Dimensions of Socio- Environmental Approaches as a Platform for Local Development Under Climate Change

Theoretical and practical considerations of transdisciplinarity

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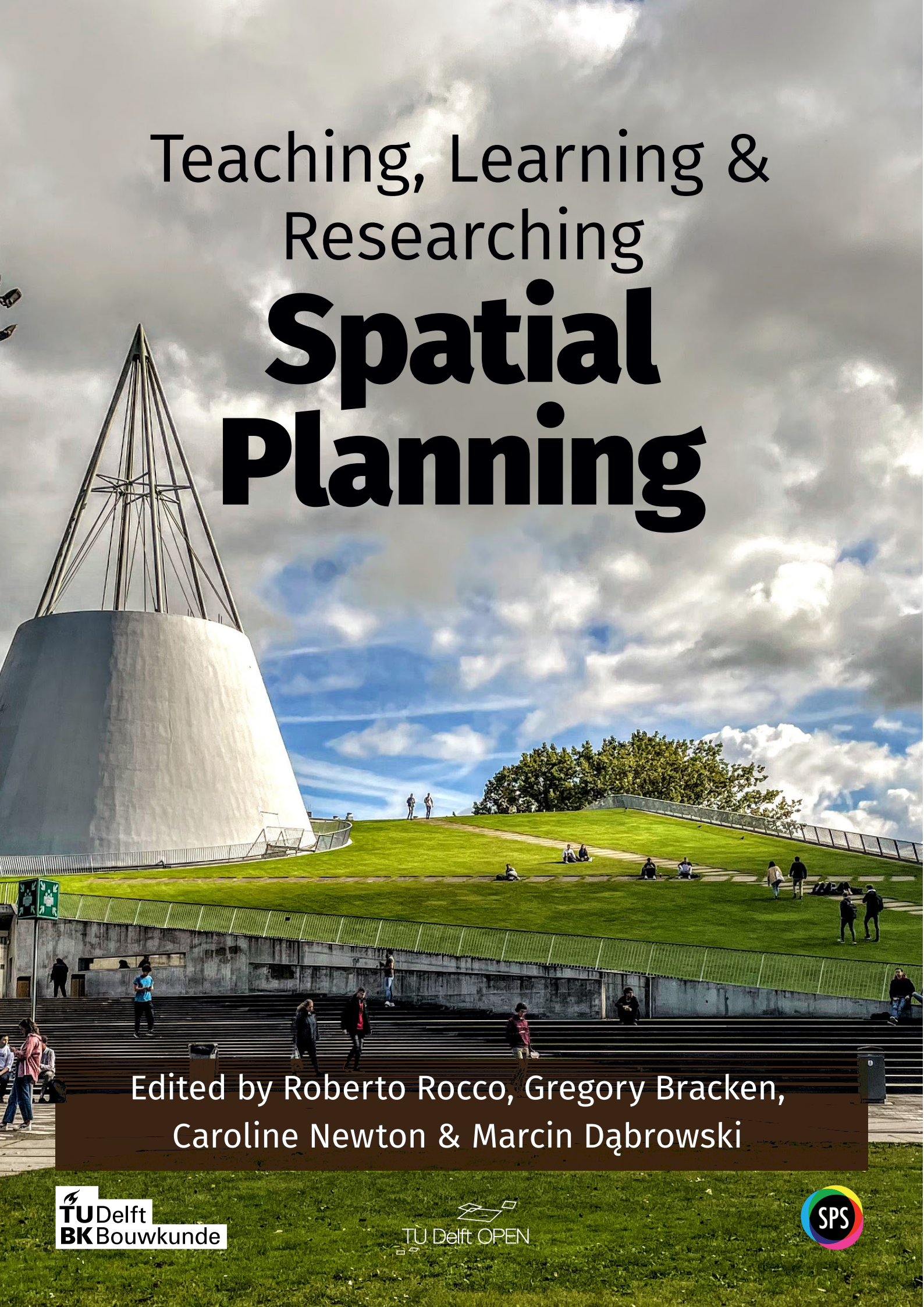

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Dimensions of Socio-Environmental Approaches as a Platform for Local Development Under Climate Change

Theoretical and practical considerations of transdisciplinarity*

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The governance of urban processes, in the face of the effects of variability and extremes of climate change, requires a complex approach, especially because of the inherent uncertainty and high infrastructure cost those solutions entails. The urgency of the responses and actions imposed by extreme weather events transfers additional complexity to less developed societies, given the drift towards sectoral responses and the structural lack of financing at the municipal level. This chapter proposes a two-pronged approach: 1) linking climate adaptation processes and 2) outlining strategies for local development. This double effect facilitates the process of climate change adaptation through the active integration of a wider range of actors in local development, integrates agendas and actions of greater complexity, and ensures a long-term perspective of evolutionary change. The chapter has a theoretical framework defined by its transdisciplinary perspective (Lang et al., 2012), i.e. a reflective, integrative, scientific principle articulated by co-participatory methods that aim to solve or transition social problems and at the same time relate to scientific problems by differentiating and integrating knowledge from various scientific and social disciplines to validate the link between climate change strategies and local development. This is presented through a case study establishing a framework for possible interventions with integrated objectives in order to determine policy recommendations and local development strategies within the characteristics and conditions recognised in the case study, paying special attention to the high number of informal settlements in abandoned areas, and the limited economic capacity of the municipality to cope with their needs.

COLLABORATIVE PLANNING, PLANNING EDUCATION, SITUATED LEARNING, SPATIAL VISION, DEVELOPMENT STRATEGY

1. Contextualising climate change variability and local development through adaptation

The literature on climate change adaptation has its basis in risk management and had been expanded to include a recognition of levels of vulnerability (social, economic, and environmental) present in each place and defined in specific conditions. The assessment of these conditions is the fundamental factor in implementing necessary socio-environmental change. This is more evident in locations that have asymmetric responses to the satisfying of basic needs, such as the main urban localities of the Reconquista river basin in the Greater Buenos Aires area, considered here as a case study.

Recognition of the causes and effects of climate change variability is defined in the complex interrelationships of diverse systems (ecological, social, and physical components under a common decision-making system), so the approach to understanding them is framed as that of a 'complex system'. This is based on the dynamic coexistence of natural and anthropogenic processes in a context of continuous change (Meyer, 2009). The locations of the selected cases are within the Reconquista river basin and could be conceptualised as part (a subsystem of) an urban delta system (the Paraná delta), which in turn is considered a complex adaptive system (Dammers et al., 2014) given its dynamic interrelationships between the water system, soil characteristics, its level of urbanisation, socio-economic conditions, and production systems, among others.

This chapter defines systemic interrelationship as 'a complex whole, a set of interconnected things or parts, an organised body of tangible or intangible things that interact to form a whole' (McLoughlin, 1969). The city is also understood as a complex system, composed of subsystems, encouraged by general systems theory (McLoughlin, 1969). From the point of view of complexity theory, cities can be understood as open systems because they exchange information with their environment (Portugali, 2006), as well as complex, because they are made up of numerous components or actors with interdependent behaviours, resulting in varied effects (Durlauf, 2005; Portugali, 2006; Zagare, 2018). In this chapter, the socio-ecological approach is proposed to reveal the interactions of the systems considered and, through it, to define the main challenges to be addressed.

Interrelationships between systems and sub-systems intersect within a non-static equilibrium (Pelling & High 2005; Johnson, 2012), i.e. one that is continuously changing and produces uncertain effects. Even a small change can trigger a qualitative impact on the whole system and thus require an adaptation process to reach a new equilibrium (Pelling & High 2005). Continuous interactions take place in a non-linear and unpredictable way, so it is necessary for the system to adjust to these changes to reach a non-static equilibrium.

Given that climate change variability has its most critical expressions at the local level, the main issues to counteract its effects lie in the capacity of territorial decision-making at the municipal level. In particular, those issues that make it possible to deal with adaptive dynamics, (necessary to manage the associated risks and embedded in a longer-term re-

silience strategy), are the development perspectives and challenges and actions to address the specific risks associated with the effects of flooding (also considering the lack of water during certain periods of the year).

This chapter argues that complex adaptive systems are defined by the resilience of the system, which implies its ability to absorb disturbances without being weakened or unable to adapt and learn. Some natural and social systems have the built-in capacity to recover from adverse circumstances, while others have to learn to be resilient. The chapter focuses on the role of networks as an interrelated support system and the role of institutions in building resilience in social and ecological systems under a framework of joint municipal territorial management, relying on their national actors and policies.

2. Resilience as adaptive capacity

The term resilience is based on three main perspectives: engineering, ecology, and evolution. Engineering resilience refers to the ability of a system to return to an equilibrium or steady state after a disturbance (Holling, 2001). Ecological resilience refers to the ability of these systems to 'absorb change [...] and still persist' (Holling, 1973). The main distinction between the two definitions is the maintained efficiency of the function versus its maintained existence (Schulze, 1996). In the proposed framework, which links territorial decisions with mandatory actions to cope with the effects of climate change, the concept of resilience needs to be broadened in order to apply it appropriately to local development conditions and thus target the necessary change-oriented adaptation. Evolutionary resilience (Davoudi et al., 2013) extends the description of resilience from the engineering and ecological viewpoints of restoring and enhancing, also considering the capacity of complex social-ecological systems to change, adapt, or transform in response to stresses and disturbances (Carpenter & Westley, 2005). The concept of resilience is thus established by thinking about local conditions and enabling the activation of an integrated process of change that integrates local development and adaptation to climate change. This study requires the consideration of local, biophysical, and social conditions, proposing to define as a basis the scalar level of vulnerability of the main system at stake, in this case the water structure, and from there to define the risks associated with other vulnerabilities (social, physical, and economic).

Wisner et al. (2004) define social vulnerability to climate change as 'the characteristics of an individual or group and their situation that influence their ability to anticipate, cope with, resist and recover from the impact of a natural hazard' (an extreme natural event or process). Anderson and Woodrow (1998) expand it to 'long-term factors that affect a community's ability to respond to events or make it susceptible to calamities'. They go on to distinguish between material, physical, social, organisational, motivational, and attitudinal vulnerabilities. According to the latter definition, the appropriate framework for integrating local development into climate change adaptation strategies requires the assessment of existing socio-environmental conditions including the need for forecasting and planning. Furthermore, the proposed theoretical framework seeks to clarify that territorial decision-making, as a

vulnerable system, should also be considered within the requested action of change, considering Cutter and Finch's (2008) contribution on defining vulnerability as 'the potential damage incurred by a person, asset, activity or set of elements that are at risk. Risk is driven by natural, technological, social, intentional or complex hazards with the potential outcome being disaster. In our approach risk expands to social, economic, political and cultural conditions and factors in decision making, i.e. vulnerability is socially constructed'.

3. Returning to adaptive capacity

Under the theoretical re-conceptualisation of risk and vulnerability detailed in the previous paragraph, this paragraph seeks to define the next step: adaptation, defined as the actions people take in response to, or in anticipation of, anticipated or actual changes and risks, to reduce adverse impacts or take advantage of opportunities presented by climate change or other recognised risks.

Adaptation is not about returning to an earlier state, because all social and natural systems evolve and, in some respects, co-evolve with each other over time. This is the basis of evolutionary resilience (Davoudi et al., 2013). Evolutionary resilience extends the description of resilience from engineering and ecological views of restoration and enhancement to the capacity of complex social-ecological systems to change, adapt or transform in response to stresses and strains (Carpenter, 2005), and thus respond to our proposal to link local adaptation strategies with local development. Therefore, the social conditions within resilience can be framed to consider the following:

• Social resilience is often used to describe the capacity to adapt positively despite adversity (Luthar & Cicchetti, 2000)

• Social resilience is the ability of groups or communities to adapt in the face of external social, political, or environmental stresses and disturbances (Adger, 2000)

This defines the basic conditions to which a social group needs to respond in order to be resilient.

4. The components of the applied approach

The theoretical approach presented in this study of modelling adaptive resilience and strategically aligning the management of climate change effects and local development began by proposing the necessary assessment of the biophysical systems involved (local conditions within various interrelated systems), defining environmental resilience in its main line of argument, and revealing its own limitations. It can be agreed that it depends on the capacity of natural systems to absorb change and still persist, 'functioning, maintaining its existence and maintaining a certain level of efficiency of its recovery functions' (Holling, 1973; Schulze, 1996) as a result of which we conclude that the proposed system can be induced by design. To do so, engineering and social aspects must be aligned with biophysical conditions and recognise existing social conditions to trigger change through an institutional perspective. This is proposed by defining an iterative process of opportunities designed through co-evaluations and strategic alignments over time.

Adaptation to present and future risks is increas-

ingly understood as an integrative process precipitated by the need to cope with extremes, within gradually changing average climatic parameters (Kelly & Adger, 2000; Jones, 2001).

Current adaptation strategies have recognised in the dynamics of biophysical systems, as well as in green spaces and urban water systems, potentials for enhancing biodiversity conservation and contributing to the solution of societal challenges (Goddard et al., 2010; Cohen-Shacham, 2016). Along these lines, the European Community has recognised the functioning of ecosystems as fundamental pillars for the mitigation of and adaptation to climate change (European Commission, 2015). While aligned to local development objectives and recognising their economic and operational constraints, these strategies can generate exponentially expanding environmental resources, economic benefits and social benefits (Kabish et al., 2015).

Within these strategies promoting the maintenance, enhancement, and systemic restoration of biodiversity by expanding urban eco-systemic capacity are nature-based solutions, as well as actions based on 'ecosystem-based adaptation', 'green infrastructure', 'ecosystem-based disaster risk reduction', and 'natural water retention measures'. All are defined around the search for answers to the various complexities that climate adaptation and local development demand today. These strategies and the concepts that validate them are mostly complementary, and can be and are used in both urban and non-urban contexts. It is important to consider that both nature-based strategies and potential associated strategies are highly complex to study and evaluate due to the multi-scalar nature of the dynamics of bio-physical systems, in both their spatial and temporal scales. As they are associated with territorial decision-making systems for applicability, they require the intervention of various levels of governance, from the purely local to the transnational territory. The local context and its particularities must always be distinguished for their possible implementation, hence the proposal described here is structured on a concrete experience that evaluates and correlates them.

This chapter argues that adaptive management processes informed by iterative learning about the ecosystem and through a systemic evaluation of the successes and failures of previous management, increases resilience, which in turn can increase the capacity to respond to climate change threats in the long term.

Thus, a second concept is proposed: the necessary activation of an adaptive management process, where the evaluation of past actions and the level of constraints considered in each time period needs to be assessed and revealed in order to define a cumulative knowledge to guide an evolutionary process of change in the various pathways taken under different levels of risk in order to improve their performance. Again, this is a request for external input. This type of adaptive management (Lee, 1999) can be used to pursue the objectives of:

- greater ecological stability
- more flexible institutions/structures for resource management
- recognising and activating the adaptive cycle (Holling, 2001)

As such, evolutionary resilience, understood as a process of cumulative/reflective knowledge, is proposed here precisely to emphasise that the system goes through different stages of change to become adaptive (Schulze, 1996) and that each decision and its context are important elements to consider in

the more holistic decision-making processes proposed as a model of associated objectives.

To fulfil the integration of these objectives, from the environmental to the social sphere at the local level, it is necessary to implement a clear organisational structure under the recognised capacities of local government bodies, so that the process proposes including resources and skills of external bodies – in this case, academic support for systemic assessments which are already defined from a socio-environmental perspective.

This would result in a call for a transdisciplinary research approach, where possible changes can be jointly assessed by the various actors involved at each step of the process, from the main biophysical assessments to the social demands and the various capacities of the local government bodies involved.

The concept of adaptive capacity relates to the potential of a socio-ecological system to reduce its vulnerability (the level at which a system is unable to cope with adverse effects) and minimise the risks associated with a specific threat (Adger et al., 2003; Adger, 2006; Smit & Wandel, 2006). According to Folke (2005), adaptability is a prerequisite for the resilience of a system, which can be defined as 'the ability of a system to absorb disturbances' by reorganising itself to maintain its identity (Folke et al., 2010) before shifting to a radical state. The proposed path for change therefore requires a high level of flexibility and territorial action defined by a constant assessment of the various conditions considered in each system and through their interactions.

The complex interrelationship of the dynamics of the natural and built environment is constantly adapting, which means that the whole process must always be cyclical and evolutionary (depending on gradual changes). Adaptations depend on each system and its interactions (positive and negative) so proposed transdisciplinary approach needs to consider co-evaluation from the scientific perspective of local conditions (including the human and economic municipal resources to support this process).

Adaptations can be seen as opportunities to improve each system and its interrelationships so that an active transdisciplinary approach that proposes various possibilities for change co-defines its main objectives and scope and needs to align with local governance capacities to result in concrete and feasible strategies (in line with the municipality's development goals) as well as effectively integrate local stakeholders in their evaluation.

5. Transdisciplinary process for a new vision of local adaptability: The Arroyo Morón case

This study is based on joint research between different institutions that bring together various disciplines with the aim of improving local development, coordinating agendas and actors to respond to the effects of climate change and the environmental crisis at the local scale. This is in addition to the concepts of evolutionary adaptation activated by participatory processes, those that integrate local, public, and private actors, academia, and various disciplines to facilitate the processes of evaluation, implementation, and monitoring of alternatives for institutional, social, and environmental change. These are recognised as systems whose effects must be assessed in their interrelationships, interdependencies, and capacities in order to define a

Transdisciplinary approach for climate change and local development			
Municipalities involved	Moron (AR) Hurlingham (AR)	Municipal Goals: Flooding controls Slum upgrading in situ program Derelict industrial area regeneration Municipal Park Local airport Nodal transport point	
		Content + Approaches	Disciplines: Conversations to Speculations 10-week course: 3 weeks in situ
Disciplines/ Technical Universities	Landscape / SLU Malmo Urbanism UBA Urban design	Landscape Urbanism Integrated planning (actor relational approaches) Urban/regional functional structures Socio-economic development Socio-environmental approaches Urban regeneration Urban design Slum upgrading strategies	A. Desk analysis: regional functional structures + densities + socio economics aspects + mobility + infrastructures + soil + water shed + flooding risk + planning operability. Synthesis: main Regional Challenges/ goals (per group) B. Site visits + meeting Municipal experts, Main local plans and interest. Synthesis: New revised set of challenges/ Goals at Municipal Level C. Meeting local inhabitants (slums), interviews and mapping daily systems. Synthesis: New local D. main spatial proposal: Local+ Municipal scales E. Final regional vision, local strategies
Other partners	City of Amsterdam AMS Institute AMS Water AMS Energy	Communicative planning Water System/ Public Private Models Water sensitive design/ local energy	A. Site visits + meeting municipal experts B. Joint speculations and proposed new case studies and experiences C. Alignment of new set of goals within diverse student groups, each choose accents and directions

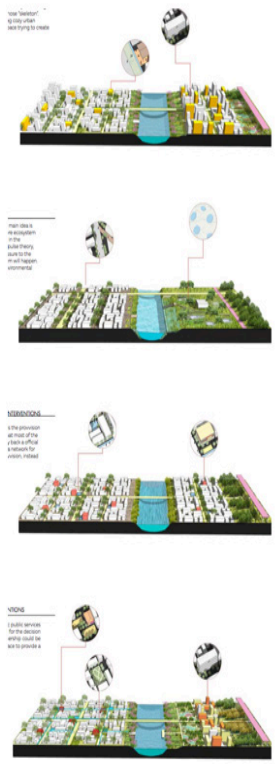

Image 1: Actors and roles in the transdisciplinary programme of the Arroyo Morón case. Authors: Diedrich, Janches and Sepulveda 2018.

plan of integrated actions in sustainable processes that increase their local impact.

From this perspective, during two three-month periods in 2018 and 2019, a research consortium called Transdisciplinarity for Climate Change in Complex Areas was formed, which offered the municipalities of Hurlingham and Morón on the periphery of Greater Buenos Aires to jointly define a possible framework of ideas for a strategic action plan for dealing with climate change. The full study forms a part of the research project 'Tactics and Strategies for the Integral Improvement of the Urban-Water Landscape in the Area of the Reconquista River Basin' by Flavio Janches and Juan Carlos Angelomé (Strategic Development Project 2018-2019, University of Buenos Aires). This exercise was carried out as part of the activities of the Master's Degree courses in urban and landscape architecture from three universities: Master of Landscape Architecture (SLU Malmo, Sweden), Master of Urban Design (University of Buenos Aires), and Master of Urban Planning (TU Delft).

The basic local conditioning factors of these two municipalities were evaluated from the disciplines

of urban planning, ecology, landscape, anthropology, and governance, recognising that: 1) the natural features present in both territories are part of the Reconquista river basin, a tributary of the Paraná river and interrelated with its deltaic dynamics, and 2) that the quality of the local tributaries combined in the Arroyo Morón reveals high levels of pollution, and that flood control infrastructure is urgently needed. At the same time, the social conditions of the area were considered, which feature a large number of informal settlements in flood-prone and polluted areas where the poverty rate is high, and informal employment is the main source of income for most of the population located in irrigated areas.

In addition, the good level of connectivity and mobility at metropolitan level was recognised, allowing for the possibility of growth and densification, so that in a first meeting the guidelines for the development of the project were agreed. In this way, the operational framework of a support agreement was followed that sought to bring together strategies for local adaptation in response to climate change and local-inter-municipal development possibilities, enhancing the objectives of local development plans, while recognising the functional interrelationships at the scales of intervention (spatial and temporal).

The operational framework of this exercise was defined as transdisciplinary and structured according to the process defined by Diedrich et al. (2015) as 'beyond best practices' as a participatory dialogue, involving inhabitants, municipal specialists, and academic disciplines of landscape/ecology, urbanism/urban design/governance, anthropology, and urban design as a platform for co-evaluation and participatory design in order to facilitate, understand, and coordinate the complexities of climate change and spatial planning at the local level.

The design of this interdisciplinary activation framework was defined as a speculative process that coordinated a way of creating, of deliberating, and of possible decision-making, as a testing ground for the definition of critical responses and evolution of the knowledge framework, particularly adapted to the strategic guidelines of climate adaptation, environmental improvement, and socio-spatial integration.

Through the results obtained in each phase of the exercise, and from re-evaluation of the processes and projects developed, it is possible to redefine the framework of theoretical, technical, and methodological reflection in order to promote new integrative proposals and provide specific disciplinary responses to each systemic feature being considered. This is essential because of the complexity of the problems, which require new approaches to transform complex urban landscapes into more sustainable environments (Janches et al., 2019).

The exercise described here is structured within this design in a non-linear and interactive process of agreements, proposals, co-evaluations, measurements, and adjustments concluding with concrete possibilities to discuss possible development strategies with multiple actors and thereby define the specific strategies to follow. These improve and expand the objectives of existing strategic plans from a process that is not linear but iterative and incremental instead.

We now describe the phases of the exercise, its actions, and the actors involved in the transdisciplinary process. These defined the operational framework of the exercise, the systems considered, and the possible interrelationships between them.

Through their spatial definition, possible potentials were detected, which in turn revealed possible paths which were re-evaluated by the local actors involved from the economic and technical capacities of the municipalities to the possible spheres of participation of private actors, among other issues.

Phase 0: Systemic (prior) analysis and background review; strategic guidelines predefined by both municipalities

• Objectives: short-term: flood control, formalisation of marginal areas, industrial regeneration and activation programme, urban regeneration programme for the municipal park; medium-term: co-evaluation of strategic guidelines for the reconversion of a disused airport into a regional airport focused on the development of a multimodal metropolitan transport hub

• Actors: academics, municipal officials, inhabitants, and NGOs

• Actions: at the invitation of the municipalities, the strategic guidelines are jointly reviewed through discussions/interviews with the different stakeholders, the areas, the systems to be considered and their levels of risk and urgency are co-defined

• Output: the framework programme of the challenges to be considered, the map of actors and the urgent needs to be considered

Phase 1: Categorisation and prototypical proposal (integrating systems)

• Objectives: to define the systems at stake, and their possible interrelationships; to determine a prototypical synthesis of possible local solutions before approved and similar constraints

• Actors: academics and municipal officials

• Actions: re-evaluation of the system and its environmental impact, rainwater and sewerage management, socio-economic mapping, and integrated re-mapping; speculations from possible solutions based on the study of past actions and impact assessment

• Output: prototypical proposal of integrated local solutions

Phase 2: Presentation of prototype proposal (integrating systems) to local stakeholders; selection and review of technical feasibility, decision-making and management capacity

• Objectives: to evaluate the potentialities and limitations of the 'speculations' presented as tools or previous solutions from the economic and technical capacities of the municipalities and local actors involved

• Actors: academics, municipal officials, inhabitants, and NGOs

• Actions: implementation of three discussion tables, coordinated according to urgent problems where prototypes of possible solutions are presented and discussed by each group of actors to later define the possible frameworks and their limitations

• Output: definition of possible solutions from concrete strategies aligning the diverse interests of the stakeholders involved

Phase 3: Adjustment of the prototypical proposal recognising technical feasibility and decision and management capacity

• Objectives: detailed review of the technical feasibility required by the proposals and joint review of the institutional support system (financial and

programmatic)

• Actors: academics and municipal officials

• Actions: presentation of detailed reports of the proposals, evaluation and discussion of their possible operability

• Output: assessment of possible actions, potentials, and constraints, both operational and in terms of decision-making and competence

Phase 4: Spatial contextualisation and co-selection of possible strategic actions

• Objectives: quantification of possible actions, spatial expression, special impact, and co-definition of strategic actions

• Actors: academics, municipal officials, inhabitants, and NGOs

• Actions: implementation of three discussion tables coordinated by actions where prototype strategies are presented and discussed by each stakeholder group and then hierarchies of interests are defined by possible agreements of their impacts

• Output: selection of local strategic plans in stages

Phase 5: Final selection according to technical feasibility, decision-making, and management capacity

• Objectives: definition of the local strategic plan for the specific framework of the transdisciplinary plan to be developed

• Actors: academics, municipal officials, and NGOs

• Actions: summary report of the actions to be developed, possible impacts, cost, and time

• Output: full report of the local strategic plan to be developed

Phase 6: Co-evaluation of socio-environmental impact

• Objectives: the implementation of a socio-environmental impact co-evaluation system

• Actors: academics, municipal officials, and NGOs

• Actions: implementation through participatory scenario system of the co-evaluations from the more technical framework to the social impact

• Output: socio-environmental co-evaluation report

Phase 7: Co-definition of strategic actions in critical areas and possible phases of evolutionary change

• Objectives: once a local strategic plan has been defined and agreed upon, its stages are defined and agreements are made for specific goals over time

• Actors: academics, municipal officials, and NGOs

• Actions: creation of two moderated discussion tables to jointly define the objectives by stages

• Output: local strategic plan, stages, goals, and possible funding

Phase 8: Detail of actions for cost definition

• Objectives: to define the estimated costs of each stage, recognising possible governmental and cooperation agency plans for potential implementation

• Actors: municipal officials

• Actions: municipal, inter-municipal assessments, and possible review at regional level

• Output: cost plan by stages

Phase 9: Local level visualisations of integrated

systems and their possibilities. Second presentation to the community

• Objectives: to generate spatial visualisations of possible proposed changes and their spatial outcomes as a means of communication and dissemination for discussion among various actors and the strengthening of possible guidelines
• Actors: academics, municipal officials, and NGOs
• Actions: iterative process of visualisation, understanding, and detailing
• Output: visualisations and systemic-functional details of selected actions

Phase 10: Speculations; detailed strategic adaptive proposal

• Objectives: the definition and detail of possible local strategic plans presented as opportunities that determine the territorial changes linked to the socio-technical capacities of the actors and defined from the operative limitations of possible strategic adaptations
• Actors: academics, municipal officials, and NGOs
• Actions: two evaluation roundtables
• Output: final report of possibilities and adaptations of the decisions framed with possible financing

In each phase, the proposed processes were defined as 'conversations' where the framework consisted of proposals executed by the students, discussed/evaluated by the municipal experts, and enriched by discussions with the different parties, from inhabitants to different stakeholders within the river area between the two municipalities, culminating in a revised and delimited proposal of possible evolutionary plans for the implementation of an inter-municipal development framework.

6. Some final observations

The possibilities proposed in this study link local adaptation strategies with local development strategies. This responds to the strategic adaptation platform and its specific theoretical foundations. The implementation possibilities of the case study are reinforced by the values of empowering local capacities and co-assessing the main causes and effects of an aligned two-pronged strategy.

The role of a more academic environment in facilitating systems assessments has been established to validate the need for a transdisciplinary research approach while offering different development alternatives. This has a crucial enabling role in the local adaptation process that aims at a long-term perspective and meets the definitions of the above-mentioned socio-environmental theories and approaches. The demands of flexible regulatory systems and the inclusive perspective of stakeholders, aligned with their shared development objectives, are fundamental for visualising co-defined assessments and opportunities.

Active strategies of co-definition, co-evaluation, and co-design for facing complex and highly uncertain problems appear as significant milestones for water management and local development. The challenges are open and the possible activation for change from different concrete and evaluated development possibilities is clearly a new opportunity for municipalities in delta conditions aiming at development but constrained by lack of resources.

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