

MECHANICAL ENGINEERING | PHYSICS |
PRESERVATION OF THE ARCHITECTURAL
HERITAGE | STRUCTURAL, SEISMIC
AND GEOTECHNICAL ENGINEERING |
URBAN PLANNING, DESIGN AND
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Chair:
Prof. Luca Gaeta

DOCTORAL PROGRAM IN URBAN PLANNING, DESIGN AND POLICY

The PhD Programme in Urban Planning, Design and Policy (UPDP) aims to explore the significance and impact of contemporary urban changes and understand how these processes can be governed through planning, design, and policy-making activities. The programme focuses on the transition towards new, more sustainable and equitable modes of urban development and advancements in planning practice to foster innovation in urban studies, urban design, and policy approaches. The integration between different fields of urban research on the one hand and between theory and practice on the other distinguishes the approach promoted by this PhD programme.

Objectives

The programme's objective is to provide PhD candidates with analytical and interpretative skills and methodologies to advance research in urban studies, spatial planning, urban design and urban policy.

Candidates are encouraged to reflect upon traditional and innovative practices in these fields by participating in research activities concerning cities and regions in Italy and abroad, paying specific attention to international comparisons.

By establishing a dialogue with the best European and International schools, this PhD programme is the place for research and innovative approaches to urban studies, spatial planning and urban design dealing with the following themes:

- Multi-scalar regional urbanization processes: reshaping the city on a regional scale and addressing the challenges for the analytical approaches and descriptions, as well as for institutional and governance processes;
- Advances and challenges in contemporary planning theory and practice: the reshaping of citizenship, boundaries and collective action in urban areas and their effects in the urban environment;
- Urban transitions towards sustainability: strategies and tools for land and biodiversity preservation, energy conservation, and natural and technological risk prevention and mitigation;
- Social and economic changes and their effects on spatial processes: social inequalities and urban segregation; economic specialization and diversification in a global context;

- Evaluation and management tools for urban projects' feasibility, equity and design quality.

Contents and research training

The educational programme's objective is to offer PhD candidates a challenging environment with space for international debate, research, experimentation, and innovation based on a truly multidisciplinary approach.

The main courses and workshops focus on the following research areas:

Urban studies: Contemporary cities worldwide face increasing challenges regarding local democracy, sustainable development, environmental resources and landscape management, social cohesion, and cultural diversity. The main issues addressed are social, economic, ecological and territorial transformations, governance problems and technological innovations. The main research topics are: forms and processes of the spatialization of social and economic inequalities; urban segregation; processes and institutions of urban governance; the spatial impact of social innovation; forms and processes of regionalization; social, economic and territorial development in local contexts.

Planning theories and practices: Urban planning is not a unitary and self-contained discipline. Planning knowledge and activities can be improved by delving into (and jointly considering) theoretical and practical issues. First, the cultures, ethics, traditions and paradigms of planning are varied and have evolved differently according to their geographical, institutional and political context. Similarly, planning practice is multiform and can be understood from several perspectives. Studying the characteristics, the peculiar interpretations, and the effects of planning practices constitutes a second relevant research field. Thirdly, selecting and discussing the intersections between planning and other disciplines (i.e., architecture, environmental sciences, policy studies, philosophy and others) can dramatically innovate planning theories and practices, going beyond traditional approaches and perspectives.

Design topics, forms and tools: In a scenario of changing socio-economic, environmental and territorial conditions, theoretical and technical issues for the construction of urban projects and the implementation of urban policies are being experimented with to improve the quality of life. Specific research themes are the role and form of urban projects in leading territorial transformations, innovation in the description and representation of urban environments and landscapes, tools for the evaluation and management of urban projects and policies aimed at mastering the feasibility and equity of land development, as well as the sustainability and the design quality of the physical outcomes and strategies for land and biodiversity preservation and energy conservation.

The fields mentioned above reflect the ongoing research at DASTU and represent a framework for future proposals. They are the backbone for PhD students' educational and research activities.

Professional and research profiles

According to its international orientation, the PhD Programme trains highly qualified researchers and professionals. It expects them to work in academic institutions, research centres, public administration and the private sector in the following fields: spatial

planning, design and management of urban projects and policy, urban studies and urban governance. PhD graduates with such a profile qualify for employment by Italian and international academic institutions, public bodies and research centres, and public and private development agencies.

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AN ENERGY JUSTICE APPRAISAL OF EU ENERGY TRANSITION POLICIES FROM THE PERSPECTIVE OF VULNERABLE FIREWOOD USER HOUSEHOLDS IN HUNGARY. VULNERABILITIES, OPPORTUNITIES AND CONTRADICTIONS

Anna Zsofia Bajomi – Supervisors: Prof. Stefania Sabatinelli, Dr. Sergio Tirado Herrero

This PhD dissertation examines the impact of the energy transition in the European Union (EU) on vulnerable households relying on firewood in Hungary. The EU has set itself an ambitious decarbonization agenda translated into policies aiming to improve energy efficiency, reduce carbon emissions and improve the share of renewable energy sources. The transition, if carried out, as promised, following the principle of 'leaving-no-one-behind', has a great potential to alleviate energy poverty. However, the justice aspects of the transition cannot be taken for granted, as there is a risk that vulnerable households will be left behind or impacted negatively, if policies are not implemented in a socially fair way. In many countries in Central and Eastern Europe, including Hungary, most of the poorest households rely on firewood to heat their homes. Firewood is considered a renewable energy source but also a significant contributor to air pollution. The research focuses on Hungary, where energy poverty is prevalent among various socio-demographic segments including income-poor households heating their homes with firewood. Traditional understandings of energy poverty in Europe explain energy

poverty as the consequence of low incomes, high energy prices and the poor energy efficiency of homes. Domestic use of solid fuels and lack of access to 'modern' energy carriers has been seldom considered as an energy vulnerability factor in Europe as the relevant literatures have often focused on exploring solid fuels in the Global South. The six energy vulnerability factors (Bouzarovski & Petrova, 2015) along with their definition of energy poverty as the inability to secure socially- and materially-necessitated levels of energy services in the home has helped to overcome the affordability-access divide in the energy poverty literature. This framework offers a more nuanced understanding of difficulties related to domestic energy use. On this ground, this PhD thesis aims to inform the scientific debate on energy poverty about European aspects of solid fuel use. The literature on just transition examines how transition's positive and negative implications impact different societal groups. It explores in priority macro level aspects of the transition of energy systems. The impact of the energy transition of specific energy users has been less explored. By assessing EU and national-level energy transition

policies with an energy justice lens and from the perspective of vulnerable households, this PhD research contributes to the energy justice and just transition literatures. First, it explores how the lived experience of firewood use shapes the vulnerabilities experienced by households in energy poverty. In this regard, a main research question is: What are the justice implications of EU energy transition policies and their national implementation in Hungary in light of the vulnerabilities experienced by firewood users in energy poverty? To respond, a mixed-method approach explored the living conditions of firewood users' and how policies impact them through the analysis of qualitative (interviews and policy documents) and of quantitative (statistical sources). The analysis of interviews with firewood users and of household budget data proved helpful in exploring the vulnerabilities experienced and foreseen by vulnerable domestic firewood users. The analysis of policy documents and interviews with stakeholders involved in policy making and implementation in Brussels and Hungary were used for assessing the justice aspects of the energy transition policy framework. By applying the framework of the

six energy vulnerability factors put forward by Bouzarovski and Petrova (2015) to the situation of vulnerable domestic firewood users in Hungary, the data collected show that a lack of access to gas or district heating networks and issues related to affordability and inefficiency are more prevalent among this subset of the Hungarian population than among average households (Bajomi et al., 2021). The analysis of households interview data indicate, that heating with firewood requires time- and labour-intensive practices. Needs of firewood user households in terms of adequate indoor temperature and air quality is often not met, as widely used iron stoves, compared to more expensive masonry stoves or central boilers, heat up quickly, often overheating the room, and cool down quickly as well, and produce significant indoor and outdoor air pollution. Vulnerability factors explicitly related to firewood use lead to energy poverty-fuelled capability deprivations (Day et al., 2016), such as low thermal comfort, reduced health, reduced ability to work or socialize, and lack of social respect due to stigmatization. Looking at the justice implications of EU energy transition policies and their implementation in Hungary at the national level in light of the vulnerabilities experienced by firewood users, some advances were made in terms of recognition of the issue of polluting solid fuel usage in the National Energy and Climate Plan (NECP). Still,

there are important concerns regarding a just transition of firewood users. At the EU level, social and environmental aspects of domestic firewood use are not recognized in energy transition legislative documents or metrics exploring energy poverty. The distribution of funding dedicated to energy transition is not targeted well enough towards households in need. Finally, the weakness of energy poverty-related elements in the EU level legislative files from an enforcement perspective raised important concerns in terms of procedural justice. In Hungary, steps have been made to recognize energy poverty and domestic firewood use as a driver of energy poverty. However, serious justice concerns emerge in terms of distribution and processes. Legislation and strategic policy documents such as the NECP include the definition of energy-poor households and also mention that domestic solid fuel use is problematic. However, the more significant public policy in housing, social and energy policy results in a pervert redistribution of public goods, benefiting the rich and excluding the poor. Distribution of the firewood in-kind subsidy (through the so-called 'social firewood' programme) is also problematic, while the quickly increasing firewood prices in the early 2020s also create regressive impacts, as the poorest households rely most on firewood. Procedural justice is problematic, as social dialogue and public consultations are generally weak in Hungary, and firewood users are hardly

represented in national arenas shaping energy transition policies. The implication of this research can be drawn at two levels. As domestic firewood users are vulnerable to energy poverty due to multiple reasons, EU renewable energy and energy poverty alleviation policies should recognize and tackle these firewood-specific vulnerability factors. Proportional and sufficient share of EU funding supporting energy transition in the residential sector (renovation, upgrade of heating device, energy communities) should be ringfenced to firewood-relying vulnerable households. Enforcement of energy poverty-related elements and policies that can improve the situation of vulnerable households should be strengthened to guarantee an inclusive transition process from a procedural and recognition perspective too. In Hungary regressive distribution measures need to be reversed, and vulnerable households must gain access to tailor-made supports in the field of housing, energy efficiency and access to clean and renewable heating methods. The voice of firewood users must be heard while planning and implementing local, regional and national energy transition policies.

ON THE QUEST OF PRESCRIBED GRAZING MULTI-FUNCTIONALITY AROUND THE MEDITERRANEAN APPLYING THE NATURE-BASED SOLUTIONS FRAMEWORK FOR WILDFIRE RISK MANAGEMENT

Anna Giulia Castaldo – Supervisors: Prof. Eugenio Morello, Dr. Yaella Depietri

Nature-Based Solutions (NBS) are increasingly recognized as sustainable approaches to addressing today's societal challenges and achieving the United Nations Sustainable Development Goals (SDGs). Disaster Risk Reduction (DRR) has benefited over time from the utilization of NBS approach in contrast to relying solely on "grey" infrastructure measures (i.e., engineering), which can offer numerous ecological and social benefits, such as fostering social cohesion and enhancing physical and mental well-being. Research in this field suggests that effective NBS DRR preserve proper ecosystem functioning to mitigate natural risks and diminish their intensity, duration, and frequency. However, NBS for DRR entail complex, multi-dimensional interventions. Moreover, their efficacy largely depends on current and future climates, local environmental characteristics, and the perceptions and needs of citizens and stakeholders. Drawing upon this backdrop, this thesis aims to explore the silvo-pastoral practice of Prescribed Grazing, employed to reduce the risk of wildfires, through the lens of NBS approach. In the European context, ecosystem-related measures conceptualized under

the NBS approach to wildfires have received insufficient both theoretical and empirical attention. Furthermore, research tends to be more focused on utilizing NBS to mitigate hydro-meteorological hazards. Additionally, the issue of wildfire risk increasingly affects urban areas, with NBS emerging as a measure to enhance urban resilience and livability. There is a pressing need for new approaches to address wildfire risk in peri-urban environments, particularly at the wildland-urban interface (WUI). The research focuses on a set of Prescribed Grazing programs currently implemented in various Mediterranean regions, including "A Paso Lento" in the province of Valencia, "Fireflocks" in the province of Girona, "Mosaic Extremadura" in the Spanish region of Extremadura, and "Landa Carsica" in the Italian region of Friuli-Venezia Giulia. For each program, stakeholders involved, decision-making processes, related policies, facilitating factors, existing barriers to implementation, and co-benefits to the territory and communities are identified to enhance wildfire governance and the sustainability of socio-ecological systems affected by wildfires.

The first section analyzes the wildfire risk management model used in the Mediterranean context and the challenges posed by current climate change impacts. Employing data from the European Forest Fire Information System (EFFIS), it highlights extreme wildfire episodes documented between 2016 and 2018 in the European Mediterranean regions, along with an analysis of the 2022 wildfire season. This information allowed for the identification of a cluster of European countries experiencing similar characteristics of wildfires episodes in terms of magnitude, frequency, and intensity, and impacts on communities, territories and urban planning tools. The second section then contextualizes the aspects necessary for effective wildfire risk management in the Mediterranean within DRR approach, emphasizing issues relevant to urban planning instruments in managing wildfire risk management as the necessity of collaborative governance systems and updated spatial planning policies. NBS interventions can contribute to effective wildfire risk management in the Mediterranean, through successful implementation in

accordance with the European Union's Fire Prevention Policies and the implementation of Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation. According to that, the fourth section presents a series of interviews conducted with experts and operators involved in Grazing Programs in European and United States contexts, delineating current obstacles and potential improvements. Based on these findings, various aspects of the benefits of Prescribed Grazing for wildfire governance are proposed for examination. The section concludes with a thematic mapping of European regions based on wildfire risk caused by anthropogenic factors, highlighting the countries most affected by wildfires. The fifth section presents case studies of Prescribed Grazing Programs, and applying a qualitative and quantitative research methodology, the analysis concerns direct stakeholder involvement in various stages of project implementation. Thus, the thesis establishes a qualitative and quantitative methodology for evaluating Prescribed Grazing's effectiveness in reducing wildfire risk and its contribution

to socio-ecological systems, as a beneficial practice for urban planning instruments, considering both advantages and limitations. The evaluation framework provides qualitative and quantitative information, identifying co-benefits of the case studies, such as promoting the rural economy, landscape maintenance, and enhancing the role of shepherds, significant for wildfire governance processes and socio-ecological systems. In conclusion, the study delineates the formulation of a Prescribed Grazing policy within a specific case study situated in the Puglia Region, with a particular focus on municipalities lining the coastal areas within the province of Salento. The selection of this context is predicated upon its enduring confrontation with wildfires, which has catalyzed local advocacy for interventions such as the implementation of a Prescribed Grazing program. Employing the evaluation framework shaped, the research underscores the advantageous implications of Prescribed Grazing for the mitigation of wildfire risks, along with its ancillary benefits for a diverse array of stakeholders encompassing policymakers, urban planners, land stewards, investors, industry affiliates,

and the resident communities. This framework is subjected to scrutiny in conjunction with qualitative insights gleaned from comprehensive interviews conducted with pertinent local stakeholders. The work of the thesis underlines the importance of addressing Urban Green Infrastructure in wildfire risk management including ecological consideration and also social aspects, renovating binding instruments and appropriate stakeholders' engagement.

LEARNING FROM DISASTERS TO ENHANCE RESILIENCE OF URBAN COMPLEX SYSTEMS: USING DAMAGE & LOSS DATA TO STRESS TESTING CITIES AND URBAN PLANS FOR RESILIENCE

Anna Faiella - Supervisor: Prof. Scira Menoni

Natural hazards are a major threat to communities resilience, hampering sustainable development, economy and social settings. The speed, severity, and complexity of known and unknown changes in climate, the often uneven impact across different areas, and the increasing interconnectedness of societies and their functions, increase the complexity of the approaches, methodologies and practices that aim at managing and reducing risks. This work proposes a shift from Disaster Risk Management to Resilience Management, as an efficient process where all those complexities find space and are systemically and comprehensively handled, linking the requirement of learning from the past to address the times to come.

The present research gets shaped around three main pillars: Damage and Loss Data, Spatial Planning and Resilience Management. Spatial Planning is key for risk reduction, prevention and climate change adaptation for existent and future anthropized environment, it shapes exposure and vulnerability to the impact of hazardous events and it has the potential to boost resilience through lesson learned from

past events. Understanding how a disaster has impacted the territory provides evidence-based knowledge through which it is possible to identify priorities to mitigate and adapt to future risks.

While shifting towards the renewed approach of Resilience Management, this doctoral thesis proposes a methodology to support a proactive Spatial Planning, which by itself can act as an ex-ante mitigation measure capable of reducing exposure and vulnerabilities while increasing resilience, to avoid future losses while generating advantageous societal, economic and environmental configurations in contemporary territories. The methodology entails an operational procedure to evaluate resilience in areas exposed to hazardous events after performing a stress testing, making use of spatial, quantitative and qualitative data. Specifically, the methodology has been applied to the case study of Benidorm City (Spain) which has been selected for its emblematic characteristics being a model of urbanisation exposed to multi-hazards and characterised by social and institutional vulnerability. By stressing the system under

consideration, resilience is assessed and framed within the Resilience Matrix. A tool which in a visual fashion delivers the results of the analysis of the urban system to highlight critical areas on which it is necessary to act in order to boost resilience through different phases of DRM and to highlight the capacity of the system to respond/withstand and react in case of disruptions.

UNIVERSITIES AS POTENTIAL SOCIAL AGENTS IN THE URBAN REGENERATION OF FRAGILE LOCAL COMMUNITIES: A MUTUAL LEARNING PROCESS

Mariana Auad Proença – Supervisor: Prof. Alessandro Balducci

This doctoral thesis is being developed as part of the research project “Fragilità Territoriali,” hosted by the Department of Architecture and Urban Studies (DAStU) within the framework of the Department of Excellence. The thesis’s content was structured by exploring socio-economic development aspects of community life when approaching the framework of territorial fragilities, focusing on urban regeneration. This context also investigates universities’ potential social and civic role and how they can contribute to finding solutions to mitigate fragilities in the territories in which they are located.

The world faces economic, social, and environmental issues more connectedly than ever before, posing challenges to identifying the leaders of future changes. Over the years, universities have played an essential role through new research strategies linked to social responsibility within communities by expanding research and teaching beyond the boundaries of the university campus.

This thesis aims to provide concepts and ideas to induce a discussion and build critical thinking on connecting universities’ work with fragile local communities. First, a general

overview of social responsibility and territorial fragility concepts is presented. Then, the importance of projects developed within communities, particularly with innovative educational practices, is illustrated through case analyses. These cases emphasize the importance of collaborative research among different actors and stakeholders and understanding the communities’ lives.

The methodology applied comprises three phases, starting with a literature review and conceptualizing the two essential pillars: the role of universities and territorial fragility. The second phase shall consist of three case analyses that explore how universities apply social responsibility and civic engagement as strategies to deal with the urban issues of fragile local communities.

The case analyses present two perspectives: the first focuses on innovative educational processes and mutual learning, and the second focuses on learning from university networks’ activities. The investigation methodology for the case analyses was based on fieldwork, data collection, and interviews with professors and students to understand the positive impact and challenges of implementing the social approach

in research when dealing with fragile local communities. Furthermore, an in-depth analysis of some internationally recognized university networks and organizations in the field of social and civic engagement takes place as an exciting contribution to place the experiences analyzed in a more general process of maturation and sensitivity of universities towards social issues. Finally, the third phase presents the conclusions and future outcomes based on the research question and sub-questions. The research question and sub-questions guide the methodology: How is the role of universities being practiced in dealing with fragile territories in the search for urban regeneration? Sub-questions: How are universities playing a role as powerful organizations that use their teaching and research knowledge to design actions beyond the borders of the campuses? How is it possible to build a relationship of common learning and mutual respect between universities and communities? What is the positive impact of the social and civic engagement approach in the urban regeneration of fragile local communities? In summary, this research

emphasizes the significant role that universities can play in addressing the fragility of the areas where they are situated. However, achieving an effective environment for mutual learning requires improving and modifying educational practices despite the challenges of implementing university-level social responsibility. It is important to note that the social aspect is critical at all university levels, whether public or private, regardless of whether they serve as institutions, economic indicators, or representatives of communities. Furthermore, social and civic engagement strategies such as participatory activities, action research (responsible research), and co-design of urban solutions and policies through collaborative research can facilitate effective changes in society and their communities.

EMBODIED LANDSCAPES: LAWRENCE HALPRIN, THE CREATIVE PROCESS AND ARTIFICIAL INTELLIGENCE

Paola Sturla - Supervisor: Prof. Michael F. Jakob

Considering landscape design as an embodied, relational creative discipline, the thesis asks what artificial intelligence is for in landscape design practice. After addressing artificial intelligence's foundational problems and defining the field of application of landscape design, the thesis explores the theoretical work of Lawrence Halprin as a framework for describing the creative process of landscape design. The analysis highlights two main characteristics defining landscape design practice: first, being relational and context-sensitive, and, secondly, being embodied. Therefore, the characterization of the landscape design falls beyond the broader discourse of humanistic design, suggesting a reconsideration of artificial intelligence as a meta (-art) tool in the landscape design process.

CULTURAL LANDSCAPE DIGITISATION IN FRAGILE AREAS: DATA AND STORYTELLING TO SHAPE STRATEGIES

Marco Vedoà – Supervisors: Prof. Rossella Salerno, Prof. Francesc Muñoz

The research starts with a review of the academic literature and national and international documents on the notion of ‘cultural landscape’ to understand how the definition evolved from the contribution of Carl Sauer in 1925 and how it is implemented in policies and regulatory frameworks. Indeed, the notion seems to influence the cultural landscape digitisation processes, which can be categorised into bottom-up and top-down approaches depending on the developer and the objectives of the initiatives. In the same direction, the landscape experience appears influenced by such approaches, and the image and storytelling follow the same pattern. From this perspective, the research focuses on how Information and Communication Technologies (ICTs) convey the landscape experience and how these digital representations can be protagonists in the regeneration processes.

To analyse these assumptions, the Italian policy *Strategia Nazionale per le Aree Interne* offers an interesting framework that combines landscape enhancement and local development in fragile areas. In addition, in the last

twenty years, inner areas have seen an increase in tourism presence and bottom-up cultural landscape digitisation initiatives. In addition, these digitisation initiatives seem able to push innovation and promote local development. The scenario can be the occasion to understand how ICTs can build a constructive link between tourism and cultural landscape enhancement. In particular, three research questions emerge from these assumptions: What innovations and networks can bottom-up initiatives promote and develop in marginal areas? Could ICTs for cultural landscape promote the dialogue between local resources and exogenous actors? Which guidelines can be identified for implementing ICTs and digitisation initiatives to push the development of community-based tourism practices in marginal areas? The research developed a qualitative and quantitative methodological framework to deepen the questions. It first analyses the context, the demographic and economic situation and tourism in inner areas to understand the background conditions. Second, the ICTs for cultural landscape are analysed, deepening the

networks built, the governance models, the innovations, and the landscape storytelling developed (fig. 1). In addition, the research developed a webGIS to compare the contributions of the bottom-up and top-down initiatives and analyse the socio-demographic and tourism data collected at the area and municipal levels (fig. 2). This comprehensive evaluation is applied to eight case studies. In particular, the research focuses on six SNAI experimental areas in the Alps: Valli Maira e Grana, Valli di Lanzo and Val d'Ossola in Piedmont; Alto Lago di Como e Valli del Lario, Valchiavenna and Alta Valtellina in Lombardy; and to two comarcas in the Catalanian Pyrenees, Bergudà and Pallars Jussà. The following comparison and analysis of the results and evaluations



Fig. 1 - Research design flow chart.

allowed learning opportunities, threats and fragilities of the cultural landscape digitisation processes concerning the socio-demographic background conditions, the technological field and the landscape storytelling proposed. The result is a set of guidelines aimed at building a constructive link between cultural landscape digitisation, enhancement and tourism for public administrations, private companies and third-sector entities.

Finally, the research process offered to deepen further the shades of the ‘cultural landscape’ notion and how ICTs and digitisation have changed the landscape experience. The study has also opened new research opportunities on the role of tourism in inner areas and on the relationships between

local development and cultural landscape digitisation and enhancement.



Fig. 2 - The webGIS shows the different concentrations of digitised features in top-down and bottom-up initiatives.