fragmented institutional arrangements, present important limitations in dealing with the dynamic, socially embedded, and territorially situated nature of agrobiodiversity (Santonieri & Bustamante, 2016). Unlike wild biodiversity, agricultural diversity is continuously co-produced through cultivation practices, informal selection processes, local knowledge systems, and sociocultural dynamics led by family farmers, Indigenous peoples, and traditional communities. Its maintenance is intrinsically linked to the continuity of livelihoods, food systems, and collective forms of territorial organization that sustain its reproduction over time (Macqueen, 2022; Levis, 2024). This recognition has stimulated growing interest in polycentric and territorialized forms of governance capable of articulating multiple institutional scales and promoting the active participation of actors directly involved in the day-to-day management of this diversity. In Brazil, recent legal and policy developments reinforce this transition toward more integrated approaches. Relevant instruments include the Lei da Biodiversidade (Federal Law No. 13,123/2015), the emerging federal framework supporting on-farm conservation of genetic resources (Decreto nº 12.097, de 3 de julho de 2024), and the Política Estadual de Produção Orgânica of São Paulo, which explicitly encourages the establishment of community seed houses. Together, these regulatory advances create a favorable environment for hybrid institutional arrangements that combine collective action, intersectoral coordination, and shared management of plant genetic resources. This research — currently ongoing — investigates how collaborative and participatory governance arrangements contribute to the conservation and sustainable use of agrobiodiversity in the State of São Paulo, Brazil. The study adopts an interdisciplinary qualitative design grounded in environmental governance and knowledge co-production. Methodologically, the research is structured in three complementary analytical stages. First, a systematic qualitative literature review was conducted to identify documented experiences of civil society organizations, public institutions, and multi-sector partnerships engaged in biodiversity and agrobiodiversity

conservation. The review focused particularly on initiatives involving on-farm conservation, community seed systems, and territorial governance mechanisms. Second, the study carried out a statewide mapping of existing initiatives related to the on-farm conservation of plant genetic resources. This mapping was organized by regions of the State of São Paulo and aimed to identify the institutional actors involved, the types of conservation practices adopted, and the forms of coordination established among stakeholders. The survey revealed significant territorial capillarity of initiatives distributed across all major regions of the state. Third, an institutional and socio-organizational characterization is being developed to analyze the composition and interaction patterns of the actors involved. The research identifies the participation of municipal departments of agriculture, state rural extension and research agencies, universities, non-governmental organizations, farmers' associations, and cooperatives. These actors form regional governance arrangements whose shared purpose is the conservation and sustainable management of agrobiodiversity. Preliminary analytical evidence indicates that, in all mapped regions, multi-actor initiatives collectively structure territorial governance dynamics. Over time, these regional governance spaces have progressively articulated into a state-level coordination arena, largely organized through the Feira Estadual de Troca de Sementes Crioulas. This arena operates both as a mechanism of horizontal coordination and as a political space for identifying priority agendas for the conservation of genetic resources in São
Paulo. Among the main concerns, emerging in these governance spaces are the risks associated with transgenic contamination and the urgent need to strengthen income-generating mechanisms for seed custodians. Proposed pathways include the development of public policies supporting on-farm conservation and the expansion of regulated markets for creole seeds. The research also advances in the socioterritorial characterization of the farmers involved. The analytical framework distinguishes between: (i) traditional communities — especially Caiçaras, Quilombolas, and Indigenous peoples; (ii) agrarian reform settlers farmers, particularly those linked to the Movimento dos Trabalhadores Rurais Sem Terra (MST); and (iii) family farmers and artisanal producers not formally affiliated with the previous categories but actively engaged in maintaining agrobiodiversity. In parallel, participating institutions are being classified according to their public or third-sector nature. The central working hypothesis is that this territorially rooted, multilevel collaborative governance configuration constitutes a strategic mechanism to strengthen the resilience, legitimacy, and long-term sustainability of agrobiodiversity hotspots. The study argues that recognizing and strengthening these hybrid governance arrangements can enhance policy coherence and improve the effectiveness of actions aimed at integrating conservation, sustainable use, and social justice. By providing an in-depth analysis of emerging territorial governance dynamics in São Paulo, this research contributes to debates on participatory environmental governance and offers empirically grounded inputs for the formulation of more polycentric and equitable policies for the conservation of genetic resources in the Anthropocene.

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From integration to participation: A systemic view of inclusion paradigms

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Over the past fifty years the concept of inclusion has significantly changed. The objective of this paper is to trace this transition, analyzing a shift in three models, or "paradigms" (Kuhn 1962), namely: *integration*, *inclusion*, and *participation*. This study is grounded on systems thinking (Morano & Barile 2024) involving qualitative methods such as interviews and focus groups. Inclusive research is supported with the participation of *underrepresented* and *marginalized* informants; the same approach is established in human sustainability science, promoting acceptance, support, and empowerment. Inclusivity aware organizations are devoted to removing barriers, for everyone to participate, meaningfully, in society. But this process is not free of controversy: inclusion is not a one-way posture, but rather a relational one, entailing an innovation within both the including and the included entities. On the other side, exclusion can be defined as a break of the social bonds that can empower capabilities for the most vulnerable individuals (Sen 1999). The social model of inclusion suggests that exclusion is not just an individual condition to settle, but a sort of inequality, derived from the comprehensive societal practices that disable persons with impairments, through power dynamics and cultural biases. The consequence is the *marginalization* of those who do not meet the expectations of this standardized idea of society. This requires urgent action on the behalf of researchers and institutions, aspiring to a multifaceted inclusion building. Following these theoretical considerations, let us now examine the three aforesaid paradigms, starting from *integration*:

1. Integration relies on the assumption of standards of normalcy, underpinning ableist theories. It compels the adaptation of one part to the benefit of the whole. By emphasizing people's disparities, it reinforces, instead of contrasting, discrimination. Integration also is a meter of power hierarchies, embedded in social disparity: it presupposes an asymmetry between those who have the capacity to integrate and the "others" in the need to be integrated. Integration, thus, may risk being a form of normalization or forced conformism to existing norms and structures rather than a dynamic process of social improvement and well-being spreading for all.
2. Inclusion is a further step towards societies capable of meeting the best conditions, for the widest variety of different human groups. It recognizes worth in experiences like belongingness, recognition, and uniqueness, stressing how marginalized persons can enrich society's expertise. It promotes all of its members' capacities, equally, not discriminating between productivity and compassion, competitiveness and cooperation, etc. No human characteristics, whether biological, social, cultural, are considered an exception to the norms, placing everyone starting on the same point. All that remains is to put in practice this principle from the bottom up.
3. Inclusion only makes sense if it is followed by effective agential possibilities for the formerly excluded. That is, to ask for independence, autonomy, and respect. Rather than drawing inclusion as a "good action", to be delegated to institutions or charities, participation shifts the focus to the margins and gives voice to the least among people. It reformulates the dichotomy inclusion/exclusion, challenging the establishment of

valuing. It emphasizes, on the contrary, the importance of mutual assistance (Bruni & Zamagni 2015). That is to say, focusing on the possible, reciprocal benefit an inclusive community provides to its members (Sugden 2018).

Moving from integration to participation is not merely a terminological variation: it requires a profound rethinking of organizational practices in a more complex view of social coexistence. Situating inclusive phenomena within a system of intertwined parts means to analyze (rather than the single) the interactions among them and the emergence of new properties. These can be summarized as follows, in the context of the three proposed paradigms: integration=*identity*; inclusion=*diversity*; participation=*agency*. Genuinely inclusive organizations, e.g., institutions, firms, or associations, are eager to transform reciprocally themselves; to guide this process, is crucial to conceive "otherness" as a rare resource, by investing time and energy in trying to understand other people's perspectives, refining the practice of discernment.

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CONCEPTUALIZACION, CUALIFICACION Y MEDICION DE LAS FUERZAS Y CAPACIDADES ENDOGENAS DE UN TERRITORIO

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El texto presente se inscribe en el marco de una investigación sobre la consideración y significado de los territorios locales en los desafíos del desarrollo -nacional y general- y sobre la orientación de la vinculación de la universidad con la sociedad.
Dentro de ello, una línea de preguntas es sobre lo que pudiesen ser consideradas capacidades endógenas de los territorios locales en función de su desarrollo, lo que hace referencia al protagonismo que debiesen jugar los agentes locales y a la pertinencia con la historia y características del territorio.

Fuerzas globales y fuerzas locales
Las corrientes globalizadoras empujan la constitución de sociedades y territorios fuertemente interdependientes con el predominio de mega agentes y mega procesos con capacidades de configuración del mundo y de los diversos territorios locales. Puede hablarse, en principio, de una realidad con agentes globalizadores y múltiples lugares globalizados. (Santos)
Pero también en las diversas territorialidades locales hay procesos donde se expresan historias, instituciones, identidades, intereses, agentes e imaginarios. Los resultados del encuentro y tensión entre estas fuerzas más globalizadoras con las de orígenes más locales pueden ser múltiples, dependiendo de diversos factores, entre los cuales están las características y orientaciones de los propios agentes locales.
La perspectiva de este trabajo es la necesidad de aumentar la capacidad de los territorios locales para ser protagonistas de sus propias historias. Para ello es necesario poseer y fortalecer lo que llamaremos capacidades territoriales endógenas que defiendan o creen márgenes de autonomía frente a los señalados procesos globales. Esto no se plantea como una propuesta de carácter autárquica, sino como una capacidad de los territorios locales de poseer y desarrollar capacidades endógenas diversas que permitan regular la interdependencia propia de esta época, con márgenes o grados de autonomía para diseñar los destinos propios.
Dicho postulado se conecta con una forma de mirar y promover el desarrollo local que parte de características y capacidades de los territorios y que a la vez recupera experiencias históricas en que ciertos procesos de desarrollo han presentado características fuertemente territorializadas y no solo ocurren “de arriba hacia abajo” sino también como procesos locales de caracteres “reptantes y difusos” (“de abajo hacia arriba”).

Introducción a la endogeneidad territorial
En los años 60 y 70 del siglo XX, el surgimiento de la idea de capacidades endógenas tuvo como escala de referencia principal a la escala nacional y se conectaba con la idea de desarrollo auto centrado. También solió ser asociada con algunas materias consideradas específicas y relevantes como la tecnología, la alimentación e incluso lo cultural. (Gonzalez, Micheletti). Posteriormente fue usado también por corrientes liberales que acentuaron el rol del progreso técnico en el desarrollo (Romer)
A partir de los años 80 y 90 del siglo XX, en América Latina, la noción de endógeno se desplaza en su uso principal hacia los territorios subnacionales o hacia el “meso nivel” conectándose con corrientes del desarrollo regional y local que hacen referencias a la necesidad e importancia del protagonismo de agentes e instituciones locales para el desarrollo subnacional. (Boisier)

Para efectos de este trabajo, y ubicados desde las escalas locales, definiremos procesos endógenos locales y desarrollo local endógeno asociado a i) algo que va más allá del crecimiento y que abarca el conjunto de aspectos significativos para un buen vivir y para una coevolución y metabolismo adecuado entre humanidad y naturaleza; ii) una dinámica que sin ser autárquica es sostenida en forma democrática con el protagonismo de los agentes locales, quienes experimentan y proyectan sus vidas y trabajo en el territorio; iii) que ejercen un contrapeso a los procesos de globalización que puedan ir acotando o cercenando posibilidades más adecuadas y autónomas de desarrollo de los territorios

Dimensiones o campos de la endogeneidad: hacia la construcción de una matriz de análisis y medición/cualificación de la endogeneidad territorial.
Lo propuesto conduce a preguntarse por las fuerzas y capacidades endógenas de los territorios, reales y posibles, lo que variara de acuerdo con cada uno de ellos. Dentro de ese marco un elemento importante que es teórico, conceptual y metodológico es definir y "medir" o "cualificar" lo endógeno que está presente en un territorio, en tanto realidad viva, que permita tanto conservarlo como ampliarlo. Esto supone avanzar hacia el desarrollo de una propuesta analítica para la lectura y evaluación de las capacidades endógenas de un territorio.

Dimensiones consideradas
Un primer plano para lo anterior se refiere a una aproximación que precise los contenidos cualitativos de lo endógeno (sus dimensiones) y enmarquen la exploración de su existencia en los distintos territorios.
Como propuesta inicial en la exploración sobre la endogeneidad existente en un proceso territorial se pueden distinguir las siguientes dimensiones o campos.

a) dimensión socio ecológica
b) dimensiones económica
c) dimensiones política
d) dimensión social
e) dimensión cultural.

En principio se asume que la endogeneidad abarca ese conjunto de dimensiones o campos. Se plantea que la endogeneidad de un territorio no es un fenómeno asociado solo a una de esas dimensiones sino se trata de una situación integral. Ello no niega que algunas dimensiones o campos en tiempos determinados puedan ofrecer más características o potenciales endógenos y otros, por el contrario, pueden ofrecer más limitaciones.
Al mismo tiempo son dimensiones relacionales que significa que lo normal es que se impacten unas y otras en términos de aumento o disminución de la endogeneidad territorial determinando procesos integrales del territorio del tipo endogeneidad ascendente o descendente. Sin embargo, también pueden existir dimensiones que en un territorio presentan situaciones muy débiles de endogeneidad y pueden constituir eslabones críticos.

Indicadores a considerar
Cada una de estas dimensiones presenta, a la vez, componentes que constituyen sus contenidos; se trata de las variables específicas que debiesen ser analizadas, cualificadas y medidas para evaluar los grados de endogeneidad en las distintas dimensiones.
Así, por ejemplo, y a manera de una visión provisoria, podemos decir que la dimensión socio ecológica presenta los componentes siguiente:

Dimensión (caso de ejemplo)	**Componentes (provisorios)**	**Indicadores (provisorios)**
socio ecológica	agua	i) capacidades de reducir demanda de agua ii) capacidad de adaptación a ciclos

		estacionales y a las alteraciones de regímenes de lluvias por cambio climático iii) conocimiento de los suelos que se tienen iv) disponer de una cierta institucionalidad responsable de la existencia de agua suficiente y de su calidad.
	energía;	i) capacidad de desacoplar aumento productivo con aumento de demanda energética ii) capacidad de actuar sobre ahorro energético iii) capacidad de reaccionar frente a restricciones energéticas iv) capacidad local de producción energética. No dependencia total de sistemas interconectados centrales. Ejemplos de energía fotovoltaica o biodigestores
	huella e impacto ecológico	**i) conocimiento de los impactos ecológicos y ambientales (de la huella ecológica) que la producción local tiene en el territorio** ii) entidades y dispositivos locales para actuar frente a los impactos ecológicos y ambientales evitándolos y mitigándolos iii) producir información e investigación acerca de los impactos ambientales y ecológicos de las distintas actividades que se desarrollan en el territorio iv) tener conocimiento del funcionamiento ecosistémico del territorio o del ecosistema del cual hace parte considerando

		todas las especies animales y vegetales alli existentes vi) capacidad de gobernar la producción y el tratamiento de residuos producidos localmente
	regulación y orientación del uso del suelo	i) capacidad de regular y orientar uso del suelo para impedir pérdida de capacidad productiva
	capacidad de gobernar la producción	i) capacidad de regular y orientar uso del suelo para impedir pérdida de capacidad productiva

En cada uno de esos componentes se podrá tener una menor o mayor endogeneidad, de acuerdo con aspectos definidos y que definirá el grado de endogeneidad en la dimensión socio ecológica. Esto será confeccionado y presentado para cada una de las cinco dimensiones señaladas

Collaborative Governance and Territorial Justice in the Ecological Transition: towards an integrated framework for just and equitable futures

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Contemporary cities and territories shaped by multiple and interconnected and interrelated crises of environmental, climatic, social, economic, and demographic nature, which are profoundly challenging the dominant paradigms of urban and territorial development, that have prevailed over recent decades. These crises cannot be adequately understood as isolated or temporary disruptions. Rather, they should be interpreted as long-term structural processes that deeply affect the material and symbolic conditions of urban life, the distribution of resources and opportunities across territories and the capacity of local and regional systems to adapt and transform in equitable and sustainable ways. Within this context, conventional sectoral approaches and predominantly technocratic forms of intervention, often oriented towards short-term efficiency and emergency management, appear increasingly insufficient to grasp and govern the complexity, uncertainty, and contested nature of contemporary urban and territorial transformations.

This paper advances the central argument that effectively addressing current urban and territorial crises requires the adoption of integrated models of territorial resilience that are explicitly grounded in principles of collaborative governance, spatial and territorial justice and socio-ecological transitions. From this perspective, resilience is critically reconceptualised beyond its widespread operationalisation as the capacity of systems to absorb shocks, maintain functionality or rapidly return to a pre-defined equilibrium. Instead, resilience is approached as a transformative, relational and politically situated process, oriented towards the reconfiguration of development trajectories, the redistribution of material and immaterial resources and the strengthening of collective capacities for the care, stewardship and democratic governance of territories and common goods.

The theoretical framework of the paper is deliberately interdisciplinary, drawing on critical urban studies, spatial and territorial planning, political ecology and transition studies. This integrated perspective enables a critical examination of how vulnerabilities and risks are unevenly produced and distributed through historical and contemporary processes of space production, shaped by power asymmetries, institutional arrangements, and socio-economic inequalities. Within this framework, urban liveability is not treated as a neutral or purely technical objective, but as a normative and contested outcome emerging from practices of space co-production, inclusive and redistributive public policies and governance configurations capable of recognising, negotiating and addressing conflicts, inequalities and territorial differences. In this sense, liveability is intrinsically linked to questions of justice, recognition and democratic participation in shaping urban and territorial futures.

Particular emphasis is placed on the role of collaborative and multi-level governance as a key enabling condition for processes of transformative resilience. The paper argues that the active and meaningful involvement of a plurality of actors, including public institutions at different scales, local communities, organised civil society, grassroots initiatives and economic stakeholders, can foster the emergence of context-sensitive, place-based and socially inclusive responses to urban and territorial crises. Such governance arrangements have the potential to strengthen social capital, enhance collective learning, and build shared responsibility for decision-making in contexts characterised by uncertainty and conflict. Within this perspective, socio-ecological transitions are interpreted not merely as technical shifts towards low-carbon or resource-efficient systems, but as deeply political and socially embedded processes that entail value-based choices, distributive struggles and the renegotiation of development priorities, rights and responsibilities across different social groups and territories.

From a methodological standpoint, the paper is grounded in a qualitative research design that examines a set of emerging experiences and practices in European urban and territorial contexts. These cases are selected for their capacity to integrate climate adaptation strategies, public space regeneration processes, civic participation mechanisms, and claims for spatial and territorial justice within coherent and innovative policy and governance frameworks. The methodology combines a critical review of the international scholarly literature, documentary analysis of planning instruments, policy documents, and institutional programmes and a comparative interpretation of selected case studies. This approach aims to identify recurring patterns, operational principles, enabling conditions and institutional configurations that can support the construction of resilient and liveable cities and territories, while also acknowledging the contextual specificity and inherent tensions of such processes.

Finally, the paper seeks to contribute to the scientific debate and to the activities of the ECOPÌA network by proposing a shared and reflexive conceptual framework that values interdisciplinarity and fosters dialogue between academic knowledge, institutional practices, and situated forms of knowledge produced by local actors and communities. In doing so, the contribution promotes a vision of resilience as a collective, open-ended, and normative project, oriented not only towards the management of crises and risks, but towards the structural transformation of urban and territorial development models in the direction of more just, sustainable and inclusive socio-spatial futures.

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Towards sustainable water and land management from the local level: The potential of Community Action Boards (JAC- by its Spanish acronym) in the face of institutional fragmentation in Colombia.

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Water management entails territorial management. In high mountain regions of Colombia, especially in areas affected by inequalities and conflict, the institutional fragmentation, and the lack of coordination between levels of government are persistent challenges. This situation is not due to implementation failures or technical deficiencies, but rather constitutes a structural problem manifested in overlapping regulations, institutional incapacities, scale mismatches, and a lack of coordination among stakeholders and decision-makers.

This article aims to contribute in three ways: i) conceptually, by offering a relational interpretation of territorial fragmentation; ii) analytically, by positioning the Urban Hydrological System (UHS) as a spatial lens through which to observe crisis and reorganization dynamics; and iii) politically, by recognizing Community Action Boards(Juntas de Acción Comunal or JAC) as key actors in building alternative, more just, resilient, and sustainable management of territory.

Based on transdisciplinary research of a case study, using participatory methods and spaces for social dialogue on knowledge, this research engaged local actors, institutions, and consultants involved in the regional use and distribution of water in the Santander region of Colombia (UHS River Tona). The study was designed as a collaborative knowledge-building process that integrated technical, community, and scientific knowledge to understand the tensions between different scales and the actual dynamics of water and land governance. This process was supported by a reflective logbook, used as a methodological tool to record tensions, lessons learned, and emerging stakeholders' dynamics during fieldwork, thus strengthening the critical and situated dimension of the collective analysis.

The research findings show that decisions regarding land-use planning and water distribution are made at macro levels, far removed from the places where their local impacts are felt. Furthermore, local governments operate with outdated planning instruments, limited capacities, and constraints imposed by higher-level entities, which dictate terms without effective mechanisms for institutional coordination. This dynamic shapes a form of management disconnected from the territory and people, lacking any anchor in local social and ecological realities.

In this scenario, the JACs as community organizations have the potential and formally acknowledged authority to act as key players in the territorial governance structure. Their capacity to sustain processes over time, mediate between diverse forms of knowledge, and connect different scales gives the JACs a strategic role in fragmented territories. They are not secondary actors or mere recipients of programs or policies, but rather social, political, and epistemic structures that operate as part of the governance framework. They also have the ability to translate policies, interconnect different forms of knowledge, and sustain processes beyond formal institutional cycles positioning them as strategic nodes in fragmented contexts. Recognizing them in this role implies a political and analytical shift that goes beyond instrumental participation and embraces the co-production of territories and water issues.

From this perspective, the hydrosocial unit or hydrosocial territory is introduced as a critical scale for analysis and action. Beyond its technical dimension, this unit constitutes a political-territorial space where power tensions reveal the need of water supply in big city of Santander is prioritized over the needs and livelihoods of small communities. In this context, the JACs in Tona river watershed promote alternative forms of institutional articulation, collaborative management, and co-production of situated knowledge to improve decision-making.

The JAC claim the need to evaluate water management from a local perspective, not as a functional deficit, but as a structural crisis affecting regional territorial systems. Water can reveal the tensions between environmental planning, land-use planning, and the social management of the territory. After conducting field work in the study area (June 2025 to February 2026), findings suggest the problem lie not only in implementation failures, but also in the institutional structure itself; sectoral models, technical approaches, and top-down decision-making dominate governance frameworks, disconnecting planning instruments from the ecological, social, and political realities of the territories.

This model is not unique to our case study; it reflects global processes of centralization, functional fragmentation, and the devaluation of territorial knowledge. In this context, we propose a territorial reinterpretation of water, in which the resource is understood as an essential part of the socio-spatial fabric, and not as an isolated object limited to its physical composition. This involves articulating scales, actors, and knowledge from a transdisciplinary approach that combines scientific and social knowledge.

The hydrosocial unit goes beyond a simple administrative hydrographic delimitation—in this case, the subsequent hydrological unit of the Tona River—to appreciate it as a lived, political, and relational space that concentrates the negative effects of fragmentation but also offers opportunities to reconfigure territorial governance.

From this perspective, the tensions between decision-making scales, regulatory frameworks, institutional capacities, and ways of life become evident. In this space, community organizations propose strategies for collaboration, build relationships, translate knowledge, and sustain processes that transcend the limits of formal administrative cycles. From the specific case analyzed, lessons can be drawn that can be applied in other contexts where institutional fragmentation and clashes between territorial scales limit the possibilities for building water justice and territorial sustainability.

One of the barriers to advancing toward more sustainable water and land management is the mismatch between life scales and decision-making scales. While territorial dynamics are shaped by everyday experience, public policies respond to standardized administrative logics designed from distant centers of power.

This mismatch generates a form of governance without a territorial basis, where rules, instruments, and structures do not effectively involve local actors and overlook the intrinsic complexity and diversity of territories. Instead of understanding multi-scale governance as a rigid hierarchy, this project proposes thinking of it as a dynamic network of relationships between actors and levels of management, where what matters is not hierarchical position, but the capacity to articulate, mediate, and generate legitimacy.

Furthermore, this scalar mismatch helps explain the persistence of conflicts, inefficiency, and institutional distrust. Overcoming it involves redistributing decision-making power, recognizing the legitimacy of territorial actors, and enabling more inclusive and effective forms of co-management. In this process, community organizations (JAC) represent a vital anchor point. Their legitimacy stems not only from legal recognition but also from their territorial positioning and their role as translators between different scales and forms of knowledge. Within this complex web of relationships, academia can contribute transdisciplinary approaches that aid in the analysis and collective construction of more sustainable alternatives.

In the context of the ECOPÍA network, this work contributes by proposing a contextualized perspective that integrates water and territorial management, based on multi-scalar collaboration, the recognition of diverse forms of knowledge, and the co-production of knowledge, all community based. In contexts marked by institutional fragmentation, these experiences offer relevant lessons for building more just, resilient, and democratic futures, in line with the principles of collaborative governance and territorial justice promoted by this network.

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Multidimensional well-being and collaborative governance: a framework for measuring the impact of the Social and Solidarity Economy

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The analysis of contemporary extractive logics draws on transdisciplinary perspectives, while their genealogy can be traced primarily through a political-sociological lens. Indeed, identifying their causes and effects requires a social analysis that incorporates cross-cutting indicators - economic, social, territorial, and political.
For more than thirty years, the debate on sustainable development has accompanied public policies and scientific production at the global level (WCED, 1987). However, in marginal territorial contexts, the persistence of environmental, social, and economic crises highlights the structural limits of dominant evaluation tools, which remain tied to a macroeconomic and quantitative vision of development. Indicators such as Gross Domestic Product (GDP) have proven unable to capture fundamental dimensions of collective wellbeing, including the quality of social relations, democratic participation, and the capacity of territories to generate non-extractive forms of resilience (Giovannini, 2018; Sassen, 2018).
Within this scenario, the Social and Solidarity Economy (SSE) is increasingly recognised as a set of economic practices grounded in reciprocity, cooperation, and collaborative governance, capable of countering extractive logics and promoting territorially rooted forms of development (Laville, 2023).
The SSE represents a structurally sustainable response to the limits of the capitalist mode of production. Its practices are characterised by a value-based approach capable of generating spaces of social innovation through its organisational features: shared democracy; focus on social needs; territorial approach; environmental protection; and profit framed as a means for the common good (Laville, 2023, Lévesque, 2014). Its diffusion and growing global visibility align with the sustainable development values of the 2030 Agenda, aimed at fostering inclusive, resilient, and sustainable futures (United Nations Conference on Trade and Development, 2024).
Despite this, the value produced by the SSE - in terms of social emancipation, community cohesion, and the protection of common goods - remains largely invisible to conventional analytical tools. This invisibility does not stem solely from a lack of empirical data, but from a theoretical gap: the absence of a shared paradigm capable of linking the democratic processes of the SSE to a multidimensional notion of wellbeing.
Starting from this critical issue, the contribution revolves around the following question: how can the Equitable and Sustainable Wellbeing (BES) framework be used as a theoretical paradigm to interpret and render visible the impact of the Social and Solidarity Economy in marginal territories?
The aim of the article is to construct a theoretical mapping between the BES domains and the foundational pillars of the SSE, in order to clarify the potential conceptual relationship between the democratic governance of economic processes and the production of multidimensional wellbeing.
Here, the BES is interpreted not as a mere set of statistical indicators, but as a theoretical architecture of wellbeing that integrates with the dimensions of the SSE (Giovannini, 2018). Through a conceptual analysis, the BES domains (such as social relations, work–life balance, environment, landscape, and quality of services) are connected to the columns of the SSE: democratic participation and collective resource management; value redistribution; environmental protection; and territorial approach. A similar attitude is proposed in Italy by the National Social Economy Plan - currently under evaluation following the 2023 European

Union Recommendation to Member States. The Plan aims to structurally define and disseminate social and solidarity policies for a democratic, digital, green, cooperative, and shared-value transition. The proposal adopts an innovative measurement approach based on outcome, process, perceived-quality, and cost-effectiveness indicators, offering an exemplary initial framework (www.finanze.gov.it). Particular attention is given to indicators that capture levels of awareness and interpretation of SSE values, especially regarding the multilevel benefits it generates. This approach enables the identification of both individual and structural factors shaping awareness among citizens and political actors where the dimension of digital perception becomes analytically central.

The article shows how the SSE can be understood as a generative device of common wellbeing - particularly relevant in disadvantaged contexts - rather than as an isolated alternative economic sector. Its theoretical contribution lies in placing multidimensional wellbeing at the centre of the analysis of the SSE, demonstrating how social emancipation - rarely examined systematically - can be rendered analytically visible within a non-extractive evaluation paradigm (Laville, 2023). From this perspective, the theoretical analysis of the democratic governance of economic processes allows the SSE to be assigned a more central role in international policy agendas oriented toward social and territorial justice and sustainable development.

The contribution is situated within the framework of the 2030 Agenda, assuming that environmental care and the reduction of territorial inequalities constitute interdependent objectives of sustainability. In line with the spirit of the ECOPÌA network, the proposed theoretical mapping seeks to offer a shared analytical framework capable of facilitating interdisciplinary dialogue among researchers, practices, and territories, contributing to the construction of a common cultural project grounded in solidarity economies, collaborative governance, and just and equitable futures.

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Academia and territorial activation: ethical and political challenges in Latin American participatory ecosystems

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This article analyzes territorial transformation processes in vulnerable contexts characterized by disputes over the meaning of the commons. The central question is how to activate territories in inclusive and resilient ways from ethical epistemological and political standpoints, in which higher education institutions (HEI) engage as critical companions rather than as technocratic actors or agents reproducing coloniality and extractivism.
A conceptual and critical framework is developed to understand the activation of territorial processes oriented toward care, governance, and valorization of the commons in Latin America. The role of academia is a central ethical and political concern.

Generative communities
Understood as collectives that actively create and consolidate practices, knowledge, relationships and institutions as collective subjects. They recognize accumulated local knowledge, foster self-organization, promote situated social innovation, construct shared governance arrangements around the commons, and develop their own narratives of transformation. University engagement can either strengthen or erode, depending on whether it operates through data extraction or co-production of knowledge.

Participatory ecosystems
Referred to the configuration of actors, institutions, practices, and relationships activated in processes of territorial transformation. Their quality depends on the density and meaning of relationships, mutual listening, the effective distribution of power in decision-making, and the learning processes in the long term. These ecosystems are shaped by structuring tensions.

Community activation
Understood as the capacity of communities to recognize themselves, organize collectively, and sustain collaborative action around shared realities, beyond short-term mobilizations or project-based interventions. Three common modes can be distinguished (Annex 1):

Community-driven activation
Endogenous, rooted in local knowledge, reciprocity, trust, and informal networks, and linked to ongoing needs rather than project cycles. It offers legitimacy, context-sensitive creativity, and resilience. However, it often faces institutional fragility, limited resources, isolation, and risks of repression.

State-driven activation
Mobilizes public funding, regulatory frameworks, and scaling capacities, benefiting from institutional legitimacy and potential for replication. However, it tends to follow top-down logics, reduce participation to consultative mechanisms, generate mismatches between

bureaucratic timelines and social urgencies, and prioritize quantitative indicators that obscure cultural and relational dimensions. Its sustainability is often medium to low and contingent on political cycles.

Externally driven activation
NGOs, universities, and cooperation agencies contribute technical expertise, methodologies, technologies, and access to global and relatively autonomous networks. However, it is shaped by risks such as academic extractivism, decontextualized approaches, dependency, and institutional voids once projects end. Its viability is generally low and tied to short-term funding cycles.
Although universities predominantly participate in externally driven modes of activation, their participation is not limited to these and can be extended to all modes, with different roles within territorial activation processes.

A critical reading of participatory ecosystems
Understood as spaces where diverse logics converge and where tensions may also be interpreted as opportunities to reorient practices. Academia may either legitimize exclusionary decisions in the name of efficiency or contribute to the design of mechanisms that integrate technical rigor with meaningful participation and ecologies of knowledge. This requires revisiting how ethical responsibility, institutional power, and situated modes of intervention are articulated.

The role of academia
An extractivist academic approach is characterized by universities and researchers "probing" community life to produce knowledge primarily useful for academic purposes, leaving communities excluded from both outcomes and decision-making processes, objectifying people, reproducing epistemic coloniality, and possible harm in the territories involved.
In contrast, a responsible academic role requires recognizing that neutrality is not possible, making explicit one's political positioning, co-defining research questions, methodologies, and uses of knowledge from the outset, and committing to long-term processes. It also entails fostering genuine co-production of knowledge through dialogues among different knowledge systems, where academic systematization is articulated with situated experience to produce outcomes that no single actor could achieve alone.
Feedback is no longer a voluntary add-on but becomes a structural component of the process, materialized in accessible and useful outputs that communities can appropriate and manage with increasing autonomy. Academic publication is thus repositioned as one among multiple forms of knowledge, subordinated to territorial relevance and cognitive justice.

An evaluation instrument for territorial activation
An evaluation instrument is proposed to identify the initial capacities involved in territorial activation processes across three types of actors: communities and grounded organizations, research teams, and HEI. The instrument is grounded in participatory action research and engages with the notion of ecologies of knowledge, prioritizing co-construction. It is structured around three dimensions (Annex 2): capacities for agency, capacities for dialogue, and conditions for long term viability.
Each indicator is assessed on a five-level scale, ranging from absence to optimal consolidation, and is evaluated through workshops and collective exercises. The aim is to make existing gaps, potential, and risks visible in order to guide accompaniment strategies.

Application
The instrument applied to three fictional cases synthesize common configurations of university–territory relationships:
Case A–Water and Territory
A rural community with organizational experience around water engages in a co-research process with a small university team, while the HEI provides limited support. Scores across

communities, research teams, and HEI are relatively similar, suggesting a fragile equilibrium with shared strengths but weak structural anchoring.

Case B–Historic Center Revitalization

An urban project supported by strong international funding and collaboration between municipal authorities, a university, and the private sector. Institutional actors demonstrate high capacities, while communities score significantly lower, revealing a technocratic model characterized by consultative participation and risks of gentrification.

Case C–Cloud Forest Defense

An Indigenous community with a long trajectory of territorial struggle is accompanied by students without formal institutional backing. The community achieves high scores, while the HEI is nearly absent, resulting in strong autonomy but vulnerability to repression and leadership fatigue.

These cases illustrate that there is no single model of university social engagement (USE), but rather at least three distinct profiles, each with specific strengths and vulnerabilities (Annex 3).

Lessons and future directions

The application of the instrument suggests that its primary value lies in identifying configurations, tensions, and critical intervention points. Its interpretation depends on the analytical approach adopted, the agreements built among actors, and the underlying political purpose, but above all on context, the quality of relationships among actors, and the capacities and limitations of HEIs in addressing territorially grounded challenges.

USE should therefore be understood not as a singular model but as a constellation of possible configurations, each characterized by differentiated strengths, vulnerabilities, and risks.

The broader horizon is the decolonization of knowledge, grounded in a systematic reflection on who speaks, from where, and with what epistemic authority, while recognizing that Western science constitutes only one among multiple knowledge traditions.

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Annexes

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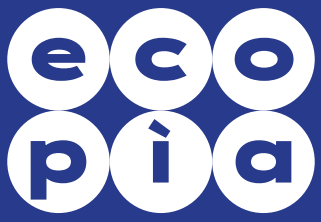

ECOSYSTEM MANAGEMENT FOR A SUSTAINABLE FUTURE

ECOSYSTEM MANAGEMENT FOR A SUSTAINABLE FUTURE

SESSION A - Wednesday 22nd – 16:30/18:30

Chair:
Fabio Teodoro De Souza, Pontifícia Universidade Católica do Paraná

Discussants:
Gianfranco Franz, Università degli Studi di Ferrara
Giuseppe Passarino, DiBEST – Università della Calabria

Chiara Cadeddu, Doris Zjalic
Nature-Based Solutions as a Lever for Regenerative Healthcare: Pathways for Systemic Transformation

Michel de Almeida Raymundo, Fábio Teodoro de Souza
Environmental determinants of metabolic syndrome in the elderly: a multi-city analysis in Paraná, Brazil, under a one health perspective

Ana Elisa Peña del Valle Isla, Matt Hare, Dinnie, L. & Karley, A.
Agro-ecological futures: Mexico and Scotland – different points on the same food and health trajectory?

Ana Clara Santos Lira, Rafael Guarnieri Groque, Fábio Teodoro de Souza
Urban environment and mental health: a spatial and psychosocial analysis of disease prevalence in Curitiba and metropolitan area

Domenica Taruscio, Alberto Mantovani
Implementing One Health and Citizen Science in Cotronei, a community of inner Calabria

Domenico Vito
Integral Ecology and One Health: Building Interdisciplinary Pathways for Planetary Well-being

Marcelo Zabandjala Cardoso, Fabio Teodoro de Souza
Predictive models of respiratory morbidity associated with atmospheric pollution in a medium-sized city in Brazil

SESSION B - Thursday 22nd – 16:30/18:30

Chair:
Gianfranco Franz, Università degli Studi di Ferrara

Discussants:
Piero Bevilacqua, DIMEG – Università della Calabria
Michal Kravčík, NGO People and Water
Nic Pacini, DIAm – Università della Calabria
Fabio Teodoro De Souza, Pontifícia Universidade Católica do Paraná

Romina D'Ascanio, Elisa Avellini, Stefano Magaudda, Anna Laura Palazzo
From fragmentation to cooperation: reframing Mediterranean wetland governance through Wetland Contracts

Giovanna Deltregia Martinelli, Filippo Magni
Participatory governance for valorising oyster farming in the Delta del Po within the local food system

Matteo Ferrara, Marilena De Simone, Ilia Negri
Photovoltaic waste generation in Italy: materials' quantification and prediction in the context of a circular economy

Michal Kravčík, Jan Pokorný, Martin Kováč, Danka Kravčíková
Returning lost water to small water cycles for sustainable regeneration of damaged landscapes and restoring climate and social security

Nic Pacini, Silas Wanjala Wabomba, Marek Baxa, David Malcolm Harper
How to restore biotic regulation in the Lake Naivasha Catchment?

Annunziata Palermo, Luisanna Iuele, Lucia Chieffallo
Ecosystem transition for planning of multifunctional green solutions

Michele Giuseppe Salvan
"Paddies' Puzzle: Multi Criteria Decision Aiding (MCDA) Approach for Enhancing Natural and Agrobiodiversity in Italian Rice Farming Districts in Northern Italy"

Monica Solorzano Gil, Pablo Vázquez Piombo, Marinés de la Peña Domene
Lake Chapala and water-linked territories in comparative perspective: biocultural landscapes, just transition, and resilient city-regions

Noemi Turano, Antonio Caporusso, Roberto Albergo, Enrico Catizzone, Massimo Migliori
Innovative approaches for the sustainable extraction of microbial oils and their subsequent conversion into derived biofuels

Walter Nocito, Rossana E. Vulcano
The Urban Bio-Region as a model and process: legal readings and institutional tools for land resource management. Hypothesis for the Crati's Urban Area.

Nature-Based Solutions as a Lever for Regenerative Healthcare: Pathways for Systemic Transformation

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The convergence of the triple planetary crisis of climate change, biodiversity loss and global pollution, together with the widening health inequities across populations, exposes a structural contradiction at the core of contemporary healthcare systems. Despite decades of biomedical progress and technological innovation, healthcare continues to operate within socio-economic models that externalize environmental degradation and social costs, while addressing health primarily through downstream, curative interventions. In doing so, health systems often contribute both directly and indirectly to the erosion of the ecological and social conditions that sustain health in the first place.
Planetary Health has emerged as a critical framework to reconnect human well-being with the integrity of Earth's life-support systems. Yet its transformative potential remains limited unless it is translated into concrete changes in how healthcare is conceived, organized and governed. This contribution argues that Nature-Based Solutions (NBS) can act as a strategic lever for a systemic transformation of healthcare toward a regenerative paradigm. Rather than treating NBS as ancillary or decorative interventions, the aim is to conceptualize them as drivers of transformation along three interrelated directions: ontological repositioning, structural integration and participatory governance.

Ontological Repositioning
A regenerative approach requires a fundamental shift in how health systems understand their role in society. Healthcare must be reframed not as a neutral provider of services operating within fixed ecological limits, but as a relational actor embedded within socio-ecological systems. This repositioning entails moving beyond anthropocentric paradigms that reduce nature to a stock of "ecosystem services" to be optimized for human benefit. Instead, health is understood as emerging from relationships of reciprocity, interdependence and co-evolution between human and more-than-human systems.
NBS can catalyze this ontological shift by making visible the material interdependencies between ecological integrity and human health. Restored wetlands, urban forests, biodiverse green spaces and blue infrastructures demonstrate that ecological regeneration is not external to healthcare but foundational to it. They reveal that health systems are not only affected by environmental degradation but also capable of contributing to ecological renewal.

Structural Integration
Ontological change must be accompanied by structural integration. NBS should become ordinary components of healthcare pathways rather than isolated pilot projects. This includes crucial actions such as the incorporation of green and blue infrastructures in clinical and community settings, the ecosystem restoration as an upstream public health intervention, and nature-based social prescribing for chronic diseases, mental health and social isolation.
When structurally embedded, NBS enable healthcare systems to act on the root determinants of health, represented by climate stability, clean air and water, biodiversity and social cohesion, in contrast with merely treating their downstream consequences. They create operational coherence between prevention, care and ecological regeneration. Moreover,

infrastructures shape worldviews: when healthcare environments are designed as living ecosystems rather than resource-intensive and sterile spaces, they foster new understandings of health, care and interconnectedness.

Participatory Governance

The transformative potential of NBS depends on participatory and multi-level governance. Without inclusive governance, NBS risk being depoliticized, reduced to technical fixes or captured by greenwashing logics. Regenerative healthcare requires collaborative arrangements that connect healthcare institutions, local communities, policy makers and territorial knowledge systems, including Indigenous and place-based ecological knowledge.

Participatory governance ensures that NBS remain context-sensitive, socially just and oriented toward collective rather than narrowly institutional benefits. Community co-management of green spaces, citizen science initiatives and nature-based social programs can strengthen social cohesion and democratize health governance. In this sense, NBS become platforms for social innovation as much as ecological regeneration.

Dialectical Method: From Contradiction to Synthesis

Methodologically, this contribution employs dialectical reasoning, treating the contradiction between healthcare's curative mission and its ecological impacts as a productive tension. The thesis identifies contemporary healthcare systems as operating within biomedical and anthropocentric paradigms focused on individual outcomes, technological intervention and efficiency. The antithesis highlights how these same systems contribute to planetary crises through emissions, waste and resource extraction that undermine the ecological foundations of health.

The synthesis emerges in the form of *regenerative healthcare*, which reframes health systems as participants in socio-ecological regeneration. Within this synthesis, NBS function as the material and institutional mechanisms through which conceptual transformation becomes operational. The dialectical method reveals how conceptual separations between human and planetary health generate harmful practices, and how new material practices such as the systemic integration of NBS enable corresponding conceptual shifts. Conceptual frameworks, governance structures and infrastructures are understood as mutually constitutive, evolving through their tensions toward more adequate and regenerative forms.

From this perspective, individual interventions such as horticulture or green prescriptions are connected to broader systemic transformation. Their cumulative integration can precipitate qualitative shifts in how healthcare systems define their purpose, responsibilities and relationship with the living world.

Contribution to the ECOPÌA Network

The contribution to the ECOPÌA network lies in articulating regenerative healthcare as a concrete field for transdisciplinary collaboration, where ecosystem management, social justice and health governance converge. By positioning healthcare systems not only as beneficiaries of healthy ecosystems but as active agents of ecological regeneration, this work invites dialogue across disciplines and territories. It supports the co-construction of health systems capable of sustaining just, resilient and life-affirming futures.

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ENVIRONMENTAL DETERMINANTS OF METABOLIC SYNDROME IN THE ELDERLY: A MULTI-CITY ANALYSIS IN PARANÁ, BRAZIL, UNDER A ONE HEALTH PERSPECTIVE

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The Anthropocene era has intensified the interdependence between environmental degradation and human health, particularly in rapidly urbanizing regions of the Global South. Air pollution is currently recognized as one of the leading environmental risk factors for global morbidity and premature mortality (Landrigan et al., 2018). Among vulnerable populations, older adults are disproportionately affected due to age-related physiological decline and the high prevalence of chronic comorbidities. Metabolic Syndrome (MetS) — a cluster of interrelated conditions including hypertension, hyperglycemia, central obesity, and dyslipidemia — represents a major determinant of cardiovascular disease and a growing burden for public health systems. While traditional biomedical approaches emphasize lifestyle and genetic determinants, increasing scientific evidence demonstrates that environmental exposure to fine particulate matter (PM2.5) significantly contributes to metabolic dysfunction through systemic inflammation and oxidative stress pathways (Han et al., 2022).

This study adopts a One Health perspective, aligned with the World Health Organization's updated air quality guidelines (WHO, 2021), recognizing that human health outcomes are inseparable from ecosystem integrity and environmental governance. By framing clean air as a strategic ecosystem service, this research contributes to the understanding of how air quality management constitutes not only an environmental priority but also a preventive health strategy. In this context, the state of Paraná, Brazil, offers a relevant case study due to its heterogeneous territorial configuration, encompassing highly urbanized, industrial, and agriculturally influenced municipalities exposed to distinct environmental stressors and climatic variability.

The primary objective of this ecological time-series study is to analyze the association between environmental stressors — specifically atmospheric pollutants and meteorological variables — and health outcomes related to Metabolic Syndrome in individuals aged 60 years and over. The study correlates both long-term and short-term exposure to PM2.5, PM10, NO2, and O3 with hospitalization rates for diabetes mellitus, hypertension, obesity, and ischemic heart diseases, operationalized as clinical proxies for MetS-related outcomes. Data from 12 municipalities with diverse urbanization profiles were integrated, covering the period from 2015 to 2025. Health data were obtained from the Brazilian Unified Health System (DATASUS), while environmental monitoring data were sourced from the Water and Land Institute (IAT). Meteorological variables, including temperature, relative humidity, and precipitation, were collected from the National Institute of Meteorology (INMET).

The analytical framework considers chronic exposure patterns as well as acute pollution episodes, including the severe drought and smoke event recorded in Paraná in September 2024. Recent epidemiological evidence suggests a strong association between PM2.5 exposure and components of Metabolic Syndrome in elderly populations, independent of behavioral risk factors (Liu et al., 2025). Pollutant inhalation may function as an "invisible accelerator" of

metabolic dysfunction by promoting systemic inflammation, particularly under conditions of low relative humidity and elevated temperatures, which intensify atmospheric pollutant concentration and persistence.
Beyond epidemiological associations, this study explores territorial disparities in exposure profiles, comparing industrialized urban centers with municipalities characterized by distinct land-use patterns and greater availability of green spaces. By examining how ecosystem features may mitigate pollution-related metabolic risks, the research highlights the importance of integrating environmental monitoring into urban planning and health surveillance
systems. The findings aim to contribute to interdisciplinary strategies that connect environmental engineering, public health, and territorial governance, reinforcing the role of air quality management as a pillar of resilient and sustainable cities. In doing so, the study supports policy approaches that recognize environmental determinants as central components of chronic disease prevention and climate adaptation strategies within the One Health framework.

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Agro-ecological futures: Mexico and Scotland - different points on the same food and health trajectory?

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Our participatory systems modelling (PSM) analyses in Mexico and Scotland investigates trends in small-scale, agro-ecological farming aimed at local consumption. Each trend has implications for human health.

In Mexico, PSM was undertaken with agricultural communities to capture the dynamics of change across a municipality. One dynamic is the loss of family-owned agro-ecological landholdings, first to "near-landlessness" and intensive agriculture, and then to the loss of land to peri-urban development. Former farming families have migrated to peri-urban areas, with restricted access to land, and changes to family-work patterns, access to food, food behaviour and health.

This trajectory away from small-scale, agro-ecological, food production is contrasted with the efforts of the Scottish Government to encourage its return in Scotland, as part of its Good Food Nation Plan. The latter seeks to improve citizens' diets to reduce high rates of diabetes and obesity. Our PSM research has sought to understand how an increase in fresh vegetable production can be supported by new agro-ecological farmers and their entry into supply chains, via the expansion of Market Gardens. Such expansion faces barriers related to dominant agri-food business models, farmer recruitment, land access, food production infrastructure, market access and consumer demand. Additionally, decades of farm size growth, the centralisation of food supply chains, ever-increasing regulation and mal-adapted food behaviour, along with centuries of restricted access to land, entrench these barriers.

We argue that Scotland and Mexico lie on two ends of a trajectory away from sustainable agro-ecological food production. Scotland represents a potential future in Mexico's current trajectory that may be hard to return from. We argue Mexico's earlier position in this trajectory; its greater experience of agro-ecological food production; and its cultural, environmental advantages can allow it to change trajectory as well as offer Scotland insights into how it might achieve its own goals.

Urban Environment and Mental Health: A Spatial and Psychosocial Analysis of Disease Prevalence in Curitiba and Metropolitan Area

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The Anthropocene era poses unprecedented challenges to human health, not only through climatic shifts but through the profound transformation of urban habitats. As global urbanization accelerates, more than half of the world's population now resides in cities, a figure projected to increase significantly by the year 2050. While urbanization remains a powerful catalyst for economic development and social innovation, disorganized and rapid urban growth has emerged as a critical determinant of the global mental health crisis.

Environmental stressors typical of densifying cities, including chronic air pollution, noise disturbance, high population density, and the progressive scarcity of ecosystem services, are now recognized by the international scientific community as primary environmental risk factors that significantly increase the burden of psychiatric conditions and decrease general well-being. Current neuroscientific and epidemiological evidence indicates that city living fundamentally affects neural social stress processing.

Individuals raised or currently living in high-density urban environments may exhibit a higher prevalence of depression, chronic stress, and anxiety disorders compared to those in rural areas. This research adopts a comprehensive One Health perspective, recognizing the inherent inseparability of human psychological well-being, environmental integrity, and urban ecosystem management. In this context, Curitiba and its Metropolitan Area (RMC), located in southern Brazil, provide a relevant and urgent case study. Analyzing this region allows for the contribution of vital data from the Global South to the international debate on resilient territories, exploring how socio-environmental inequalities and territorial configuration impact public health in developing nations.

The primary objective of this study is to analyze the complex association between urban environmental stressors, specifically population density, territorial configuration, and the lack of accessible green spaces, and health outcomes related to mental disorders in individuals within the RMC. The study seeks to identify spatial and temporal patterns by correlating socioeconomic indicators with epidemiological data. By doing so, the research aims to provide a data-driven framework to support healthy urban planning and public policies that prioritize psychological resilience as a pillar of sustainable development in the face of contemporary environmental crises. To achieve these goals, the study is designed as an ecological and exploratory investigation, integrating multidimensional databases to analyze the period between 2015 and 2025. The interdisciplinary research process begins with the systematic extraction of epidemiological data regarding morbidity and mortality associated with mental and behavioral disorders from the Brazilian Unified Health System database (DATASUS). The data collection specifically targets ICD-10 codes within Chapter V, focusing on depression,

anxiety, and stress related conditions, while also considering mortality rates to understand the most critical outcomes of mental health crises in the region over a decade of observation.
Concurrently, indicators of urban configuration and socioeconomic status are retrieved from state and municipal databases, such as IPARDES and DETRAN. These variables include population density, vehicle fleet numbers as a proxy for noise and air pollution, and access to urban green infrastructure. The analytical strategy adopts a temporal and correlational approach to evaluate how variations in these urban environmental features impact health outcomes over the selected timeframe. To ensure statistical robustness, the research utilizes data normalization techniques, calculating the rate of hospitalizations and occurrences per 100,000 inhabitants. This allows for a fair comparison between Curitiba, the metropolitan core, and the smaller surrounding municipalities. By synthesizing these diverse datasets, the study identifies clusters of vulnerability where urban configuration may act as a catalyst for psychological distress. This interdisciplinary framework ensures that the association between territorial dynamics and mental health is analyzed within a rigorous context, allowing for the proposal of evidence-based interventions for public health and urban management.
The preliminary framework of this research suggests that the urban environment acts as a silent architect of mental health. It is hypothesized that chronic exposure to urban stressors triggers integrated neurobiological and inflammatory responses, including amygdala overactivation and systemic inflammation, which together underlie the development of affective disorders. This connection between the neurofunctional processing of stress and the biological inflammatory response is crucial to understanding how the physical city influences the biological state of its inhabitants. Furthermore, the study explores the buffering effect of ecosystem services within the RMC. It is argued that integrated territorial management, promoting accessible nature, urban forests, and blue spaces, can significantly reduce the prevalence of stress-related disorders, acting as a vital non-pharmacological intervention for the population. Preliminary observations indicate that municipalities with higher ratios of green space per inhabitant may present lower rates of acute mental health crises.
Therefore, territorial dynamics in the RMC reveal that urban configuration and environmental features are not just background elements but active components of public health. The discussion emphasizes that addressing the health challenges in the Anthropocene requires a shift toward resilient urban planning that views green infrastructure as an essential public health tool. This perspective aligns with the need for cities that are not only sustainable in terms of resources but also supportive of human psychological integrity.
This study contributes to the ECOPIA network by effectively bridging Clinical Medicine, Data Science, and Urban Engineering. It reinforces the notion that territorial management and ecosystem-based strategies constitute a central strategy for chronic disease prevention in the twenty-first century. By framing balanced urban environments as a fundamental determinant of mental health, the findings aim to support public policies that integrate mental health surveillance into urban management systems. This approach strengthens urban resilience and advances the goal of creating liveable cities where human psychological well-being is recognized as a key indicator of a healthy and sustainable ecosystem.

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SILASCIENZA (”Science in Sila”): implementing One Health and Citizen Science in Cotronei, a community of inner Calabria

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One Health is the recent and developng, conceptual and operational, paradigm based on the interconnections among the health of humans,of the other living beings and the ecosystems. Consequently, One Health implementation calls for the involvement of multiple disciplimes, stakeolders and components of society. This holds especially true when considering the definition by the World Health Organization of “health” as physical, psychological nd cultural well.being. Thus, One Health should be exploited both in the prevention of health menaces (pollution, zoonoses, etc.) as well a sas a path toward well-being.
The Study Centre KOS is an Italian non-profit organization that aims at building-up projects that may bridge human, biomedical and environmental expertise, with a strong focus on One Health The project SilaScienza has started in 2024 from the collaboration between KOS and the muncipality of Cotronei, a small (slightly more than 5000 inhabitants) city of the Sila, an inner, mountain part of Calabria.
Cotronei has many interesting fetures: a large part of municipality is comprised in the National Park of Sila, with remarkable biodiversity and environmental quality; has a place in Italian modern history, because, from the water-rich Sila mountains, artificial lakes were built in the 1930s to provide electric power to whole Southern Italy; there is a tradition of healthcare, as several private clinics are active since decades, exploiting also some favorable characteristics (peaceful community, clean air, good drinking water). Meanwhile Cotronei is affcted by many problems shared byminor urgan centres throughout Italy, from North to South, in particular those connected with the increasing mean age of the population and the dripping loss of young active individuals, attracted by better opportunities in metropolitan areas. Also, along time the population is losing the past knowledge of the great environmental treasure provided by the Sila National Park, which is increasingly seen just as a place for spending holydays/weekends. The community is, however, lively and there are associations, in particular “Il Barattolo” dedicated to promote knowledge of the Park. This has given the opportunity to promote also , Citizen Science, another main goal of KOS.
Citizen Science is the active, quality-controlled participation of citizens and communities to the production of knowledge: while it has now an established in natural sciences (e.g., ornithology), the potential in health-promoting activities has still to be fully exploited.
SilaScienza is developing as multi-step proect, whose goals and activities develop from the cross-talk beween the community and the national network of experts brought by KOS.
SilaScienza activities, therefore include:

- A series of annual scientific symposia (to date: “Agriculture and territory” April 2024; “Primary prevention” May 2025; next one “Ecosystem and energy” April 2026) where qualified national experts dialogue with expertise, including “lay” ones, present in Cotronei and the surrounding communities. It is noteworthy that SilaScienza is currently the only culturaò event in the area where science features prominently.
- Each symposium is followed-up by working groups with the participation of of the national experts, appointed chairs and and rapporteurs that discuss the progress of ongoing activities and the new activities to be launched .

- Working groups follow-up as whatsapp groups and with monthly virtual meetings, that till have always seen an intense participation. The activities point out the promotion of personal and community welfare and empowerment, in particular a better integration into and knowledge of the Park biodiversity, healthy lifestyles and cross.talk between older and younger generations. Here a list of ongoing activities
- Validation of forest walks within or close to Park areas taking into account of the health-promoting values (quality of the air, exposure to helth/wellness-promoting terpenes) as well as of their accessibility and practicability
- Ethnobotany across generations: alike many other mountain areas the Sila has a rich array of vegetable species that in local culture have been used as food, spices, medicines, for personal care and/or household. This cultural tradition, owned by oolder generations is going to be lost, if not revitalized. This project joins the guided and sustainable search and identification of plant species by groups of students (primary-to-high school) with the knowledge of their use by the older generations. This project leads to a rediscovery of the surrounding biodiversity.
- Strictly connected to this, the schools and the association "Il Barattolo" are organizing guided tours to know the many features of the Sila environment, which is just outside home'door and yeti s often ignored. The ai mis to integrate openair physical activity, and empowerment of younger generations toward landscape and environmental quality.
- In adition, the "junior scientist" group gathers children 10-13 years old who collect and identify spontaneous plant species in order to characterize the biodiversity just outside theit home's door.
- A parallel project is "Butterfly", adressing people living in hoses for the elderly and leading them to improve their attention to the environment and psycho-physical activity by identifying the many species of butterfiles living in the area. Overall, besides improving people's welfare these activities might provide also intereting insights on some features of Cotronei and Sila biodiversity achieved by "lay" groups, in accordance with the principles of Citizen's Science.

Another project need being mentioned: "1000 day" adressing health operators, women and couples physicians and citizens on primary prevention during the critical period of pregnancy and infancy (first 1000 days of life): Indded, valuable documents on primary prevention have been produced by public health institutions, with the contributions also of KOS members D. Taruscio and A. Mantovani, when they were staff scientists at the Istituto Superiore di Sanità. However, these documents did not receive adequate dissemination at the primary healthcare level in many inner Italian areas, including Calabria.
The way just paved by SilaScienza brings together scientific expertise, evaluation of community needs and participation: hence it can represent a model for step-wise local implementation of One Health also in other inner areas.

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Integral Ecology and One Health: Building Interdisciplinary Pathways for Planetary Well-being

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Grounded in the principles of Integral Ecology and Human Ecology, this contribution highlights the interconnectedness of human, animal, and environmental health, emphasizing the need for holistic and interdisciplinary approaches to contemporary global challenges. Integral Ecology, as articulated in Pope Francis' encyclical Laudato Si', promotes a comprehensive understanding of environmental stewardship that recognizes the intrinsic relationships between ecological systems, social justice, and human well-being. This perspective aligns closely with the One Health framework, which advocates for collaborative and multi-sectoral strategies to address health risks emerging at the interface between humans, animals, and ecosystems. By acknowledging that human health is deeply intertwined with environmental integrity and animal health, the One Health paradigm provides a practical and policy-oriented pathway for addressing complex global threats. Human Ecology further strengthens this integrated vision by exploring the dynamic interactions between human societies and their natural, social, and built environments. It recognizes that human well-being is fundamentally dependent on healthy ecosystems, sustainable resource management, and resilient communities. In this context, environmental degradation, biodiversity loss, and climate change are not only ecological concerns but also critical determinants of public health. The integration of Human Ecology and Integral Ecology offers a conceptual foundation for rethinking development models and governance systems, encouraging more responsible and sustainable relationships between humanity and nature.

The COVID-19 pandemic has dramatically highlighted the fragility of global health systems and the urgent need to implement integrated paradigms such as Planetary Health and One Health. The pandemic demonstrated how disruptions at the human–animal–environment interface can rapidly escalate into global crises, underscoring the importance of prevention, early detection, and coordinated responses across sectors. Health today represents a key dimension of modern societies that requires a multidisciplinary perspective capable of bridging the gap between scientific knowledge, policy-making, and societal action. Strengthening collaboration among researchers, health professionals, environmental scientists, urban planners, and decision-makers is therefore essential to develop innovative strategies capable of addressing emerging health threats.

Several policy frameworks have been developed to promote the integration of health considerations across sectors. Among them, the Health in All Policies (HiAP) approach represents one of the most relevant governance models. HiAP encourages governments and institutions to systematically consider the health implications of public policies, seek synergies among sectors, and prevent negative health outcomes in order to improve population well-being and reduce health inequalities. This approach is closely aligned with the objectives of the World Health Organization and with the global agenda established by the United Nations through the Sustainable Development Goals. In particular, the urban dimension plays a crucial role in this framework, as cities represent the primary centers of human activity and anthropogenic pressures. Urban environments concentrate many of the determinants of environmental change, including greenhouse gas emissions from transport systems, energy production, and food supply chains. Consequently, cities are strategic arenas for implementing transformative policies capable of reducing emissions, improving air quality, and promoting healthier lifestyles. Strengthening partnerships at the city level can enable the design of integrated strategies that simultaneously address climate mitigation, public health, and social equity. Such actions also contribute to achieving the objectives of the Paris Agreement on

Climate Change, which aims to limit global temperature rise and guide the transition toward climate neutrality by mid-century. Enhancing synergies between the Paris Agreement and the Sustainable Development Goals can generate significant co-benefits, including reductions in poverty, improvements in environmental quality, and enhanced resilience of vulnerable populations.

However, recent studies highlight the complexity of balancing climate mitigation and socio-economic development. While ambitious emission reduction strategies are essential to address climate change, they may also generate short-term economic challenges if not accompanied by inclusive policies and social protection mechanisms. Therefore, integrated approaches that consider environmental sustainability alongside social justice and economic resilience are crucial. This perspective resonates strongly with the principles of Integral Ecology, which emphasize the inseparability of environmental protection, social equity, and human dignity.

Within this broader context, the Mediterranean region offers a particularly significant case study. The Mediterranean basin represents a hotspot of climate change, biodiversity loss, and socio-economic vulnerability, while simultaneously hosting diverse ecosystems and densely populated coastal cities. Environmental degradation, rising temperatures, water scarcity, and pollution are increasingly affecting both ecosystems and human communities across the region. Addressing these interconnected challenges requires integrated strategies that combine scientific knowledge, policy innovation, and community engagement.

By placing the One Health approach at the center of Mediterranean research and policy agendas, this conference seeks to promote interdisciplinary collaboration capable of addressing the complex interactions between environmental, societal, economic, and health factors. Drawing inspiration from international One Health initiatives, the conference encourages knowledge sharing, capacity building, and the empowerment of local communities. Such collaborative efforts are essential to strengthen resilience against climate-related risks, emerging infectious diseases, and environmental hazards.

Ultimately, integrating Integral Ecology, Human Ecology, and the One Health framework offers a powerful pathway toward sustainable development and global health security. By recognizing the interconnectedness of life systems and promoting coordinated actions across disciplines and governance levels, it becomes possible to develop comprehensive solutions that protect ecosystems, safeguard public health, and enhance the well-being of present and future generations. In this perspective, the Mediterranean region can serve as a living laboratory for innovative policies and practices that place One Health at the core of environmental governance, demonstrating how integrated approaches can contribute to building a healthier and more sustainable planet.

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PREDICTIVE MODELS OF RESPIRATORY MORBIDITYASSOCIATED WITH ATMOSPHERIC POLLUTION IN A MEDIUM-SIZED CITY IN BRAZIL

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Air pollution is one of the main determinants of morbidity and mortality in urban centers, especially in medium-sized cities experiencing population density, industrial intensification, and growth in the motor vehicle fleet. In the Brazilian context, municipalities of this size have structural limitations for environmental monitoring and the implementation of preventive health policies, which ultimately contributes to greater exposure of the population of these municipalities to air pollution and, consequently, to its adverse effects. Pollutants such as fine and coarse particulate matter (PM) and gases resulting from the burning of fossil fuels are associated with an increase in the incidence and severity of respiratory diseases such as asthma, bronchitis, chronic obstructive pulmonary disease and acute airway infections.
Given this scenario, understanding the relationship between air quality, weather conditions, and respiratory morbidity is essential to support and plan strategic actions for urban health management guided by sustainability, territorial resilience, and socio-environmental justice. It is believed that the integration of environmental and health data combined with statistical predictive models will enable the identification of spatio-temporal patterns of population illness, thus making it possible to anticipate health actions aimed at prevention.
The objective of this study is to develop a predictive model of respiratory morbidity in a medium-sized Brazilian city to guide health actions. In addition, it seeks to describe the seasonality and temporal patterns of hospitalizations for respiratory diseases, evaluate the association between atmospheric pollutants, meteorology, and respiratory outcomes, construct and validate models capable of predicting periods of greater vulnerability in the population, and contribute data for health planning.
The study adopts a quantitative, observational, and retrospective approach based on the integration of public environmental and health data. The study area is a medium-sized city in the interior of the state of Paraná called Ponta Grossa, which has a population of 358,371 inhabitants. The city is characterized by a subtropical climate with significant seasonal variability. Environmental data include concentrations of air pollutants such as PM2.5, PM10, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide, as well as meteorological variables such as temperature, relative humidity, atmospheric pressure, and precipitation in the period from January 2015 to December 2025. The data were obtained from Brazilian national systems dedicated to environmental monitoring. In turn, the health data refers to hospital admissions for respiratory diseases extracted from DATASUS/AIH.
The data was extracted into spreadsheets using Microsoft Office Excel® software, where they were cleaned, standardized, and organized according to the time series. Data analysis and the creation of a predictive model are being performed using TIBCO® Data Science/Statistica software. Model performance is evaluated using metrics such as RMSE, MAE, and coefficient of determination (R^2), using data division into training and test sets (70/30) and cross-validation.

The study is still in the data cleaning and organization phase, with data being organized in Microsoft Office Excel® spreadsheets, followed by statistical analysis together with the predictive model. However, it is expected that the predictive models will be able to estimate and anticipate variations in outbreaks and increased incidence of respiratory diseases in the context of medium-sized cities in Brazil. The results should allow for the identification of critical seasonal periods and greater vulnerability of the population, contributing to the anticipation and greater prevention of hospitalization peaks and overload of the health system.
The proposal of this work is part of a field of research that recognizes health as an integrality between social, environmental, and territorial factors. By analyzing a medium-sized city, the study contributes to reducing an important gap in the literature, where studies addressing pollution are concentrated in large urban centers. The use of a predictive model allows for the advancement of public prevention policies, aligned with the logic of anticipatory and evidence-based governance. In addition, the research dialogues with the premises of the challenges imposed by climate change and contemporary urbanization, where it is increasingly evident that there is a need to integrate public health into technological and integrated urban planning and management systems.

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From fragmentation to cooperation: redefining Mediterranean wetland governance through Wetland Contracts

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Mediterranean wetlands represent ecosystems of exceptional ecological, social and economic relevance. According to the Ramsar Convention (1971), wetlands include natural or artificial areas characterized by permanent or temporary freshwater, brackish, or saltwater. Despite covering a limited portion of the Earth's surface, wetlands host a disproportionate share of global biodiversity and provide critical ecosystem services, including flood regulation, water purification, climate change mitigation and carbon sequestration. At the same time, they support traditional economic activities such as agriculture, fisheries and nature-based tourism, which are particularly significant in Mediterranean coastal and rural contexts. Nevertheless, Mediterranean wetlands have experienced a dramatic decline over recent decades. Since the 1970s, nearly half of their natural extent has been lost due to urbanization, agricultural reclamation, water abstraction, hydrological alterations, pollution, and climate change. Beyond these environmental pressures, one of the most persistent challenges lies in the fragmentation of governance. Wetlands are often managed through sectoral and territorially fragmented policies, involving multiple authorities with overlapping or poorly coordinated competences. This institutional fragmentation generates conflicts between conservation and development objectives, limits the effectiveness of ecosystem-based approaches, and undermines long-term ecological resilience. At the European level, a comprehensive policy framework has progressively emerged to address these challenges, including the Water Framework Directive, the Habitats and Birds Directives, the Floods Directive and, more recently, the EU Nature Restoration Law (2024). The latter introduces binding restoration targets for degraded ecosystems and explicitly recognizes wetlands as priority systems for biodiversity conservation, water security, and climate adaptation. Crucially, it promotes integrated, participatory and multi-level governance approaches, emphasizing that effective restoration cannot rely solely on site-based protection measures but requires coordination between spatial planning, water management and local communities. Within this evolving policy landscape, Wetland Contracts have emerged as innovative instruments of collaborative environmental governance. Inspired by the experience of River Contracts, Wetland Contracts are voluntary, non-regulatory agreements that bring

together public authorities, private actors, civil society organizations and local communities around shared objectives for ecosystem management. Over the past decade, several European projects have tested and consolidated this approach, demonstrating its potential to reduce conflicts, foster stakeholder engagement, and integrate conservation goals with local development needs. At the same time, these experiences have revealed structural limitations, including dependence on project-based funding, uneven institutional support, and difficulties in ensuring continuity beyond the lifespan of individual initiatives. Building on these lessons, the project Interreg Euro-MED WE GO COOP – Improving Wetland Governance through a Community of Practice (January 2024 – March 2026), funded under the Interreg Euro-MED Programme 2021–2027, represents an illustrative case for rethinking wetland governance at a broader Mediterranean scale. The project is implemented by a transnational partnership composed of Anatoliki S.A. (Greece); Association Secrétariat MedWet (France); the Department of Architecture, Roma Tre University (Italy), FAMP – Andalusian Federation of Municipalities and Provinces (Spain); Public Institution Nature Park Vransko Jezero (Croatia); PPNEA – Protection and Preservation of Natural Environment in Albania (Albania) and RCDI – Network for Development and Innovation (Portugal). This multi-actor consortium brings together public authorities, research institutions and civil society organizations, ensuring a balanced representation of EU and non-EU Mediterranean countries and fostering institutional dialogue across different governance traditions. The overall objective of WE GO COOP is to overcome the fragmentation of local wetland governance initiatives by strengthening coordination across scales and enhancing the transferability of the Wetland Contract model. To achieve this goal, the project adopts a dual-scale organizational structure. At the transnational level, it builds a Mediterranean framework for cooperation and policy alignment; at the territorial level, it supports both the transfer of the Wetland Contract model to new contexts (Albania, Croatia and Portugal) and the consolidation of existing or experimentally tested activities (Italy, Greece and Spain). Through this structure, the project connects local practices with macro-regional learning processes. Project activities combine capacity building, peer-learning exchanges, methodological harmonization, and on-the-ground support for local Wetland Contracts. These actions are designed not merely to replicate governance tools, but to adapt them to diverse socio-ecological and institutional contexts through co-design processes and participatory approaches. A central outcome of these activities is the establishment of the Mediterranean Community of Practice on Wetland Contracts, formally founded in Marseille in November 2025. The Community is conceived as an “open house” for actors engaged in wetland governance across the Mediterranean. Supporting this Community is a collaborative digital platform, which acts as a governance infrastructure that facilitates knowledge sharing, comparative analysis, and collective learning. Its core component is a Wiki-based web GIS that systematizes data on Wetland Contracts across the Mediterranean through standardized datasets, including geographic location, institutional arrangements, funding sources, protection status, stakeholder composition, thematic objectives and financial resources. The platform integrates qualitative indicators, such as self-assessments of stakeholder participation, knowledge sharing, and adaptive governance capacity, thereby capturing dimensions often overlooked in conventional monitoring frameworks. By combining spatial visualization and evaluative tools, the platform enhances transparency, accountability, and evidence-based policymaking. Beyond local and transnational activities, WE GO COOP produced a policy paper addressed to the EU, its Member States, and MENA countries, calling for formal recognition of Wetland Contracts as instruments to promote inclusive stakeholder engagement, integrate territorial strategies and nature-based solutions, and strengthen financial capacity. It also emphasizes institutional recognition, methodological harmonization, networking, dissemination, and dedicated support to ensure effective and sustainable governance, positioning Wetland Contracts as strategic tools for Mediterranean wetland management and ecological transition. By combining locally grounded activities, a transnational Community of Practice, a shared digital infrastructure and a clear policy advocacy dimension, WE GO COOP demonstrates how collaborative and adaptive governance frameworks can operate across scales and institutional boundaries. This model enhances alignment between local practices and European policy objectives, supports informed decision-making, and creates conditions for the transferability and long-term sustainability of governance processes. More broadly, it highlights the role of Mediterranean wetlands as

laboratories for experimenting with interdisciplinary, participatory, and context-sensitive approaches to ecosystem management.

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Participatory governance for valorising oyster farming in the Delta del Po within the local food system

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Aquaculture has long shaped the landscape, economy, and socio-cultural identity of the Po Delta Biosphere Reserve, where mollusc farming—particularly Manila clams (Ruditapes \philippinarum)—has historically sustained local livelihoods and territorial knowledge. In recent decades, this sector has faced increasing challenges from climate stressors, including rising water temperatures, declining water quality, and invasive species such as the blue crab (Callinectes sapidus), which preys on clams and disrupts ecosystem stability. As an alternative, local actors have begun exploring oyster farming, particularly the Delta Po's unique Ostrica Rosa, as a resilient alternative. This species is distinctive due to specific hydro-morphological conditions, lagoon water quality, and historical cultivation practices, which together confer unique organoleptic properties and a strong territorial identity. However, there remain many challenges in shifting practices, including technical details about its implementation and management, considering ecosystem-based approaches and mainly, engaging the community into a solid governance. This study investigates the constraints and opportunities to valorise oyster farming within the local food system, based on the results of the on-going governance frameworks being carried out within the PRISMA funded RES-MAB project to support the community in the transition. The methodology combines bibliographic research on food governance, stakeholder participation, and value creation alternatives cross-referencing analysis of governance processes implemented in the Po Delta.

Until now, a diverse set of stakeholders were engaged, including fishermen, tourism entrepreneurs, environmental associations, local and regional authorities, NGOs, specialised consultancy firms, and universities. Governance processes were designed as an iterative and multi-layered process aimed at building trust, shared understanding, and collective ownership of the transition toward oyster farming. Semi-structured interviews with key local stakeholders and policymakers were first used to identify priorities, constraints, and existing capacities within the territory. These insights were subsequently discussed and validated through focus groups, enabling collective reflection and alignment among actors with different roles and interests. Individual consultations with fishermen and meetings with local organisations, such as municipalities, fisheries associations and consortia, water management authorities, and the Veneto Region, allowed for the integration of sector-specific knowledge and institutional perspectives. Multi-actor meetings, including intersections with other projects operating within the Po Delta Park, fostered cross-sectoral dialogue and helped situate oyster farming within broader territorial strategies. Workshops and participatory events supported co-design processes, facilitating the discussion of alternative solutions, sharing of best practices, and collaborative problem identification. Technical site visits and exchanges with reference activities were planned to strengthen practical knowledge and encourage peer learning, while participation in local food fairs contributed to raising public awareness and connecting production with gastronomy and tourism.

The initial results of these processes have raised the importance of diversifying farmed species, investing in innovation, and proactively managing environmental threats. Innovative farming methods, such as the Tabouriech technique imported from France, have improved production efficiency and quality, demonstrating the potential of adaptive approaches. Co-

created insights emphasize multiple strategies to enhance oyster farming territorial value: integrating storytelling and historical memory, promoting gastronomy and tourism links, supporting local markets, recognizing environmentally sustainable practices (e.g., woody packaging, CO_2 _sequestration by oysters), creating new jobs and resilient communities, and offering training for technical and business capacity. Further opportunities include establishing a territorial brand for the MAB area, supporting diversification of local economic activities, fostering collaborative networks among producers, distributors, and restaurants, and aligning production with Italian food policies and UNESCO biosphere regulations.

At the same time, stakeholders identified several constraints that need to be addressed. Despite growing global and national demand for oysters, Italian production remains limited, imports dominate the market, and autochthonous oysters remain largely unknown to consumers. Its production in inland lagoon environments entails higher costs than imported alternatives, and the sector is still emerging, with few operators and limited visibility. Additional challenges include resistance to innovation linked to historical dependence on clam harvesting, environmental pressures associated with offshore infrastructure, and institutional rigidity.

Overall, the findings suggest that participatory governance processes can play a central role in identifying concrete pathways for valorising oysters beyond market price, reinforcing territorial identity, ecological resilience, and socio-economic diversification. The study demonstrates how participatory governance can function as a planning tool to integrate environmental adaptation, food policy objectives, and local development within a biosphere reserve context, contributing to increasing social food resilience in the Po Delta.

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Photovoltaic waste generation in Italy: materials' quantification and prediction in the context of a circular economy

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Renewable energy systems allow for sustainable energy production by avoiding greenhouse gas emissions into the atmosphere, reducing the use of fossil fuels, and promoting energy independence in Europe and Italy. Among these, photovoltaic (PV) technology enables electricity generation by exploiting solar energy. Today, the end-of-life (EoL) is not adequately considered as the attention is mainly focused on the operational phase and its energy performance. Currently, it is noted a growing importance of this issue due to the enormous diffusion of the PV technology in the national scenario driven by incentive policies. This corresponds to the production of significant quantities of PV waste in the immediate future (Solar Power Europe, 2024). In this context, the implementation of circular economy principles permits adequate material recovery at EoL, combining the benefits of decarbonization during the operational phase.

This study aims to demonstrate the importance of the materials involved in the production of a PV panel and the potential that Italy has in using circularity principles in this sector. An appropriate recovery and reuse of such materials from decommissioned PV plants, in fact, would allow for savings in raw materials and reduce the environmental impact related to their disposal.

There are several PV technologies available on the market or in the prototype stage. The types of PV modules are divided into first, second, and third generation. The first generation includes crystalline silicon (c-Si) modules, differing into monocrystalline (mc-Si) and polycrystalline (pc-Si). The first generation represents approximately 90% of the current market. The monocrystalline silicon cell is the most efficient (25%), compared to the polycrystalline one (18-20%), despite having the same composition in terms of materials. The second generation includes amorphous silicon (a-Si) and thin film modules (e.g. CIGS and CdTe), with lower efficiencies (15%), but greater lightness and flexibility. The third generation is still in the experimental phase, and combines silicon with other materials (e.g. PERC and tandem cells) (Lunardi et al., 2018; Sim et al., 2023).

A photovoltaic panel is made up of elements assembled together, involving materials of different economic values. The main materials are glass (70% by weight), aluminium (15%), polymers (9%), silicon (5%), and copper (1%). There is also silver, representing a small fraction by weight (0.07%), but constituting 47% of the total economic value of the panel. On the other hand, glass dominates by weight, but contributes only 7% of the value. The photovoltaic cell also contains strategic materials such as silicon, indium, gallium, and germanium, essential for advanced solar technologies (Solar Power Europe, 2024).

Considering such aspects, the study presents the regional distribution of photovoltaics in Italy. Territorial differences are highlighted, starting from the data on installed power in the territory (source: Energy Services Operator, GSE). Successively, a methodology is proposed for calculating the flows of materials used in modules installed up to 2023, divided by technology and region. The useful life of a PV module is estimated at 25 years, but the failure mode of a panel is not pre-established, rather following a probabilistic distribution. A prediction of the quantity of PV modules that will reach the EoL in the coming years is made by using a statistical methodology that takes into account forecasting scenarios (i.e. Early Loss, Regulary Loss and EUWEEE), based on the probabilistic Weibull distribution (Kastanaki et al., 2022; Franzoni et al., 2024).
Each scenario has different failure probabilities over time. The prediction scenarios are adapted to the Italian context and allow to evaluate the temporal evolution of the quantity of photovoltaic waste, from 2008 to 2040. The results show a significant production of waste from crystalline silicon modules, in particular pc-Si modules have a higher distribution in the regions of northern Italy, reaching a total of 80,000 tonnes in 2040, followed by the regions of southern Italy with approximately 60,000 tonnes. The regions of central Italy present lower values of expected photovoltaic material (40,000 tonnes). This is due to the less accentuated installations and the more limited geographical extension of central territory. Technologies belonging to the second generation of PV involve the production of almost 600 tonnes of material from amorphous silicon in northern Italy, and approximately 500 tonnes in the south of the country, and a minor quantity in the central zone. According to the statistical model, over 3,000 tonnes from thin film modules are expected in northern, 1400 tonnes in central, and 4,000 tonnes in southern regions. Considering the growing trend in installations, the probabilistic model shows the evolution up to 2040 with over 260,000 tonnes of total photovoltaic material to be disposed.
In 2025, the statistical model shows quantities of PV waste approximately equal to 20,000 tonnes.
In summary, the results of the study are useful to:

- provide a methodology for quantifying the material installed on the territory and statistical tools for understanding future scenarios in terms of material flows and waste generation;
- distinguish the contribution to the formation of material flows by type of module and by geographical area.

Italian regions are going to be highlighted for the potential in terms of recovery of decommissioned photovoltaic material and the possible creation of dedicated recycling farms. The topic would promote a new economic system based on the reuse of EoL panels or valuable materials from used PV modules, creating new jobs and discouraging the expensive importation of raw materials.

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THE WATER PARADIGM SHIFT FOR LOCAL AND GLOBAL CLIMATE SECURITY

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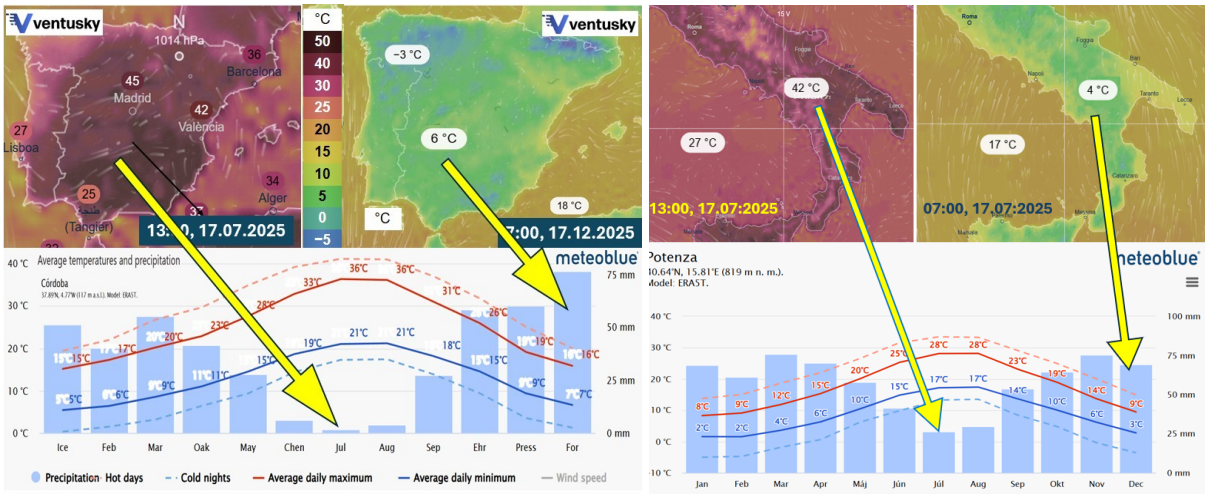
Water constitutes the fundamental connective medium of the Earth system, linking catchments, vegetation, soils, rivers, and the atmosphere through tightly coupled biophysical and thermodynamic processes. However, dominant climate paradigms implicitly assume that the continental branch of the hydrological cycle is macroscopically stable and that anthropogenic influence primarily affects atmospheric radiative forcing rather than the structural integrity of regional water cycles [1,2]. Within this framework, hydroclimatic extremes are interpreted largely as consequences of greenhouse gas–driven warming, while land-surface processes are treated as secondary modifiers.

This paper challenges that reductionist assumption and argues that large-scale land-use transformation has fundamentally altered land–atmosphere coupling, moisture recycling ratios, and boundary-layer dynamics across continental interiors [2,3,4,5]. Drainage of wetlands, deforestation, agricultural intensification, river channelization, and urban soil sealing have collectively reduced soil water storage capacity, accelerated runoff, shortened water residence time, and weakened groundwater–surface water interactions [1,7,9]. These structural changes modify surface energy balance partitioning by decreasing latent heat flux (LE) and increasing sensible heat flux (H), thereby amplifying land-surface temperatures and altering atmospheric stability regimes [2,3,4].

Declining evapotranspiration fluxes directly affect atmospheric moisture availability and reduce the continental moisture recycling ratio—the proportion of precipitation derived from terrestrial evapotranspiration rather than oceanic sources [3,5]. As evapotranspiration weakens, boundary-layer humidity decreases, cloud-base formation heights rise, and convective initiation thresholds become more difficult to reach [2,4]. The suppression of cloud formation reduces regional precipitation feedbacks, particularly during warm seasons when local recycling plays a dominant role in sustaining rainfall. Consequently, continental interiors experience declining summer precipitation, increased vapor pressure deficit (VPD), enhanced vegetation stress, and escalating wildfire risk [1,2,4,9].

Simultaneously, drainage infrastructure and river regulation systems export precipitation rapidly to oceans, bypassing terrestrial retention and atmospheric re-evaporation pathways [1,7]. This redistribution disrupts small water cycles—defined as regionally closed evapotranspiration–condensation–precipitation feedback loops—and weakens their thermoregulatory function. Over desiccated landscapes, increased sensible heat flux intensifies near-surface thermal gradients, promoting the formation of persistent thermal low-pressure anomalies. These “thermal domes” or mesoscale heat islands alter local circulation patterns and inhibit condensation processes, including horizontal precipitation such as dew

formation [2,4]. The positive feedback between soil desiccation, increased albedo variability, and surface overheating reinforces hydroclimatic instability [1,2,5].
Seasonal land–sea thermal contrasts further modulate this destabilized system. In mid-latitude coastal regions, when winter land-surface temperatures fall below adjacent sea surface temperatures, strong baroclinic gradients can enhance cyclogenesis and trigger extreme precipitation events [6,5]. Landscapes with diminished infiltration and retention capacity are unable to buffer these high-intensity rainfall pulses, leading to increased flash-flood frequency. Thus, the same regions may simultaneously experience prolonged summer drought driven by reduced moisture recycling and intensified winter precipitation driven by amplified thermal gradients—a manifestation of seasonal hydroclimatic asymmetry linked to altered surface energy flux partitioning [3,4,9].
Empirical evidence from paleoecological reconstructions and modern hydrological observations supports this interpretation [6,7]. Multi-millennial pollen-based reconstructions in Eurasian regions demonstrate tight coupling between vegetation structure, soil moisture regimes, and climatic stability [6]. Contemporary 20th-century hydrological analyses in Central Europe reveal correlations between landscape drainage intensity, declining soil water storage, increasing runoff coefficients, and rising seasonal precipitation variance [1,9]. In Mediterranean basins, surface temperature mapping and precipitation records indicate strengthening summer desiccation alongside more concentrated winter rainfall, consistent with weakened evapotranspiration-mediated cooling and altered boundary-layer humidity dynamics [2,4].



Character of land surface temperature and precipitation during the year in Cordoba (Southern Spain) and in Potenza (Southern Italy), Sources www.ventusky.com, www.meteoblue.com

These findings suggest that terrestrial freshwater reserves are not passive storage components but active regulators of continental energy redistribution and atmospheric moisture supply. Rainfall over land is sustained partly through internal recycling mechanisms, and its persistence depends on sufficient evapotranspiration fluxes maintained by ecosystem-based retention [1,3,5]. When soil–vegetation–atmosphere coupling weakens, hydroclimatic feedback loops destabilize, and precipitation regimes shift toward greater temporal concentration and spatial variability [4,5,9].
We therefore propose a water paradigm shift grounded in restoration of land–atmosphere coupling through ecosystem-based rainwater retention at the catchment scale [1,7,8,10]. Increasing distributed water storage in soils, wetlands, forests, and regenerative agricultural systems enhances infiltration, prolongs water residence time, and restores evapotranspiration fluxes [2,9,10]. Strengthening latent heat exchange stabilizes boundary-layer development, reduces extreme surface heating, moderates vapor pressure deficits, and supports convective precipitation recycling during warm seasons [3,4]. Simultaneously, enhanced infiltration and soil storage attenuate peak runoff during cold-season cyclonic events, reducing flash-flood risk [9].

Reframing water management in this manner positions hydrological restoration as a core climate stabilization strategy rather than a peripheral adaptation measure [1,7,10]. In a context of global population growth and intensifying land degradation, continued adherence to the conventional paradigm—focused primarily on engineered extraction and redistribution—risks further weakening continental moisture recycling and amplifying hydroclimatic extremes [1,2,5,9]. Environmental destabilization may cascade into water scarcity, food insecurity, ecosystem collapse, and socio-political instability [1,7].
Achieving local and global climate security thus requires integrating hydrology, boundary-layer meteorology, ecosystem ecology, and thermodynamics into water governance frameworks [2,3,5]. Recognizing and restoring the climatic function of small water cycles is essential for maintaining stable precipitation regimes, moderating land-surface temperatures, and sustaining the biosphere's resilience under accelerating climate change [1,3,4,10]. The proposed paradigm shift redefines water not only as a renewable resource but as a dynamic regulator of Earth system stability [1,7,8].

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How to restore biotic regulation in the Lake Naivasha Catchment?

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Throughout the Lake Naivasha Catchment (Kenya), regulatory ecosystem services ensuring biotic regulation were disrupted by direct human impact, as well as by indirect anthropogenic causes. We promoted restoration initiatives, to support the resilience of local ecosystems.
Over the past 100 years or so, anthropogenic impact upon Lake Naivasha has turned it into a 'novel ecosystem i.e.: a system characterised by a combination of species (and/or their abundances) never observed before in the ecosystem's previous history with the establishment of a new ecological dynamic equilibrium. Major drivers of change did not include severe anthropogenic pollution or a decline in water resource availability, as could have been expected, but two highly influential processes that proceeded in parallel:

1) Wood extraction from surrounding mountain forests, deforestation of stream riparian zones, and clearing of the lakeshore papyrus swamp radically affected the structure of the catchment's vegetation (Pacini, Giberti & Harper 2024) and hence rainfall.
2) Spread of directly and/or indirectly introduced alien invasive aquatic mammals, fishes, crustaceans and molluscs, entirely restructured aquatic trophic chains and affected the human use of the catchment's resources.

A new composition of plant assemblages developed, along a change in the dominant life-form and in the physical structure of ecosystems (i.e., for example from forest to pasture, from wooded savannah to a semi-desertic bushland, from riparian wetland to farmland); this modified the temperature regime of the whole catchment as a consequence of a steep decrease in evapotranspiration. Degradation of the Small Water Cycle (sensu Kravčík, et al. 2008) of local evaporation-condensation-precipitation cycles weakened biotic control over hydrological processes. Land-to-water fluxes became more intense, timing of runoff response to precipitation sharply decreased, and this increased upstream erosion and downstream sedimentation, in parallel to nutrient accumulation in receiving aquatic ecosystems.
The principles of ecohydrology (Zalewski et al., 2008) provided a theoretical background highlighting the crucial role of native plant communities (Papyrus swamps, Acacia riparian forest, Red Cider mountain forest) and guided the prioritisation of activities. Pilot demonstration projects were implemented to rationalise the management of wetlands, to support the renewal of native riparian zones and forests, to treat used water, and to stop

erosion (Wanjala et al. 2018). Ecohydrology principles may be adopted as a general paradigm to interpret ecosystem functioning, evaluate the performance of ecosystem services, design impact mitigation measures and/or measures for ecosystem service enhancement. Designing ecohydrological solutions for the novel Naivasha ecosystem implied developing strategies aimed at three parallel objectives:

1. *wise use* of the new opportunities offered by the Lake Naivasha ecosystem under present conditions for its sustainable utilisation.
2. restoration of its previous ecological state as far as it is possible. The principles of Ecohydrology guide strategies to optimise immediate benefit in the perspective of longer-term sustainable development (restoration of the Small Water Cycle).
3. development of new Nature-based Solutions for improved water storage and water treatment in the whole catchment, which will themselves contribute to 2.

The wise use of "novel" as well as "old" provisional ecosystem services led us to propose adjusted management measures related to Carp, Tilapia and Catfish fisheries, water abstraction and water harvesting, controlled Papyrus harvesting, expansion of the North Papyrus Swamp, restoration catchment wetlands for water supply and erosion control, reducing erosion by means of targeted reforestation measures, development of artificial wetlands on the shores of the lake to support sediment filtration and water quality enhancement.

Figure. A restored wetland in the Middle Naivasha catchment

Next to field-based research and development initiatives, we address the social challenge posed by these measures. The implementation of ecohydrological tools necessarily impacts on the competition for space and for resources between economic sectors. Without the active mobilisation of Social Capital it may be impossible to create sufficient momentum for protecting Natural Capital; neither it can be possible to evaluate and compare alternative management options. Social ecohydrology includes three essential components (Harper, Zalewski, Pacini 2008):

a) Awareness of key cause-effect linkages underlying sustainability
b) Participation in establishing what values should be protected
c) Trade-offs in resource use to maximise overall benefits

Tools to integrate society within an Ecohydrological framework, included the following examples: Through a cooperation established with the Naivasha Environmental Conservation Center (NECC) of Ndabibi, hundreds of farmers were trained on sanitation, water abstraction and use, sustainable agriculture, wise use of ecosystem services. Through a collaboration with ENKI o.p.s. (Czech Republic) and Czech national broadcasting, students from local universities were trained in developing documentary films on subjects selected from around the catchment area. Some of these were broadcasted at national level, others were shown during public meetings and in buses transporting flower farm workers to and from their

place of work. Water Resource Users associations (Kenyan Water Act, 2006), competent grass-root resource users organisations were approached and involved through meetings, whole catchment workshops, on-site restoration works, reforestation projects. Payment for Ecosystem Service programmes were publicised, to mobilise large horticultural growers to support farmers in the steep-sided upper catchment to undertake sediment control measures, within a realistic water user perspective.
As contribution to the ECOPIA Network debate, we stress that the recognition of the power of biotic control and of key regulatory ecosystem services provided by vegetation is paramount to provide a meaningful sense to the concept of Sustainable Development. The social awareness of the key role of vegetation in stirring the Water Cycle is a major challenge in ecosystem restoration, and it must be purposely addressed to ensure restoration success.

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Ecosystem transition for planning of multifunctional green solutions

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Contemporary urban realities are called upon to face crises of different natures, which generate diverse transformations of their territories and a significant decrease in urban liveability. The critical dynamics affecting cities are so far only partially recognised, despite extensive scientific production on the subject, and, in general, are linked to the intensification of extreme weather events, the growing loss of biodiversity, and the rise in air pollution levels. Furthermore, the set of environmental criticalities is accompanied by conditions of fragility closely linked to the social and "spatial-territorial" sphere, such as the increase in inequalities in access to quality public services and spaces and the reduction in the degree of well-being of citizens. In light of what has been introduced, it can be deduced that such critical situations should not be interpreted as isolated phenomena, but as expressions of structural alterations that contextually involve the ecological and socio-economic dimension of urban development. Therefore, it is essential to implement territorial planning and management strategies capable of addressing crises structurally, thereby overcoming the limits of traditional approaches characterising the discipline, such as a single-sector focus and fragmented interventions. Urban policies, in fact, must be based on integrated and long-term visions to guarantee actions that effectively address current and future critical issues, making cities more sustainable, liveable and resilient. In addition, the will to ensure a suitable transition of ecosystems, placing them at the centre of the various decision-making processes, must emerge in these policies. In general, various measures capable of supporting urban contexts in mitigating the effects of crises and preventing the creation of new critical conditions are recognized and, in this contribution, attention is paid to the priority role played by interventions for the improvement and enhancement of urban greenery, which also aim to concretise the green ecosystem transition of cities. In particular, the latter is pursued through multidimensional strategic approaches aimed at enhancing existing green areas and integrating new vegetation into the urban fabric, in a vision that includes suitable planning, design and management activities. Furthermore, this transition is not configured exclusively as a quantitative increase in the green component of cities but represents a process in which the quantity and multifactorial quality of urban greenery cooperate synergistically to respond to contemporary environmental and socio-economic needs. With reference to the aspects introduced, green areas are considered fundamental resources capable of increasing environmental sustainability and improving the quality of life, performing ecological, aesthetic and recreational functions. In addition, green infrastructure, as reported by European Communication and considering a broader vision of the topic, generates advantages in multiple key areas. Specifically, reference is made to the enhancement of natural capital, the protection of biodiversity and ecosystem services, the increase in human health levels,

sustainable soil management and climate adaptation. Therefore, based on these last observations, it is immediate to understand how urban greenery can become a generator of useful experiences to respond to current crisis systems, contributing to the achievement of a suitable balance between territorial development and environmental protection and to the creation of inclusive realities. The translation of the potential of urban green spaces into concrete benefits is implemented through specific planning processes, and, in fact, the discipline of urban and territorial planning is called upon to define a strategic vision that ensures the integration of green spaces within urban policies and territorial government tools. This contribution aims to introduce the key elements of a study developed as part of a research project connected to the Italian National Recovery and Resilience Plan (called PNRR). Specifically, this project, conducted under the scientific supervision of Prof. Annunziata Palermo, is funded by Ministerial Decree No. 629/2024 (Next-GenerationEU - PNRR). The study aims to analytically support the planning processes of multifunctional green infrastructures by local administrations, thus increasing the quality of urban facilities in terms of ecological efficiency and liveability for inhabitants. Specifically, attention is focused on the definition of interventions compatible with the action strategies of the so-called “green plans”.

In general, the latter, introduced by the national guidelines for the management of urban green spaces (2017) and recognised at various regional levels, are strategic planning tools useful for promoting the functionality of urban green areas, of a sectoral nature, voluntary and integrative to general urban planning. This plan represents the main tool for defining the future structure of green infrastructure of cities, through the creation and systematic management of suitable green areas. The basic principle on which the green plan is based concerns the creation of the “green profile” of the urban context of reference, considering the naturalistic component associated with it and the provision of urban greening interventions in a medium-long time horizon.

As previously introduced, the research activity focuses on the implementation of urban greenery in line with the provisions of the aforementioned plans, but, in addition, aims to tend towards a vision in which green solutions take on greater weight in planning choices, to overcome the thematic sectorial of urban planning tools and ensure the introduction of devices capable of organizing and managing cities sustainably.

Urban green planning processes, therefore, must involve interdisciplinary approaches to integrate the environmental, social and economic dimensions of cities. In this perspective, the definition and planning of multifunctional green solutions must be based on multiple interconnected aspects: the protection and enhancement of ecosystem services, adaptive planning aimed at climate resilience, the reduction of land consumption, the regeneration of degraded areas, the promotion of the active participation of citizens, the creation of suitable conditions for access and usability of public spaces and the improvement of human health.

At the European and national level, various green plans have been developed, which, in general, present different objectives and strategies for actions consistent with their territories. Furthermore, only a few urban realities have demonstrated the ability to transversally integrate the theme of greenery within urban planning. In detail, the city of Valencia (Spain) and the Municipality of Trento (Italy) have translated the local territorial government strategies and operational guidelines into concrete and multifunctional interventions, thus ensuring an effective synergy between the implementation of the green component and the aspects closely related to the environment and the socio-economic sphere. The analysis of the elements that form the green plans of the two realities introduced confirms how green urban planning, through the adoption of interdisciplinary and integrated approaches, can constitute an urban governance tool capable of contributing positively to urban transformations and adequately coping with the crises that affect contemporary cities, creating opportunities for growth, well-being and social cohesion. Furthermore, through critical assessment of these elements, it is possible to identify good practices that, appropriately contextualised, can be adopted and implemented in other urban contexts and contribute to the definition of one’s own green plan.

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Biodiversity and agro-biodiversity for climatic resilience promotion in rice farming

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Michele Salvan Ph.D. project, fruit of the collaboration between the Department of Life Science and Systems Biology of University of Turin and the non-academic Rete Semi Rurali (RSR) Community Seed Bank (CBS), explores the relationship between natural and agrobiodiversity. The major goal is fostering diversity at various levels, ranging from rice Heterogeneous Organic Materials and low input rice cultivars (cv), promoting on the long term diversified and resilient rice farming systems. In particular, this work aims to analyze rice cultivation systems at different scales (landscape, farm, field, and crop practice). The analytical part then intends to study the complex interactions between the environmental matrix and the set of field management and cultural practices that make up the agro-ecosystems in their entirety. Further elements of analysis involve the assessment of the role of low-impact farm-specific practices, and that of diversification at crop and varietal levels. This implies the assessment of rice agro-ecosystems with substantially different rice farming methodologies, both conventional and organic, and the selection of suitable genetic material for low input and more sustainable rice production. More specifically the thesis has been developed in three specific chapters, with specific sub-goals: a) The first paper (Chapter II) was characterized as a review work, able to unite and evaluate the themes of rice varieties and fields options diversity, and that of biodiversity, and not only of arthropods, associated with humid areas, through an enlarged panel of experts, assessing the impact of the crop on the production and cultivation cycle of rice with an innovative Multi Criteria Decision Aiding (MCDA) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approaches. The paper is structured through analytical and decision-making methods so that a comprehensive picture can be obtained of the structure of the various operational components in the field, as well as of the specific impacts along the production chain. The objectives were manifold: 1) To assess the impact of individual practices associated with rice cultivation, directly and indirectly, on the biodiversity associated with wetland substitution areas; 2) To assess the role of agrobiodiversity, in varietal, botanical and crop system terms on the overall quality of the rice agrosystem and biodiversity; 3) To define an ideal operational protocol according to different production scenarios, environmental context and conservation priorities; b) The second paper (Chapter III) focused on the multi-scale impact (landscape, farm, and field) in the Italian rice district, comparing two-way production realities, rice organic farms, experiencing rice dynamic populations, with conventional farms. The presence of plots containing rice HOM, although of small size, was considered and evaluated within the research. The study was structured on a double perspective: a) daily sampling of butterflies and dragonflies, used as a proxy for biodiversity in the rice-growing areas; b) the development of a pool of literature-based indicators, to assess environmental quality on a broader scale. The objectives were manifold: 1) To assess the scale gap in impact and damage mitigation, as well as the role of the surrounding environment; 2) To identify key areas for promoting or reducing the biodiversity associated with wetlands. c) Chapter IV: Third paper (Chapter IV) is focused on the role of seed banks, in the context of Italy and Europe, both at the technical support level, as a source of diversified seeds, and also for their social role economically and representative of farmers' interests within the context of agro-biodiversity. The objectives were manifold: 1) To assess the impact of individual practices associated with rice cultivation, directly and indirectly, on the biodiversity associated with wetland substitution areas; 2) To assess the scale gap in impact and damage mitigation, as well as the role of the surrounding environment; 3) To assess the role of agro-biodiversity, in varietal, botanical and crop system terms on the

overall quality of the rice agro-ecosystems and biodiversity; 4) To identify key areas for promoting or reducing the biodiversity associated with wetlands; 5) To define an ideal operational protocol according to different production scenarios, environmental context and conservation priorities. d) Ph.D. Thesis General Perspective and Aims Current Ph.D. Thesis objective is also strengthening awareness of biodiversity's different components and associated values.. Therefore dissemination of results through public activities such as conferences, lectures, and bioblitz, in addition to posters and dedicated articles, will be a substantial part of current research work. It therefore makes sense to think about rice cultivation systems within the relationship between natural and agro-biodiversity through the lens of a multiple-choice system. A further final goal is to propose a feasible multi-scale action strategy aimed at defining a common technical approach for farmers, experts and public decision-makers. Therefore a decision-making tool, albeit indicative, and relatively easy to use can be considered final Ph.D. thesis'outcome. This can be useful to propose and promote good agricultural practices in the definition of Rural Development Plans (RDPs), helping farmers, technicians, political decision makers, activists and other stakeholders to include literature based farming practices to support and foster biodiversity within local RDPs.

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Lake Chapala and Water-Linked Territories in Comparative Perspective: Biocultural Landscapes, Just Transition, and Resilient City-Regions

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Water-linked territories are among the most vulnerable socio-ecological systems in the contemporary world, simultaneously exposed to climate change, extractive pressures, accelerated urbanization, and structural governance deficits. Lake Chapala, the largest freshwater lake in Mexico and the hydrological backbone of the Lerma–Chapala basin, offers a paradigmatic case of these compounding crises. This contribution presents the research and pedagogical framework developed by LABTER (Laboratory of Territory, Heritage and Landscape), positioning Lake Chapala within a comparative international perspective to explore integrated pathways toward livable and resilient water-dependent city-regions.

Socio-environmental crisis in Lake Chapala: beyond water scarcity

The ecological degradation of Lake Chapala cannot be reduced to a water quantity problem. It is the material expression of decades of structural imbalances in land use, resource governance, and socio-spatial development. The lake supplies approximately 60% of the drinking water for the Guadalajara Metropolitan Area, home to over five million people, while simultaneously sustaining traditional fishing communities, irrigated agriculture, and a tourism economy whose growth has dramatically transformed shoreline landscapes and displaced long-standing local practices.

Pollution from agrochemical runoff, industrial effluents, and inadequately treated urban wastewater has severely degraded water quality, collapsing fish stocks and threatening the livelihoods of riparian communities that historically depended on the lake's ecological productivity. The accelerated proliferation of water hyacinth (*Eichhornia crassipes*), favored by eutrophication, has further disrupted aquatic ecosystems and obstructed artisanal fishing. Meanwhile, uncontrolled urban expansion along the lakeshore, driven by real estate speculation and retirement tourism, particularly from international migrants, has generated profound socio-spatial tensions: rising land values, displacement of indigenous and mestizo communities, loss of vernacular architectural heritage, and the progressive commodification of a landscape that had historically been constituted through generations of biocultural interaction.

These dynamics are not merely environmental: they are expressions of hydro-social conflict (Swyngedouw, 2009), where differential access to water, land, and territorial resources reflects and reproduces deep inequalities. The governance architecture compounds these vulnerabilities: the lake basin spans multiple municipalities across two states (Jalisco and Michoacán), managed through fragmented and poorly coordinated institutional arrangements. Decision-making processes remain largely centralized and sectoral,

disconnected from the complex socio-ecological realities of the territory and from the communities most dependent on it. This institutional fragmentation undermines adaptive capacity and perpetuates the conditions of crisis rather than transforming them (Ostrom, 2010).

Biocultural landscape as an integrating framework

In response to this complexity, LABTER advances the concept of biocultural landscape as both an analytical and operational framework. This concept rejects the separation between nature and culture, understanding landscapes as dynamic co-productions of ecological processes, human practices, material transformations, and accumulated meanings. In Lake Chapala, the biocultural landscape encompasses wetland and lacustrine ecosystems, traditional fishing and agricultural knowledge, indigenous heritage, vernacular built environments, and collective place-based identities, all of which are under simultaneous threat.

Integrated landscape management, conceived within this biocultural framework, proposes a shift from sector-by-sector interventions toward territorially coherent strategies that simultaneously address ecological restoration, cultural heritage conservation, livelihood diversification, and spatial equity. Concretely, this implies developing landscape planning instruments that recognize the lake and its surroundings as a living cultural landscape, subject to heritage-based protection frameworks that can constrain speculation, guide tourism development, and support community-based resource management. It also implies the articulation of ecological corridors connecting the lake with surrounding agricultural and forest systems, and the recovery of traditional ecological knowledge as a legitimate input into conservation and management decisions.

Participatory models and pedagogical–research interface

A defining methodological feature of the LABTER framework is its commitment to participatory and co-productive research. The project integrates qualitative and spatial methods, including GIS analysis, landscape metrics, remote sensing, stakeholder network analysis, and participatory mapping, with community-based co-design processes that actively involve fishing cooperatives, indigenous communities, municipal governments, civil society organizations, and academic institutions.

A distinctive mechanism for operationalizing this approach is the PAP LABTER (Professional Application Project), which mobilizes interdisciplinary undergraduate students from architecture, landscape design, environmental studies, engineering, law, tourism, and social sciences in structured fieldwork and community engagement. Students contribute to territorial diagnostics, participatory cartography, and the co-design of landscape and governance interventions, functioning as a bridge between academic research and social learning. This pedagogical–research interface not only strengthens the empirical base of the project but also builds local capacity and sustains long-term relationships with communities; relationships that are foundational to the legitimacy and effectiveness of participatory planning processes. These participatory methodologies serve a political function as well: they generate co-produced knowledge that challenges technocratic and top-down planning rationalities, creating counter-maps, community narratives, and alternative territorial visions that can feed into formal policy processes or support advocacy and community self-organization.

Comparative perspective and contribution to ECOPÌA

The LABTER framework is embedded within a structured comparative international design involving lake and river-basin territories in Italy, Spain, Colombia, Ecuador, and Argentina. This comparative architecture allows the identification of shared structural patterns (e.g. governance fragmentation, tourism-driven displacement, heritage loss, ecological degradation) alongside context-specific divergences in institutional capacities, cultural configurations, and adaptive strategies. Rather than seeking universalizable solutions, the comparison produces grounded learning that is transferable across different socio-ecological and political contexts.

By positioning Lake Chapala simultaneously as a critical hotspot of socio-environmental crisis and as a territory with significant biocultural potential for collective recovery, this contribution offers the ECOPÌA network an empirically grounded, methodologically transferable, and politically engaged research framework. It demonstrates how integrated landscape management, linking ecological restoration, heritage-based spatial planning, participatory governance, and just transition policies, can constitute a concrete and place-sensitive response to the overlapping crises facing water-dependent city-regions globally.

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Innovative approaches for the sustainable extraction of microbial oils and their subsequent conversion into derived biofuels

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Despite the implementation and widespread dissemination of policies on environmental sustainability and the conscious and efficient management of atmospheric pollutants, global greenhouse gas emission trends continue to rise, a symptom that again the world population is not all proceeding in the same direction. Road and air transport, still largely dependent on fossil fuels, contributed approximately 37% of global CO2 emissions as of 2021 (Ambientale, 2025), and significant percentage increases have been recorded in the following years, as showed by *Matura A. et al.* documenting that the transport sector accounted for 7.97 gigatons of CO2 emissions in 2022 (Ashish Matura, 2025). It is necessary to research, produce, and implement new tools that are truly effective, applicable, and sustainable to convince the entire global population that it is possible to protect nature, and consequently humanity, by using new natural resources and alternatives to fossil fuels. It is essential to create a new dependency: one based on bio-derived fuels. The production of biofuels starting from microbial oils, also know as Single Cell Oils (SCO) represents an innovative and renewable approach to replacing fossil fuels.
Microbial oils have a chemical composition similar to that of vegetable oils and are produced by specific microorganisms, such as bacteria, microalgae and oleaginous yeasts. Among these, yeasts are of particular interest due to their ability to grow on diverse carbon sources and accumulate high quantities of lipids *(Caporusso A., 2021).* The chemical composition of the oils consists of a mixture of saturated free fatty acids (FAs), polyunsaturated fatty acids (PUFAs), and triglycerides (TAGs), making them a suitable raw material for biofuel synthesis. However, the economic feasibility of biofuels from microbial oils remains a major barrier to large-scale commercialization. The cost of commercial glucose can account for up to 40% of total production costs, driving research toward low-cost carbon sources, such as agri-food residues and lignocellulosic biomass. Additionally, high costs associated with lipid extraction and the environmental impact caused by organic solvents represent a critical topic of research. In fact the most widely used methods for lipid extraction derived on volatile solvent systems based on chloroform-methanol mixtures, which pose significant concerns in terms of safety, environmental impact, and sustainability.

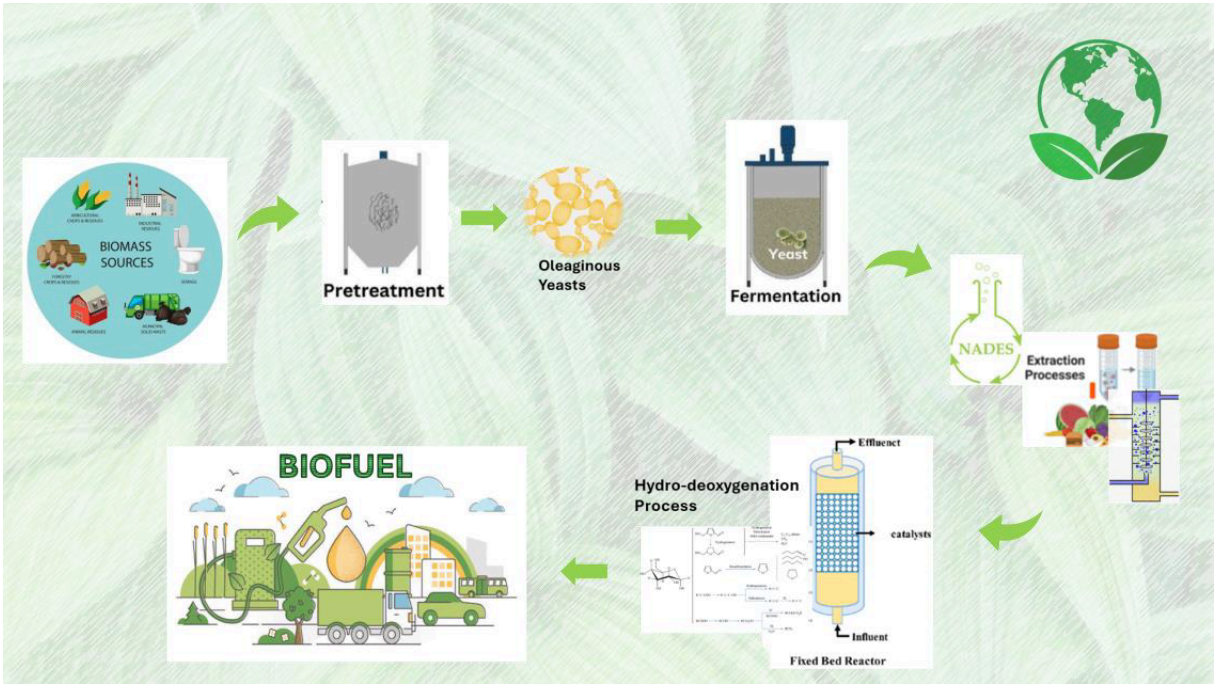

Figure 1:Production process of biofuels from microbial lipids produced through biomass fermentation with oleaginous yeast strains.

The aim of this project is to optimize microbial lipid extraction through the development of innovative and scalable extraction methods that reduce environmental impact, improve process efficiency, and enhance lipid recovery yields, in line with green chemistry principles. Among the various applicable extraction techniques, green solvents such as NADESs (*Natural Deep Eutectic Solvents*) are chosen. Their components, a hydrogen bond donor (HBD) and a hydrogen bond acceptor (HBA), are derived from naturally available sources. These solvents offer excellent extraction capabilities, are eco-friendly, biodegradable, and possess good thermal capacity. However, it is essential to control their viscosity and polarity to obtain a liquid mixture that is highly selective toward microbial oils. Glycerol will be used as the HBD component, while choline chloride or other sustainable alternatives will serve as the HBA. Glycerol is derived from vegetable oils and fats, whereas choline chloride (ChCl) is sourced from wheat and legumes. Once the solvent is prepared, the extraction process will be implemented on a thin-film filter extraction column. Following extraction, the mixture will be purified to separate the target component from the solvent using sustainable methodologies. The next step involves the catalytic conversion of the extracted oils into biofuel, with a focus on biokerosene. The process consists of catalytic hydrogenation of the oil and the subsequent removal of polluting heteroatoms (oxygen, sulphur, nitrogen), which are responsible for low-quality fuel production. The catalyst employed is metallic with partial acidic character to promote hydrogenation and subsequent isomerization, improving its cold-flow properties. Specifically, Ni/Al-MCM-41 will be used, and NiMo/Al-MCM-41, CoMo/Al-MCM-41, CoMo/SBA-15, and NiMo/SBA-15 will also be tested. Furthermore, the advantages of hierarchical catalytic structures (mesopores - micropores) will be exploited, such as increased selectivity, improved molecular diffusion, and greater accessibility, to promote hydrogenation and isomerization while controlling coke formation.

Before testing the catalysts, they must be characterized morphologically, structurally, and functionally. The characterization includes: *XRD analysis*, *TGA analysis*, *porosimetry analysis*, *TPR analysis*, *FT-IR analysis*. The first two characterization techniques are performed on the catalyst as prepared (*As made*) and after calcination, while the remaining analyses are conducted on the calcined catalyst. The oil hydrogenation reaction will initially be performed at a laboratory scale in a fixed-bed batch reactor. The output stream will be a hydrocarbon mixture, which will be analysed to identify the types of molecules present and modified to reach the desired product target: a hydrocarbon chain length of C10-C14, high thermal and chemical stability, and good cold-flow properties.

The resulting fuel will be green and sustainable, as environmental sustainability is prioritized throughout all production phases. Furthermore, the objective is to integrate the biofuel into a circular biorefinery vision, minimizing (and nearly eliminating) process waste while economically and sustainably valorising each by-product. This approach promotes a circular economy, aiming to obtain a product that can truly replace fossil fuels through a sustainable process.

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The Urban Bio-Region as a model and process: legal readings and institutional Tools for Land Resource Management. Hypotheses for the Crati's Urban Area

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Context analysis
Over the past seventy years, urbanization, based on a center – periphery model, has favored the increase of asymmetries due both to the concentration (population, economy, services) in urban/periurban areas and to the abandonment and marginalization of rural/inland areas.
Very often, in fact, spatial planning is modulated to respond to the growing productive needs of the economic system, where urban areas are organized for "working citizens" who require tertiary services (administrative offices, schools, hospitals, banks and shopping centers).
As a result, contemporary urban areas are devoid of identity characteristics from an architectural – urban, cultural, landscape and environmental point of view, with extremely negative economic and social impacts for housing settlements and their inhabitants. In particular, the erosion of natural resources, due to indiscriminate land consumption, excessive abstraction of available water, pollution and waste production (approximately ¾ of global resources are consumed by urbanized contexts), generates recurring situations of environmental risk and food insecurity (food safety and food security).
Growing concerns at various institutional levels about the unsustainable conditions facing metropolitan areas have led, thanks also to extensive scientific literature, to the development of numerous policy documents aimed at identifying new policies and regulatory tools. These include OSS Nos. 11, 12 and 13, contained in Agenda 2030, which define an integrated planning and governance system that includes profiles of urban regeneration, sustainable management of resources, green infrastructure, reduction of food losses along production and supply chains. The same approach (holistic and multidimensional) found its way into the F2F and Biodiversity strategies of the European Green Deal, calling for the creation of sustainable and resilient production systems (short supply chains, local and interconnected urban and rural areas) and the restoration of ecosystems (ecological corridors, greening plans).

Thesis and argumentations
The context just described calls for a legal rethinking of the institutional tools for managing territorial resources through a *territorial project that aims to address in an integrated way the economic, political, environmental and housing components of a socio-territorial system that pursues a 'coevolutionary balance' between human settlement and the environment*.[1]
The approach underlying the theory of the Urban Bioregion aims to build a circular local system where common goods (agro – environmental) are managed both through forms of self-government that ensure the well-being of communities in the area and through multifunctional redesign of open spaces (agroforestry, riverine, naturalistic).
The translation into legal terms of these aspects requires reflection on the existence of some elements:

- *on a publicistic level*, of organizational forms at the territorial level (Consortia and Unions, Programme Agreements, see Articles 30, 31, 32, 33 and 34 TUEL) and of planning tools (River Contracts) capable of ensuring an integrated administration of the territory, with particular regard to ecological needs.
- *on the private*, associative, contractual and partnership level (Biodistrict, Biological Districts, River Contracts, see art. 13 Law 9 March 2022, n° 23 and Ministerial Decree of the Ministry of Agriculture, Food Sovereignty and Forestry of 28 December 2022, River Contracts art. 68-bis of the Legislative Decree. 152/2006 Board of Directors) for the establishment of agri – environmental supply chains that sustainably use natural resources, stimulating and promoting a territorial approach.

In this regard, it should be noted that, over time, the contribution of agricultural activity to the governance of the territory has assumed increasingly defined profiles due to the services it offers through the maintenance of ecosystems and the protection of biodiversity, in addition to the guarantee of food security (Agenda 2000 introduced the concept of multifunctional agriculture at European level, later incorporated into the Italian legal system with the Legislative Decree. 228/2001).
Therefore, the positive externalities produced by agricultural enterprises, emerging from a purely rural dimension, reach urban and peri-urban areas with the aim of rebalancing the territorial system, as in the case of Biodistricts or Biological Districts, whose circular economy aims are focused on the integration of environmental, social and economic elements.
The regulation also provides that to achieve these objectives, the participation of entities other than agricultural entrepreneurs is necessary, such as local authorities (in a single or associated form), which adopt policies for the protection of organic production, environmental protection, conservation of agricultural soil and protection of biodiversity, the research bodies carrying out scientific activities in this field and the groups of operators within the meaning of reg. 2018/848.
Although it is difficult to trace and extrapolate an urban bioregion regulatory eco-system in Italian law, the analysis of the tools just mentioned aims to demonstrate that, in light of the principles of the "Ecological state" (De Leonardis 2022), it is possible to initiate an ecological administration process that uses the tools of municipal and urban planning legislation to activate territorial and functional cooperation based on the "à la Magnaghi" model institutional of Urban Bioregion.
In this regard, the regulatory reference can be both the instrumentation of municipal mergers (formerly Law 56 of 2014), municipal unions and the other forms of functional re-aggregation available in the TUEL (Articles 30 to 35).
In other words, the Urban Bioregion can be initiated as a process that transitions between tools and norms of intersubjective and intermunicipal planning and cooperation with the involvement of public-private partnerships and the channeling of European funds (post-PNRR).
Finally, the result of this analysis will consist of a real “legal tool kit” (legal toolbox) to promote an urban bioregion hypothesis in the Crati metropolitan area that ensures sustainable and resilient management of agri-environmental resources through administrative cohesion of local authorities.

Cases and methodology
The hypothesis of an urban bioregion of Crati that we intend to advance derives from the observation of the existence of an evident state of conurbation, which presents geomorphological characteristics and socioeconomic elements attributable to the model described so far.
This area can be easily identified by describing its natural boundaries: to the east the Silan Plateau, to the west the Paulan chain, to the north the Sibari Plain, to the south and south – east the Busento, the Iassa and Cardone streams, within which lie the administrative borders of the municipalities of Cosenza, Rende, Casali del Manco, Castrolibero and Montalto Uffugo[2] (approximately 190,000 inhabitants).

A brick for the Ecopia's network

This proposal promotes a dynamic and constructive dialogue, drawing on various scientific disciplines (such as, in particular, law, territorial sciences, and socioeconomic sciences) that is rooted in the innovative and evolutionary vision of sustainable models and practices promoted by the Ecopia network.

In particular, the "legal tool kit" that will be defined in the hypothesis of an urban bioregion of the Crati area, could then be used in similar cases.

[1] A. Magnaghi, *La bioregione urbana nell'approccio territorialista*, in *Contesti. Città, territori e progetti*, 2018, pp. 26 – 51.

[2] Reference is made only to centers with greater territorial extension and housing concentration. In fact, the municipalities crossed by the Crati are much more numerous: Aprigliano, Bisignano, Lattarico, Luzzi, Mongrassano, San Marco Argentano, Rose, Tarsia, Torano Castello.

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FACING CRISES FOR LIVEABLE CITIES & RESILIENT TERRITORIES

FACING CRISES FOR LIVEABLE CITIES & RESILIENT TERRITORIES

SESSION A – Wednesday 22nd – 16:30/18:30

Chair:
E.R. Morales García de Alba, ITESO Universidad Jesuita de Guadalajara

Discussants:
Roberto Bruno, DIMEG- Università della Calabria
Luigi De Napoli, DIMEG – Università della Calabria
Maria Giovanna Durante, DIAm – Università della Calabria
Alfonso Senatore, DIAm – Università della Calabria

Francesco Aiello, Graziella Bonanno, Lucia Errico, Sandro Rondinella
Efficiency Unveiled: Exploring Geographical Challenges and Natural Risks in Italian Municipalities through a Stochastic Frontier Analysis

Roberto Bruno, Antonio Cristaudo, Natale Arcuri
Living Walls in Urban Environments: the Role of Irrigation on the Building Energy Performances

Pierpaolo Rago, Carmelina Costanzo, Pierfranco Costabile, Margherita Lombardo, Luigi Pontieri, Pietro Sabatino, Francesco Folino
Evaluating Machine Learning Methods for AI-Enhanced Urban Flood Mapping: the case of Crotone (Italy)

Maria Eugenia Ibarraran, Gabriela Pérez-Castresana
Flood risk management in periurban marginalized areas in Puebla, Mexico

Annunziata Palermo, Aldo Cristiano, Lucia Chieffallo
Integrated local climate adaptation strategies to plan and manage resilient territories

Tommaso Toccafondi, David Fanfani
Rethinking territorial resilience to flooding through a dynamic approach: the soil-vegetation nexus as a challenge to current planning and governance tools

Giacomo Franco, Paolo Zimmaro
Impact of climate change on the multi-hazard vulnerability of river-protection levees under earthquake and flood events

João Gabriel Pedreira de Moura Gomes, Silvia Mikami Pina
Housing adaptation to climate change in knowledge territories: a critical reading based on a systematic literature review

Francesca Salvo, Daniela Tavano
Climate Resilience and Property Valuation: The Role of Climate Risk in Value Formation

Giuseppe Alì
Neural networks for reaction-advection-diffusion equations in wildfire propagation modelling

SESSION B –Thursday 22nd – 16:30/18:30

Chair:
E.R. Morales García de Alba, ITESO Universidad Jesuita de Guadalajara

Discussants:
Matias Barberis Rami, European Future Innovation System Centre
Carmelina Costanzo, DIAm – Università della Calabria
Pietro Iaquinta, DiSCAG – Università della Calabria
Marco Schmidt, Technische Universität Berlin

Emma Regina Morales
Urban planning in times of uncertainty: the Mexican Case

Antonella Pelaggi
Cultural mapping and participatory GIS for new territorial legacies

Pietro Iaquinta, Eveny Ciurleo
Ecological transitions and demographic constraints: the role of population in sustainability

Rafaella Monsalve Tapia
Geographic Information Systems as Infrastructures for Participatory Multilevel Coastal Governance

Alejandra Fonseca Durand
Diverse Households, Rigid Housing: Reconversion and Territorial Justice in Guadalajara, Mexico

Cassandra Carroll Funsten
Living Labs for Landscape Design in Crisis Contexts: Reflections from the Naples Metropolitan Area

Tomoyuki Mashiko
Generation of individual micro-scenarios and transformation of diverse partnerships in marginal territory

Federico De Francesca, Francesco Demarco, Pierpaolo Fusaro, Francesca Librandi
Mapping the Invisible: Interactive Digital Heritage Tools for the Revitalization of Arbëreshë Communities in Calabria

Marco Schmidt
Evaporative cooling: an energy efficient and climate sensitive lowtech approach on urban heat islands

Allan Daniel Melgar Ramírez, Mónica López Franco
Housing as an Urban Asset: Inclusive Land Management Strategies in the Context of Valorisation and Exclusion Processes in Guadalajara, Mexico

Efficiency Unveiled: Exploring Geographical Challenges and Natural Risks in Italian Municipalities through a Stochastic Frontier Analysis

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Over the past three decades, research on local government efficiency has progressively evolved from the evaluation of single public services—such as waste collection or road maintenance—to broader assessments of overall municipal performance (Aiello and Bonanno, 2019). More recently, scholarly attention has increasingly focused on identifying the determinants of efficiency, emphasizing the role of external environmental and geographical factors (Narbón-Perpiña and De Witte, 2019). Despite this growing body of research, the relationship between persistent natural hazards and municipal performance remains underexplored, particularly in contexts characterized by geomorphological heterogeneity and multiple environmental risks.

This paper seeks to address this gap by investigating (i) whether long-term environmental risks influence municipal cost efficiency and (ii) how these effects vary across geographical contexts. By integrating environmental risk analysis with efficiency measurement, the study contributes to ongoing debates in public economics, regional science, and institutional resilience.

Italy offers a particularly suitable setting for this investigation. The country combines pronounced regional disparities with high exposure to seismic, hydrogeological, and volcanic hazards, making it an ideal laboratory for analyzing local government performance under persistent environmental constraints. These challenges are further compounded by the longstanding North–South divide, marked by significant differences in economic development and industrial structure. Together, these features provide a unique context in which to examine how municipalities with varying institutional capacities respond to compounded environmental pressures.

Although an expanding literature acknowledges the influence of environmental hazards and geographical constraints on local government performance (Guo et al., 2023), empirical evidence on their combined effects on cost efficiency remains limited—particularly in countries characterized by strong spatial inequalities and multiple environmental stressors, such as Italy. Geographical constraints, including altitude and spatial isolation, tend to increase infrastructural and administrative costs by limiting economies of scale and access to services.

These structural disadvantages may be intensified by persistent environmental hazards—such as earthquakes, landslides, and floods—which place additional pressure on local resources, increase institutional complexity, and heighten fiscal strain (Llanquileo-Melgarejo et al., 2021). Rather than if environmental risks necessarily reduce performance, this study explores whether—and under what conditions—long-term exposure may affect efficiency through more complex mechanisms. The interpretation of the findings is informed by the literature on institutional resilience, adaptive governance, and inter-municipal cooperation. By focusing on structural exposure indicators rather than isolated disaster events, the analysis captures the enduring dimension of environmental vulnerability across Italian municipalities.

Methodologically, the study employs a Stochastic Frontier Analysis (SFA) framework to estimate municipal cost efficiency while explicitly accounting for environmental and institutional heterogeneity. SFA is particularly appropriate in this context, as it allows inefficiency to be distinguished from random shocks and enables the inclusion of contextual determinants in the efficiency equation. The empirical analysis relies on a longitudinal dataset combining municipal balance-sheet data and environmental risk indicators over the period 2014–2020, allowing for the examination of efficiency dynamics under varying local conditions. Two complementary perspectives are adopted: first, an assessment of overall efficiency across municipality types through a three-way interaction model; second, an analysis of the marginal effects of environmental risks.

The results highlight substantial heterogeneity across regions and altitudinal areas. Hydrogeological and landslide risks are associated with higher inefficiency in northern and lowland municipalities, whereas their effects are weaker—or even reversed—in central and southern areas. By contrast, seismic risk is positively correlated with efficiency scores, a result that may reflect the influence of post-disaster reconstruction policies or targeted institutional adaptations.

Overall, the findings suggest that exposure to environmental risks does not automatically undermine municipal efficiency. Instead, outcomes appear to depend on institutional capacity and context-specific adaptation strategies. Municipalities facing higher levels of risk may streamline administrative processes, prioritize core services, and invest in resilient infrastructure, potentially generating long-term efficiency gains. Moreover, environmental stress may encourage inter-municipal cooperation, enabling resource sharing and the realization of economies of scale that offset structural disadvantages (Song et al., 2024). Although the specific mechanisms of institutional adaptation cannot be directly observed, the efficiency patterns identified in high-risk areas are consistent with processes of organizational learning, policy adjustment, and institutional resilience. This perspective shifts the analytical lens from viewing environmental risk solely as a constraint to recognizing its potential role as a catalyst for adaptive transformation.

In conclusion, environmental risks should be understood not merely as exogenous limitations but as structural determinants of local efficiency that deserve explicit consideration in both policy design and empirical analysis. By adopting this perspective, the study enhances our understanding of how local governments respond to persistent external stressors, offering relevant implications for governance, public policy, and resilience planning.

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Living Walls in Urban Environments: the Role of Irrigation on the Building Energy Performances

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Integrating natural ecosystems into building envelopes significantly enhances energy performance and environmental sustainability, particularly in summer, contributing positively to urban transformation and green transition (Marsaglia, 2024). The implementation of Living Walls (LWs) on the building's façades allows for producing shading on the exposed surface and, by benefitting from the latent thermal exchanges driven by transpiration in the plants and vaporization in the in the growing media, external air temperature surrounding the structure can be reduced, alleviating the heat island effects in urban districts (Bakhshoodeh et al., 2022). LW system can be installed on decrepit façades, by improving the building aesthetic, and modular features allow for overcoming eventual issues deriving from geometrical discontinuities such as windows, balconies and wingwalls. Finally, LW can be exploited to improve the air quality within the urban spaces and to alleviate the effects deriving from extreme rainfall events, enhancing the city's livability. LWs are generally constituted by four main layers assuming a lumped parameter approach: the foliage (1) on the external side, the growing media (2) that fills suitable pots, which in turn are installed on a frame opportunely anchored on the façade and forming an air-gap (3) with the structural wall (4), as depicted in Fig. 1 (Barreca et al., 2024).

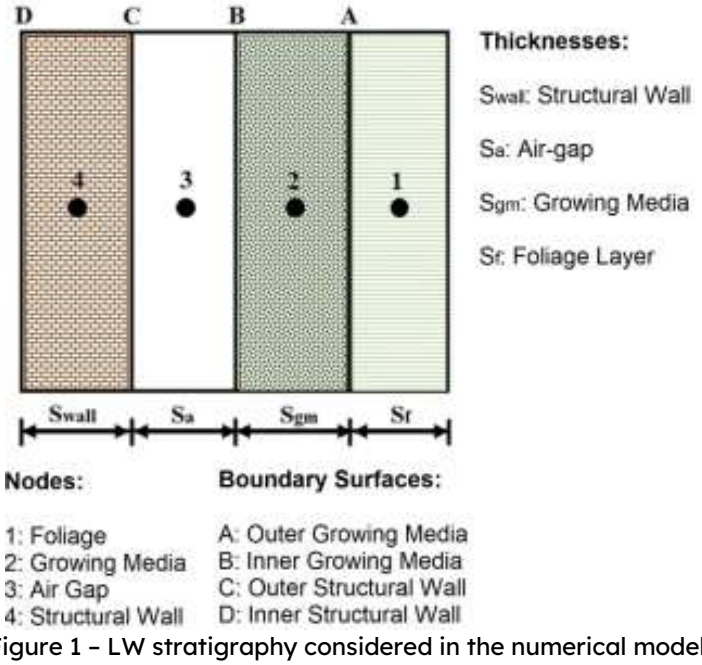

Figure 1 – LW stratigraphy considered in the numerical model.

The achievable thermal performances are quite difficult to generalize, because they depend on the climatic context, the planted vegetation, the employed substrate and the water content inside the pots. For these reasons, proper calculation models are required to consider how the previous parameters affect the building's energy performance; these models must be able to interact with Building Energy Simulation (BES) tools to consider the interaction between the nature-based solution and the building fabric. Unfortunately, available BES tools are not equipped with such a model, whereas the scientific community has produced in-house codes in which the interaction between the naturebased solution and the building is neglected (Eumorfopoulou and Kontoleon, 2009). Another issue that makes the implementation of an LW model difficult is the necessity to consider simultaneously mass and heat transfer within green surfaces and to carry out a water mass balance, because the water content affects the energy balance considerably.
In light of this, in this work, a novel dynamic model of LW is developed and implemented in the MATLAB® environment and arranged in order to be coupled with the building model available in the BES TRNSYS, following the scheme depicted in Fig. 2 (Bruno and Cristaudo, 2026) that highlights the reciprocal information exchange. This allows for considering the sensible and latent exchanges occurring on the building structure by considering the role of water mass balance, in turn influenced by parameters such as irrigation and rainfall.

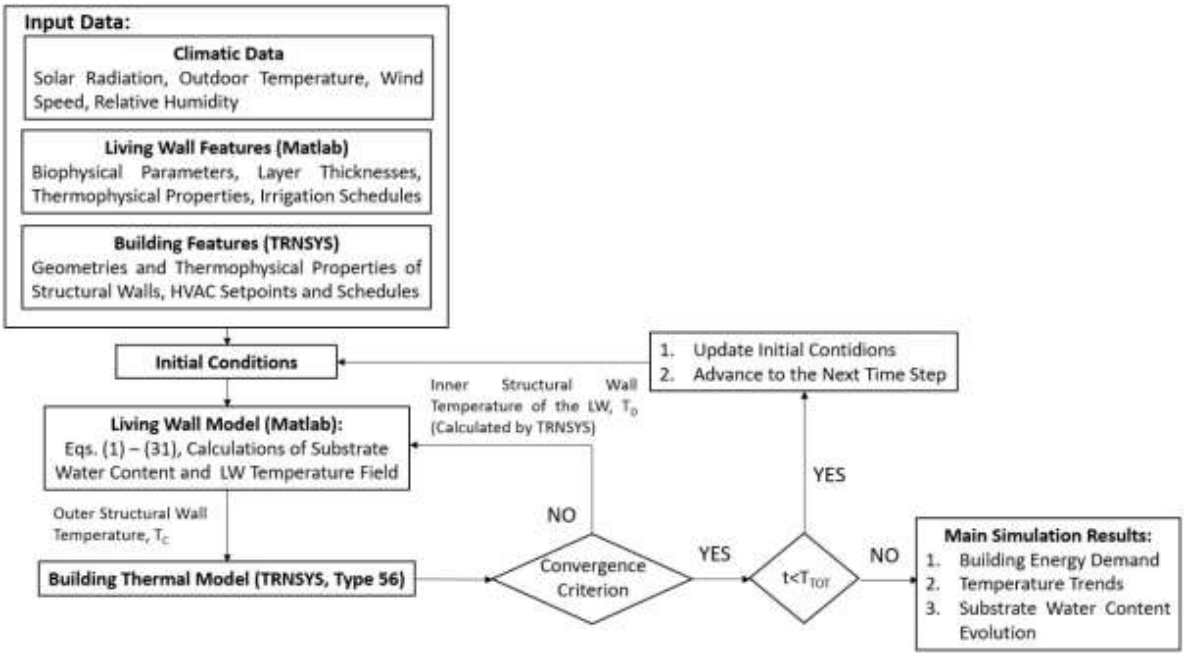

Figure 2 – Flowchart illustrating the methodology and
the dynamic data exchange between the TRNSYS building model and MATLAB® code.

Through these features, dynamic simulations allow evaluation of the impact of water content in vertical greenery on building energy demand. Considering the peculiar characteristics of the Mediterranean climatic context, in which the cooling demands are increasing continuously, driven by climate change, irrigation represents a significant parameter to monitor in order to attain a rational consumption of water, a crucial aspect to solve the issue connected with the scarcity of the water resource in the considered area. From the mathematical point of view, the volumetric water content (ω) in a substrate with thickness (S_{gm}) is obtained from the following mass balance equation within the substrate (Djedjig et al., 2017):

$$R + I - ET = \rho_{water} \cdot S_{gm} \cdot \frac{d\omega_{gm}}{dt} \quad (1)$$

where R, I and ET are respectively the shares related to rainfall, irrigation and evapotranspiration (kg/m²·s), the latter determined as a function of the latent exchange

calculated by the model inside the foliage and the growing media. The dynamic calculation of the water content, in turn, also modifies the thermal features of the substrate in the code, assuming a homogeneous distribution along the LW due to the uniform presence of pots on the façade. Fig. 3 shows the results obtained in terms of cooling demand for a reference building located in Cosenza (Lat. 39.3°N, Csa type according to the Köppen classification) by varying the irrigation share provided continuously in the period 8:00 a.m./20:00 for all the summer days, and comparing them with the building configuration without the LW (bare wall). The case with null irrigation (I=0 kg/mÇs) considers only rainfalls as the substrate water supply. The building has a 100 mÇ footprint and was modelled in TRNSYS as a single-air-node zone, using hourly climate data as inputs, including vertical-surface solar irradiance, outdoor air temperature, relative humidity, wind speed, and precipitation. The LW height is 3 m facing East, with a non-insulated vertical wall thick 20 cm, assuming other thicknesses of 5 cm, 10 cm and 15 cm, respectively, for the air-gap, the substrate and the foliage, the latter assuming LAI (Leaf Area Index) = 2, a typical value expected for LWs, with a coverage ratio of 90% and minimal stomatal resistance of 200 s/m. The simulated growing media is characterized by a saturation volumetric water content of 0.63 mÑ of water per mÑ of substrate. It can be appreciated that, compared to the bare wall configuration, irrigation shares greater than 10-4 kg/mÇs can produce an evident limitation of the cooling demand, with a maximum saving obtained with 4·10-4 kg/mÇs
amounting to 814 kWh for the whole season, that is 10% lower than the building energy need required with a bare wall configuration. Nevertheless, for irrigation shares greater than 4·10-4 kg/mÇs, no improvements in terms of limitation of the cooling demand can be observed, meaning that the growing media has achieved water saturation; therefore, these cases imply an evident water wastage, however the goodness of the LW system as a passive solution to promote energy savings in buildings is confirmed.

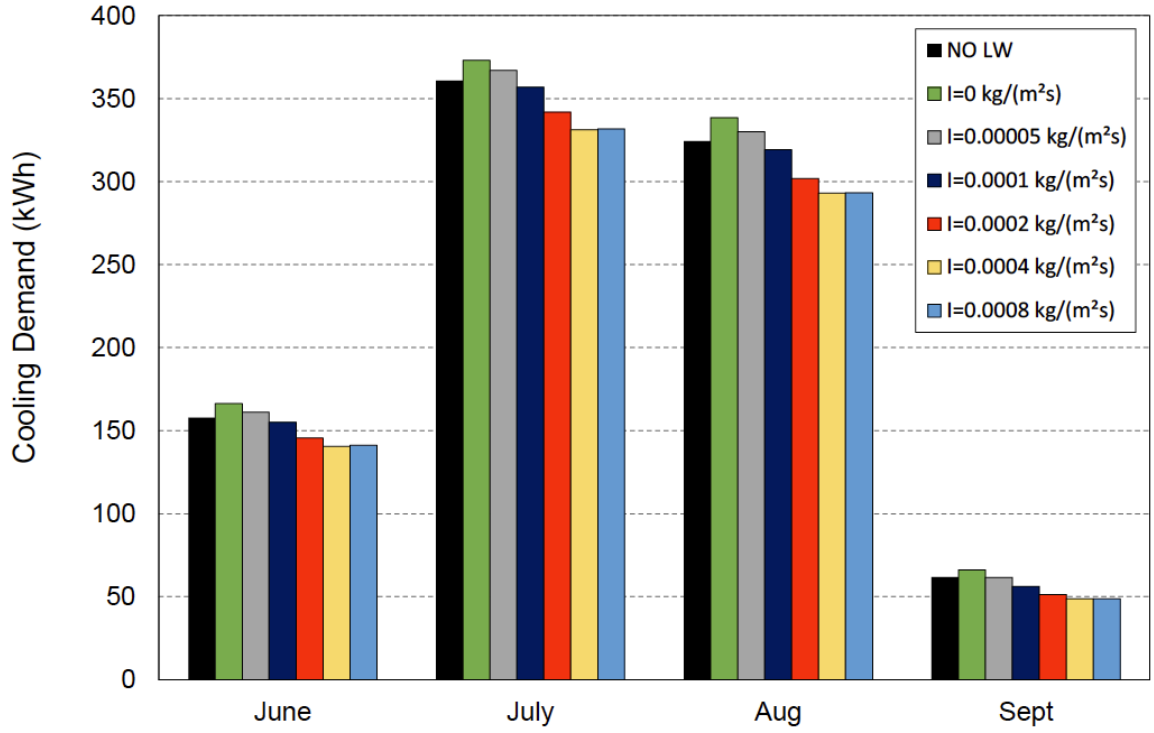

Figure 3 – Monthly cooling energy needs determined for a reference building by varying the irrigation rate.

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Evaluating Machine Learning Methods for AI-Enhanced Urban Flood Mapping: the case of Crotone (Italy)

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Accurate mapping of urban flood hazards requires detailed knowledge of the spatial distribution of water depths and flow velocities generated by intense rainfall events. Physically based hydrodynamic models remain the gold standard for simulating flood dynamics, particularly in complex urban environments where drainage networks, micro-topographic variations, and land-cover interactions strongly influence runoff behaviour. However, the high computational cost of high-resolution simulations—especially when multiple rainfall scenarios must be explored—and the need for high-performance computing infrastructure often limit their suitability for rapid decision-making, early warning systems, and operational flood-risk management by local authorities and civil protection agencies.
In this context, fast and flexible machine learning (ML) models offer a promising alternative by approximating hydrodynamic simulations and providing rapid estimates of flood variables while maintaining acceptable accuracy. Training ML models on simulation outputs is often more practical than relying on historical flood observations, which are frequently unavailable at the spatial resolution and representativeness required to capture the full range of possible rainfall events, including unseen extreme scenarios.

The task of deriving surrogate models from simulation data for the efficient computation of flood hazard and susceptibility maps has been widely addressed in recent literature (Li et al., 2025; Bentivoglio et al., 2022). A broad spectrum of ML approaches has been explored, ranging from interpretable but low-capacity models—such as Linear Models (LMs) and Regression Trees (RTs)—to high-capacity ensemble methods and Deep Neural Networks that deliver accurate yet "black-box" predictions. However, in real-world flood analysis and management contexts, it is crucial to provide decision makers with faithful and interpretable explanations for individual predictions (Xing et al., 2025). Global feature-importance scores alone are insufficient in highly heterogeneous urban environments, where different spatial units may respond to distinct flood-related drivers.

This study investigates the performance of three widely used ML methods characterized by different interpretability–accuracy trade-offs: Linear Regressor Trees (LRT), Random Forests (RF), and Multi-Layer Perceptron neural networks (MLP). While LRT models provide easily interpretable predictions, their reliance on local linear assumptions may limit predictive capacity. In contrast, RF and MLP models (i.e., tree ensembles and feed-forward neural networks) can capture complex nonlinear dependencies, generally achieving higher predictive accuracy at the expense of transparency.

The objective is to assess their ability to reproduce, generalize, and explain flood patterns simulated by a previously calibrated and validated hydrodynamic model applied to the urban area of Crotone, southern Italy—an area historically affected by pluvial flooding and characterized by a dense and highly heterogeneous urban fabric (Costabile et al., 2026).

The dataset used for training and testing consists of maximum water depths and hydraulic hazard levels simulated under a large ensemble of synthetic extreme rainfall events. These events were generated through a stochastic procedure consistent with local depth–duration–frequency (DDF) curves, ensuring that rainfall inputs reflect the variability and extremeness expected in the region. Eighty percent of the simulated events were used for model training, while the remaining portion formed an independent test set. The input features mirror those commonly adopted in flood susceptibility and flood-extent modelling, including hydrological, hydraulic, morphological, and land-use descriptors. Sensitivity analyses were conducted to assess the contribution of each feature to model performance.

The underlying hypothesis is that ML models, when trained on high-quality outputs from physically based simulations, can approximate the spatial variability of flood hazards with sufficient accuracy to support operational applications. The RF model shows clear performance improvements, effectively capturing complex interactions and threshold effects through recursive partitioning of the feature space. It performs particularly well in reproducing medium-to-high water depths and in identifying areas prone to concentrated runoff. Comparable, or in some cases superior, accuracy is achieved by MLP models, although their performance strongly depends on careful hyperparameter tuning and regularization to prevent overfitting. LRT models yield intermediate results, offering a balanced compromise between predictive accuracy and interpretability. Error analysis indicates that predictive performance decreases in areas where micro-scale topographic variability is not adequately represented by the available predictors.

Overall, the results demonstrate that all ML models can approximate hydrodynamic model outputs with considerable accuracy while dramatically reducing computational time—from hours on high-performance computing clusters to seconds on standard hardware. This efficiency makes ML approaches particularly suitable for rapid scenario analysis, emergency response support, and iterative evaluation of mitigation strategies. Importantly, the findings highlight the complementary roles of ML and hydrodynamic modelling: while physically based models remain essential for detailed and physically consistent simulations, ML surrogates can extend modelling capabilities by providing fast, flexible, and operationally accessible tools for time-critical applications.

By comparing models ranging from simple linear regressors to advanced neural networks, this work contributes to a clearer understanding of how data-driven techniques can support urban flood-risk assessment at varying levels of transparency and usability. It emphasizes the value of hybrid modelling workflows, in which hydrodynamic simulations provide the physical foundation and ML models act as efficient surrogates, enhancing scalability and accessibility. Building on the promising results obtained with LRT, ongoing work is extending the analysis to

a Mixture-of-Experts (MoE) neural architecture (Cuzzocrea et al., 2025), where multiple interpretable linear experts and a routing function are trained end-to-end through gradient-based optimization.

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Flood risk management in peri urban marginalized areas in Puebla, Mexico

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This paper advances the thesis that flood risk management in marginalized periurban areas must move beyond technocratic and sectoral approaches and be reframed as a process of co-construction that integrates green infrastructure with the strengthening of the social fabric. Through a three-year interdisciplinary project in the periurban settlement of Ampliación Valle del Paraíso (AVdP), in Puebla, Mexico, we argue that risk reduction can only be effective and sustainable when ecological restoration, community organization, and local knowledge are articulated within a shared governance framework. Addressing flood risk as a socio-ecological and political issue—rather than solely as a hydraulic problem—enables the creation of liveable and resilient territories in contexts marked by inequality and environmental degradation.

AVdP exemplifies the intertwined crises characterizing the Anthropocene: climate change intensifies pluvial and fluvial flooding, while unregulated urban expansion, soil sealing, and the degradation of natural drainage systems exacerbate runoff and erosion. At the same time, recurrent droughts, water shortages, and extreme heat events reveal the paradox of water abundance and scarcity coexisting within the same territory. These dynamics disproportionately affect economically marginalized residents, whose limited access to infrastructure, secure tenure, and public services increases their exposure and sensitivity to hazards. Flood events in AVdP not only damage housing and assets but also disrupt livelihoods, schooling, mobility, and community networks, thereby deepening pre-existing social vulnerabilities.

Despite decades of policy discourse on sustainable urban development, risk management in periurban Mexico has largely relied on reactive emergency responses and grey infrastructure solutions disconnected from local social realities. Such approaches often fail to address underlying vulnerabilities and may inadvertently reinforce inequalities. In this context, our project proposes an alternative pathway grounded in three interrelated objectives: (1) identifying threats and vulnerabilities to determine flood risk in AVdP; (2) co-designing a comprehensive and participatory flood risk reduction strategy based on green infrastructure; and (3) strengthening community organization and local capacities in the face of climate-related hazards. The research is currently in the first year of a planned three-year duration, and the findings presented here refer primarily to the diagnostic phase and the initial stages of participatory engagement.

The first phase combines hydrological and spatial analysis with participatory risk assessment. Using rainfall and topographic data, GIS-based mapping, and on-site inspections, we identified critical runoff pathways, flood-prone zones, and areas of soil erosion. These technical assessments were complemented by household surveys, focus groups, and participatory mapping workshops, through which residents reconstructed the history of flood events, localized micro-risk areas, and identified socially vulnerable groups (elderly people, children, female-headed households). This mixed-methods approach allowed for a multi-layered understanding of risk as the interaction between hazard, exposure, and social vulnerability, bridging scientific data and lived experience.

The second phase focuses on the co-design of green infrastructure interventions aimed at restoring ecosystem functions while responding to community priorities. Proposed measures

include vegetated swales, rain gardens, infiltration trenches, reforestation of communal areas, and the recovery of natural drainage corridors obstructed by informal construction and waste accumulation. Rather than imposing predefined technical solutions, the project adopts a co-construction methodology: design workshops, model simulations, and collective decision-making processes enable residents to evaluate alternatives in terms of feasibility, maintenance requirements, and social acceptability. Green infrastructure is thus framed not only as an environmental tool for water regulation and temperature mitigation, but also as a catalyst for collective action and territorial stewardship.

The third phase addresses the strengthening of the social fabric as a core component of resilience. Flood risk management is treated as a vehicle for community empowerment, fostering the creation or consolidation of neighborhood committees, early warning protocols, and maintenance brigades. Training sessions on risk awareness, climate change adaptation, and participatory monitoring contribute to building local capacities and reducing dependency on external actors. By reinforcing horizontal ties among residents and vertical links with municipal institutions and academic partners, the project seeks to embed flood risk reduction within a broader process of socio-political inclusion.

Methodologically, the research integrates socio-hydrological analysis, participatory action research, and co-design practices. The interdisciplinary team—composed of urban planners, hydrologists, social scientists, and local facilitators—works alongside community members as co-researchers. Iterative cycles of diagnosis, design, implementation, and evaluation ensure that knowledge production is dialogical and adaptive. The project also includes the development of indicators to assess environmental performance (e.g., runoff reduction, soil permeability), social outcomes (e.g., participation rates, network density), and governance transformations (e.g., new institutional arrangements or agreements).

Preliminary findings indicate that co-constructed green infrastructure can simultaneously reduce peak runoff, improve microclimatic conditions, and enhance perceptions of safety and collective efficacy. Equally important, the process itself has generated new forms of collaboration within the community and between residents and local authorities. These relational gains suggest that resilience is not merely the capacity to absorb shocks, but the ability to reorganize collectively around shared visions of territorial care.

The contribution of this paper to the ECOPÌA network is threefold. First, it offers an empirically grounded example of how interdisciplinary action can address the complexity of contemporary crises at the local scale, weaving together ecological restoration, social justice, and participatory governance. Second, it provides a methodological framework for co-constructing climate adaptation strategies in marginalized periurban contexts, potentially transferable to other territories facing similar challenges. Although grounded in the specific socio-ecological conditions of periurban Puebla, the approach developed through this project is highly relevant for Mexico and for many other urban contexts worldwide, particularly in the Global South, where rapid urbanization, inequality, and climate vulnerability intersect. The co-construction process and the integration of green infrastructure with community capacity-building offer a replicable and adaptable model for community-based flood risk management and ecosystem restoration. Third, the paper foregrounds the centrality of the social fabric in ecosystem management, arguing that resilient territories emerge from the convergence of environmental and social regeneration.

By situating flood risk management within a broader project of co-creating liveable cities and resilient territories, the paper aligns with the Symposium's call for a choral convergence of knowledge, practices, and visions. It demonstrates that, in the face of climate crisis and inequality, sustainability must be reinterpreted as a dynamic, collective, and context-sensitive process—one that reclaims the commons and redefines the relationship between communities and their ecosystems.

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Integrated local climate adaptation strategies to plan and manage resilient territories

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The green and energy transition of urban areas represents one of the most urgent and complex challenges of the current political and environmental agenda. In Italy, the National Recovery and Resilience Plan (called PNRR) has constituted a valuable national opportunity for urban regeneration at all scales of intervention, configuring itself as an important test bed for the implementation of sustainable and energy transition policies. In particular, through the mission “Green Revolution and ecological transition”, the PNRR has provided a financial and regulatory framework of reference, allowing Public Administrations to use tools aimed at a more resilient and sustainable management of their territories.
The thesis supported is that the ecological transition, and particularly the energy transition, of Italian cities can be efficiently achieved through the adoption of the urban model of the eco-district, as defined in the meaning of the Positive Energy District (PED). In fact, the district represents the privileged scale of intervention in order to promote the integration of climate, energy, social and economic policies. The PED should not be understood simply as a technological solution, but as a complex urban device, capable of guiding the planning choices, design and management of urban areas by pursuing the objectives of climate neutrality, resilience and social inclusion. Starting from these assumptions, the research work aims to identify strategic guidelines for sustainable and climate-resilient urban and territorial planning, which support Public Administrations or local authorities in the implementation and management of interventions. In fact, it is up to them to overcome the ordinary sectoral and fragmented approaches and to translate the general objectives and guidelines provided at European, national and regional levels into concrete actions that evaluate both the purely environmental and the social and economic aspects, while analysing local specificities and the needs of the community.
In this context, Climate Change Adaptation Plans (PACCs) represent a fundamental tool for addressing the environmental impacts that have affected the fragile national territory from North to South in recent years. In fact, the research straddles climate adaptation policies and mitigation policies, considering that PACCs can constitute the strategic reference framework in which to place energy transition actions based on the establishment of eco-districts. This type of approach makes it possible to holistically address actions to reduce climate vulnerability and emissions, while strengthening the resilience of urban systems.
Starting with a literature review and a comparative study of the best international practices, this work will develop operational guidelines to support Public Administrations in planning and implementing integrated adaptation strategies. This product is conceived as a tool that will facilitate the adoption of innovative and participatory approaches, promoting effective and sustainable territorial governance. From a methodological point of view, the research adopts

a qualitative, quantitative and comparative strategy, based on the analysis of the Italian reference context, with particular attention to planning, governance and management methods.
In the preliminary planning phase of urban regeneration projects, we propose using four evaluation tables. These tables are designed to systematically organise contextual information and provide an initial interpretative framework of the critical issues and potential of the urban areas targeted for intervention. The tables allow for the collection of indicators organised according to homogeneous and comparable criteria. The same are structured consistently with the integrated research approach and address strategic areas for defining energy transition interventions at the district level. The first table collects sociodemographic data and analyses population composition, household structure, and socioeconomic conditions, in order to tailor interventions to community needs. The second focuses on building data collection, to reconstruct the characteristics of the building stock, such as construction period, state of conservation and intended use, providing the knowledge base for defining redevelopment priorities. The third focuses on collecting data on public spaces and infrastructure, assessing their urban amenities, the quality and accessibility of open spaces and infrastructure networks, as well as the presence of hydrogeological, seismic, environmental, and urban planning constraints or risks. The final phase involves collecting mobility data, examining transportation systems, travel methods, and accessibility to various services, in order to integrate energy strategies with emission reduction policies and sustainable adaptive urban planning.
The data collected is designed to form an integrated system of information sources that relevant Public Administration personnel can consult during the preliminary design phase. To facilitate its use, links to various institutional portals have been identified for each topic addressed, allowing simple and coherent access to the updated datasets needed to analyse the project context.
Evaluating a critical analysis of the emerging evidence, the work is therefore geared toward defining a structured process for developing a PED, from planning to management, through the use of an urban context assessment matrix, conceived as an operational decision-making support tool. Specifically, the data collected through the four preliminary tables are combined into a summary matrix that integrates and correlates the various dimensions analysed, enabling a comprehensive assessment of the urban context and informing design decisions. This matrix is divided into seven components, namely Population and families, Economic conditions, Education and training, Building characteristics, Real estate values and price lists, Territorial constraints, Public spaces and infrastructures, Mobility and logistics, whose integrated analysis makes it possible to calibrate possible projects on an urban scale and operational strategies based on the specificities of the territory, increasing the effectiveness and replicability of the interventions.
The seven components are assessed by assigning a colour. In detail, four colours qualitatively indicate the feasibility of interventions, considering technical, economic, social, and environmental constraints. Green indicates interventions that are feasible without limitations, with simple and straightforward implementation. Yellow highlights interventions that are potentially feasible but subject to certain restrictions, such as costs exceeding estimates, landscape constraints, or difficulties in community engagement. Orange indicates complex interventions with significant limitations that require additional studies or significant investments. Red represents interventions that are unfeasible, where regulatory, economic, environmental, or technical obstacles clearly impede their implementation. This colour coding, therefore, allows for a rapid assessment useful for supporting design decisions based on the characteristics of the urban context.
Finally, the study conducted intends to actively contribute to the Ecopìa network, offering a shareable and replicable methodological framework, mainly focused on the Italian context but open to international comparison, to encourage the exchange of experiences and the dissemination of the urban model of the eco-district in the particular meaning of the PED as a strategic lever for the ecological transition of the territories.
The research studies presented in this contribution are conducted under the scientific supervision of Professor Annunziata Palermo, funded by Ministerial Decree No. 629/2024 (Next-GenerationEU - PNRR).

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Rethinking territorial resilience to flooding through a dynamic approach: the soil-vegetation nexus as a challenge to current planning and governance tools

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Humanity is increasingly confronted with its own legacy: a development pathway marked by unsustainable environmental exploitation that has disrupted natural cycles and ecosystem balances. In this context, today's flood crisis can no longer be interpreted as a sequence of isolated, local emergencies, but rather as the product of co-evolving atmospheric dynamics and long-standing territorial transformations (land take, soil sealing, ecological fragmentation, etc.). Evidence linking anthropogenic climate change to the increasing frequency and intensity of heavy precipitation events (IPCC, 2021), together with urbanisation trajectories that concentrate people and assets in vulnerable settings (with global urban growth projections to 2050 on the order of 986 million people; United Nations, 2025), points to a future in which cities and their wider territories must relate in an increasingly integrated way. Within this framework, spatial planning is called upon to move from reactive to preventive responses and to shape environments that are consistent with the complex climatic and socio-economic dynamics of the Urbanocene. Yet, despite the widespread adoption of terms such as Nature-Based Solutions (NBS) and ecosystem services in policy narratives, territorial governance tools often remain outdated and lack a genuinely operational translation of ecosystem processes. Accordingly, the main limitation lies not in the absence of "virtuous" concepts, but in the lack of a dynamic, measurable, and replicable knowledge framework capable of making the soil–vegetation nexus a strategic priority for flood mitigation.

Governing flood risk effectively requires understanding how cities relate to their key natural components, soil and vegetation, recognising them as assets to be safeguarded and as regulatory infrastructures. Trees, for instance, provide multiple services: rainfall interception, increased surface roughness, reduced overland flow velocity, improved soil structure, and, consequently, attenuation of runoff peaks (Sjöman et al., 2025). These benefits, however, depend on species-specific choices and their fit with local contexts and with the processes that need to be regulated. In parallel, sound soil management (structure regeneration, organic composition, increased porosity, reduced compaction) can reduce runoff peaks in urban environments while fostering more informed and sustainable practices in peri-urban agricultural areas (Mauro et al., 2023; Sittig & Sur, 2024). Despite this evidence, the operational integration of such elements into territorial governance instruments remains insufficient and is often confined to terminology. Moreover, flood issues are frequently addressed through predominantly sectoral engineering-led approaches, with spatial planning playing a less central role as the arena for multi-scalar, cross-sector coordination. As a result, a persistent gap remains between the formal articulation of knowledge-based principles and their practical uptake. In particular, there is a lack of territorial indicators capable of providing a realistic, decision-relevant reading of flood dynamics.

This condition clearly emerged in research focused on the flood event that struck the Tuscany Region (Italy) in early November 2023. Like many comparable cases, it exposed the fragility of contemporary urbanized areas, which, worldwide, often exhibit levels of soil sealing sufficient to disrupt hydrological functioning. The study area covers part of the

Florentine Plain, with reference to the Ombrone Pistoiese and Bisenzio river basins, enabling a territorial interpretation of anthropogenic influences on surface runoff. Using this event as a testbed, this contribution demonstrates how a coherent dataset can be assembled and systematised through a dynamic approach. The analysis considers, among other factors, rainfall intensity and type, basin morphology, vegetation cover, soil sealing conditions, and anthropogenic works (e.g., flow obstacles and alterations to the drainage and hydrographic network). Read through an integrative, multidisciplinary lens, these components support the construction of a robust and dynamic evidence base, updatable, quantifiable, and qualitatively sound, regarding flood hazard.

The research develops a dynamic analytical approach that is both event-based and scenario-based, combining GIS tools, basic hydrological concepts, and InVEST to strengthen an ES-based reading of territorial drivers. The methodological workflow involves: (i) an initial quantification of rainfall volumes converted into runoff, based on rainfall data and key territorial attributes (land use/land cover, soil hydrological groups, and topography); (ii) an estimation of how these volumes contribute to network load and peak discharges; and (iii) the production of maps and indicators, derived from numerical and spatially explicit data, that describe territorial responses to extreme events. The "dynamism" referred to here does not correspond to detailed hydraulic simulation; rather, it lies in the capacity to treat the event - and potential future scenarios - as variable configurations of drivers, thereby making explicit the link between territorial transformations and hydrological response. Modular and updateable in relation to available datasets and skills, the methodology is designed both to describe observed events and to explore simulated future scenarios, supporting a more preventive approach to territorial flood resilience.

Against this background, the contribution seeks to introduce into territorial governance policies a modular and dynamic component that is crucial for addressing contemporary climate challenges, by narrowing the distance between theoretical knowledge, analysis, and operational implementation. The resulting outputs (maps and quantitative indicators) can support the practical uptake of ES-based strategies grounded in the soil–vegetation nexus within governance instruments such as regional planning frameworks, basin plans, Flood Risk Management Plans, and municipal planning tools (e.g., structural and operational plans). Furthermore, by informing regulatory devices - such as Strategic Environmental Assessment (SEA) procedures - these outputs can strengthen coherence between objectives and adopted measures. The contribution also points to the development of new parameters, including territorial and urban standards that define minimum permeability and green-infrastructure parameters calibrated at basin scale, as well as PES schemes to incentivise local stakeholders' participation and enable more effective place-based action. From this perspective, ECOPÌA is seen as an appropriate venue to advance reflection on the proposed topic and to consolidate a shared line of inquiry consistent with the climate challenges we are facing.

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Impact of climate change on multi-hazard vulnerability of river-protection levees under earthquake and flood events

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River-protection levees are fundamental infrastructure systems ensuring safety against flooding. However, such distributed infrastructure is often not designed according to rigorous engineering criteria. As a result, they are highly vulnerable to both flooding and earthquakes. While seismic hazard is independent of the effects of climate change, the intensity and frequency of flooding events are strongly influenced by climate change. It follows that earthquake-flood cascade events are likely to occur more frequently in the future. This combination of actions is generally not considered in levee vulnerability analyses. Therefore, assessing their safety requires a multi-hazard approach that can simultaneously consider hydraulic and seismic actions. There are studies in the literature that have already addressed this issue. One example is the study by Zimmaro et al. (2019), which analyzes the vulnerability of levees to earthquake and flooding events, taking into account the effects of climate change. The analysis is based on a multi-hazard methodological framework applicable to any distributed infrastructure system. The study by Zimmaro et al. (2019) highlights the importance of probabilistic system approaches for assessing levee safety and provides conceptual and methodological tools useful for risk management in multi-hazard contexts. The authors predict that the results of this study could have a positive impact on predicting damage to river protection embankments subject to earthquake-flood cascade loads. There are other studies that also take a multi-hazard approach, such as that by Selmi et al. (2022). They analyze the problem of earthquake-induced liquefaction in an earthen embankment, introducing a probabilistic methodology that considers the temporal variability of the groundwater level linked to precipitation events. Through a frequency analysis based on AM/GEV (*Annual Maxima/Generalized Extreme Value*) extreme values and the use of data from CPT (*Cone Penetration Test*) tests, the authors demonstrate that adopting a constant groundwater level may be overly conservative, while probabilistic modeling of hydrogeological conditions provides hazard curves that are more representative of the actual behavior of the structure. A further aspect was addressed in the contribution by Janga et al. (2024). In this case, the picture is broadened further by including the safety of embankments in the context of climate change. The authors emphasize how the increase in the frequency and intensity of extreme events makes it necessary to adopt non-stationary risk analyses. The use of appropriately scaled global climate models (i.e., transferring climate information from global models to a lower spatial scale that is locally significant), combined with hydrological models and hydro-mechanical analyses of levees, allows for the estimation of realistic future loads and the development of resilient adaptation and maintenance strategies. In this study, we propose a multi-hazard method based on level-crossing statistics, making it both computationally efficient and robust. This method expands that by Zimmaro et al. (2019). In

the first phase, the vulnerability of the embankments in their current state of construction is analyzed with respect to seismic scenarios consistent with the hazard level of the site. Following the earthquake, the vulnerability of the embankment system is degraded; this degradation is quantified in a manner consistent with the level of damage induced by the earthquake. Subsequently, high water level events with different probabilities of occurrence are applied, and a final vulnerability level is defined that takes into account the sequence of the two events. The integration of seismic, hydrological, and climatic analysis, together with the modeling of geotechnical uncertainties, emerges as a key element for a more reliable risk assessment and for the design of effective long-term mitigation measures. This topic fits within the "ECOPÌA - ECO Partnership for Interdisciplinary Action" network; in fact, among the various topics covered, there is "facing crises for liveable cities & resilient territories". A study addressing the issues described above is an excellent example of how the search for new solutions to address new challenges is vital to making territories more resilient to the changes the world is facing. It also provides innovative tools that are useful from both a technical and a political-economic point of view, so as to support any decisions on the prevention and protection of territories subject to various risks.

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Housing adaptation to climate change in knowledge territories: a critical reading based on a systematic literature review

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Contemporary cities are increasingly shaped by the convergence of environmental, social, and territorial crises, in which the impacts of climate change intensify long-standing socio-spatial inequalities and expose the limits of dominant urban planning paradigms. In this context, housing emerges as a central yet often underestimated dimension of urban climate adaptation, as it articulates environmental justice, access to basic rights, everyday well-being, and protection against climate-related risks. Despite its structural relevance, housing remains marginal in many adaptation frameworks, particularly within knowledge and innovation territories, where technocratic and infrastructure-led approaches tend to prevail. This paper addresses this gap by critically examining how housing adaptation to climate change has been conceptualised and operationalised in recent scientific literature, with a specific focus on knowledge-based urban development contexts, aiming to identify dominant patterns, emerging shifts, and conceptual imbalances, and to contribute to a more integrated, socially grounded understanding of urban climate adaptation.

This tendency is particularly evident in knowledge and innovation territories, often framed as privileged spaces for sustainable experimentation within the paradigm of knowledge-based urban development. However, technological innovation alone does not ensure socially just or climate-resilient outcomes, as these territories frequently reproduce socio-spatial inequalities when housing, especially affordable and social housing, is marginalised. In response, this paper examines how housing adaptation to climate change has been addressed in recent scientific literature, focusing on its articulation within knowledge territories through a systematic review of publications from 2015 to 2025 conducted in the Dimensions database. Following the removal of duplicates, temporal filtering, and the application of inclusion and exclusion criteria, the resulting corpus underwent a multi-stage qualitative analysis. Abstracts were initially screened and ranked according to relevance, after which a subset of publications was selected for full-text reading. Adaptation strategies were extracted through systematic coding, with particular attention to sections where authors articulated results, discussions, and conclusions, as these proved to be the primary loci for practical propositions and normative assumptions. Conceptually overlapping strategies were subsequently consolidated through semantic comparison, allowing for the identification of shared conceptual cores while preserving analytically distinct approaches.

The extracted strategies informed the construction of a conceptual framework organised according to thematic axes and sub-axes, reflecting the multiscalar and multidimensional nature of housing adaptation. The framework incorporates interventions at the scale of the plot and building, urban design and land-use regulation, grey infrastructure, green and blue infrastructure, governance and policy instruments, community engagement, and housing-specific dimensions such as environmental justice, access to housing, and residential comfort. Rather than adopting a purely spatial logic, the grouping of axes also considered political dimensions, thereby capturing the socio-spatial character of adaptation processes.

A key methodological feature of the framework is the incorporation of temporal information associated with each strategy, based on the year of publication of the source in which it was identified. This temporal mapping allows for the identification of trends, shifts in emphasis, and moments of increased thematic density within the literature. The analysis reveals a growing diversification of adaptation approaches from 2020 onwards, with more recent publications placing greater emphasis on housing, community engagement, and justice-oriented perspectives, while earlier contributions predominantly focused on infrastructural and physical interventions.

In addition, the framework employs a dual hierarchical organisation. The vertical hierarchy reflects the relative conceptual centrality of each thematic axis in relation to the objectives of the research, particularly housing adaptation to climate change. Axes positioned higher in the framework correspond to those that exhibit greater transversal relevance across scales and domains. The horizontal organisation, by contrast, does not imply normative prioritisation but is structured according to a gradient of environmental impact, ranging from strategies characterised by lower levels of physical intervention and greater

reliance on social or ecosystem-based processes, to those involving more intensive infrastructural modifications.
The analysis highlights a clear predominance of strategies focused on grey infrastructure and physical risk control, particularly those aimed at immediate protection and damage reduction. In contrast, strategies addressing housing conditions, social inclusion, community participation, and justice-oriented approaches appear less frequently in the literature, although they tend to be more prominent in recent publications. This temporal pattern suggests an ongoing thematic shift, especially from 2020 onwards, towards a more integrated understanding of climate adaptation as a process that exceeds sectoral interventions and requires articulation between infrastructure, housing policies, governance structures, and local capacities.
The emergence of housing as a distinct analytical axis within the conceptual framework constitutes an empirical finding of the review rather than a merely organisational choice. It reflects a growing recognition in the literature that housing plays a transversal role in mediating the impacts of climate change and in shaping everyday experiences of vulnerability and resilience. From this perspective, housing adaptation is understood not as an isolated technical adjustment, but as an integrated socio-spatial process that intersects with issues of justice, rights, and territorial inequality.
By engaging with the themes of the ECOPÌA Symposium, this paper contributes to broader debates on liveable cities, resilient territories, and collaborative futures. It critically reflects on the limits of adaptation strategies grounded exclusively in technical and infrastructural solutions, and emphasises the need for approaches that recognise housing as a key arena for climate justice and socio-spatial transformation. The proposed conceptual framework is not intended as a prescriptive model, but as an analytical and interpretative tool that can support comparative analysis, inform planning and policy discussions, and foster interdisciplinary dialogue. In this sense, it offers a concrete contribution to the construction of shared research agendas and collective knowledge production within the ECOPÌA network, supporting more inclusive, context-sensitive, and socially grounded responses to the climate crisis.

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Climate Resilience and Property Valuation: The Role of Climate Risk in Value Formation

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The climate crisis is generating increasingly significant impacts on urban and peri-urban areas, affecting settlement safety, building habitability, environmental quality, and the overall performance of urban systems. Phenomena such as more frequent flooding, prolonged heatwaves, extreme precipitation events, and hydrogeological instability are progressively reshaping the spatial distribution of risk and the functional organization of cities. However, these transformations are not yet systematically reflected in real estate market values (Brändle et al., 2025). Traditional property valuation, mainly anchored to observed transaction prices and consolidated market evidence, incorporates environmental and climate-related risks only partially and with a delay. This time lag contributes to an underestimation of built-environment vulnerability and to an incomplete interpretation of value-formation processes, especially in contexts where risk perception evolves more rapidly than market adjustment mechanisms.

According to the theoretical framework established by the Intergovernmental Panel on Climate Change (IPCC) (2022), climate risk is characterized as the consequence of the interaction among hazard, exposure, and vulnerability. In this perspective, property value cannot be assessed independently from territorial risk conditions and from the adaptive capacity of buildings and urban systems. Real estate assets are embedded in spatial systems whose physical, infrastructural, and social characteristics influence both their exposure to climate hazards and their ability to respond to disruptive events. Recent scholarly work emphasizes the growing influence of environmental risks on real estate dynamics, highlighting price discounts in high-risk areas and emerging premiums for safer or better-adapted locations, notwithstanding the heterogeneous and spatially differentiated nature of market responses.

Within this framework, the paper critically examines the relationship between property valuation, climate risk, and territorial resilience, proposing an interpretation of climate resilience as an economically relevant property characteristic. Rather than treating resilience as an abstract or purely qualitative concept, the study conceptualizes it as a measurable attribute that can influence expected economic performance. Resilience is understood as the capacity of a building or settlement system to reduce the economic impacts of extreme climate events — such as floods, intense precipitation, and heatwaves — through adaptation measures, technological solutions, construction techniques, and design strategies that act on vulnerability and response capacity. Examples include elevation measures, waterproofing systems, passive cooling solutions, green infrastructure, and improvements in drainage and urban microclimate regulation.

From a methodological standpoint, the contribution proposes an approach to the economic quantification of climate resilience based on the estimation of Expected Annual Loss (EAL), a metric widely used in the risk analysis and catastrophe modeling literature (Merz et al., 2010). Climate risk is formalised as the product of the annual probability of hazardous events and the associated economic consequences. For each relevant climate hazard, annual probabilities are derived from hazard maps, return periods, and climate indicators available at national and European scales. Expected damage is estimated through vulnerability curves,

reconstruction costs, depreciation dynamics, and, where relevant, indirect economic losses such as temporary loss of use, reduced rental income, and business interruption effects. This analytical structure allows risk to be translated into an annualised monetary value, thus creating a bridge between environmental assessment and economic appraisal.

Adaptation measures reduce expected losses by lowering vulnerability and, in some cases, mitigating the impacts of hazards (Hallegatte, 2009). The difference between the annual risk cost of a non-adapted property and that of a resilient one represents the economic benefit attributable to resilience. This benefit may also include reductions in insurance premiums, improved creditworthiness, lower long-term maintenance costs, and enhanced long-term market attractiveness (Bin & Landry, 2013). In this sense, resilience can be interpreted not only as a risk-mitigation strategy but also as a factor of competitive advantage within increasingly climate-sensitive real estate markets.

Finally, the paper proposes translating these annual benefits into a synthetic economic value through discounting procedures consistent with real estate investment time horizons and income-capitalisation logic. By capitalising avoided future losses, climate resilience becomes measurable within valuation processes, overcoming purely qualitative interpretations and supporting more risk-aware appraisal practices. The proposed framework contributes to integrating climate risk into standard valuation methodologies, fostering greater transparency in investment decision-making and supporting the alignment of property markets with long-term sustainability and adaptation objectives. In doing so, the study situates property valuation within the broader debate on climate-adaptive cities and resilient territories, highlighting its potential role in orienting both public policies and private investment decisions toward more sustainable and risk-informed development pathways.

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Neural networks for reaction-advection-diffusion equations in wildfire propagation modelling

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Wildfire spread represents a major environmental and societal challenge, requiring reliable models capable of describing and predicting the dynamics of fire propagation. Mathematical models based on Partial Differential Equations (PDEs), particularly reaction-advection-diffusion formulations, provide a powerful framework to capture key mechanisms of wildfire dynamics, such as flame front propagation and interactions with the surrounding environment. However, traditional numerical approaches used to solve these PDEs, including finite difference and finite element methods, can become computationally expensive and difficult to apply in real-time scenarios or over complex and irregular terrains. In this work, we focus on a reaction–diffusion model for wildfire spread and investigate the use of Neural Networks (NNs) as an efficient alternative for approximating its solutions. By leveraging the approximation capabilities of NNs, we aim to obtain accurate and computationally efficient predictions of flame front evolution. This approach highlights the potential of neural-network-based solvers to support wildfire monitoring, forecasting, and risk assessment in time- sensitive applications.
Wildfire spread is modeled with a coupled reaction–advection–diffusion system for the temperature U(x,y,t) and fuel fraction V(x,y,t). The governing equations are

$$\frac{\partial U}{\partial t} = R(U,V) - \alpha U - w \cdot \nabla U + \nabla \cdot [K(U)\nabla U],$$
$$\frac{\partial V}{\partial t} = -\frac{\epsilon}{q} R(U,V),$$

where $R(U,V)$ is the nonlinear combustion reaction, $-\alpha U$ accounts for cooling and vertical heat losses, $-w \cdot \nabla U$ models wind-driven heat tr4ansport, and $K(U) = 1 + \kappa(1 + \varepsilon U)^3$ captures nonlinear diffusion and radiative effects.
The reaction term is

$$R(U,V) = S\big(U - u_{pc}\big)V(1 + \varepsilon U)^{\frac{1}{2}} \exp\left(\frac{U}{1 + \varepsilon U}\right),$$

with $S(z)$ a smooth activation function to regularize ignition, and u_{pc} the dimensionless pyrolysis temperature threshold.
The initial temperature field is localized around the ignition point:

$$U(x, y, 0) = U_{max} \exp\left(-\frac{x^2 + y^2}{\gamma_0}\right),$$

while the fuel fraction is initially uniform:

$$V(x, y, 0) = 0.5.$$

Homogeneous Neumann boundary conditions are imposed for the temperature:

$$\frac{\partial U}{\partial n} = 0 \text{ on } \partial\Omega,$$

representing an insulated system with no heat flux across the domain boundaries. In the numerical implementation, these conditions are enforced using ghost points and mirror symmetry.
The coupled reaction–advection–diffusion system for temperature $U(x, y, t)$ and fuel fraction $V(x, y, t)$ is solved using a Physics-Informed Neural Network (PINN). This approach enforces the governing PDEs, initial conditions (ICs), and boundary conditions (BCs) within a single composite loss function via automatic differentiation.
A fully connected feed-forward neural network is employed, inspired by SIREN architectures but using sigmoid activations. The network maps the spatial and temporal coordinates (x, y, t) to the scalar fields $U(x, y, t)$ and $V(x, y, t)$.
The network has L= 2 hidden layers with N= 64 neurons each. Hidden layers use a modulated sigmoid activation:

$$\sigma(\omega(\mathbf{Wx} + \mathbf{b}))$$

where ω is a frequency-scaling parameter to capture high-frequency solution components. The output layer uses a softplus activation to ensure non-negativity of temperature and fuel fraction.
Training is performed over a discrete set of collocation points covering the space–time domain $\Omega \times [0, t_{max}]$:

$$\Omega = [-25,25] \times [-25,25], \qquad t_{max} = 10.$$

Spatially, a uniform 51 ×51 grid is employed. Temporally, 101 points sample the initial subinterval [0,1] to capture rapid transients, followed by coarser unit-step sampling up to t_{max}.
The total loss function minimized during training is

$$\mathcal{L}_{tot} = \mathcal{L}_{PDE} + \mathcal{L}_{IC} + \mathcal{L}_{BC},$$

where $\mathcal{L}_{PDE}$ penalizes residuals of the PDEs at collocation points, $\mathcal{L}_{IC}$ enforces initial conditions, and $\mathcal{L}_{BC}$ enforces
boundary conditions. Ignition is imposed at (0,0) using a short finite-difference evolution to initialize local fuel consumption. This state defines the initial-condition term in the loss function.
To address fuel memory issues observed during training, a history-dependent correction is applied: at each time t and spatial location, the fuel fraction is constrained to the minimum value attained up to that time, ensuring consistency of previously burned areas.
The optimization procedure relies on the Adam algorithm, combined with a dynamic learning rate decay strategy to enhance convergence stability. In particular, whenever the total loss exhibits a deterioration over five consecutive training epochs, the learning rate is reduced according to the update rule

$$LR \leftarrow 0.99\ LR.$$

During training, the network state corresponding to the minimum observed loss value is stored and retained as the optimal solution. This strategy effectively implements both an early

stopping mechanism and a best-model saving criterion, mitigating overfitting and ensuring robust convergence.

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Urban planning in times of uncertainty: the Mexican case

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Since the Industrial Revolution, scholars have discussed the risks and hazards of urban life. Some of the most influential planning innovations of the 19th century in Europe and North America emerged in response to studies suggesting that industrial activity affected health and productivity. Global institutions like the United Nations Development Program (UNDP) have encouraged delegates to adopt a more comprehensive approach to risk management in urban areas, as the number of disasters has increased dramatically in recent years. UNDP states that 'risk in urban areas is a combination of two factors: first, location and exposure to hazards; and second, increased vulnerability due to poor local governance, environmental degradation and overstretching of resources' (UNDP, 2010, p.1). Cities are therefore seen as places framed by permanent risk, amplified by human activities, and Disaster Risk Reduction (DRR) programs promote a culture of prevention aimed at improving identification, communication, institutional response, and community involvement.

The Modern planning paradigm of the 20th century promised to solve the problems of urban life through tools such as zoning and land-use regulations. However, as cities face increasingly complex issues like climate change, inequality, forced migration, political polarisation, and a perverse economic system that prioritises individual gain over collective benefit, the promise of urban planning is fading. Moreover, traditional prescription-like planning is unable to respond to the growing uncertainty that defines modern times. Mexico's urbanisation process has been fast and chaotic. This fast-paced development, along with a large population living one day at a time, makes planning more challenging. This article focuses on recognising uncertainty in the country's recent history and on how people's capacity to adapt to challenges is an opportunity to evolve towards an adaptive urban planning approach. The reflection is part of a research project that analyses the impacts of urban planning in different Mexican cities over the past 10 years, using qualitative methods, including on-site observation, semi-structured interviews, and a comprehensive review of urban planning regulations and policies.

The World Bank urges urban planners and decision-makers in developing countries to use frameworks such as the Urban Risk Assessment (URA) to address disaster and climate risks (Dickson et al., 2012). Risk reduction programs aim to assess hazards to increase institutional and social capacity and awareness; cities can identify, pre-empt, adapt to, and mitigate risk, but it is different with uncertainty, as the latter is not measurable, predictable, or defined by a reliable indicator. Risk assessment focuses on data, while uncertainty requires the capacity to adapt and stay flexible. The highly influential book *Risk Society: Towards a New Modernity* by Ulrich Beck (1992) inspired social scientists to look beyond the limited visions of risk management focused solely on the physical elements, recognising that risk is created by 'social systems' built on relations, processes, institutions, and actors. Recognising the connections between risks and social factors, including power relations and class, is valuable from a policy perspective because these factors primarily affect the poor and the most vulnerable. Ouf and Elshater (2025) argue that urban planning requires a less rigid framework because it limits its ability to address complex, uncertain scenarios. A more adaptable urban planning can help decision-makers identify, implement, re-evaluate, and reconfigure strategies in the face of such uncertainties.

For decades, scholars have suggested that the problems of Latin American cities resulted from 'poor planning,' or that the region's planning failures stem from the superimposition of foreign ideas over valuable locally developed knowledge. This research suggests that in the Mexican case, recent planning instruments and policies have been designed to work under ideal conditions rather than in the complex, often chaotic, and contradictory reality. Rigid planning

strategies, rather than generating more liveable, just, and functional urban environments, have contributed to fragmentation and exclusion, while less-structured urban initiatives, emerging in response to uncertainty, have had a more successful and long-lasting impact. Melé (2016) suggests that scholars have focused too much on what planning cannot solve and on who is to blame – everyone from society to the weakened state, the real estate sector, or the financial markets. Understanding uncertainty can be a gamechanger for planners because, instead of treating the territory as a homogeneous body that can be fixed with a single action, it can be seen as a space of multiple possibilities.

Mexico City has been seen as an example of urban resilience, social engagement, and adaptability. The most remarkable example is the 1985 earthquakes, which proved that civil society could organise more quickly than the State to save lives, recover after a tragedy, and find creative ways to make a living under any circumstances. The future was uncertain, and the events were tragic, but creativity and survival mode brought valuable lessons for generations to come; the emergence of grassroots social housing initiatives and the implementation of stricter construction codes promoted by professional guilds and universities. The country had faced one of its darkest hours, and a few months later, it was ready to open its doors to celebrate during the 1986 FIFA World Cup. Uncertainty did not immobilise people; it moved them. This is by no means a romanticisation of tragedy or precarity, but rather a mindset that focuses on possibilities rather than limitations. In 1999, the state of Puebla experienced another strong earthquake that damaged over 800 heritage-listed buildings. There were two different positions: the capital city, Puebla, engaged in lengthy discussions about how the restoration process would be conducted, which took years, while small towns immediately gathered communities around parishes to fund and collaborate in the reconstruction of churches and monuments that meant something to them. They did not wait for the authorities to set a plan or bring funding; they just made it happen.

Another example of resilience in times of uncertainty was the COVID-19 pandemic. Even though many Mexicans lost their lives and some are still struggling with side effects, there are valuable lessons to be learned. Unlike most countries in the Global North, Mexican authorities were unable to implement a strict lockdown policy or provide economic support to companies or individuals during the pandemic. While professionals in other countries were able to stay home, millions of Mexicans working in hospitality, tourism, and services were suddenly left without their livelihoods, forcing them to find new ways to earn a living. It is unfortunate that the federal government did not have a comprehensive plan for families' economic stability; however, as there was no other choice, most people found new, creative ways to continue.

In conclusion, Mexico is a country marked by territorial, economic, and social conflict, yet also a land of opportunities, solidarity, hope, and creativity. The latter have been the drivers of urban resilience and the emergence of bottom-up initiatives to tackle multifaceted challenges. Planning instruments and institutions were created to address environmental and urban problems, but they should embrace the solutions that chaos and opportunity bring. Planning in times of uncertainty requires a more adaptable and flexible system that empowers collective capacities, particularly in heavily devastated areas by crime and violence, ageing populations, climate risks, and social inequalities. However, to face uncertainty, public institutions should first guarantee adequate services and infrastructure, affordable housing, safe public transport, and opportunities for all social groups.

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Cultural mapping and participatory GIS for new territorial legacies. Towards integrated frameworks for fair and resilient territories

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In recent years, Mediterranean inner areas have increasingly been regarded as key spaces where environmental, demographic, and socio-economic crises intersect, but also as places for experimenting with new development trajectories based on proximity, landscape care, and territorial justice. Within this framework, mapping practices take on a strategic role in making visible dispersed heritage, vulnerabilities, and latent resources, thereby contributing to the orientation of place-based policies and governance arrangements capable of addressing depopulation, inequalities in access to services, and ecological and digital transitions.
This paper proposes a theoretical-methodological reflection on the potential of cultural mapping and GIS methodologies, which are increasingly driven by the concept of participation and a socio-digital approach. This perspective supports the current context in building new territorial heritages, particularly in inner, rural areas and small Mediterranean municipalities.
Starting from a careful review of the literature on cultural mapping, these practices are interpreted not only as tools for "inventorying" a territory's heritage, but as true cognitive infrastructures that help highlight emergences, criticalities, and the value of a given territory. They support the identification of both material and immaterial resources that were previously unrecognized or not systematized. Moreover, these tools enable the structuring of local narratives and bottom-up heritage-making processes, bringing to the fore issues of spatial justice and power imbalances that shape planning processes.
At the same time, the paper reflects on the contribution of GIS (Geographic Information Systems) as a fundamental tool for analysis, data collection, and the characterization of Mediterranean rural and mountain landscapes. These tools strengthen the capacity for systemic territorial interpretation and enable multi-scalar analysis. A current limitation lies in the still limited use of GIS not only for physical, morphological, or strictly quantitative dimensions, but also for social, relational, and qualitative aspects, which are often overlooked despite their crucial importance for a territory's identity and cultural value. This highlights the usefulness of opening up to forms of Public Participation GIS (PPGIS) and volunteered geographic information, which allow the integration of qualitative data, narratives, and perceptions, but require a careful methodological framework to avoid forms of "soft participation" that do not effectively address conflicts and inequalities.
From this perspective, it becomes clear how important it is to foster dialogue between cultural mapping, GIS systems, and European policies focused on smart rural areas and smart villages, as well as policies such as the National Strategy for Inner Areas (SNAI) and the National Strategic Plan for Inner Areas 2021–2027 (PSNAI). These are interpreted as an institutional framework within which to experiment with integrated socio-digital mapping frameworks. Mediterranean inner areas are thus understood as transition laboratories where integrated mapping devices can support "the right to stay" strategies, improve access to essential services and socio-digital infrastructure, and strengthen the capacity of local communities to co-produce policies and planning tools.
From this standpoint, a conceptual scheme for an Integrated Mapping Framework is proposed, linking three dimensions: (a) cultural mapping as a device for recognizing and narrating tangible and intangible heritage; (b) GIS methodologies for the multi-scalar interpretation of landscapes, vulnerabilities, and territorial invariants; (c) place-based policies (SNAI/PSNAI, smart villages, European territorial cooperation) as the framework within which

maps can be transformed into governance devices. The scheme aims to make explicit the link between mapping practices, territorial justice, and the strengthening of community capacities, suggesting how the construction of new territorial heritages can become a driver for more livable and resilient territories.
Furthermore, several operational examples found in the literature—such as community maps and place-based landscape planning experiences developed in the Mediterranean—demonstrate how participatory mapping can act as a tool capable of influencing rules of use, protection, and care of landscapes, anticipating many of the issues currently at the center of the debate on inner areas.
In this context, the paper reflects on both the limits and potential of mapping, emphasizing the need to:

- integrate expert knowledge and local knowledge in co-production processes
- explicitly address conflicts and asymmetries
- design accessible socio-digital platforms that do not exacerbate the digital divide typical of many Mediterranean inner contexts

In conclusion, this contribution aims to encourage reflection on how integrated mapping approaches can support a just transition toward more cooperative and resilient territories, capable of providing higher levels of well-being for their populations. The proposed framework is offered as a theoretical basis for future empirical experimentation—including a case study in Calabria—and as a tool to rethink the role of maps in the governance of the multiple crises affecting cities, rural areas, and Mediterranean inner regions.

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Ecological transitions and demographic constraints: the role of population in sustainability.

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Abstract
Contemporary environmental crises have reignited the debate on sustainability, which has focused primarily on technological and economic solutions and less on demographic dynamics. However, population directly impacts ecosystem pressure and exhibits strong inertia, evolving over much longer time horizons than climate policies.
The research analyses whether sustainability actions can be independent of demographic evolution or whether the latter represents a structural constraint. Models linking population and environmental impact, which treat demography as an exogenous variable, are examined. The results highlight a convergence in considering population as a factor that cannot be changed in the short term, capable of defining sustainable development trajectories. This implies that sustainability should be interpreted as a long-term adaptation process, requiring integrated policies and a vision.
The paper argues that demographic dynamics constitute a structural constraint that cannot be changed in the short term, which sustainability policies cannot ignore.

1. Introduction

The ongoing environmental transformations, accelerated by the climate crisis, have brought the sustainability of development models back to the forefront of the debate. Attention has focused primarily on technological and economic solutions, neglecting a structural dimension that affects the ability of socio-territorial systems to adapt: demographic dynamics.
Population size, spatial distribution, age structure, and mobility directly impact resource consumption and ecosystem pressure, making it difficult to conceive of sustainability independently of population size. Despite this, demography is often treated as a simple contextual variable. This underestimation is problematic because demographic processes evolve much more slowly than environmental and technological ones.
The paper therefore proposes a reinterpretation of the relationship between sustainability and demographics, interpreting population as an exogenous or semi-exogenous variable, characterized by transformation times incompatible with the urgency of environmental crises. The aim is to highlight how failing to consider this temporal dimension can lead to an overestimation of the immediate effects of climate policies and an underestimation of the structural constraints of change.

2. Methodology

The work adopts a theoretical-interpretative approach based on a critical analysis of the international literature on the relationship between demographic dynamics and sustainability, assuming a systemic perspective that considers the population as a structural component of social and ecological systems.
The research starts from the question: can environmental sustainability actions be independent of demographic evolution?

The analysis pursues three objectives: to reconstruct the main theoretical interpretations of the relationship between population and environmental impact; to examine the treatment of demography as an exogenous variable in climate and economic models; and to highlight the temporal divergence between economic and technological variables and demographic dynamics.

3. Literature analysis

The literature on the relationship between environmental sustainability and population size converges in considering population not as a variable dependent on environmental policies, but as a structural factor that conditions the possibilities for sustainable development. The IPAT model expresses environmental impact as a function of population, affluence, and technology, attributing demographic size the role of multiplier of anthropogenic pressure on ecosystems (Ehrlich & Holdren , 1971). This approach was subsequently expanded upon by the STIRPAT model, which shows how population growth and per capita income are associated with higher emissions levels even in the presence of complex technological variables (Dietz & Rosa, 1997).

The most recent literature explicitly treats population as an exogenous variable in forecasting models: in climate mitigation studies, it is assumed to be a predetermined parameter, unchangeable in the short term, which affects resource demand and overall emissions (Scovronick et al., 2017). A similar approach emerges in energy transition and economic growth models, in which population, derived from demographic projections, defines energy consumption and the sustainability of development trajectories (Režný & Bureš , 2019). Finally, analyses of the economy and biodiversity highlight how demographic dynamics, although indirectly influenced by social factors, cannot be directly controlled in the short term, configuring itself as a systemic constraint within which sustainability strategies must be designed (Dasgupta, 2021).

4. Results

The literature converges in identifying population as an exogenous factor characterized by high inertia. Demographic transformations unfold over much longer time horizons than environmental policies, making it difficult to envision rapid interventions independent of such constraints.

Human pressure therefore appears to be rooted in long-term dynamics, which require decades to change. However, the temporal dimension of demography is often overlooked in sustainability models, which tend to consider population as a static data. This suggests that sustainability should be interpreted as a process constrained by the rate of evolution of human populations.

5. Implications and conclusions

The findings indicate the need to rethink sustainability governance from a long-term perspective; if population is an exogenous variable with high inertia, ecological transitions cannot be based on expectations of rapid change.

Sustainability emerges as a systemic adaptation process that requires environmental, social, and territorial policies capable of managing the pressures arising from demographic structure. This implies the adoption of longer decision-making horizons and an intergenerational vision of development. Demography, therefore, does not represent a neutral backdrop, but a structural element that guides possible transformation trajectories.

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Geographic Information Systems as Infrastructures for Participatory Multilevel Coastal Governance. Case studies: Europe, Italy and the Calabrian context.

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Coastal territories are dynamic, socio-ecological and vulnerable environmental systems, where conflicts of space use, spatial segmentation and institutional fragmentation converge. Governance in coastal areas faces a unique condition, characterized by land-sea interactions and historical territorial, administrative and sectoral fragmentation (Beunen & Ferraro, 2025). For this reason, the development of multilevel participatory governance models at different scales is not oriented as a static administrative exercise, but as a dynamic and multi-scale process.

Coastal land use planning is mainly based on the implementation of Integrated Coastal Zone Management (ICZM), Marine Spatial Planning (PEM) and sustainable management of coastal ecosystems, which together with digital spatial information infrastructures seek to identify and designate preferential and compatible uses of the coast in accordance with regional interests. in order to promote the appropriate use of coastal spaces by strengthening regional governance through a participatory and decentralized approach.

The zoning of the coastal margin aims to assign preferential uses of the territory, both productive and non-productive, through agreements between public and private actors. This process takes into account environmental, social and economic factors that aim to ensure compatibility with the Sustainable Development Goals (SDGs) and compliance with the regulatory framework in force in the territory. Among the most relevant SDGs on these issues are SDG 14, which promotes the conservation and sustainable use of oceans and marine resources; SDG 13, focused on climate action to mitigate impacts on coastal ecosystems; and SDG 8, which promotes sustainable economic growth and job creation in coast-related activities. Similarly, the objectives related to the protection of biodiversity (SDG 15), access to clean water (SDG 6) and the promotion of sustainable communities (SDG 11) are integrated, thus ensuring a comprehensive and balanced approach to coastal space management. The effective implementation of sustainable development strategies requires strengthening the capacity of local and regional authorities to translate strategic visions into concrete actions through decentralized functional zoning (Beunen & Ferraro, 2025).

The organization of the use of coastal-marine space must balance the needs of productive economic development with those involving the protection of ecosystems, from a focus on sustainability, adaptive management, social justice, coordination and cooperation as a precaution in situations of uncertainty, considering the pressures of coastal development and nature conservation.

Digital spatial information infrastructures have transformed decision-making processes into a coastal or land-based interface. However, despite the widespread diffusion of Geographic Information Systems (GIS), geoportals and spatial data infrastructures, their function as socio-technological systems necessary for multilevel governance is poorly executed. From a governance perspective, the transformation of coastal management towards sustainable models intrinsically depends on the integration of five key dimensions, including digitalization and the use of sustainable tools. E-governance play a catalytic role (Beunen & Ferraro, 2025). Geographic Information Systems (GIS), integrated into Spatial Data Infrastructures (SDIs), should not be understood only as technical tools, but as complex adaptive systems that facilitate interaction between actors, structures and decision-making processes at multiple levels (Partelow et al., 2020).

This article proposes a theoretical and empirical analysis of GIS as infrastructures that structure forms of collaborative and multilevel governance. From the perspective of environmental governance, theoretical contributions are incorporated that underline the polycentric and relational nature of coastal governance (Partelow et al., 2020) and their need to integrate knowledge, power, and legitimacy at different scales. Similarly, the approach of E-governance to digital governance, understood as a process in which GIS platforms and geoportals actively influence the definition of actors, rules and possibilities of participation (Beunen & Ferraro, 2025).

The analysis is based on recent studies on the governance of spatial data infrastructures, which reflect how networked governance models and interinstitutional cooperation are more effective than traditional hierarchical approaches to coordinate territorial actors and resources (Sjoukema et al., 2021). The case of Marine Spatial Planning (MSP) in Italy demonstrates the need for a nested approach in which national guidelines are integrated with local planning units (zoning), allowing biological and economic processes to influence each other at different scales. This implementation of a multiscale approach in planning highlights the strategic role of GIS and interoperable data in supporting multilevel co-planning processes between the State, regions and other territorial actors (Ramieri et al., 2024).

In this context, the Calabrian situation shows a distance between the advanced use of GIS in technical processes of coastal risk assessment and the limited institutionalization of participatory practices and co-production of knowledge. This discrepancy suggests that the availability of geospatial data, while playing an important role in decision-making processes, does not guarantee the effectiveness of information infrastructures, in short, it depends on the ability of institutions to integrate these tools into shared procedures, enhancing interscalar cooperation and the coordinated use of spatial information.

The integration of GIS as a governance infrastructure requires not only technical sophistication, but also a profound institutional reform that promotes territorial justice, transparency in data flow and multi-level coordination (Ramieri et al., 2024; Bianchi & Chiedei, 2023; Gonçalves & Pinho, 2024). The stability of coastal systems depends on the ability of actors to respond to the constant feedback provided by geospatial monitoring tools. The transition to sustainable models in these territories depends on the barrier-free flow of spatial information between levels of government and on stakeholders having the tools to co-create future visions of coastlines.

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Diverse Households, Rigid Housing: Reconversion and Territorial Justice in Guadalajara, Mexico

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Introduction and Context

Contemporary cities in Latin America face a paradox that is simultaneously spatial, demographic, and institutional. On one side, the housing stock accumulated during the second half of the twentieth century occupies vast consolidated urban territories equipped with complete infrastructure, proximity to employment and services, and relative accessibility to public transit. On the other, the households that inhabit these territories today bear little resemblance to those for whom these dwellings were designed. The canonical Mexican middle-class home—a single-family detached house with three bedrooms, a living room, front yard, and parking space, conceived for a nuclear family of two parents and two or three children—no longer maps onto the social reality of a metropolitan area that has undergone decades of demographic, economic, and cultural transformation. The result is a persistent and growing mismatch between housing morphology and household structure, one that generates territorial exclusion, reinforces spatial inequalities, and drives an expansive dynamic of peripheral urbanization that is ecologically and fiscally unsustainable. This paper examines housing reconversion—the transformation of existing dwellings to accommodate different or additional households—as a territorial justice strategy capable of addressing this mismatch in the Guadalajara Metropolitan Area (GMA), Mexico. Drawing on a mixed-methods empirical study conducted in three consolidated neighbourhoods of the municipality of Zapopan, it argues that reconversion practices already underway in these territories represent a legitimate and undertheorized form of social production of habitat. When recognized, regulated, and supported by appropriate policy instruments, these practices can democratize access to well-located urban land, optimize installed infrastructure, and reduce pressure on peri-urban ecosystems, thereby articulating spatial justice with ecological transition. The paper is structured as follows: after establishing the theoretical framework, it characterizes the GMA housing crisis and the demographic transformation of households; it then documents informal reconversion practices in the field and examines comparative international and national cases; it presents the research methodology and the policy proposal emerging from the findings; and it concludes by situating the contribution within the ECOPÍA network's thematic axes.

Theoretical Framework

The conceptual architecture of this research draws on three intersecting bodies of scholarship. The first is the tradition of spatial justice and the right to the city, rooted in the work of Henri Lefebvre (1968) and elaborated by geographers such as David Harvey (2012) and Edward Soja (2010). For Lefebvre, the right to the city is not merely the right to access existing urban resources but the right to participate in the production of urban space itself—to inhabit, use, and transform the city according to the needs of its residents rather than the logic of capital accumulation. Harvey radicalizes this formulation, arguing that the right to the city is a collective right to reshape the urban environment in ways that serve the majority of its inhabitants, and that the exercise of this right necessarily involves a struggle over who controls the processes of urbanization, land development, and housing production. Soja's notion of spatial justice adds a geographic specificity: injustice is not only social but spatial, inscribed in the organization of territory and reproduced through it in ways that may persist long after the conditions that generated them have changed. In the context of this research, typological rigidity—the enforcement, through zoning regulations and credit instruments, of a single

acceptable housing form designed for a particular family configuration—constitutes precisely such a spatial injustice, one that operates by rendering certain household forms invisible, unrecognized, and unhoused within consolidated urban territories. The second body of scholarship concerns the social production of habitat, a framework developed by Latin American housing scholars and practitioners—principally Enrique Ortiz Flores (2012) through the work of the Housing and Habitat International Coalition (HIC-AL)—to describe and theorize the processes by which popular and middle-class households transform their living environments through their own initiative, labour, and resources, often outside formal regulatory channels. The social production of habitat is not a marginal or residual phenomenon in Latin American cities but the dominant mode through which the majority of their built environment is produced and reproduced. It encompasses a wide range of practices, from incremental self-construction on peripheral lots to the informal subdivision of existing dwellings in consolidated areas, and it reflects a profound territorial intelligence about household needs, neighbourhood change, and local economic possibility. Housing reconversion, as documented in this research, is a specific form of social production of habitat appropriate to consolidated urban areas where the residential stock is not new but inherited, and where the challenge is not construction from scratch but transformation of what already exists. The third theoretical axis concerns the relationship between household diversity and housing policy. Feminist urban scholars, including Zaida Muxí (2018) and researchers working in the tradition of non-sexist urbanism, have documented how modern housing design and urban planning were constructed around an idealized nuclear family form that rendered women's domestic labour invisible and structured housing space, block layouts, and neighbourhood organization accordingly. The diversification of household structures—the growth of single-parent families (the majority female-headed), single-person households, multigenerational cohabitation arrangements, non-family and chosen-family configurations—is not simply a demographic trend to which housing policy must adapt but a social transformation that demands a rethinking of housing from its normative foundations. Housing reconversion, understood as the adaptation of existing stock to accommodate diverse household forms, is thus not a merely technical intervention but a political one: it challenges the normative family model embedded in housing typology and asserts the spatial legitimacy of diverse ways of living and dwelling.

Housing Policy and Its Contradictions in the Guadalajara Metropolitan Area

The Guadalajara Metropolitan Area is Mexico's third-largest urban agglomeration, with approximately 5.3 million inhabitants distributed across nine municipalities. Its growth trajectory over the past six decades reflects the contradictions of Mexican urbanization policy with particular clarity. During the 1960s, 1970s, and 1980s, a wave of middle-class residential development transformed the municipalities of Guadalajara and Zapopan, producing the consolidated colonias that are the object of this research: La Calma, Las Águilas, Arboledas, Chapalita, and dozens of similar subdivisions characterized by medium-density single-family construction, generous street widths, green areas, and full provision of potable water, drainage, electricity, and paved surfaces. These neighbourhoods accumulated social capital, commercial activity, and institutional services over decades, becoming the kind of complete urban environments that are extremely difficult and expensive to produce from scratch. Yet their housing stock remained almost entirely frozen in the typological form of their original development: single-family homes designed for households that no longer exist in significant numbers. The post-NAFTA period witnessed a dramatic shift in Mexican housing policy that deepened rather than resolved this contradiction. The expansion of mortgage credit through INFONAVIT, the national workers' housing fund, and the emergence of large-scale private developers transformed housing provision from an incremental, socially-produced process into an industrial one, generating hundreds of thousands of standardized units on the urban periphery. In the GMA, this process produced vast new suburban zones in the municipalities of El Salto, Tlajomulco de Zúñiga, and Tonálá, far from employment centres, poorly served by public transit, and built on agricultural and ecological land at the urban fringe. The financial instrument that drove this expansion—the INFONAVIT credit scheme—was oriented almost exclusively toward new construction for nuclear families in formal employment, leaving behind informal workers, diverse households, elderly residents, and inhabitants of consolidated areas

whose housing needs were not new units but the transformation of existing ones. The result is a metropolitan landscape of simultaneous underutilization and scarcity: oversized homes in well-located consolidated areas occupied by reduced households, and inadequate peripheral housing occupied by households that were channelled there by the only credit instrument available to them. The consequences for affordability are severe. According to analysis of INEGI census microdata, the median household in the GMA allocates approximately 49% of its income to housing costs—nearly double the 30% threshold established by UN-Habitat as the upper limit of affordability. Land values in consolidated colonias have increased substantially relative to incomes over the past decade, driven by speculation, the absence of supply-side responses to demand, and the recognition among higher-income households of the quality premium of well-located, well-serviced urban land. For households seeking smaller, more affordable units in these territories—young adults, single-parent families, empty-nesters, recently separated individuals—no adequate supply exists through formal channels, and no credit instrument addresses their specific situation. The gap between what households need and what the formal housing market offers is precisely the space in which informal reconversion operates.

Household Diversity and Typological Mismatch

The demographic transformation of Mexican households over the past three decades has been rapid and profound, yet housing policy has responded with remarkable institutional inertia. INEGI data for the state of Jalisco reveal that 71.44% of households do not conform to the nuclear family model that underlies the design of the consolidated housing stock. Single-parent households—the large majority headed by women—represent 33% of the total metropolitan household count; single-person households account for approximately 13%; multigenerational households including grandparents, adult children, and other relatives constitute another significant share; and non-family and chosen-family arrangements, though less legible within census categories, are present throughout the metropolitan area. In the ZPN-6 “Las Águilas” zone of Zapopan, which constitutes the primary empirical field of this research, 32% of households are female-headed, a proportion that reflects both the high rate of union dissolution in Jalisco and the economic vulnerability of women in a labour market that systematically underpays and informally employs them. These structural changes are compounded by demographic ageing. Projections based on INEGI census data indicate a 24.7% growth in the population over 60 in the GMA by 2030, a cohort with distinct housing needs—smaller units, accessibility features, proximity to health services and social networks, options for supported independent living—that are poorly met by the existing three-bedroom single-family stock. The ageing-in-place challenge is acute in the consolidated colonias, where many long-term residents are now elderly and physically unable to maintain large homes, yet lack the financial resources or legal mechanisms to subdivide and rent without jeopardizing their property rights. At the same time, the generation currently entering the housing market for the first time confronts conditions radically different from those of their parents: widespread informal and precarious employment, the dramatic collapse of real wages relative to land prices, delayed family formation, and a documented preference for smaller units in central locations over large units in peripheral subdivisions. The CORETT regularization programme that formally registered 18,650 lots in ZPN-6 between 1975 and 1993 demonstrates that informal consolidation followed by institutional regularization is a well-established pattern in Mexican urban history, and that the state has both the capacity and, under the right political conditions, the will to recognize and legalize housing forms that initially develop outside formal channels. What is required today is a contemporary equivalent that addresses not land tenure but functional transformation: a regularization pathway for informal reconversions that already exist, and a forward-looking regulatory framework that enables future reconversions to be undertaken formally, safely, and with access to appropriate financing. The H1 and H2 zoning designations that govern most of the consolidated colonias of Zapopan currently prohibit the subdivision and densification that would allow the existing stock to serve diverse household needs, creating a regulatory framework that is not merely ineffective but actively counterproductive: it does not prevent reconversion from happening, but it ensures that reconversion happens informally, without quality control, without structural safety assessment, and without legal recognition.

Informal Reconversion in La Calma, Las Águilas, and Arboledas

The empirical core of this research consists of fieldwork conducted in three consolidated colonias of Zapopan: La Calma, Las Águilas, and Arboledas. These neighbourhoods share the defining characteristics of the ZPN-6 zone: middle-class residential origin, full urban services, strategic location relative to employment corridors and public transit, and a recognizable and growing pattern of informal typological transformation. Established between the 1960s and 1980s, they represent the kind of mature urban environment—complete, walkable, mixed-use at the street level, well-connected—that urban planners across the world are attempting to create from scratch in peripheral greenfield developments, at enormous cost and with uncertain results. The surveys conducted with 68 households document a wide range of reconversion practices motivated by diverse needs and economic strategies. The most common form is the addition of a secondary dwelling unit within the existing lot—what North American housing policy terms an accessory dwelling unit or ADU—typically achieved by converting a garage, garden area, or rooftop terrace, or by vertically extending the original structure with a second storey. These units are most frequently occupied by adult children who cannot afford independent housing in the metropolitan market, by elderly parents who require proximity to family without full cohabitation, or by unrelated tenants whose rental income supplements the main household's budget. A second common form is the horizontal or vertical subdivision of the original dwelling into two fully independent units, each with its own entrance, kitchen, bathroom, and services—typically retaining one unit for owner occupation while renting or eventually selling the other. A third form, less frequent but documented in all three neighbourhoods, involves the more radical transformation of the original structure: the demolition of the single-family home and its replacement by a small multifamily building of four to eight units, or the conversion of a ground-floor commercial use that has itself become obsolete. The semi-structured interviews reveal a consistent tension between the practical rationality of reconversion and the regulatory framework that prohibits or ignores it. Residents describe their transformations as common-sense responses to changing household circumstances—an adult daughter who returns with a child after separation, an ageing parent who can no longer live alone, a spare bedroom that could generate income to supplement a pension—rather than as violations of planning law, of which many are either unaware or indifferent given its apparent irrelevance to daily life. The absence of formal channels means that reconversions are typically undertaken without architectural design, without structural engineering assessment, without building permits, and without access to mortgage financing, resulting in constructions of variable quality that expose residents to legal insecurity and, in some cases, structural risk. Several residents who attempted to formalize their transformations described a process of bureaucratic obstruction: zoning regulations that categorically prohibited what they sought to do, permit processes designed for new construction rather than existing-building transformation, and the complete absence of any institutional actor offering technical or financial assistance for reconversion. This experience of institutional absence is not incidental but systemic: it reflects a housing policy apparatus that was designed for a different moment in Mexico's urban history and has not yet been reconfigured to address the challenges of the consolidated city.

International and National Reference Cases

The comparative dimension of this research draws on a set of international and national cases that illustrate the regulatory, design, and financial strategies through which housing reconversion has been institutionalized in other urban contexts, and that provide transferable lessons for the GMA. These cases are not proposed as direct models for uncritical adoption—their specific regulatory, cultural, and economic contexts differ significantly from that of Jalisco—but as existence proofs that the challenges identified in this research have been confronted elsewhere, and that effective responses are possible. The DeFlat Kleiburg project in Amsterdam (2013–2016) is perhaps the most thoroughly documented case of large-scale housing reconversion enabling residential diversity within existing stock. Kleiburg is a 400-metre-long residential slab of 500 apartments in the Bijlmermeer district, originally constructed in the 1970s as part of a modernist social housing scheme that was subsequently stigmatized, partially emptied, and proposed for demolition. Rather than demolishing the structure, the Amsterdam Housing Corporation opted for a radically open-ended rehabilitation

model in which the structural shell, facade, and common areas were renovated, while each individual apartment was sold as an unfinished shell to buyers who designed and finished their own units according to their preferences and budgets. The result is an extraordinary diversity of dwelling sizes, social profiles, and spatial organizations within a single building, achieved at approximately one third of the cost of demolition and new construction. The project's relevance to the GMA context lies in its demonstration that regulatory flexibility—the authorization of non-standard floor plans, simplified internal permit processing, and the separation of structural from interior building approvals—can release enormous creative and social potential within existing housing stock without requiring either public subsidy or bureaucratic complexity. The Grand Parc Bordeaux project (Lacaton and Vassal, Druot and Hutin, 2017) illustrates a different dimension of reconversion: the transformation of existing social housing blocks through the addition of prefabricated winter gardens and balconies to 530 apartments, achieved without displacing any household during construction. The project's explicit political philosophy—transformation in place rather than demolition and replacement, addition rather than subtraction, enhancement of what already exists rather than its erasure—is directly relevant to the GMA context, where the risk of displacement through gentrification is real and where the retention of existing social networks is a priority articulated by many interview respondents. The cost per unit was substantially below that of equivalent new construction, and post-occupancy studies documented significant improvements in residential satisfaction, thermal comfort, and spatial autonomy. California's ADU reform legislation (2017–2020) provides the most empirically robust case of regulatory liberalization enabling rapid and distributed densification of consolidated residential areas. Prior to the reform, accessory dwelling units in California were effectively prohibited by local zoning in most municipalities. After state legislation pre-empted local restrictions, streamlined permitting processes, reduced fees, and allowed ADUs on virtually all residential lots, the results were dramatic: from approximately 5,000 ADU permits annually before the reform, the state reached over 23,000 in 2021, totalling more than 82,000 cumulative permits within five years. The units produced were disproportionately concentrated in well-located urban areas—precisely the territories where affordable housing is most needed and hardest to produce through conventional development. At the municipal level, the Zapopan "Desdoblamiento de Vivienda" programme represents an important precursor, permitting floor area ratio increases of up to 50% on qualifying lots under specified infrastructure conditions. Its scope is limited—it addresses new construction on existing lots rather than transformation of existing structures, and its uptake has been modest—but it establishes a municipal precedent for the normative principle that consolidated residential lots can be densified in the public interest. The FUCVAM cooperative housing model of Uruguay and the Buenos Aires co-housing law of 2021 further demonstrate the viability of collective governance frameworks for housing production and management that go beyond both individual ownership and conventional rental.

Methodology

The research employs a convergent mixed-methods design in which quantitative and qualitative components are developed simultaneously and integrated at the interpretation stage. This integration is not merely additive but dialectical: quantitative patterns generate hypotheses that qualitative fieldwork interrogates and complicates, while qualitative findings indicate variables and relationships that are subsequently tested through spatial and statistical analysis. The methodological approach is grounded in the tradition of participatory urban research and social production of habitat studies, which centres the knowledge and experience of residents as primary informants about processes that official data systematically undercount and that institutional actors frequently misrepresent. A resident advisory group participated in the design of the survey instrument and in the validation of preliminary findings, ensuring that the research agenda was responsive to the concerns and priorities of the communities under study. The quantitative component draws on three principal data sources. First, INEGI's 2020 Censo de Población y Vivienda provides baseline data on household composition, housing tenure, and physical housing characteristics at the Área Geoestadística Básica (AGEB) level, allowing spatial analysis of demographic patterns relative to housing stock characteristics across the ZPN-6 zone and the broader municipality

of Zapopan. Second, cadastral data from the Catastro Municipal de Zapopan provides information on lot areas, registered construction areas, building permits, and assessed values for properties in the study neighbourhoods, enabling the identification of modifications that alter built area relative to recorded baselines—a proxy, however imperfect, for informal reconversion activity. Third, field surveys conducted with 68 households in La Calma, Las Águilas, and Arboledas document the physical characteristics, legal status, motivations, and financing strategies of reconversion practices. The survey instrument, developed collaboratively with a resident advisory group during a pilot phase, covers household composition and trajectory, description of physical modifications, permit status, financing sources and constraints, motivations for reconversion, satisfaction with the process and its outcomes, and hypothetical willingness to participate in a formal reconversion programme under specified conditions. GIS analysis integrates survey data with municipal zoning layers, public transit network buffers, land value gradient data from Catastro, and AGEB-level demographic variables to produce spatial analyses of reconversion intensity relative to regulatory environment, infrastructure quality, and proximity to services and employment. The qualitative component comprises three interconnected elements. Twenty-four semi-structured interviews were conducted with residents who had undertaken or were actively considering reconversion, structured around three thematic axes: housing trajectories and the circumstances that led to reconversion, experience with regulatory and financial institutions, and visions and expectations for the future of their homes and neighbourhoods. Eight interviews with housing professionals—architects, construction workers, real estate agents, and municipal planning officials—provide an institutional and technical perspective on the reconversion process and its formal and informal dimensions. Systematic direct observation carried out in all three neighbourhoods over four months documents visible transformations at the street and lot level, the range of physical typologies produced by informal reconversion, and the relationship between spatial change and the social uses of outdoor and semi-public space. Normative analysis of federal, state, and municipal regulations—including the Ley General de Asentamientos Humanos, the Plan de Desarrollo Urbano de Zapopan, the Plan Parcial ZPN-6, and the INFONAVIT credit scheme portfolio—establishes the regulatory framework within which empirical findings are interpreted, mapping the gaps, contradictions, and perverse incentives that structure informal reconversion as the default mode of habitat adaptation in consolidated urban areas.

Policy Proposal: Programa Casa Viva AMG

The “Programa Casa Viva AMG” (Fonseca, 2026) proposes four interconnected strategies for housing reconversion in consolidated metropolitan areas. First, a Metropolitan ADU Programme would establish a streamlined permitting pathway for accessory dwelling units—garage conversions, rooftop additions, garden units, and vertical extensions—using pre-authorized typologies that eliminate the need for individual architectural review, reducing permit costs and time by an estimated 60–70%. A dedicated credit line adapted from INFONAVIT’s Unamos Créditos product and free technical consultations through existing Centro Integral de Servicios offices would accompany the regulatory reform. Second, a Regularization Pathway would offer existing informal reconversions legal recognition through a simplified inspection process, conditional on minimum habitability standards, and supported by subsidized upgrading loans and fiscal incentives including property tax amnesty. Third, a Flexible Housing Catalogue—an open-license repository of twelve to fifteen pre-designed reconversion prototypes with structural drawings, cost estimates, energy performance data, and pre-completed permit applications—would lower the design barrier for households who cannot afford professional architectural services. Fourth, a Co-Housing Legal Framework, drawing on the Buenos Aires co-housing law (2021) and the FUCVAM cooperative model, would enable groups of eight to twenty households to collectively acquire, reconvert, and co-manage existing buildings through a condominium-cooperative legal form, with collective mortgage access and a land trust mechanism to preserve long-term affordability. A pilot project in ZPN-6 would test and document the model for metropolitan replication.

Contribution to the ECOPÍA Network and Conclusions

This research contributes to the ECOPÍA network's "Facing Crises for Liveable Cities and Resilient Territories" axis from three complementary dimensions. Empirically, it documents that 13.4% of Zapopan's housing stock has already undergone informal reconversion—establishing this as a systematic urban process, not an exception—and maps its spatial distribution relative to zoning, transit, and land values to inform targeted policy intervention. Theoretically, it integrates spatial justice (Lefebvre, Harvey, Soja), social production of habitat (Ortiz Flores), and feminist urbanism (Muxí) into a framework that makes visible the gender, generational, and class dimensions of housing transformation, offering policy actors a conceptual tool for understanding reconversion as territorial justice rather than regulatory violation. Propositionally, the Programa Casa Viva AMG translates these findings into four fiscally viable, politically feasible strategies implementable within the existing institutional framework of Jalisco, without requiring federal legislative reform. More broadly, the research argues that the consolidated housing stock of Latin American metropolises is an undervalued resource whose transformation offers a more equitable and ecologically sustainable path than continued peripheral expansion. The GMA's experience is not exceptional: the mismatch between inherited housing typology and contemporary household diversity—visible equally in Mexico City's colonias populares, Buenos Aires' barrios, and Bogotá's urban blocks—points to a shared condition that the ECOPÍA network is uniquely positioned to address through comparative research and cross-regional policy dialogue.

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Living Labs for Landscape Design in Crisis Contexts: Reflections from the Naples Metropolitan Area

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Urban regions facing persistent environmental, social, and institutional crises increasingly experiment with collaborative and adaptive planning approaches to respond to uncertainty, fragmentation and complexity. In this context, Living Labs have emerged in the literature as methodological devices that bring together diverse actors to co- produce knowledge, test situated solutions, and explore new forms of governance. Their growing use in urban landscape projects raises important questions about how such experimental settings contribute to the pursuit of liveable cities and resilient territories.

Building on key contributions in Living Lab scholarship (e.g. Concilio, 2016; Höflehner et al., 2018; Amenta et al., 2019), this paper advances the thesis that Living Labs can function as landscape design tools when they are understood not merely as innovation platforms, but as relational settings in which the landscape is jointly perceived, interpreted, and transformed through collective action. In crisis-affected contexts—characterised by overlapping ecological degradation, social vulnerability, institutional fragmentation, and discontinuous planning trajectories—this interpretative and process-oriented dimension becomes particularly relevant.

To frame this argument, the paper draws on Eugenio Turri's conception of landscape as a collective process of representation and action (Turri, 1993). For Turri, the landscape functions as an interface between social and territorial systems, a communicative space where perception feeds representation and representation, in turn, guides action. Living Labs resonate with this understanding by enabling iterative feedback between interpretation and intervention, allowing the landscape to emerge not as a fixed backdrop but as a "theatre in construction." By engaging multiple forms of knowledge and lived experience, they create conditions in which stakeholders collectively "learn to see" the landscape while acting upon it. In this sense, Living Labs have the potential to operationalize the principles of the European Landscape Convention, which frames the landscape as a shared living environment shaped by everyday practices and whose quality depends on the aspirations, values, and active involvement of the populations who inhabit it. By empowering stakeholders as responsible participants rather than passive consultees, Living Labs can translate this normative framework into situated planning and design practices.

Empirically, the paper reviews a set of documented research and experimental projects carried out in the metropolitan area of Naples, Italy, drawing on available scientific and grey literature. These include initiatives developed within various research projects addressing coastal, post-industrial, peripheral, and peri-urban contexts in the metropolitan area of Naples such as REPAIR (https://h2020repair.eu/) and the Lido Pola Laboratorio Permanente (https://commonsnapoli.org/gli-spazi/lido-pola/), to name just a few illustrative examples. These contexts can be understood as transitional landscapes, shaped by cyclical processes of abandonment, functional withdrawal, and reconfiguration that characterize many European urban regions (Russo, 2023). Neither residual nor fully redefined, these landscapes are marked by ongoing change, where ecological pressures, social inequalities, and governance uncertainties intersect. Their proximity to everyday life makes them critical arenas for experimenting with participatory forms of care, stewardship, and co-management that can reconnect environmental regeneration with social practices.

Naples represents a particularly instructive case study for examining Living Labs in conditions of territories in crisis. Here, Living Labs are mobilized not only to support innovation and participation, but also to mediate conflicts, sustain fragile alliances, and engage with issues of maintenance and continuity over time. Previous research conducted within the REPAiR programme (Amenta et al., 2019) showed that Living Labs in Naples

involved a comparatively stronger participation of civil society actors—such as associations and civic groups—compared to the other European case examined in Amsterdam. This suggests that Naples offers a particularly dense civic landscape in which Living Labs intersect with pre-existing forms of collective action, making it a relevant context for exploring how participatory tools influence landscape representation, decision-making, and responsibility.

Methodologically, the paper adopts a comparative perspective grounded in literature review and qualitative analysis. Rather than assessing individual projects in terms of predefined performance indicators, the analysis focuses on how Living Labs structure processes of interpretation, negotiation, and action in complex landscape contexts. Three evaluative criteria are proposed to assess Living Labs as devices for resilient landscape design in crisis contexts:

1. the configuration of actors involved in perceiving and acting upon the landscape, and which forms of knowledge are recognized as legitimate;
2. the relationship with conflict, understood as a potential resource for collective learning and negotiation rather than an obstacle to be neutralized; and
3. the capacity to operate over time, including the ability to accompany projects beyond funding cycles and to engage with unforeseen outcomes, testing whether Living Labs function as episodic project formats or as enduring frameworks for landscape stewardship.

By reframing Living Labs as methodological tools for landscape planning in territories in crisis, the paper contributes to ongoing debates on collaborative governance, landscape resilience, and experimental planning practices. In line with the objectives of the ECOPIA network, it aims to support dialogue on how interdisciplinary, place-based approaches can more effectively integrate ecological integrity, social inclusion, and long-term territorial care.

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Empirically, the paper reviews a set of documented research and experimental projects carried out in the metropolitan area of Naples, Italy, drawing on available scientific and grey literature. These include initiatives developed within various research projects addressing coastal, post-industrial, peripheral, and peri-urban contexts in the metropolitan area of Naples such as REPAIR (https://h2020repair.eu/) and the Lido Pola Laboratorio Permanente (https://commonsnapoli.org/gli-spazi/lido-pola/), to name just a few illustrative examples. These contexts can be understood as transitional landscapes, shaped by cyclical processes of abandonment, functional withdrawal, and reconfiguration that characterize many European urban regions (Russo, 2023). Neither residual nor fully redefined, these landscapes are marked by ongoing change, where ecological pressures, social inequalities, and governance uncertainties intersect. Their proximity to everyday life makes them critical arenas for experimenting with participatory forms of care, stewardship, and co-management that can reconnect environmental regeneration with social practices.

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Mapping the Invisible: Interactive Digital Heritage Tools for the Revitalization of Arbëreshë Communities in Calabria

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This contribution presents a digital heritage mapping initiative developed for the Arbëreshë communities of Northern Calabria (Southern Italy), a group of Albanian-origin settlements established in the fifteenth century that have maintained a distinct ethno-linguistic and religious identity over nearly six centuries (Attema et al., 2022). These communities, scattered across the Calabrian Apennines, practice Byzantine-rite Catholicism, a living liturgical and architectural tradition that constitutes a unique intangible and tangible heritage within the Mediterranean cultural landscape. Today, these territories face acute socio-demographic fragility, characterized by accelerating depopulation, ageing populations, economic marginalization, and the progressive erosion of cultural memory. These communities belong to what Italian territorial policy has come to call "inner areas" (Cirianni et al., 2022), places far from essential services and economic opportunity, where depopulation has been not an exception but a structural condition.

The research team developed an interactive web-based mapping platform, built using Python and Node.js, specifically designed to document, visualize, and communicate the Byzantine-rite Catholic churches distributed across the Arbëreshë territories of Northern Calabria. The platform integrates a georeferenced cartographic interface with a rich multimedia layer, enabling users to access detailed archival information on each religious site directly from the map. A defining technical feature of the system is its integration of navigable 360-degree spherical photography, accessible across all digital devices, allowing remote users to experience immersive virtual visits of architecturally significant sacred spaces that would otherwise remain unknown or inaccessible to broader audiences.

The system has been designed with explicit attention to accessibility and multi-audience usability. Each point of interest within the map is associated with descriptive content, historical contextualization and photographic archives, structured to serve cultural tourism practitioners, local communities, and policymakers involved in territorial development. The work is grounded in the conviction that cultural heritage, when made accessible and narrated effectively, can become a resource for the regeneration of fragile territories (Verardi et al., 2023). Place-based approaches and participatory processes are central to

this vision. Digital tools serve here as instruments of territorial storytelling and civic engagement, capable of making visible what risks being forgotten and of connecting local communities with broader audiences.
The platform was developed through a process of close collaboration with the local community, and the data collection was carried out with the direct involvement of the "Eparchy", the diocesan authority that, in the Byzantine Catholic tradition, oversees the spiritual and cultural life of the Arbëreshë communities. This engagement ensured both the accuracy of the heritage documentation and a degree of institutional legitimacy that purely desk-based research could not have achieved. A deliberate emphasis was placed on the use of well-established, widely documented open-source technologies and libraries for 360-degree visualization, ensuring that the system remains maintainable over time and can be replicated or adapted by other communities and institutions with limited technical resources. This architectural choice reflects a broader commitment to scalability: the platform is conceived not as a closed product but as an expandable framework, designed to grow incrementally as new sites are documented, new
communities engage with the project, and new digital functionalities become available. Beyond its documentary value, the initiative highlights the potential of digital heritage mapping as a policy-relevant instrument within integrated strategies for inner area regeneration (Chirivì et al., 2026). In particular, it suggests how such tools may contribute to territorial governance and spatial planning instruments, informing planning frameworks and supporting decision-making processes at the local level. In this perspective, the project offers public administrations and local stakeholders a concrete example of how digital technologies and cultural identity can work together to support place-based planning processes and foster sustainable territorial development.
By presenting the Arbëreshë mapping project, this contribution aims to illustrate how transdisciplinary, technology- assisted heritage documentation can support liveable and resilient territorial futures, offering a replicable model for other fragile communities where cultural distinctiveness, digital innovation, and participatory governance converge as drivers of place-based regeneration.

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Evaporative cooling: an energy efficient and climate sensitive lowtech approach on urban heat islands

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The rise in global temperatures, increasing urbanisation and the resulting increase of the urban heat island effect urges the development of adaptation strategies at the building level. Globally, the primary energy demand for cooling and air conditioning in summer dominates heating in winter. At the same time, increasing urbanisation and climate change are exacerbating issues such as heavy rainfall management and changes to the natural water cycle resulting from evaporation and groundwater recharge.
Buildings play a key role in both adaptation and mitigation strategies for climate change, particularly as contributors through energy and other resource consumption, waste heat emissions, heavy rainfall runoff, etc. A wide range of compensatory measures exists; through the implementation and evaluation of 'flagship projects', these measures can be brought to the attention of a wider public, of planners, politicians, the city administration and students. Greening plays a key role here, as only through the evaporation process the ambient air, the interior of buildings and the city can be effectively cooled. All other strategies merely shift the energy budget from short-wave radiation to long-wave emissions or generate additional waste heat.
A flagship project of international note is the extension of the Bunker St.Pauli in Hamburg (www.bunker-stpauli.de). Whilst densification in urban areas generally worsens the ecological situation, the extension and greening of the bunker with almost 5,000 trees and shrubs has actually improved it. The project was opened on 5 July 2024 following a five-year construction period. The urban development agreement with the Hamburg Senate stipulated the creation of a publicly accessible park, which attracted more than 2 million visitors in its first year after opening. Planning and site management for the greening were handled by the office Landschaftsarchitektur plus; construction was carried out by the landscaping company Hildebrandt, with the irrigation technology subcontracted to Grahm.
Lorenz von Ehren supplied the trees and shrubs. Overall planning and site management were handled by Phase 10 Architekten, Freiberg. The investor is Matzen Immobilien GmbH & Co. KG. Since 2023, the building has been monitored as part of a Federal Environment Ministry funding programme for climate adaptation, with the greening measures being evaluated by TU Berlin in cooperation with the company Optigrün. As part of the construction project, various sensors were installed to quantify the impact of the greening on the building structure and the urban environment. The hydrological water cycle plays a key role in climate adaptation measures, particularly the ratio of evaporation to incoming solar radiation. At the project site, the green spaces exceed the global average of 50% latent heat from solar radiation, reaching 56%. Thus, the greening of areas not only represents an adaptation measure to climate change but can also be attributed to climate protection.
According to DWA M 102, the natural water cycle for each local sites is a key target parameter. At the Bunker, this objective is achieved through a 500 m^3 rainwater tank, which supplies water for irrigation and stores rainwater runoff. From the evaluation of precipitation and various water meters, the total energy budget can be derived with high temporal resolution for individual rainfall events and dry periods.
A Scientific monitoring of flagship projects such as the greened Bunker St. Pauli in Hamburg, the TAZ publisher building in Berlin and the Potsdamer Platz in Berlin is essential both for successful operation and for applying the findings to future construction projects. As a result, various recommendations for optimisation were already made at the start of operations. In

addition to climate adaptation, the focus is also on analysing the growth performance of individual species depending on challenging site conditions and overall operating costs. So far, the project in Hamburg has been of huge success, as reflected in various awards.
The assessment of the water balance comprising evaporation, groundwater recharge and runoff aims to provide a deeper understanding of climate change. Water evaporation is the key strategy for reducing local overheating and, at the same time, the source of precipitation. Only the drop of water that evaporates returns as rain via the small water cycle. The small water cycle of land surfaces is more significant than the so-called large water cycle between the
world's oceans and land surfaces. Antonio Nobre refers here to the so-called 'flying rivers' – the clouds – which transport considerably more water than the rivers on land surfaces. The phase change from liquid water to a gaseous state converts 680 kWh of energy per cubic metre during evaporation. This enormous transfer of energy acts in nature like a heat pipe, transporting nearly 50% of the solar radiation from the Earth's surface latent into the atmosphere. There, the consumed energy is released again during the condensation of water vapour into clouds. The difference in atmospheric back radiation on clear, cool nights compared to cloudy skies allows us to both feel and measure this effect.
The daily loss of around 800 km² of vegetation worldwide is leading to an increased shift in the global flow equilibrium of water and energy. 350 km² of forest is lost daily, around 150 km² is lost due to urbanisation.
Through projects such as the Bunker St. Pauli in Hamburg and other construction projects supported by the Technical University of Berlin, the positive effects of greening initiatives on the climate can be analysed both locally and globally, and measurements of the water and energy budget can provide a nucleus for future climate models.

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Housing as an Urban Asset: Inclusive Land Management Strategies in the Context of Valorisation and Exclusion Processes in Guadalajara, Mexico

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Thesis
Within the context of contemporary urban transformations, housing has increasingly shifted from being primarily conceived as a social right to becoming an urban asset embedded in processes of valorisation, financialisation, and capital accumulation. In the Guadalajara Metropolitan Area, this transformation is not only associated with broader global trends in land commodification, but is also concretely shaped by planning instruments, densification strategies, and public investment schemes that, in the absence of redistributive mechanisms, tend to reinforce socio-spatial exclusion.
This research argues that the housing accessibility crisis should not be understood as a cyclical market fluctuation or as the sole outcome of supply and demand dynamics. Rather, it reflects the structural interaction between urban regulations, private capture of land value increments, and incentives for vertical development oriented toward middle- and upper-income segments. From this perspective, housing challenges form part of a wider issue of urban habitability and territorial justice, where planning decisions influence whether metropolitan development contributes to social cohesion or spatial fragmentation.
In dialogue with the thematic axis Facing Crises for Liveable Cities & Resilient Territories, the paper examines how socio-spatial inequalities, housing accessibility, and urban fabric transformation intersect within densification processes. It analyses how regeneration and compact city strategies, when not accompanied by mechanisms for value redistribution, may contribute to the consolidation of socially selective urban territories, thereby affecting the prospects for building more liveable and resilient cities.

Arguments Supporting the Thesis
The thesis is supported by four central arguments:

- Strategic public investment functions as a catalyst for land valorisation, generating expectations of profitability that reshape real estate markets.
- Urban planning instruments enable increased building intensities and densification without embedding structural mechanisms for redistributing the value generated, thereby facilitating private capture of land value increments and reinforcing socio-spatial disparities.
- Vertical residential development in consolidated areas is predominantly oriented toward middle- and upper-income groups, altering local price structures and gradually displacing lower-income residents through indirect exclusion mechanisms.
- The absence of institutionalised collective housing schemes limits the capacity of the urban system to counter speculative dynamics and to secure access to housing in strategically located areas.

Cases Analyzed

The study focuses on a consolidated urban sector located in the north-central area of Guadalajara, between the neighbourhoods of La Normal and Mezquitán, structured around Parque Alcalde. This area holds significant historical and symbolic value within the metropolitan structure and is articulated along a strategic mobility corridor serving metropolitan-scale facilities.

The sector represents a convergence of built heritage, recently modernised transport infrastructure, urban regeneration initiatives, and new high-rise residential developments. The coexistence of patrimonial buildings, traditional housing fabric, and contemporary real estate projects provides a spatial setting in which tensions between conservation, valorisation, and urban transformation become particularly visible.

The analysis is situated within the period 2015–2025, corresponding to an intermediate phase of the valorisation cycle. While transformation processes have not yet fully consolidated, dynamics related to price increases, typological substitution, and pressures on residential permanence are already observable.

The case analysis addresses:

- Morphological and typological changes associated with verticalisation;
- Land-use transformations and replacement of traditional housing;
- The relationship between infrastructure improvements and land value variations;
- Pressures on rental markets and conditions of residential permanence;
- Institutional narratives linked to regeneration strategies.
- To inform the proposed intervention, the case is examined in dialogue with international experiences in alternative land and housing governance, including:
- The cooperative housing movement in Uruguay (FUCVAM), as a consolidated model of collective and non-speculative urban land management.
- Community Land Trust initiatives in the United Kingdom, particularly in London, where collective land ownership mechanisms have been implemented to mitigate price escalation and exclusionary dynamics.

These references are considered as comparative learning frameworks rather than directly transferable models.

Methodology Adopted

The research employs a mixed (quantitative and qualitative) exploratory–interpretative methodology aimed at analysing the territorial, regulatory, and social implications of exclusionary access to land and housing in Guadalajara. The approach is grounded in a critical perspective on urban planning and adopts a territorially situated analytical framework.

The methodological route includes the following phases:

Contribution to the Construction of the ECOPÌA Network

This paper contributes to the ECOPÌA network by presenting a Latin American metropolitan case that connects land valorisation, urban governance, and territorial justice within the broader debate on urban crises and resilience.

It offers:

- An integrated analytical framework linking conceptual, regulatory, territorial, and socio-economic dimensions of housing exclusion;
- A territorially grounded methodology that may be adapted to other urban contexts experiencing similar tensions between densification, regeneration, and accessibility;
- A cooperative model of inclusive housing management proposing concrete mechanisms for redistributing urban value within existing planning systems.

By bridging structural analysis and actionable institutional strategies, the research seeks to contribute to interdisciplinary dialogue on pathways toward more liveable, equitable, and resilient urban territories.

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READING THE CLIMATE CRISIS: HUMANITIES AND ACTION IN THE ANTHROPOCENE ERA

READING THE CLIMATE CRISIS: HUMANITIES AND ACTION IN THE ANTHROPOCENE

SESSION A – Wednesday 22nd – 16:30/18:30

Chair:
Ana Elena Builes Vélez, Universidad Pontificia Bolivariana de Medellín

Discussants:
Andrea Casals Hill, Universidad Finis Terrae
Gilda Catalano, DISPeS – Università della Calabria
Ingrid Molderez, KU Leuven

Matias Barberis Rami
Resilience narratives: navigating the intersection of community epistemologies and hyper-technological futures

Ana Elena Builes Vélez
Epistemological Ruptures of the Anthropocene: Locating Jamaica Kincaid's A Small Place

Gilda Catalano
Disrupting the narratives of sustainability: rare earth extraction, geopolitical transition, and climate injustice

Leonardo Delmonte
Composting Permacrisis: Wunderkammer as a Climate Nest through More-than-Human Governance

Concetta Castiglione, Elena Iakimova, Janna Smirnova, Marianna Succurro
Multilevel Evidence on Environmental Patents: The Role of Gender Equality and International Mobility Projects

Maria Woolson
A community topographic digital archive of stories and cultural heritage to amplify access to local knowledge of the natural world in Rapa Nui

Andrea Casals Hill, Mariana Lazzaro, Sofía Rosa
Local narratives and storytelling as an act of resistance in rural communities in Central Chile

Flavia Mendes de Andrade e Peres, Dyego Carlos Sales de Morais, Renata Carvalho da Silva
Biocultural Memory and Artifact Development: Pathways toward an Education with Territorial Belonging in Brazil and Chile.

Flavia Mendes de Andrade e Peres, Dyego Carlos Sales de Morais, Renata Carvalho da Silva
Relationship between Science, Technology, and Agroecology: Education as a Fundamental Component in Counter-Hegemonic Digital Mechanisms

Resilience narratives: navigating the intersection of community epistemologies and hyper-technological futures

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Both dystopian imaginaries and contemporary resilience policies reveal that the future is a contested narrative space. The key question that emerges is: whose knowledge, values and stories define what resilience means, how this is translated into resilience strategies, and which worlds are created through this translation process? What can dystopian literature teach us about understanding these dynamics?

Dystopian and speculative narratives such as Clarke's The City and the Stars, Ballard's The Drowned World or Riddle's Winter World do not merely project distant futures; they function as critical mirrors of the present. They depict hyper-technological or radically transformed worlds in which survival depends on scientific research, infrastructural control or technocratic governance, often embodied in heroic experts racing to avert collapse. In doing so, they foreground a particular resilience imaginary: hyper-technological worlds take centre stage, while broader social fabrics, everyday practices and community epistemologies remain peripheral. In these futures, the capacity to cope, adapt and transform is mediated by technical structures and the institutions that control them, rather than by plural and localised forms of knowing and collective agency. Yet it is precisely through this asymmetry that dystopian literature plays a critical role: it reveals how claims of stability and progress can coexist with deep epistemic exclusion, social stratification and the silencing of alternative ways of imagining and creating the future.

This critical lens resonates strongly with contemporary practices of resilience building. This strand of dystopian literature presents imaginaries in which current dominant narratives of progress fail. Today, resilience has become a central keyword in policy and planning, used to navigate climate change, digital transformation and geopolitical uncertainty. It links past, present and future, promising sustainable transformation in the face of disruption. At the same time, it remains a deeply ambiguous and contested concept, navigating between descriptive stories of how systems persist and normative prescriptions of how societies should adapt or transform. Resilience is therefore not a neutral capacity but a narrative device: different actors define what it means and in whose interests it is pursued. These definitions are embedded in power relations and institutional path-dependencies, shaping which futures become thinkable and governable. Yet the dominant resilience narrative contrasts with perspectives that view risk as socially perceived and constructed in different ways across contexts. This latter view situates resilience within a social and policy arena where multiple narratives coexist, rather than within a single, overarching frame.

In this context, science and technology innovation do not merely mediate between present conditions and future visions; they actively define what counts as progress and, in doing so, contest and reshape its legitimacy. Through the construction of sociotechnical imaginaries— collectively held visions of desirable, technology-enabled futures— dominant expert communities and policymakers naturalise trajectories of digitalisation, automation and large-scale technologisation as both inevitable and desirable. These are translated into official roadmaps, investments and regulatory frameworks, often framed in the language of transitions, competitiveness or an emptied notion of resilience. Much like the highly engineered worlds of dystopian fiction, such imaginaries promise protection, efficiency and, often implicitly, control. They also embed a normative claim: that resilience and collective well-being are to be achieved primarily through technical optimisation and innovation-driven growth. As a result, dominant innovation narratives not only mediate but also

constrain the horizon of possible futures, marginalising alternative conceptions of progress and alternative meanings of resilience within prevailing policy frameworks.

Participatory and co-creative processes operate as interfaces between community narratives and hyper-technological visions, but they function more as spaces of translation than of genuine co-production. Technical languages, quantitative indicators and pre-structured scenarios filter and reshape local concerns so that they fit dominant policy logics. Dystopian literature helps to think this gap and make it visible. By exaggerating the effects of technocratic closure, it shows how resilience framed solely in terms of system stability or technological robustness can drift into stagnation, surveillance or social fragmentation, as in Clarke's self-contained city or Ballard's psychologically disintegrating climate landscapes. At the same time, these narratives suggest that survival is never purely technical: it is mediated by memory, affect, social bonds and the capacity to re-imagine collective purpose. In this sense, dystopia operates both as a critique of resilience reduced to control and adaptation as well as an invitation to ask whose resilience is being secured and what the social cost is.

The intersection between community perspectives and hyper-technological futures is therefore neither harmonious nor linear. It is mediated by institutions, policies and expert cultures that translate local vulnerabilities and aspirations into abstract categories of risk, performance and innovation. This mediation can enable resilience by mobilising resources and coordinating action, but it can also render resilience more complex and fragile by narrowing the range of legitimate futures and limiting alternative pathways grounded in distributed or relational forms of knowledge.

In this setting, counter-narratives can challenge technocratic and elite-driven scripts of resilience by foregrounding lived experience, historical inequities and place-based knowledge, and by questioning the assumption that technological acceleration and innovation automatically equate to collective well-being. Like strands of speculative and dystopian fiction that privilege communal survival, mutual aid or ecological embeddedness over heroic techno- solutions, these counter-narratives reframe resilience as a transformative, relational and political practice rather than a technical fix. They expose the partiality of dominant policy epistemologies and insist that futures are not simply to be engineered, but to be negotiated, narrated and ethically co-constructed.

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Epistemological Ruptures of the Anthropocene: Locating Jamaica Kincaid's A Small Place

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Abtract
Jamaica Kincaid's A Small Place (1988) offers a hybrid form between novel and essay on the history and present of Antigua that resonates with new urgency in the context of the Anthropocene and the global climate crisis. Central to the text is a profound ambivalence regarding the relationship between the "small place" and the "larger picture"—a tension that today signals a major epistemological rupture. The narrator's contradiction hinges on whether Antigua is a backwater separate from larger contexts or a site inextricably linked to the comprehensive frames of modernity. On one hand, Kincaid deconstructs the tourist's perception of the island as an exotic, "quaint" exception, revealing it as a repackaged product of colonialism (16). In the era of the Anthropocene, this tourist gaze is further complicated in the sense that the "harmony" sought by the visitor is now a fragile facade masking the island's extreme vulnerability to rising sea levels and intensifying storms—impacts driven by the "mainland" carbon economies.
On the other hand, Kincaid claims that "people in a small place cannot see themselves in a larger picture" (p. 52). While this has traditionally been read as a critique of insularity, in the context of the climate crisis, it suggests a rupture in how we perceive scale. The Anthropocene collapses the distance between the local and the global; the "chain of something" Kincaid mentions is no longer just a metaphor for neo-colonialism, but a literal, material entanglement in the Earth's changing systems.
This ambivalence pinpoints a provocative way of dealing with the "place of place" in a warming world. In what follows, I first historicize the perception of islands as "small places" through the lens of the Anthropocene, where the island is repositioned from a "parochial backwater" to a prophetic site of global ecological collapse. Subsequently, I consider Kincaid's island story in relation to two influential conceptualizations: Foucault's heterotopia, reimagined as a site where the "order of things" is disrupted by the encroaching reality of environmental precarity; and Bakhtin's chronotope analyzing how the "time" of the island is forcibly synchronized with the accelerated, catastrophic time of the Anthropocene.

The big picture: the Caribbean
Caribbean history has been marked by a series of historical processes in which colonization, decolonization and neo-colonization are perceived as constant. Firstly, during the 15th Century, a process of colonization was built upon the base of deterritorialization, force displacement, human trafficking, systemic elimination of ancestral peoples and the implementation of single-crop export farms. Later on, during the first half of the 19th Century, a process of mild decolonization that occurs with the emancipation processes of enslaved subjects and the proclamations of independence of some of the Caribbean islands. Finally, during the last years of the 20th Century and all of the 21st Century, a process of neo-colonization manifests through the indiscriminate presence of the hotel industry and the constant arrival of tourist to the island territories, among other phenomena, which appear to be the result, among other things, of the rise of capitalism, thereby exacerbating racism and environmental injustice in these territories.
The archipelago known as the Caribbean Islands (or the Antilles) has been inseparable form a past, which include the abandonment to ordinary chronological sequences. Those islands have moved backwards and forwards with distinct places and times. The year 1492 marks the beginning of a series of dissonances in time within repetitions of multiple forms of colonialism. In retrospective, the postcolonial condition of the Caribbean islands indicates that there was

no cultural identity, in countertradition to the theory that states that post coloniality allows identity by and for subjects. The complexities of the Caribbean become more evident when considering the internal impediment that divides the region: the indigenous cultures and civilizations that define a realm of transgression, uncertainty, asymmetry, and imbalance that subverts the universal foundations of the Caribbean as a region and of Latin America in general.
The significant formation of Caribbean postcolonialism first appeared in Haiti in 1803 against the French. The wars of independence are an event, an antagonistic and impossible relationship with the colonial powers; they culminated in the emancipation of the Dominican Republic in 1865, while the turn of the century marks the struggle between the United States and Spain for the Caribbean (Cuba and Puerto Rico). We must note that the chronotopes of modernity were linked to a utopian process allegorized in progressive romanticism.

Anthropocene and the Caribbean
The Anthropocene serves as both a stratigraphic marker of unprecedented planetary change and a potent political label that redefines notions of agency and responsibility. Beyond its utility for earth scientists, the concept has catalyzed a "geological turn" in the social sciences and humanities, challenging established understandings of the relationship between life and Earth processes. For postcolonial historian Dipesh Chakrabarty (2009, 2012, 2013), the Anthropocene—and climate change specifically—destabilizes the primacy of the human. He argues that the consequences of human activity can no longer be interpreted through the lens of social theory or political economy alone; instead, the human has emerged as a "geological force" irrefutably bound to the natural world. This creates a "tense figure" in contemporary narrative—a subject that is simultaneously a biological individual and a geophysical collective—forcing humanists to acknowledge that humanity is never truly "free" from the vital, material realities of planetary existence.
Complementing this perspective, science studies scholar Bruno Latour (2013) highlights the inherent ironies of the Anthropocene, viewing it as a decisive "alternative to the very notions of 'Modern' and 'modernity'" (p. 77). For Latour, the Anthropocene functions as a philosophical "confession," exposing the fallacy that human history and Earth's biogeochemical processes can be examined in isolation. By collapsing the artificial vacuum between these spheres, the Anthropocene demands a new mode of inquiry that recognizes the entanglement of all actors. Ultimately, this collapse of the modern dichotomy suggests that any analysis of social justice or political statehood must now be conducted through an ecological lens, as the "natural" and the "political" have become one and the same.
The geographer Lorimer (2012) also speculates that the idea of the Anthropocene represents the nail in the coffin of the modern dichotomy between nature and culture that has been so central for Western environmentalism (but see also Crist 2013). He contends that the idea of "pure Nature" has not gone quietly from the sciences, instead leaving a trail of confusion in its wake, what Robbins and Moore have labeled "ecological anxiety disorder" (2013). Lorimer contends that there is a multiplicity of natures at play that stem from the variety of political ecological scenarios in the world, and that these scenarios involve integrations of the human and nonhuman that cannot be uniformly described in an a priori fashion and that require radically new research approaches (for example see Holm et al. 2013). When it comes to taking up the provocations of the Anthropocene idea in scholarly depictions of the world, Irvine and Gorji note that the turn towards "Writing Culture in the Anthropocene" is part of a broader move in the academy (2013, following Kirksey & Helmreich 2010). The environmental historian Cronon is one well-known early exemplar of this Anthropocene turn in the humanities. His work, exemplified in publications like Nature's Metropolis (1992), explores historical socioecological relationships shaped by market institutions in the American Midwest using a methodological blend of ecological and economic history. He has argued that it would have been problematic to reinforce the boundary between human and nonhuman in his investigation of the growth of Chicago because neither city nor country can be understood as solely natural or unnatural.
In the Caribbean context, Yarimar Bonilla (2017) argues that catastrophic events are not merely environmental accidents; rather, vulnerability is not simply a product of natural conditions; it is a political state and a colonial condition. This vulnerability is exacerbated by climate change, as seen in the 2017 hurricane season which laid bare the underlying fragility

of Caribbean states. These conditions are not grounded in geography alone but are actively constructed through neocolonial frameworks of non-sovereignty, neoliberal coercion, and "disaster capitalism" (Klein, 2018). However, to fully understand the origins of this political vulnerability, one must look toward a Caribbean philosophical framework that situates these contemporary crises within a deeper historical trajectory.

Malcom Ferdinand (2019) addresses this by theorizing "modernity's colonial and environmental double fracture" (p. 3), a concept that connects the violence of enslavement and racism with the destruction of the nonhuman world. While Bonilla focuses on the immediate political state, Ferdinand bridges the gap between racial justice and environmental politics by embracing "the Caribbean world as a scene of ecological thinking" (p. 12). By pivoting from the generalized Anthropocene to the "Negrocene"—an unjust mode of habitation that historically exploited both "Black wombs" and the Earth's vitality (pp. 58–59)—Ferdinand provides a foundational lens for Bonilla's observations. Ultimately, he moves beyond the diagnosis of disaster to propose a solution rooted in the Maroon "matrigenesis" of the Haitian Revolution, reimagining Mother-Earth not as a neutral Gaia, but as Ayiti (p. 182).

By centering the Caribbean literary experience, such as that of Kincaid's, the limitations of a universal "Anthropos" become clear. While the broader Anthropocene discourse dismantles the nature-culture dichotomy, thinkers like Bonilla and Ferdinand demonstrate that this dismantling is incomplete without an accounting of coloniality. If the Anthropocene is a "golden spike" in geological time, in the Caribbean it is a spike driven through the historical intersections of the plantation and the hurricane. Therefore, moving forward, this [essay/research] adopts an approach that does not merely observe environmental change in the Bahamas, but analyzes it as a manifestation of the "Negrocene"—a site where ecological survival and decolonial struggle are one and the same.

In a more politically explicit vein, the geographer Sayre argues that, "the key points to draw from the Anthropocene have less to do with when it began then how it affects the underlying assumptions that scientists make about understanding the world" and how these assumptions affect policy (2012, p. 63). He cautions that declaring the age of anthropogenesis should not lead to an assumption of a trans-historic "Anthropos" with no attention to the uneven distribution of Anthropocene responsibilities and impacts. Therefore, the Anthropocene necessitates questions of "socioenvironmental justice" (p. 67). Sayre's work and my own are aligned in that he recognizes that the Anthropocene cannot be reduced to climate change alone and that the idea presents a number of opportunities for anthropological participation. He states, "the challenge is to rebuild our conceptual scaffolding to reflect these novel realities" (p. 63). The last few years have seen solidifications of scholarship around climate change, the proliferation of political ecology and the rise of social studies of nature. The social sciences and humanities have begun to discuss the Anthropocene, engaging with the idea and its challenges and invitations for scholarship. But what about specifically anthropological engagements with the Anthropocene? What orientations are needed to explore anthropological puzzles like those I have begun to follow in Antigua and other Caribbean Islands? This analysis crafts new frameworks that will open doors for the anthropological engagement with the Anthropocene, expanding the scope of the political ecology of global change.

Problematizing scale: Islands as "small places"

The cultural and literary imaginaries of the islands as small places, semi-circles and closed inside themselves, appear at the same time the island in the Atlantic Ocean were the center of commercial and cultural hyper-connectivity.

Historically, the Caribbean has been marginalized within the Western imagination as a collection of "small places"—parochial backwaters existing on the periphery of global concern. However, the Anthropocene forces a radical repositioning of this geography. Through the lens of planetary change, the island is transformed from an isolated footnote into a prophetic site of global ecological collapse. As the boundaries between the human and the natural dissolve, the "smallness" of the island no longer signifies insignificance; rather, it marks the precise location where the consequences of the "geological force" of humanity are most acutely felt.

In this sense, the Caribbean is not merely a victim of the Anthropocene but the very site where its novel realities are being most urgently defined.
In *A Small Place*, the author enacts an epistemological rupture by reframing the smallness of Antigua not as geographic insignificance, but as a dense site of global entanglement; by connecting Elizabeth DeLoughrey's island ecologies with Kincaid's critique of the tourist gaze, it can be said that the Caribbean island serves as the primary site where the catastrophic legacies of colonialism and the Anthropocene converge, collapsing the distance between local suffering and global responsibility. While the Western continental imaginary views the Caribbean as a peripheral playground, Kincaid's narrative voice asserts an archipelagic epistemology that aligns with Édouard Glissant's *Poetics of Relation*; through this lens, *A Small Place* functions as a repeating fractal of resistance that exposes the Anthropocene not as a new phenomenon, but as a continuation of the extractive colonial rhythms identified by Antonio Benítez-Rojo in *La isla que se repite.*
This novel - essay challenges the Anthropocene's universalizing narrative by asserting a localized epistemology that links environmental degradation to the unforgetting of colonial history. By applying Glissant's concept of errantry and DeLoughrey's sea of islands, it can be demonstrated how Kincaid ruptures the static imagery of the 'small place' to reveal the Caribbean as an essential, rather than incidental, vantage point for understanding planetary crisis.
In *A Small Place*, Kincaid's searing second-person address (You) functions as an epistemological mirror, forcing the reader to inhabit the role of the tourist—a figure who embodies the detached, consumerist logic of the Anthropocene. To the tourist, the smallness of Antigua is a curated commodity, a paradise defined by its perceived isolation and static beauty. However, the author ruptures this illusion by exposing the infrastructure of the island as a site of colonial residue; the shabbiest aspects of the landscape, from the broken water pipes to the unrepaired library, are not merely local failures but the material consequences of a global system of extraction.
This aligns with Elizabeth DeLoughrey's argument that island ecologies are never truly isolated, but are instead the primary nodes where the global flows of capital and waste become visible. By emphasizing the tourist's indifference to the island's drought or its lack of a modern hospital, Kincaid illustrates a fundamental rupture in understanding: the tourist consumes the island's environment while remaining epistemologically divorced from its reality. In the Anthropocene, this represents the continental delusion—the belief that one can consume resources from a "small place" without being implicated in its eventual collapse.
If Kincaid locates the "small place" through the claustrophobia of the tourist gaze, diasporic writers reconfigure the island as a market spot—a site of intense epistemological exchange. Here, the island ceases to be a fragment and becomes, as Glissant suggests, a point of relation. In the Anthropocene, this connectivity is a double-edged sword: the island is small enough to be overwhelmed by global ecological shifts, yet large enough to anchor a global network of people whose identities are traded across the sea.
In *A Small Place*, Kincaid presents the island as a static, almost stagnant environment where time is frozen by the tourist gaze and the rubbish of empire. Her Antigua is a place one is trapped in, where the epistemological rupture occurs because the inhabitant cannot escape the physical and historical borders of the island. In contrast, the mobile island found in the work of diasporic writers like Edwidge Danticat (e.g., *Breath, Eyes, Memory*) or Junot Díaz (e.g., *The Brief Wondrous Life of Oscar Wao)* reimagines the "small place" as a portable reality. For the diasporic subject, the island is a "market spot"—not just for goods, but for the exchange of remittances, political ideologies, and cultural trauma. This aligns with Édouard Glissant's *Poetics of Relation*, where the island's identity is not defined by its isolation, but by its errantry and its connection to the "elsewhere."
While Kincaid's island is a "small place" under a microscope, the diasporic island is a "small place" that has undergone a cellular division, existing simultaneously in the Caribbean and the diaspora. In the Anthropocene, this mobility creates a unique vulnerability: the island is small enough to be physically erased by rising sea levels or hurricanes, yet its market of people and memories is so widely dispersed that it cannot be contained by any single border. The rupture here is the realization that the "small place" is both a fragile ecosystem and a global, indestructible network of human relation.

Kincaid´s island story: an epistemological rupture of the Anthropocene

A Small Place (1988) by Jamaica Kincaid is a novel - essay that recounts the relationship between Antigua and the world; the island and the continent; the small place and the big place; between the local and the global. Thus, in the novel – essay there seems to be a contradiction, a question, assertion, or statement about whether or not Antigua is a small place, a separate and different haven from other large places in the world. The novel – essay offers a critique of the perception of Antigua as an exceptional place for tourists, who ignore the history and reality of the island. The author strongly criticizes the picturesque and exotic view that tourists who come to the island, recognizing it as the result of colonization, as repackaged products of the colony. In this way, the concept of place in this novel – essay is related to the different perceptions of it held by the islander and the tourist, visions that perpetuate the relationship between the small place, the island, and the big place, the Caribbean.

Kincaid explores the nature of what it means to form a historical narrative that focuses on both the nature of the colonizer and the perspective of the colonized. By moving back and forth between different points of view, the author dives into the idea of tourism in Antigua as a form of neocolonialism. She also analyzes the impact of English colonization on the island while at the same time considering ways in which the dynamics of colonial power could be altered. Kincaid demonstrates through her use of different points of view that it is necessary for the members of colonized communities to construct their own histories because a narrative made by a colonizer can only be a colonized and incomplete story. The author explores how English colonization altered the power dynamics by forcing the colonized to use the language of their masters to describe their own oppression. This can be read in many quotes from the novel – essay, like this: "For isn't it odd that the only language I have in which to speak of this crime is the language of the criminal who committed the crime?" (p. 31). Here, Kincaid moves into the "I" (the colonized perspective). She acknowledges that even her own narrative is "colonized" because she must use English to protest English rule. Supporting the idea that a narrative made by a colonizer is "colonized and incomplete." Kincaid is showing that for the colonized to construct their own history, they must first grapple with the fact that their tools for storytelling were stolen or modified by the oppressor.

Kincaid's narrative strategy hinges on the realization that the language of the criminal is the only tool available to the colonized. When she transitions from the "you" of the tourist to the "I" of the native, she reveals that the history of Antigua is not found in brochures, but in the scars left by British administration. She writes of the old library, damaged in an earthquake and left in ruins, while the private Mill Reef Club—a playground for wealthy foreigners—remains pristine. This contrast illustrates how neocolonialism functions, the physical infrastructure for the people's history, the library, is allowed to rot, while the infrastructure for the colonizer's pleasure, the resort, is maintained. By documenting this decay, Kincaid constructs a history that the tourist narrative intentionally ignores. For her, the act of writing is an act of reclamation; she proves that a story told by the colonizer is inherently incomplete because it lacks the weight of the native's lived resentment and memory.

Kincaid's writing in the second person describes a tourist, which is "you," as disgusting and undesirable, an ugly thing that is where it should not be. Here, Kincaid is expressing what it is like to be an outsider and othered but is also putting "you" in the position of someone who has both constructed a narrative and had a narrative constructed about them. As a tourist, "you" may have created an idea in your head of what Antigua and its citizens are like, and Antiguans will also have a preconceived notion of who you are, the empty non-Antiguan traveler. This phenomenon serves to make you more aware of the importance of narratives and how they are held up because they allow you to feel as if you have both made assumptions and are targeted by them. Dialoging with the tourist and the shift to the second person: "The thing you have always suspected about yourself the minute you become a tourist is true: A tourist is an ugly human being." (p. 14), isn't just an insult; it's a narrative strategy, the author highlights that the tourist's history of Antigua is limited to the weather and the luxury of the hotel. This illustrates that the colonizer/tourist perspective is willfully ignorant. It proves that if history is left to the visitor, the reality of the islanders (the "human rubbish" the tourist ignores) is erased. Kincaid's deconstruction of Antigua as a "small place" reveals that the ruptures of the Anthropocene are inextricably linked to the scars of colonialism. When she describes the tourist's experience as a "way of being that is a dead end" (p. 14), she identifies a spatial

rupture where the island—once a "heterotopia" of colonial extraction—is now a site of modern environmental exhaustion. This "dead end" is not merely metaphorical; it is the physical limit of a global carbon economy that treats the island as a disposable backdrop. Furthermore, Kincaid's image of people in a "closed room" who see only the "smoke" of a world on fire (p. 52) perfectly captures Bakhtin's chronotope of catastrophe. This suggests that the time of the island is no longer a slow, post-colonial stagnation, but is now violently synchronized with a global timeline of collapse. The rupture, therefore, lies in the realization that the chain of something linking the island to the mainland is a continuous line of exploitation: the same systems that once moved enslaved bodies across the Atlantic are now driving the rising tides that threaten to erase the island entirely.

Traditionally, Antigua is viewed as a small place—a secluded backwater. Kincaid's narrative creates a rupture by proving that this smallness is an illusion. The Anthropocene collapses the distance between the mainland (carbon-producing economies) and the island (the site of climate impact). Kincaid's chain of something is reinterpreted. It's no longer just a metaphor for the history of slavery and colonialism; it is now a physical, biological chain linking global carbon emissions to the literal disappearance of Antiguan coastlines. In the islands, not only in Antigua, there exists a tourist gaze versus the ecological reality of the territory. The tourist seeks harmony and quaintness, and the Anthropocene reveals this harmony as a fragile façade, the beauty the tourist enjoys is actually a site of extreme vulnerability, environmental, social and economic vulnerability. Thus, the rupture occurs when the island is exposed not as an exotic escape, but as a prophetic site of global collapse. Like we can read not also in Kincaid´s novel – essay, but also en many Caribbean literary works in the contemporary era.

It can be said, that there is also a rupture of space, heterotopia, in Kincaid's work. Recognizing Foucault's heterotopia, it is possible to observe that the order of things on the island is being broken. An island is often treated as a bounded space, a limited space surrounded by water. The Anthropocene ruptures this boundary by allowing the encroaching reality of environmental precarity to flood in. The island becomes a space where the failures of modernity are most visible. These theoretical arguments can be seen in Kincaid's actual prose, here are two specific passages from A *Small Place* that illustrate the spatial and temporal ruptures of the Anthropocene.

In the first section of the book, Kincaid famously addresses the tourist, deconstructing the beauty of the island. This passage perfectly illustrates the rupture of the heterotopia, where the tourist's escapist space is revealed to be a site of physical and historical decay:

> *You see yourself taking a walk on that beach… and you see yourself in a picture… But it is a way of being that is a dead end. The people who inhabit the place you are visiting… cannot stand you. You are a tourist, a ghost… Your visit to this place is a way of being in the world that is a dead end. (p. 13-14)*

Kincaid suggests that the beauty the tourist sees is a stagnant, dead-end space. Through Foucault's lens, the Anthropocene turns this dead end into a literal precarity. The order of things is disrupted because the tourist thinks they are in a paradise, but the narrator reveals they are in a site of colonial wreckage that is now being physically reclaimed by the sea.

Applying Foucault's concept of the heterotopia—a "world within a world" that mirrors yet upsets the outside—Kincaid's Antigua emerges as a site where the order of things is fundamentally disrupted. While the tourist perceives the island as a managed, idyllic heterotopia of leisure, the Anthropocene ruptures this illusion. The island is no longer a contained space; it is a site where the external, mainland carbon economies physically intrude via rising tides and intensifying storms. This environmental precarity turns the island into a crisis heterotopia, where the global consequences of modernity are concentrated and made visible. The "small place" is thus not a separate entity, but a specialized zone that exposes the terminal flaws of the larger world's industrial logic.

Using Bakhtin's chronotope, a shift can be identified in how time is experienced on the island. Synchronized Catastrophe, in Antigua seems constantly present. There is a rupture between island time (often perceived by outsiders as slow or stagnant) and Anthropocene time (accelerated and catastrophic). Through the lens of Bakhtin's chronotope, the time of Kincaid's island undergoes a violent synchronization with the global climate crisis. Traditionally, colonial

narratives trapped islands in a stagnant or primitive time, separate from the progress of the West. However, the Anthropocene creates a temporal rupture, forcing the island's local history to merge with the accelerated, catastrophic timeline of the planet. Kincaid's narrator challenges the idea of a slow, quaint island existence by highlighting a chain of something that is both historical (colonialism) and immediate (ecological collapse). This new chronotope suggests that the "time" of the island is actually ahead of the rest of the world—it is a prophetic timeline where the future's environmental end-point is already arriving in the present.
The island's history is forcibly synchronized with the global timeline of climate change. The past (colonialism) and the future (ecological collapse) collide in the present moment. Later in the text, Kincaid discusses the inability of the Antiguan people to "see themselves in a larger picture," which you can use to argue for the catastrophic chronotope:

> *They are too involved in the 'small place' to see themselves in the 'larger picture'... They are like people in a closed room who have been told that the world outside is on fire, but they cannot see the fire, only the smoke. (p. 52)*

This closed room is Bakhtin's chronotope. The time of the island is disconnected from the time of the world outside, yet the smoke (the environmental and economic impacts) is already seeping in. The rupture occurs when the islanders (and the reader) realize that the "fire" of the Anthropocene has synchronized their local timeline with a global, terminal one.
In the final section, Kincaid shifts to a more philosophical, almost detached point of view to analyze the island's inhabitants as "people" rather than subjects. For example, she states: "They [the Antiguans] are too poor to escape the reality of their lives; and they are too poor to live in the world of the imagination." (p.XX). She explains that for the colonized, history is not a series of grand events, but a stagnant reality. The tourist sees a "timeless" paradise; the Antiguan sees a lack of a future. With this, the author, justifies the necessity of the colonized constructing their own history. Since the colonizer views the island as a static playground, only the colonized can narrate the weight of time and the desire for change.

Conclusion

Jamaica Kincaid's A Small Place functions as an aggressive epistemological mirror, forcing the reader to inhabit the "ugly" and detached role of the tourist. By shifting between the consumerist "you" and the resistant "I," she exposes the colonizer's history as an inherently incomplete and "colonized" story. This narrative strategy highlights how the tourist gaze purposefully ignores the "human rubbish" and the decaying infrastructure—such as the unrepaired library—that signify the material consequences of colonial extraction. Ultimately, Kincaid demonstrates that for the colonized to reclaim their identity, they must navigate the "odd" paradox of using the "language of the criminal" to voice their own history. This act of writing centers the Antiguan citizen, transforming the island from a curated, picturesque commodity into a site of lived memory and active resistance.
Beyond postcolonial critique, the Anthropocene acts as a revelatory force that ruptures the neocolonial myth of island isolation. By deconstructing the "small place" through Foucault's heterotopia and Bakhtin's chronotope, Kincaid reveals that Antigua is not a peripheral backwater, but a prophetic site where the terminal flaws of modern industrial logic are first made visible. The "chain of something" linking the island to the mainland is no longer merely a metaphor for slavery; it has become a literal, material entanglement where global carbon emissions drive the rising tides threatening Antiguan coastlines. This forced synchronization of local time with a global, catastrophic timeline signals a radical epistemological shift. The island is repositioned as the center of the "larger picture," marking the precise location where the breakdown of the "order of things" provides a grim preview of an encroaching, planetary precarity.

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DISRUPTING THE NARRATIVES OF SUSTAINABILITY: RARE EARTH EXTRACTION, GEOPOLITICAL TRANSITION, AND CLIMATE INJUSTICE

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The paper examines the role of rare earth elements (REEs) in contemporary technological and energy transitions, arguing that the global expansion of REE extraction reveals structural tensions within prevailing sustainability frameworks, and raises critical questions for climate justice. Although REEs are central to technologies widely characterized as environmentally beneficial, their extraction is frequently associated with ecological degradation and social disruption, complicating claims that low-carbon transitions are inherently sustainable.
This analysis is grounded in an interdisciplinary theoretical framework drawing on human ecology, political ecology, and climate justice scholarship. As far as the supported hypothesis, sustainability is approached as a socio-ecological process shaped by power relations, institutional arrangements, and uneven resource distribution, rather than as a purely technical objective; similarly, climate justice is understood as a framework concerned with equity and the distribution of environmental burdens, which increasingly intersects with geopolitical and security considerations linked to critical mineral supply.
Methodologically, the study adopts a qualitative, interpretive approach based on a review of environmental, economic, and geopolitical literature, combined with a comparative examination of global REE supply chains. Case-based analysis is used to explore how sustainability and justice are negotiated in practice through extraction activities and governance structures. This approach allows for the integration of local environmental impacts with broader political and economic dynamics.
The case studies, primarily located in the Global South, document the environmental and social consequences of rare earth mining, including deforestation, water contamination, soil degradation, toxic waste accumulation, and biodiversity loss. These ecological impacts are accompanied by social effects such as community displacement, labor precarity, and health risks. Rather than treating these cases as exceptional, the article situates them within a broader extractive model supporting renewable energy technologies and digital infrastructures, highlighting patterns of cost externalization across regions and populations.
The paper underlines two main arguments.
A first argument of the paper examines the geopolitical dimensions of REE production and circulation. The strategic importance of rare earths has intensified competition among states and contributed to the securitization of mineral supply chains. Concentration of extraction, refining, and processing capacities in a limited number of countries has increased strategic dependencies and supply vulnerabilities, influencing industrial policy and resource governance. These dynamics shape sustainability governance by prioritizing resource security and technological capacity, often at the expense of environmental protection and social considerations. At a structural level, the article situates these dynamics within broader approaches to ecological transition that emphasize technological substitution without sufficiently addressing patterns of consumption, production, and economic growth. While decarbonization is a central policy objective, the findings suggest that its outcomes depend on how social equity, environmental integrity, and geopolitical relations are addressed within transition strategies. From a human ecological perspective, sustainable transitions require systemic changes in material flows, governance arrangements, and resource use practices.
As far as the second argument, the paper also explores the relationship between REE extraction and migration dynamics. Increased demand for REE-dependent technologies in importing countries can intensify extraction pressures in exporting regions, contributing to environmental degradation, livelihood disruption, and social instability. These conditions

interact with climate-related stressors, shaping migration patterns that are linked not only to climate change, but also to extractive economic processes.
Overall, in relation to Ecopìa network, the article contributes to human ecological research by analyzing rare earth extraction as a socio-ecological system embedded in global political and economic structures. It highlights how sustainability narratives are shaped by power relations and how environmental benefits and burdens are unevenly distributed. The paper concludes by suggesting the need for integrative governance approaches that more fully account for social, ecological, and ethical dimensions of critical resource management, consistent with emerging discussions on just and inclusive transitions.

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Composting Permacrisis: Wunderkammer as a Climate Nest through More-than-Human Governance

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Hybrid cultural centres are increasingly expected to operate as civic infrastructures under conditions of permacrisis, where ecological disruption intersects with social fragmentation, institutional fatigue, and conflicting temporalities. This contribution argues that a hybrid cultural centre becomes a climate nest only insofar as it develops a more-than-human governance framework: a decision-making ecology that recognises nonhuman agencies, long durations, and maintenance as core forms of political work. The argument is developed through Wunderkammer (Ferrara, Italy), a consortium-based cultural centre located in former riverside warehouses, and through PALUDICOLA, a research-action project that treats amphibious territories and wetland logics as both context and method.

The paper adopts Donna Haraway's invitation to "stay with the trouble" as an institutional stance rather than a theoretical slogan. Here, "staying" is operationalised as a form of governance that refuses purification (culture versus nature, event versus infrastructure, innovation versus upkeep) and replaces solutionist responsiveness with ongoing practices of care, negotiation, and accountability. Within this framework, biophilia and deep ecology are not simply curatorial themes but organisational principles: attention to green–blue infrastructures as living counterparts, refusal of extractive urgency, and cultivation of practices that make coexistence durable, situated, and non-elitist.

PALUDICOLA (inhabiting hybrid spaces, 2025–2027) is a Creative Living Lab funded by the Italian Ministry of Culture (Directorate-General for Contemporary Creativity) within the programme Laboratorio di Creatività Contemporanea (2024–2026). The project investigates "inhabitants of hybrid spaces" through themes including synurbanisation, re-appropriation practices, technological and transitional ecosystems, cultural geologies, water-based cultural and agricultural practices, hydrofeminism, climate, and identity. It is co-produced through an extended ecosystem of partners and networks. In this sense, the project does not simply accompany regeneration processes; it actively prototypes governance devices for open, hybrid, and climate-responsive infrastructures.PALUDICOLA frames the wetland/palude as both a territorial matrix and an epistemic device. Wetlands absorb disturbance, redistribute flows, and host multispecies thresholds without stabilising into a single order. Translated into institutional terms, more-than-human governance is framed as a permeable membrane. This stance enables the centre to act as a "composter": an infrastructure that metabolises trouble into collective capacities for learning, repair, deliberation, and shared stewardship. Composting is thus understood as a governance outcome: the capacity to hold friction, redistribute responsibility, and transform contradiction into durable conditions of liveability. Empirically, the paper focuses on how PALUDICOLA treats Wunderkammer's consortium governance as an object of transformation. Three governance shifts operationalise the climate nest: maintenance reframed as cultural work; deliberative formats that expand accountability; and programming conceived as stewardship of conditions rather than events.

Finally, the paper situates Wunderkammer within a network of networks, where governance knowledge is co-produced across Europe. From this perspective, the climate nest is an infrastructural capacity to host vulnerability, sustain access, and keep ecological responsibility operational through time.

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Multilevel Evidence on Environmental Patents: The Role of Gender Equality and International Mobility Projects

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Introduction

Environmental patents are a key indicator of countries' green innovation capacity. Existing cross-country studies have predominantly focused on economic and environmental determinants of green patents, overlooking two structural dimensions: the role of gender equality in aggregate innovation capacity and the contribution of international academic mobility to green technology diffusion. This study addresses both gaps using data for 167 countries over 2014–2023, a period covering the post-Paris Agreement phase and the consolidation of Erasmus+ as a structured mobility programme. We test two hypotheses: *(H1) gender inequality is negatively associated with environmental patenting; (H2) participation in EU-funded international mobility projects, designed to promote shared values and sustainability, is positively associated with green innovation.*

Literature Review

Environmental innovation output is commonly proxied by green patent counts, which provide a standardized and internationally comparable measure of technological activity in environmental fields (Johnstone et al., 2010). Although investment in research and development (R&D) constitutes a primary input, the capacity for innovation is also significantly influenced by the broader institutional frameworks and socio-economic conditions within which firms operate.

Gender equality has been linked to environmental outcomes, though rarely examined in relation to aggregate patenting. Ergas and York (2012) find that women's status is negatively associated with per capita CO_2 emissions in cross-country analysis. Karaduman (2023) shows that greater gender equality improves environmental quality in OECD countries. However, no study has directly quantified the impact of gender inequality on environmental patent production across a global sample.

International academic mobility represents a potential channel for knowledge diffusion. Franzoni et al. (2012) document higher patent propensity among internationally mobile scientists. Siekierski et al. (2018) identify patenting as a key innovation outcome associated

with academic mobility, particularly for destination countries. Yet the role of structured mobility programmes in shaping national-level environmental patenting remains unexplored.

Data and Methodology

Data are drawn from WIPO, the Erasmus+ Project Results Platform, the World Bank, and UNDP. The dependent variable (Env_Patents) measures the number of environmental patent applications - covering renewable energy, pollution control, and waste management technologies - classified according to Field 24 of WIPO's technology concordance table. Key explanatory variables include R&D expenditure, per capita CO_2 emissions, Erasmus+ mobility projects, the Gender Inequality Index (GII), material footprint per capita, a standardised health index, and education inequality. Missing values were imputed via CART. Given the extreme overdispersion of Env_Patents, the study employs a Negative Binomial mixed-effects model:

$$Y_{it} \sim \text{NegBin}(\mu_{it}, \theta), \quad \log(\mu_{it}) = \beta_0 + \sum_{k=1}^{K} \beta_k X_{kit} + u_i$$

where: $u_i \sim N(0, \sigma_u^2)$ captures country heterogeneity and θ governs overdispersion.

Our main results, consistent with H1, show that gender inequality exhibits a strong and statistically significant negative association with environmental patenting: countries with higher gender inequality systematically produce fewer environmental patents, with effect sizes comparable to those of R&D expenditure. In support of H2, participation in international mobility projects is positively and significantly associated with green innovation, confirming that cross-border academic exchange constitutes an independent channel for knowledge diffusion. R&D expenditure and CO_2 emissions emerge as strong positive predictors, reflecting the complementary roles of technological capacity and environmental pressure. Population health positively contributes to innovation output, while educational inequality acts as a significant structural constraint. Robustness checks confirm the stability of results across alternative lag structures, imputation methods and income-group subsamples.

Discussion

The findings suggest that environmental innovation arises from a multidimensional interplay among technological capacity, environmental pressure, and social development conditions. Gender inequality is associated with lower green innovation capacity, though the direction of causality remains an open empirical question given the observational nature of the data. Participation in international mobility projects appears to constitute an independent innovation channel, complementing domestic R&D through knowledge transfer and sustained research networks. Population health supports sustained research output while educational inequality limits absorptive capacity. Overall, the results suggest that gender parity and academic mobility merit consideration as potential strategic innovation instruments alongside traditional technological investment, warranting integrated policy approaches that couple R&D with broader social development goals. Findings align with SDGs 3, 4, 5, 9, and 13.

Conclusions

This study provides new macro-level evidence that gender inequality is significantly associated with lower environmental patenting, while Erasmus+ mobility participation is positively correlated with green innovation across 167 countries. Although causal identification warrants further research, the robustness of these associations carries clear policy implications.

Governments should embed gender equality in innovation and climate policies by increasing women's participation in green sectors and supporting gender-balanced R&D. At the same time, international mobility programmes should be strengthened, expanding sustainability-focused exchanges and facilitating access for low- and middle-income countries.

Overall, the findings suggest that innovation capacity is not solely input-driven but socially embedded. Sustainable innovation requires policy frameworks that combine technological investment with inclusive social development.

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A community topographic digital archive of stories and cultural heritage to amplify access to local knowledge of the natural world in Rapa Nui.

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The project's main objective has been to bring together and amplify Rapa Nui's efforts to revitalize their autochthonous language that have been ongoing on the island for the past three decades. Rapa Nui (also known as Easter Island, Chile) is one of the most isolated places on Earth, an iconic setting that has been invoked as both a cautionary tale for the Anthropocene and a remarkable case of cultural resilience. Its isolation can be understood as a quasi-closed system that, as a manageable microcosm, provides a unique setting for observing complex systems and adaptive knowledge. Much of Rapa Nui's adaptive knowledge of the natural world and its expressions within their distinct ontology are rooted in their ancestral language. Exclusionary colonial practices and sustained cultural assimilation into mainstream Chilean society has reduced native speakers to fewer than 800, making Rapa Nui an endangered language (Moseley 2010). The interdependence between language and the community's traditional and ancestral knowledge, places both their language and knowledge-base at-risk.

We are building a community-based, digital, open-access repository in the form of a topographic archive of stories and language resources that will serve to both preserve and be used for revitalizing the Rapa Nui language. Rapanui stories in the oral tradition encode a kind of ecological knowledge that directly responds to the Rapa Nui interconnected existence with the natural world. Plants, rocks, ocean life, are the territory. The language that names them is the universe through which they become what they are. Language, in addition to coding communication, is a metaphor for cultural reality and the essence of collective identities (Boroditsky, 2023). Therefore, if threatened semantic domains in traditional and ancestral practices were to vanish, we would see the disappearance of a broad knowledge base: in agroecological management, natural healing, water harvesting and sustainable fishing –for once you can no longer name a fish or a natural life cycle, its complex nature ceases to exist in the realm of local knowledge.

Today's moment is unique. Historically, the Rapanui people were denied participatory governance of their territory, their voices were brutally silenced in all matters of living, from self-representation to sustainable living or archaeological conservation. By the twenty-first century, Chilean state policies had led to material appropriation of the territory and its resource base, while the island's international World Heritage designation resulted in a conceptual appropriation of assets and identity that has, in turn, fostered the global imagination of Rapa Nui as a "museum island" (Fischer, 2010, p. 199). Following a transformation from isolation to a dynamic space of global interactions, today the Rapanui people have advanced a case of self-determination in managing their ancestral land that had been effectively off-limits until the past decade. In 2016, after an Indigenous consultation, the Chilean State recognized the 1888 annexation treaty or Agreement of Wills, and the Rapanui community was granted full administration of their cultural heritage —over 70 percent of the insular territory (Aguilera Hey, 2022).

This historic moment is an opportunity. As the community continues to pursue cultural and political emancipation from the colonial legacy, there is simultaneously a need to emancipate suppressed non-Western knowledges and enable the emergence of unique resources for understanding long-term adaptation to systemic change (Woolson, 2016). Paradoxically, though, as the Rapanui are experiencing, for the first time, their right to govern their territory and cultural heritage, the community use of the Rapanui language continues to decline.

Revitalization therefore requires increasing the number of second-language learners, as many children learn Spanish as their first language, which is the Chilean school system language of instruction. The community is now open to sharing their firm resolve to maintaining their Polynesian identify, linguistically rooted in Rapa Nui language. This, in turn, enables collaboration for advancing the
creation of a digital repository of resources that would bring together current community efforts.

Methodologically, the project began with on-site ethnographic research that was used to engage community in the selection of content for populating a database and archival map. The analytical approach is biocultural diversity, a frame that seeks dialogical opportunities across knowledge systems, Western and non-Western. The technology component of the project is embedded in Western knowledge, so as such, it needed to be scrutinized from a decolonial lens (Mignolo 2005, Ferrante 2021). A description of the decolonial approach and process in selecting available technologies to design the website prototype can be found in the recent publication "Endangered Languages in the New Age of AI" (Woolson, 2025). Research focused on identifying a self-host repository that would run locally so no cloud services or third-party providers would interact with the data and, as a result, we could guarantee total data sovereignty by the Rapa Nui community. The design had to be an open-access platform for an easy transition to management and ownership by the community.

Subsequent phases involved team-based work with community members for accessing and selecting authentic language resources while assessing how different ways of appropriating knowledge would give rise to new learning environments and forms of resources organization. The outcome has been a pilot that simultaneously provides scholarly value to the project and effectively serves future research and community efforts for language revitalization. Its lexical database documents threatened semantic domains of ancestral traditions of life with the ocean, such as sustainable fishing, seacoast management, and local oceanic knowledge, while enabling the compilation of content for formal instruction in ancestral agroecological practices.

Ongoing is the assembly of a sample of stories from the Rapanui oral tradition to be archived as text, audio, and visual material. The ultimate documentation's goals include: (1) a pilot completion of high-quality textual and audio-visual material, presented bilingually, with a focus on stories and oral traditions that could illustrate a future corpus of Rapa Nui language resources; (2) the provision of lexicons with Spanish translations (as well as English and French when the community requests it), and content for formal instruction of ancestral sustainable practices; (3) an initial storytelling map designed to be expanded by younger generations of high school students. This interoperable language resources database is the first language documentation project of this kind to engage the Rapanui community living on the island.

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Collective storytelling as a tool for understanding ecological adaptation amongst rural communities in Chile Font Garamond

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The project "Eco(s) of Climate Change. Biodiversity from coast to mountains. A socio-environmental study of rural communities' cultural practices in a scenario of climate change" (Ecos of Climate Change here on) analyzes rural communities' socio ecological practices in the context of water scarcity and biodiversity changes due to climate change. One of the project's objectives is to strengthen and develop resilience strategies amongst rural communities in coping with, adapting to and mitigating changes driven by climate change.
The collective storytelling workshops described in this presentation are part of a larger ecosystem of tools designed and implemented by the researchers of the interdisciplinary project Ecos of Climate Change. The project assumes that climate change poses a major challenge to humanity. Within this context, the aim of this study is to analyze the socio-environmental practices of rural communities in the context of water scarcity and biodiversity shifts caused by climate change in Chile. To achieve this, we studied socio-cultural and socio-economic factors, as well as demographic aspects such as age and gender, within given communities. To achieve the project's objectives, our interdisciplinary team studied a wide range of coastal and inland rural communities from the north to central-south Chile, combining a mix of traditional and innovative methodologies. Specifically, aiming at understanding the resilience and coping strategies of the communities, we applied disciplinary-specific as well as interdisciplinary and innovative methodologies, to fulfil our research aims. Among these, we developed a collective storytelling workshop. In this presnetation, I will share the theoretical background and design of these workshops.

State of the art in storytelling and narrative inquiry
Storytelling is an ancestral practice that has brought communities together across cultures. Shared stories have an entertainment and pedagogical function, as well as a therapeutic one. In a conversation with Jonathan White (2016), Ursula K. LeGuin asserted that storytelling is a tool that helps us understand who we are and what we want. In a similar venue, the German researcher Ute Seydel (2014) affirmed that traditional oral stories are a form of collective memory (210).
In the current socio-ecological critical period we live in, storytelling may provide an opportunity for people to commit emotionally with critical situations (Marks, E. et al, 2022). There is emerging evidence that demonstrates the benefits of shared narratives workshops that contribute to constructing more promising narratives in contrast to the public apocalyptic scenarios (Harcourt et al., 2021). Sharing stories and personal life experiences, close listening to other people's experiences is a powerful tool that can prompt changes in viewpoint as it offers an opportunity to appreciate life from a broader perspective. Just as well, oral narrative

also contributes to composing intergenerational bonds, safeguarding tradition and identity, and assessing continuous adaptation to ecosystem changes (Diagle et al., 2019).
As a research tool, Annika Arnold suggests that *narrative inquiry* contributes to understanding the role of storytelling particularly in environmental narratives (2018). Narrative inquiry emerges as a key tool when "Surveys, questionnaires and qualitative analyses of behavior are not sufficient to capture the complexity of meaning embodied within stories" (Mitchel and Egudo, 2003). As D. Jean Cladin asserts, "Narrative inquiry is an approach to the study of human lives conceived as a way of honoring lived experiences as a source of important knowledge and understanding" (Clandin, D. Jean, 2023, *Narrative inquiry* 7). This definition is central for the methodological design of Ecos of Climate Change fieldwork. That is, we assume that *lived experiences* are firsthand creators of knowledge. Thus, narrative inquiry explores "the stories people live and tell" (Clandin, 7), and such stories result from ""a confluence of social influences on a person's inner, social influences on their environment, and their unique personal history." (Clandin & Rosiek, 2007)". (Clandin, 6)

Workshops design
Following narrative oral tradition (John Diagle et al, 2019), combined with reflexive action research (Margaret Gearty, 2015), the collective narrative workshops (CNW here on) are designed as a closing activity aimed at touching the more personal or subjective experience of change, adaptation, stewardship and loss shown in its many colors, supplementing and corroborating the pieces of information obtained by the previous activities: ecosystem recognition (BioBlitzers), individual survey and focus group.
Considered within the larger ecosystem of the project, and the field day, the CNW's aim is to complement and cross-check the information that arises from the individual interviews and the focus group, from a more experiential perspective.
In a nutshell, a CNW displays as follows: participants come together in a circle (usually in a community facility or a school classroom). A round of introductions is not necessary since the participants have already been introduced in the previous activities or are active members of the community. The CNW begins with a brief mindfulness exercise conducted by a mediator (eyes closed, conscious breathing), which is followed by guided imagery….
That is the theory and the design; executing the workshops presented its own challenges, which I will share with you in person….

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Biocultural Memory and Artifact Development: Pathways toward an Education with Territorial Belonging in Brazil and Chile

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Extended abstract
The mode of production of technological artifacts exacerbates biocultural homogenization through a centralization of power (who owns the means of production and the technical know-how) and an erasure of biocultural memory (resulting from the mass use of these technologies imbued with the values of those who created them). Grounded in epistemological discussions in the biocultural axiom, this study articulates the concepts of artifact and biocultural memory in order to approach intercultural and interspecies dimensions in rural territories and their socio-environmental challenges. To this end, dialogism and historical-cultural psychology are adopted as the theoretical-methodological framework to explain the discursive interplay involved in authorial processes of artifact development and use, as well as to understand their relationships with educational processes aimed at biocultural conservation.
The research is conducted in two Latin American regions with distinct ecological characteristics: the Zona da Mata region of Pernambuco in northeastern Brazil and the Araucanía region in Chile. This is an action-research study whose central objective is to understand the interweaving of social voices present in the utterances that emerge from the everyday lives of subjects in these territories, as well as their relationships with the articulation of two methodologies oriented toward the development of sustainable artifacts, based on principles of socio-environmental justice and sustainability in the school context, within a single methodological model. In this sense, we sought to integrate and refine two social practices into a unified educational proposal: Sustainable Multimedia Educational Development (DEMULTS) (Morais et al., 2021) and Environmental Philosophy of the Countryside (FILAC) (Tauro et al., 2021).
An initial affective cartographic mapping (Hutta, 2000) was carried out in each investigated context, enabling the identification of local potentials for implementing the methodological model and strengthening processes of social participation. Methodological procedures included participant observation, questionnaires, and interviews, focusing on enunciative and interactional aspects in two interrelated stages: (i) interactions among subjects in the territories and educational contexts conducive to applying the methodology in their daily lives; and (ii) interactions among subjects within educational settings during the artifact development process under the proposed methodology. In both contexts — Brazil and Chile — it was possible to identify processes that both foster more harmonious relationships with

nature and produce forms of distancing that lead to the extinction of territorial experience, accelerating processes of biocultural homogenization.

We understand biocultural homogenization as the "extinction of experience" directly with one's own territory and the loss of biocultural diversity (Tauro et al., 2021). From this perspective, biological and cultural diversities are fundamentally interconnected, with the latter reflecting the former. There is an interconnection between subjects and ecosystems, between emotional aspects and the everyday experience of co-inhabiting, in relationships between humans and other-than-human beings. This adds a spatiotemporal dimension to the mind–body discussion, as it roots us in territories, with humans historically related to other species. In light of this scenario, we emphasize the recovery of biocultural memory, understood as a fundamental condition for biocultural conservation in the implementation of the methodology.

To define the concept of biocultural memory, we draw on Toledo and Barrera-Bassols (2015), who describe it as the form of dissemination and transmission of traditional wisdoms, marked by repertoires of symbols, concepts, and perceptions constituted in both individual and collective minds. The authors use the term to explain the vast and
complex collection of local knowledge that is disseminated mainly through biological, linguistic, and cultural diversity. This conceptual matrix makes it possible to characterize knowledge in its dynamic (patterns and processes), relational (interactions among natural elements), and utilitarian (use of natural resources and landscapes) dimensions. Such knowledge is organized at multiple scales: cultural, referring to the knowledge of a specific ethnicity or culture; regional, delimited by historical territory and the culturalized nature surrounding it; community, related to the space appropriated by a community; domestic, linked to the working area of a producer and their family; and individual, restricted to the space of the subject themselves. At the individual scale, we reflect on embodied aspects of biocultural relations.

As initial results, we established methodological guidelines that integrate subjects in the territories as active participants in the processes of developing material and/or symbolic artifacts, with the potential for scaling to other Latin American territories in the search for solutions to socio-environmental problems. The articulation between DEMULTS and FILAC highlights the need for different fields of knowledge to abandon idealisms and presumed neutralities in contemporary contexts marked by the hegemony of a way of life that has produced homogenized human footprints, as seen, for example, in the fields of computing and mass tourism.

Thus, these methodologies place at their core the problem of the historical invisibilization of territories and the erasure of Peasants and indigenous peoples' knowledge, in order to identify pathways to overcome modes of oppression. In the next stage of the research, which will be dedicated to artifact development with the direct participation of subjects, we seek to access these wisdoms through students' lived experiences and the recovery of biocultural memories present in their territories, alongside family members and local culture bearers.

We acknowledge that the nature of biocultural knowledge is profoundly complex, especially when attempting to explicate its embodied aspects; nevertheless, we emphasize the relevance of these elements, as they draw attention to mnemonic processes related to emotions, dimensions not made explicit in the matrix proposed by Toledo and Barrera-Bassols, yet fundamental to an education grounded in territorial belonging. Finally, we point to aspects that require further in-depth examination throughout the practical actions in the territories, such as gender relations implicated in power disputes within recurring human interactions that assign exclusionary meanings to diverse bodies; historical processes of visibility and invisibility and their impacts on senses of territorial belonging; and discussions in the field of Earth rights, aimed at constructing meanings that enable the updating of legislation in favor of legitimizing biocultural diversity.

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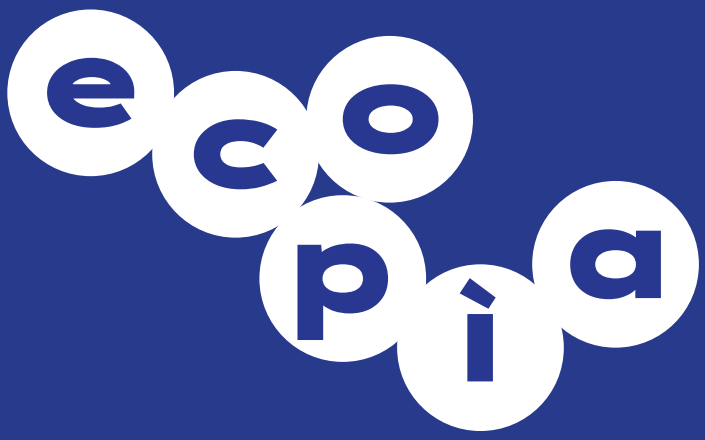

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