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When building Resilience could increase Vulnerability: urban resilience trade-offs and the challenges for policy design

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Abstract

Global policy frameworks increasingly linked the concept of sustainability and resilience as if the latter could literally enable sustainability. However, emerging theoretical tensions (when addressing urban resilience through multidisciplinary perspectives) and evidences from the ground are both highlighting that the normative concept of “building resilience” could unfortunately imply a set of trade-offs (between resilience and social justice, environmental long term sustainability, increasing spatial disparities or inducing development patterns lock-ins). This presentation explores these emerging trade-offs through a set of case studies developed by the members of the Urban Resilience Research Network (URNet), an academic global virtual platform addressing urban resilience research challenges from multidisciplinary and integrated perspectives. The goal is to rise a critical debate around urban resilience not to be a normative positive concept for urban studies and practices, but a challenging concept to handle in formulating adequate policies. The need of a paradigm shift from “building resilience” to the more critical “managing resiliencies” is presented as a necessary step for urban studies and policy makers, in order to tackle complex urban processes and goals in a comprehensive way.

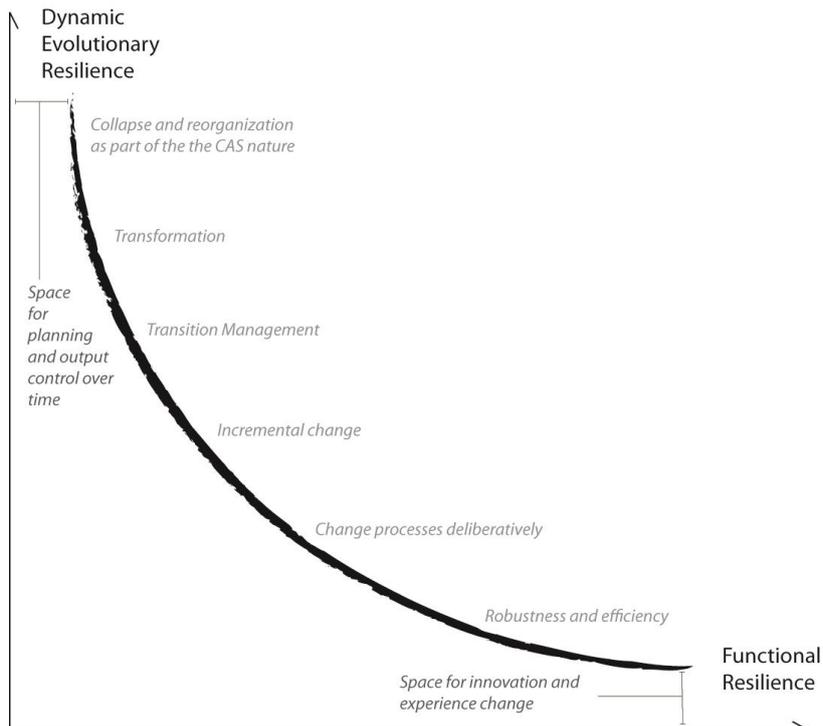
Introduction

When urban resilience was introduced, more than a decade ago, it referred to definitions and characteristics of “resilient cities”, tackling climate change and disasters (Newman, Beatley, & Boyer, 2009; Lawrence J Vale & Campanella, 2005). Policy discourses and reports have been increasingly introducing the concept of resilience when referring to the set of adaptive capacities which could enable the still un-met sustainability targets (GSP, 2012). Nowadays almost every global post-2015 framework dealing with urbanization challenges refers somehow to resilience (Peters, Langston, Tanner, & Bahadur, 2016) and its linkage with sustainability. However, if from one side resilience could be seen as a “mobilizing metaphor” (Béné et al., 2017), scholars have been highly critical in exploring the fuzziness of this concept. Christopherson et al mentioned that “the diversity of our understanding (about resilience and its applications) denies us the convenient notion that we are ever talking about the same thing” (Christopherson, Michie, & Tyler, 2010), since as agreed by others this “amorphous concept” is understood

and applied in different way by different disciplines (Patel, Rogers, Amlôt, & Rubin, 2017). Indeed, in a book introducing multidisciplinary perspective on urban resilience (Lorenzo Chelleri & Olazabal, 2012a) I explored with colleagues such a diversity of meanings and applications, and the two main insights resulting from this review have been that i) contrary to the policy reports and discourses, resilience is a normative positive characteristic (could decrease specific vulnerabilities while increasing others, and could be not always desirable) and that ii) it encompassed conflictive approaches within its application (mainly) in urban systems. Those findings open(ed) the ground to further investigation across a range of case studies from Morocco, to Europe, Mexico, Bolivia, Taiwan, Korea with the purpose of exploring both the theoretical tensions and practices trade-offs which resilience thinking was implying when framed around urban systems. In this paper, I explore those theoretical tensions (within resilience, and among resilience and other driving principles as sustainability and equitable development) in order to define and frame the trade-offs which urban resilience implies on the ground. In the light of those trade-offs, key questions are proposed in order to answer how can policy design contribute to the implementation of urban resilience in an integrated way? And what challenges and future questions need to be addressed?

1. Urban resilience and “change”: theoretical tensions

Among all the different definitions of resilience, authors agree that *resilience thinking* allows a systemic view of how to deal (in multiple ways) with change (external or internal) at different scales (C. Folke, 2006). However, when digging into responsive, recovery and adaptive mechanisms for coping with change, resilience thinking reveals different and potentially conflicting approaches distributed between two very ends of a continuum: engineering (or functional) resilience and evolutionary (or transformative, dynamic resilience). Engineering was conceived as the set of capacities to resist a threat or accelerate recovery (Hollnagel, Woods, & Leveson, 2006), contributing to a “bouncing back”, or “equilibrium-driven” paradigm (Holling, 1996). Jumping from resilience thinking to urban resilience, engineering resilience translates as the set of capacities useful to resist or quickly recover to shocks (hurricanes, infrastructures failures etc) and it is better recognized as functional resilience (Woods, 2015). The goal of functional resilience is therefore to control the system in an efficient way, change is deliberately controlled and planned (White & O’Hare, 2014), in order to maintain safe key functions and structures, with low margin for innovation (see fig 1). On the other side, the more we embrace uncertainty, and open to innovation and change, a more social-ecological perspective of resilience emerges (F. Berkes, Colding, & Folke, 2003), related to the capacities to accommodate stresses, but also to flip and collapse in order to transform the system adapting new regimes (Gunderson & Holling, 2002; B. Walker & Salt, 2012). Different scholars have conceptualized such a perspective calling it transformational resilience (Kates, Travis, & Wilbanks, 2012), evolutionary resilience (Davoudi, Brooks, & Mehmood, 2013; Simmie & Martin, 2010) or dynamic resilience (Tanner, Bahadur, & Moench, 2017). The latter scholars illustrated in clear way the relationship between dynamic and functional resilience, something very appropriate to urban studies, and which are the implications for policies. Indeed, because of the progressive loose of control over the system (regime) trajectory, functional resilience is more likely to be implemented through urban planning and governance, since not threatening power and institutionalist structures (Pelling, 2011a; Redman, 2014).



This figure is a simplification which illustrates a profound ongoing debate on the relationship between adaptive and transformative capacities, explored from social-ecological (Carl Folke et al., 2010), sustainability scientists (Pearson & Pearson, 2012), climate change adaptation and mitigation studies (Pelling, 2011b; Revi et al., 2014), planning and development studies (Davoudi et al., 2013; Satterthwaite & Dodman, 2013), natural disaster scholars (Asprone & Manfredi, 2015; Matyas & Pelling, 2015). In the next section, the paper will dig into those debates, but not before introducing the urban systems main issues to be addressed if linking cities and resilience thinking.

2 Urban resilience profiles and regime: emerging complexities and trade-offs

Policy reports, plans, some scholar assume that resilience thinking (Brian Walker & Salt, 2006) can help cities in better adapting present and future challenges. However, the few cited, above among dozens of, published papers in the last 5 to 10 years, illustrate the inappropriateness of the social ecological resilience thinking to be translated for urban planning and governance. However, this tension between resilience thinking and urban resilience is addressed through a critical mass of assumptions and evidences from case studies, which could result in been dispersive, since addressed from different disciplines and topics (planning, governance, urban poor and development, infrastructural studies, regional and economics among others). In this section the paper tries to provide the big picture explaining those tensions and inappropriateness.

While defining resilience, the very same Folke et al recognized that agency, “trust building and power relations have often been underestimated and social relationship simplified” (Folke, et al 2005): 462. Indeed, resilience thinking and related key research challenges adopt a techno or eco-centric approach which overlook the role of individuals, groups, power and politics in building resilience (Bahadur & Tanner, 2014; Cannon & Müller-Mahn, 2010; Gillard, 2016). This would justify why among the first reactions of

urban studies scholars to the call of building resilient cities there have been dozens of papers arguing what resilience thinking was adding to past and current planning practices, tools and methods (Albers & Deppisch, 2012; Davoudi et al., 2012; Wilkinson, 2012), among which critical perspectives emphasizing that resilience was a perfect de-politicized framework legitimizing neoliberal planning (MacKinnon & Derickson, 2013; Pizzo, 2015). These debates highlighted the discrepancy in term of objectives and processes among different resilience perspectives in cities. For instance, while engineers and risk management scholar shared an old tradition of tools and practices (linked to functional resilience approaches) to build more resilient critical infrastructures and safer built environment (Bosher, 2008), other scholars discussed the unaccounted qualitative, soft measure enhancing community resilience (Weichselgartner & Kelman, 2014). Critical geographers, social and development studies scientists brought to light interesting issues related to the concept of community resilience, posing the challenge of defining community, who is excluded and who is not, and which is the role of politics in leveraging through communities and groups processes of change or resistance (Mulligan, Steele, Rickards, & Fünfgeld, 2016). Social capital has been repeatedly mentioned as a determinant of disaster resilience (Aldrich, 2012), climate change adaptation processes (W. Neil Adger, Hughes, Folke, Carpenter, & Rockstrom, 2005) and sustainability transition through personal and community resilience (Penha-Lopes, Henfrey, & Maschkowski, 2017). However the nexus between social and physical infrastructure and how these constitute different, potentially synergistic or conflictive, facets of resilience, is still poorly understood because of the uncritical assumptions about how development is promoted and resilience built (Weichselgartner & Kelman, 2014). At the same time, there's a fragmented understanding and lack of exploration about how financial markets, cities to city networks and global commodities chains interact (Sassen, 2009) and influence urban development patterns and local resilience to market fluctuations and economic crises (Martin, 2012; Müller, 2011). This to say that in general terms there is a lack on in-depth understanding about the interactions among different facets of urban resilience (Lorenzo Chelleri, 2016).

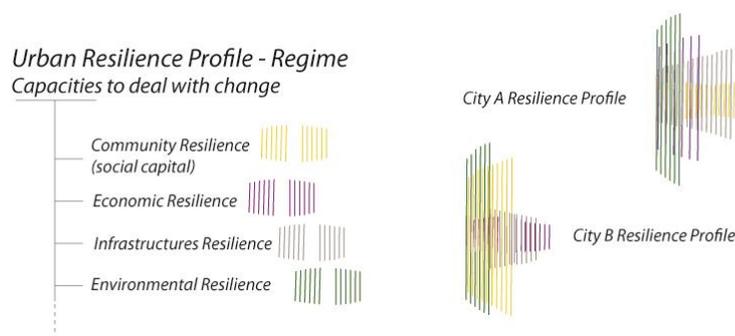
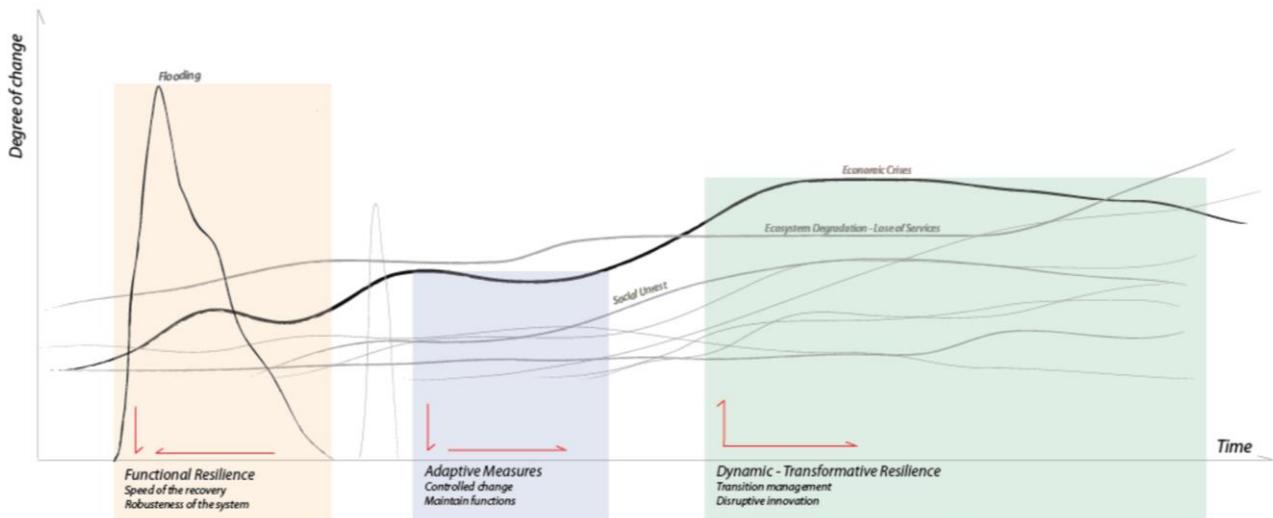


Figure 2 simplistically illustrates those facets. There is an increasing literature addressing and explaining ecosystems' related resilience in cities, mostly dealing with biodiversity, green infrastructures and ecosystem services (Barthel & Isendahl, 2012; McPhearson, Andersson, Elmqvist, & Frantzeskaki, 2014; Schewenius, McPhearson, & Elmqvist, 2014), social or community resilience (Fikret Berkes & Ross, 2012; Cutter et al., 2008; Magis, 2010), infrastructure and built environment resilience (Wang, Hong, & Chen, 2012), as well as a range of studies classifying urban functions and respective attributes conferring resilience for each function (Da Silva & Morera, 2014; Meerow, Newell, & Stults, 2016; Toubin, Laganier, Diab, & Serre, 2014; Tyler & Moench, 2012). In figure 2 few of the many components of urban resilience have been illustrate just for the purpose of arguing that there is a still very poor understanding of the influences and relationships among those coexisting resilience(s) in cities, which brought together should describe and represent the "city resilience regime" (been the regime the amount of change that city functions could safety operate with before collapsing), or "city resilience profile".

Not only ARUP, commissioned by the Rockefeller 100 Resilient Cities Program, but other international, sectoral and multilateral agencies have been recently trying to conceptualize city resilience profiles (to cite but a few, the UN Habitat City Resilience Profiling Program CRPP; the “Resilience Scorecard” from UNISDR, IBM and AECOM; the Grosvenor City Resilience Index; the City Resilience Program by the Global Facility for Disaster Reduction and Recovery (GFDRR) among others). In these, as in others more than 35 tools assessing and measuring city resilience, the resilience profile is a sum-up game (Sharifi, 2016), in which the different resilience characteristics are small or bigger parts of the puzzle which need to be enhanced up the 100% of city resiliency. This is the very gap, still, between theory and practices, between research and policies: different facets of resilience cannot be add up together synergistically without counting actual and potential trade-offs (Bahadur & Tanner, 2014; Lorenzo Chelleri, Waters, Olazabal, & Minucci, 2015).

This gap is in part relaying on the blind and mainstream behave promoted by policy reports and discourses, that resilience is a positive characteristic of systems, without assuming that resilience at one scale could decrease resilience at another (W. Neil Adger et al., 2005; Carpenter, Walker, Anderies, & Abel, 2001). Scholars have indeed been arguing that resilience is not a positive concept per se (Lorenzo Chelleri & Olazabal, 2012b; T. Elmqvist, 2014) but rather a neutral “neutral characteristic which, in itself, is neither good nor bad’ (Béné, Wood, Newsham, & Davies, 2012):13. There is a need of “reflect on what precisely it is that is being made resilient, in the face of which specific dynamics, for whom and by what criteria this is good or bad, and whether such resilience is consequently problematic or not” (Smith & Stirling, 2010):10. Recently, many papers from urban studies addressed the politics of urban resilience, by exploring the potential “side-effects” of city resilience strategies questioning which resilience, for whom, by whom and why has been built (Meerow & Newell, 2016; Pizzo, 2015; Lawrence J. Vale, 2013).

These critical perspectives open the floor to the need of further research for better understanding which kind of trade-offs could be implied by resilience in cities. At the same time, emerging trade-offs highlight how the urban resilience profiles could not be made that easily, requiring further research to understand, for instance, the difference between city case A and B, illustrated in Fig 2 (having a different mix of resilience facets but similar regimes in term of operational space). Also, a critical question would be how those different city resilience profiles relate to different urban challenges (short-long term stressor, internal or external abrupt change etc). Figure 3 proposes a schematic representation of how shocks and stresses look like along a time axis, and how the diverse resilience approaches introduced in the first section of the paper (functional/engineering resilience, adaptive measures and dynamic/transformational resilience) relate respect to time and degree of change.



As already introduced: functional resilience (dealing mainly with disruption and disasters) is quickly bounce back of the amount of change happened; adaptive measures try to keep the systems' properties and functions alive for the longer time possible avoiding transformations, while transformative resilience approach is embracing change looking for long time horizons. The critical question to be addressed here, is how policy makers (resilience frameworks and scholars) should manage in cities the capacities to react bouncing back, adapting or transforming when all these 3 approaches are happening simultaneously (at different scales) within the city.

3 Framing urban resilience trade-offs (a tentative approach to)

The emerging literature discussing the political dimensions of urban resilience (Lawrence J. Vale, 2013) and the existence of practical trade-offs when resilience is implemented (Bahadur & Tanner, 2014; Lorenzo Chelleri et al., 2015) calls for a clarifying framework for assessing those theoretical tensions and resilience trade-offs. In this section two overall categories of trade-offs are discussed: i) trade-offs within urban resilience and ii) trade-offs between resilience and other fundamental principles driving urban systems.

3.1 Trade-offs within urban resilience

In the first part of the paper the difference between functional and dynamic resilience has been presented, and in figure 3 it has been clarified how bouncing back, adaptive and transformative approaches relate to time scales and system change acceptance. Within urban resilience perspectives, the first trade-offs identified is a trade-offs happening when one of those 3 approaches is preferred to the others. Indeed, when functional resilience is expressed through policies in order to maintain the status quo (regime) of a city, this enhance the resistance to change of power relationships, enhance the robustness of infrastructures configuration and lock-in the development patter of the system to a determined trajectory (Reghezza-Zitt, Rufat, Djament-Tran, Le Blanc, & Lhomme, 2012; Weichselgartner & Kelman, 2014). This is relevant both for cases in which development trajectories are linked to determined technologies (dependency on fossil fuels, for instance) but also in justifying poverty traps (Waters & Adger, 2017). A classic example of this trade-offs is the levee paradox in The Netherlands. Flooding protection was implemented through building dikes, and this conservative approach, while protecting the land from waters in the short term, was exposing in the long term cities to higher risks. Only recently a paradigm shift in the approach to flooding resilience embraced and allowed the water to enter the cities, reducing the risks to be

flooded since planned to accommodate (and partially float) on water (Zevenbergen, Rijke, van Herk, Chelleri, & Bloemen, 2016). The Netherland flooding resilience transition correspond to what has been conceptualized as the paradigm shift from been fail-safe to safe-to-fail (Ahern, 2011). However, planning for a paradigm shift in the resilience approach chosen is however a very difficult political task. Transformational resilience implies disruptive path of development, which could be deliberate or forced (Tanner et al., 2017) but anyway consists with a fundamental shift in values, beliefs, functions and structures. Another example showing this trade-offs among dominant resilience approaches is the case of the Italian city of L'Aquila post-earthquake recovery. The city suffered in 2009 a dramatic disaster which destroyed almost completely the city centre. Having received a strong financial support from the government for re-building the whole city, the most of the money have been invested in the built-environment, and almost 10 years after the earthquake the city physically looks like it was, but due to the lack of investments in the city economy and social infrastructure the city faces now the pre-event economic and demographic shrinkage, accentuated from the disaster (Di Giovanni & Chelleri, 2017). Again, the trade-offs is clear when investments through conservative approaches (while building disaster resilience) limit the opportunity of building transformative resilience through new regulations, policies and economies.

While in these last examples trade-offs between conservative or transformative approaches emerged through the temporal scale, a second typology of trade-off within urban resilience is related to the spatial scale. As demonstrated through the literature and already introduced in the previous sections, resilience at one scale could led the resilience at other scales (W. N. Adger, Arnell, & Tompkins, 2005; Carpenter et al., 2001). The recently developed concept of land-uses teleconnection (Seto et al., 2012) introduces and demonstrates how land use changes in one part of the world could be linked and induced from distant places in cities (Sassen, 2009). These phenomenon, a part of justifying the planetary environmental impacts of cities (Newman, 2006), enable the understanding of spatial resilience trade-off. An in-depth case study exploring spatial resilience trade-off is the Quinoa crop boom. Indeed, while completely transforming the rural subsistence farming along the villages of the Bolivian Altipiano in global producers and exporter of this recently discovered super healthy semi-cereal, a set of nested trade-offs among sub-systems and near territories have been mapped in a recent publication (Lorenzo Chelleri, Minucci, & Skrimizea, 2016): Within Bolivian Altipiano transition to Quinoa mono-cropping, the economic resilience of the farmers decreased because of mono-cropping, as well as their social capital and ecosystem quality. On the other side, technological innovation and international networking contributed to a transition to a more sustainable cropping and infrastructures building and managing, fostering the access, and connections among villages and the relationship between cities and villages (Ibid 2016). Because extremely complex, it is of utmost importance to better understand and assess the spatial resilience trade-off, since any strategy in one place/system could have both direct and indirect, expected and unexpected, reversible or irreversible consequence in decreasing or fostering different vulnerabilities (Lauer et al., 2013).

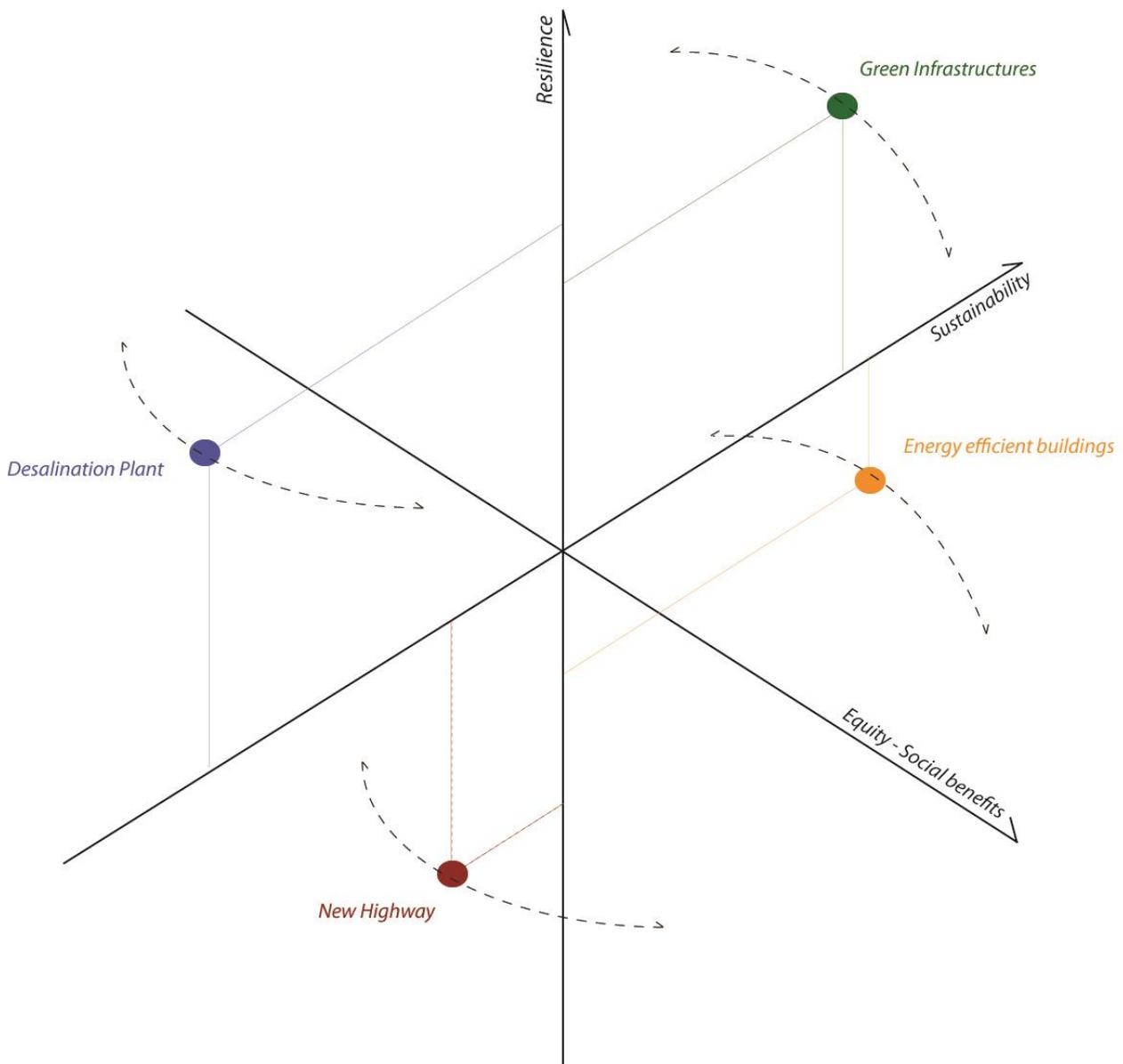
Finally, a last trade-off within urban resilience is represented by a trade-offs among the very resilience principles themselves. Indeed, while it is widely recognized that efficiency operates at the expenses of redundancy, or flexibility to robustness (Ulanowicz, Goerner, Lietaer, & Gomez, 2009) it has been recently argues how the same principles could actually have different meanings and implications when applied from different domains (Lorenzo Chelleri, 2016). Redundancy is a clear example for this trade-off. When applied to infrastructure planning or management redundancy could either implies investments within the existing redundancy of the energy network (owned by the utility company) or in diversifying the energy network through different companies or cooperatives. In both cases the energy provision resilience will be enhanced through a redundancy-building investment. However, there is a critical trade-off when it comes to evaluate who is benefitting from such a redundancy enhance.

3.2 Trade-offs between urban resilience and complementary driving principles

Different examples from the previous section relate to trade-offs which are beyond resilience, since implying consequences in term of systems sustainability. The relationship between resilience and sustainability has been not questioned from the policy reports and normative assumptions that by becoming more resilient, system will adapt change, and therefore persist longer (GSP, 2012). However, in the light of the trade-offs happening when a functional resilience perspective is preferred to a transformative one, the patterns of un-sustainability are maintained within the system (Smith & Stirling, 2010; Weichselgartner & Kelman, 2014). Far from the normative social-ecological understanding on linking resilience to sustainability (Carl Folke et al., 2002), only recently the theoretical and methodological differences between resilience and sustainability has been explored explicitly (Derissen, Quaas, & Baumgartner, 2011; Redman, 2014) and a call for not confusing urban resilience with urban sustainability has just been published (Thomas Elmqvist, 2017).

Notwithstanding disciplinary conceptualization, traditions and alignments between the two concepts proposed from most of the post-2015 global frameworks and agendas (see the UN SDGs and The New Urban Agenda among others), evidences from a range of study cases illustrate that building resilience in practice could be far from addressing sustainability and *viceversa*. Desalination plants responding to droughts and water scarcity are definitely not a sustainable solution because of the salt production and still high consumption of energy required in the process. At the same time, projects enhancing sustainability per se could result in decreasing resilience, as it is the case for the MENA region long term cross-countries program DESERTEC, which through the building of a network of centralized solar power plants along Norther Africa wishes to bring up to 30% of European required Energy in 2050 (Dessouky, 2013). A recent paper demonstrated how the sustainability of this project implies a set of trade-offs in term of decreasing social capital, environmental biodiversity, water scarcity in the nearby oases where the project started (Lorenzo Chelleri, Minucci, Ruiz, & Karmaoui, 2014). On the contrary, a set of best practices synergistically enhancing both resilience and sustainability exists, as it the case of ecosystem services and green infrastructures (Barthel & Isendahl, 2012; Gómez-Baggethun & Barton, 2013; McPhearson et al., 2014), and deserve further research.

Figure 4 introduces this relationship, explaining the potentially embedded trade-offs, between resilience and sustainability, and adding a third variable to the perspective: equity, which recently has been introduced from many papers when addressing social justice and resilience (Fainstein, 2015). Recent papers have indeed explored and demonstrated how climate adaptation plans could enable social injustice (Anguelovski et al., 2016). This trade-off about resilience building implying social capacities and rights losses has emerged from disaster literature, referring to the inequality of some post-disaster reconstruction process (Colten, Kates, & Laska, 2010) but expanded in the scientific literature widely, calling for an integration of social justice perspective in resilience (Ziervogel et al., 2017).



As reported in the figure 4, when a resilience strategy is framed, it is not sufficient that it both fosters sustainability and resilience (lets imagine a flooding resilience plan operationalized through an nature based solution approach, enhancing greening, ecosystem services and resilience). Indeed, as reported in a recent paper addressing flooding resilience in Mexico City, notwithstanding a decentralized approach to building flooding resilience was calculated and demonstrated to be technically feasible, governance choices not allowed such an option (of distributing the management of the water infrastructure) but preferred a centralized approach, which resulted to be a less equitable development approach (L. Chelleri, Schuetze, & Salvati, 2015).

The issue of linking sustainability, resilience and social justice is indeed a call for politicizing resilience (Lawrence J. Vale, 2013) in the light of its neutral characteristic (Béné et al., 2012) and potential multiple trade-offs (Lorenzo Chelleri et al., 2015; Lauer et al., 2013). As Tanner et al reported while citing(O'Brien & Wolf, 2010) “resilience is contingent on social values about what we deem important and how we ought to allocate resources to foster it” (Tanner et al., 2017):16.

Conclusion

This paper explored the concept of urban resilience and the potential trade-offs resulting from the operationalization of its diverging approaches, relationship with scales and other driving principles for cities. In challenging the appropriateness of resilience thinking for urban systems, this paper explained why the linear nexus linking vulnerability and resilience needs to be broken, calling for a broader and more complex understanding of this relationship. Indeed, resilience results to be not a positive normative concept reducing vulnerability anymore, but a neutral concept which could, or could not, be desirable depending of many factors.

In order to inform policy design about how to conceive and implement resilience in a consistent way respect to the current global urban challenges, the paper proposes a maybe preliminary but systemic framing of the potential trade-offs resulting from urban resilience implementation. These could be related to resilience potentially conflictive resilience approaches (robustness, adaptation and transformation) leveraged by functional or transformative paradigms of resilience building. Those trade-offs could have implications on systems sustainability and social justice, highlighting that there is not a normative way of building resilience cities, rather different component of urban resilience need to be un-packed and understood. Community resilience (the existence and role of social capital and social infrastructures) and its relationship with economic city resilience features, or infrastructure resilience ones, need to be better understood, since context dependent. Also, these resilience facets play across physical and virtual networks (institutions, social networks, financial markets) and it is still not clear which are the mechanisms linking virtual and physical resilience building features.

Although the complexity of the issue seems to constitute a barrier to the implementation of resilience into practices, the paper results better suggest to design policies which are able to address specific resilience in integrated ways (carefully assessing potential trade-offs in order to overcome them on time), rather than trying to address the so called “generic” resilience. This indeed reveals to be a still fuzzy, unclear concept, in which different resiliencies coexist through synergies and trade-offs which we are not able to understand. On the contrary, and beyond theoretical assumptions, by offering a typology of resilience trade-offs, this paper calls for an accurate and wise framing of specific resilience strategies, able to align resilience with sustainability and social justice in urban management and planning practices.

References

- Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change-Human and Policy Dimensions*, 15(2), 77-86. doi:10.1016/j.gloenvcha.2004.12.005
- Adger, W. N., Hughes, T. P., Folke, C., Carpenter, S. R., & Rockstrom, J. (2005). Social-Ecological Resilience to Coastal Disasters. *Science*, 309(5737), 1036-1039.
- Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning*, 100(4), 341-343. doi:10.1016/j.landurbplan.2011.02.021
- Albers, M., & Deppisch, S. (2012). Resilience in the Light of Climate Change: Useful Approach or Empty Phrase for Spatial Planning? *European Planning Studies*, In press, 1-13. doi:10.1080/09654313.2012.722961
- Aldrich, D. P. (2012). *Building resilience: Social capital in post-disaster recovery*: University of Chicago Press.
- Anguelovski, I., Shi, L., Chu, E., Gallagher, D., Goh, K., Lamb, Z., . . . Teicher, H. (2016). Equity Impacts of Urban Land Use Planning for Climate Adaptation Critical Perspectives from the Global North and South. *Journal of Planning Education and Research*, 0739456X16645166.
- Asprone, D., & Manfredi, G. (2015). Linking disaster resilience and urban sustainability: a glocal approach for future cities. *Disasters*, 39(s1), s96-s111.

- Bahadur, A., & Tanner, T. (2014). Transformational resilience thinking: putting people, power and politics at the heart of urban climate resilience. *Environment and Urbanization*, 26(1), 200-214.
- Barthel, S., & Isendahl, C. (2012). Urban gardens, agriculture, and water management: Sources of resilience for long-term food security in cities. *Ecological Economics*, *In press*(0). doi:10.1016/j.ecolecon.2012.06.018
- Béné, C., Mehta, L., McGranahan, G., Cannon, T., Gupte, J., & Tanner, T. (2017). Resilience as a policy narrative: potentials and limits in the context of urban planning. *Climate and Development*, 1-18.
- Béné, C., Wood, R. G., Newsham, A., & Davies, M. (2012). Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. *IDS Working Papers*, 2012(405), 1-61.
- Berkes, F., Colding, J., & Folke, C. (2003). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change* (Vol. null).
- Berkes, F., & Ross, H. (2012). Community Resilience: Toward an Integrated Approach. *Society & Natural Resources*, 26(1), 5-20. doi:10.1080/08941920.2012.736605
- Bosher, L. (2008). *Hazards and the Built Environment: Attaining Built-In Resilience*: Taylor & Francis.
- Cannon, T., & Müller-Mahn, D. (2010). Vulnerability, resilience and development discourses in context of climate change. *Natural hazards*, 55(3), 621-635.
- Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: resilience of what to what? *Ecosystems*, 4(8), 765-781.
- Chelleri, L. (2016). *The urban resilience fallacy: Gaps between theory and practice*.
- Chelleri, L., Minucci, G., Ruiz, A., & Karmaoui, A. (2014). Responses to Drought and Desertification in the Moroccan Drâa Valley Region: Resilience at the Expense of Sustainability? *International Journal of Climate Change: Impacts & Responses*, 5(2).
- Chelleri, L., Minucci, G., & Skrimizea, E. (2016). Does community resilience decrease social-ecological vulnerability? Adaptation pathways trade-off in the Bolivian Altiplano. *Regional Environmental Change*, 16(8), 2229-2241. doi:10.1007/s10113-016-1046-8
- Chelleri, L., & Olazabal, M. (2012a). *Multidisciplinary perspectives on Urban Resilience*. Bilbao: Basque centre for Climate Change (BC3).
- Chelleri, L., & Olazabal, M. (2012b). *Multidisciplinary perspectives on urban resilience* (Vol. null).
- Chelleri, L., Schuetze, T., & Salvati, L. (2015). Integrating resilience with urban sustainability in neglected neighborhoods: Challenges and opportunities of transitioning to decentralized water management in Mexico City. *Habitat International*, 48(0), 122-130. doi:<http://dx.doi.org/10.1016/j.habitatint.2015.03.016>
- Chelleri, L., Waters, J. J., Olazabal, M., & Minucci, G. (2015). Resilience trade-offs: addressing multiple scales and temporal aspects of urban resilience. *Environment and Urbanization*, 27(1), 181-198. doi:10.1177/0956247814550780
- Christopherson, S., Michie, J., & Tyler, P. (2010). *Regional resilience: theoretical and empirical perspectives*: Oxford University Press.
- Colten, C., Kates, R., & Laska, S. (2010). *Community Resilience: Lessons from New Orleans and Hurricane Katrina* (Vol. null).
- Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4), 598-606. doi:<http://dx.doi.org/10.1016/j.gloenvcha.2008.07.013>
- Da Silva, J., & Morera, B. (2014). City resilience framework. *Arup & Rockefeller Foundation*. Online: http://publications.arup.com/Publications/C/City_Resilience_Framework.aspx [12/15/2015].
- Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary Resilience and Strategies for Climate Adaptation. *Planning Practice & Research*, 28(3), 307-322. doi:10.1080/02697459.2013.787695
- Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., . . . Porter, L. (2012). Resilience: A Bridging Concept or a Dead End? "Reframing" Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does it Mean in Planning Practice? Resilience as a Useful Concept for Climate Change Adaptation? The Politics of Resilience for Planning: A Cautionary Note. *Planning Theory & Practice*, 13(2), 299-333.
- Derissen, S., Quaas, M. F., & Baumgartner, S. (2011). The relationship between resilience and sustainability of ecological-economic systems. *Ecological Economics*, 70(6), 1121-1128. doi:10.1016/j.ecolecon.2011.01.003
- Dessouky, M. O. (2013). *The environmental impact of large scale solar energy projects on the MENA deserts: Best practices for the DESERTEC initiative*. Paper presented at the EUROCON, 2013 IEEE.
- Di Giovanni, G., & Chelleri, L. (2017). Sustainable Disaster Resilience? Tensions Between Socio-economic Recovery and Built Environment Post-disaster Reconstruction in Abruzzo (Italy) *Urban Regions Now & Tomorrow* (pp. 121-144): Springer.
- Elmqvist, T. (2014). Urban Resilience Thinking. *Solutions*.
- Elmqvist, T. (2017). Development: Sustainability and resilience differ. *Nature*, 546(7658), 352-352. doi:10.1038/546352d
<http://www.nature.com/nature/journal/v546/n7658/abs/546352d.html#supplementary-information>
- Fainstein, S. (2015). Resilience and justice. *International Journal of Urban and Regional Research*, 39(1), 157-167.
- Folke, C. (2006). Resilience: The emergence of a perspective for social, ecological systems analyses. *Global Environmental Change*, 16(3), 253-267.
- Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. *AMBIO: A Journal of the Human Environment*, 31(5), 437-440.
- Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: integrating resilience, adaptability and transformability. *Ecology and Society*, 15(4), 20.
- Gillard, R. (2016). Questioning the diffusion of resilience discourses in pursuit of transformational change. *Global environmental politics*.

- Gómez-Baggethun, E., & Barton, D. N. (2013). Classifying and valuing ecosystem services for urban planning. *Ecological Economics*, 86(0), 235-245. doi:<http://dx.doi.org/10.1016/j.ecolecon.2012.08.019>
- GSP, U. (2012). Resilient people, resilient planet: A future worth choosing: New York: United Nations.
- Gunderson, L., & Holling, C. S. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems* (Vol. null).
- Holling, C. (1996). Engineering resilience versus ecological resilience. *Foundations of Ecological Resilience*, 51-66.
- Hollnagel, E., Woods, D. D., & Leveson, N. (2006). *Resilience engineering: Concepts and precepts* (Vol. null).
- Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences*, 109(19), 7156-7161. doi:10.1073/pnas.1115521109
- Lauer, M., Albert, S., Aswani, S., Halpern, B. S., Campanella, L., & La Rose, D. (2013). Globalization, Pacific Islands, and the paradox of resilience. *Global Environmental Change*, 23(1), 40-50. doi:<http://dx.doi.org/10.1016/j.gloenvcha.2012.10.011>
- MacKinnon, D., & Derickson, K. D. (2013). From resilience to resourcefulness: A critique of resilience policy and activism. *Progress in Human Geography*, 37(2), 253-270. doi:10.1177/0309132512454775
- Magis, K. (2010). Community Resilience: An Indicator of Social Sustainability. *Society & Natural Resources*, 23(5), 401-416. doi:10.1080/08941920903305674
- Martin, R. (2012). Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography*, 12(1), 1-32. doi:10.1093/jeg/lbr019
- Matyas, D., & Pelling, M. (2015). Positioning resilience for 2015: the role of resistance, incremental adjustment and transformation in disaster risk management policy. *Disasters*, 39(s1), s1-s18. doi:10.1111/disa.12107
- McPhearson, T., Andersson, E., Elmqvist, T., & Frantzeskaki, N. (2014). Resilience of and through urban ecosystem services. *Ecosystem Services*.
- Meerow, S., & Newell, J. P. (2016). Urban resilience for whom, what, when, where, and why? *Urban Geography*, 1-21. doi:10.1080/02723638.2016.1206395
- Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. *Landscape and Urban Planning*, 147, 38-49. doi:<http://dx.doi.org/10.1016/j.landurbplan.2015.11.011>
- Müller, B. (2011). *Urban Regional Resilience: How Do Cities and Regions Deal with Change?* (1st Edition ed. Vol. XIII): Springer.
- Mulligan, M., Steele, W., Rickards, L., & Fünfgeld, H. (2016). Keywords in planning: what do we mean by 'community resilience'? *International Planning Studies*, 1-14. doi:10.1080/13563475.2016.1155974
- Newman, P. (2006). The environmental impact of cities. *Environment and Urbanization*, 18(2), 275-295.
- Newman, P., Beatley, T., & Boyer, H. (2009). *Resilient cities: responding to peak oil and climate change*: Island Press.
- O'Brien, K. L., & Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 1(2), 232-242.
- Patel, S. S., Rogers, M. B., Amlôt, R., & Rubin, G. J. (2017). What Do We Mean by 'Community Resilience'? A Systematic Literature Review of How It Is Defined in the Literature. *PLOS Currents Disasters*.
- Pearson, L. J., & Pearson, C. J. (2012). Societal collapse or transformation, and resilience. *Proceedings of the National Academy of Sciences*, 109(30), E2030-E2031. doi:10.1073/pnas.1207552109
- Pelling, M. (2011a). *Adaptation to Climate Change: From Resilience to Transformation* (Vol. null).
- Pelling, M. (2011b). *Adaptation to climate change: from resilience to transformation*: Taylor & Francis US.
- Penha-Lopes, G., Henfrey, T., & Maschkowski, G. (2017). *Resilience, Community Action & Societal Transformation: People, Place, Practice, Power, Politics & Possibility in Transition*.
- Peters, K., Langston, L., Tanner, T., & Bahadur, A. (2016). 'Resilience' across the post-2015 frameworks: towards coherence? Retrieved from
- Pizzo, B. (2015). Problematizing resilience: Implications for planning theory and practice. *Cities*, 43(0), 133-140. doi:<http://dx.doi.org/10.1016/j.cities.2014.11.015>
- Redman, C. L. (2014). Should sustainability and resilience be combined or remain distinct pursuits? *Ecology and Society*, 19(2). doi:10.5751/ES-06390-190237
- Reghezza-Zitt, M., Rufat, S., Djament-Tran, G., Le Blanc, A., & Lhomme, S. (2012). What resilience is not: uses and abuses. *Cybergeo: European Journal of Geography*.
- Revi, A., Satterthwaite, D., Aragón-Durand, F., Corfee-Morlot, J., Kiunsi, R. B. R., Pelling, M., . . . Sverdlík, A. (2014). Towards transformative adaptation in cities: the IPCC's Fifth Assessment. *Environment and Urbanization*, 26(1), 11-28. doi:10.1177/0956247814523539
- Sassen, S. (2009). Global inter-city networks and commodity chains: any intersections? *Global Networks*, 10(1), 150-163.
- Satterthwaite, D., & Dodman, D. (2013). Towards resilience and transformation for cities within a finite planet. *Environment and Urbanization*, 25(2), 291-298. doi:10.1177/0956247813501421
- Schewenius, M., McPhearson, T., & Elmqvist, T. (2014). Opportunities for Increasing Resilience and Sustainability of Urban Social-Ecological Systems: Insights from the URBES and the Cities and Biodiversity Outlook Projects. *Ambio*, 43(4), 434-444. doi:10.1007/s13280-014-0505-z
- Seto, K. C., Reenberg, A., Boone, C. G., Fragkias, M., Haase, D., Langanke, T., . . . Simon, D. (2012). Urban land teleconnections and sustainability. *Proceedings of the National Academy of Sciences*, 109(20), 7687-7692.
- Sharifi, A. (2016). A critical review of selected tools for assessing community resilience. *Ecological Indicators*, 69, 629-647.
- Simmie, J., & Martin, R. (2010). The economic resilience of regions: towards an evolutionary approach. *Cambridge Journal of Regions, Economy and Society*, 3(1), 27-43. doi:10.1093/cjres/rsp029
- Smith, A., & Stirling, A. (2010). The politics of social-ecological resilience and sustainable socio-technical transitions. *Ecology and Society*, 15(1), 11.
- Tanner, T., Bahadur, A., & Moench, M. (2017). Challenges for resilience policy and practice.

- Toubin, M., Laganier, R., Diab, Y., & Serre, D. (2014). Improving the conditions for urban resilience through collaborative learning of Parisian urban services. *Journal of Urban Planning and Development*, 141(4), 05014021.
- Tyler, S., & Moench, M. (2012). A framework for urban climate resilience. *Climate and Development*, 4(4), 311-326.
doi:10.1080/17565529.2012.745389
- Ulanowicz, R. E., Goerner, S. J., Lietaer, B., & Gomez, R. (2009). Quantifying sustainability: Resilience, efficiency and the return of information theory. *Ecological complexity*, 6(1), 27-36.
- Vale, L. J. (2013). The politics of resilient cities: whose resilience and whose city? *Building Research & Information*, 42(2), 191-201.
doi:10.1080/09613218.2014.850602
- Vale, L. J., & Campanella, T. J. (2005). *The resilient city: How modern cities recover from disaster*: Oxford University Press.
- Walker, B., & Salt, D. (2006). *Resilience thinking: sustaining ecosystems and people in a changing world*: Island Press.
- Walker, B., & Salt, D. (2012). *Resilience Thinking: Sustaining Ecosystems and People in a Changing World* (Vol. null).
- Wang, S., Hong, L., & Chen, X. (2012). Vulnerability analysis of interdependent infrastructure systems: A methodological framework. *Physica A: Statistical Mechanics and its Applications*, 391(11), 3323-3335.
doi:<http://dx.doi.org/10.1016/j.physa.2011.12.043>
- Waters, J., & Adger, W. N. (2017). Spatial, network and temporal dimensions of the determinants of adaptive capacity in poor urban areas. *Global Environmental Change*, 46(Supplement C), 42-49.
doi:<https://doi.org/10.1016/j.gloenvcha.2017.06.011>
- Weichselgartner, J., & Kelman, I. (2014). Geographies of resilience Challenges and opportunities of a descriptive concept. *Progress in Human Geography*, 0309132513518834.
- White, I., & O'Hare, P. (2014). From rhetoric to reality: which resilience, why resilience, and whose resilience in spatial planning? *Environment and Planning C: Government and Policy*, 32(5), 934-950.
- Wilkinson, C. (2012). Social-ecological resilience: Insights and issues for planning theory. *Planning Theory*, 11(2), 148-169.
- Woods, D. D. (2015). Four concepts for resilience and the implications for the future of resilience engineering. *Reliability Engineering & System Safety*, 141, 5-9.
- Zevenbergen, C., Rijke, J., van Herk, S., Chelleri, L., & Bloemen, P. (2016). Towards an adaptive, flood risk management strategy in The Netherlands: An overview of recent history. *International Journal of Water*, 3, 140.
- Ziervogel, G., Pelling, M., Cartwright, A., Chu, E., Deshpande, T., Harris, L., . . . Michael, K. (2017). Inserting rights and justice into urban resilience: a focus on everyday risk. *Environment and Urbanization*, 29(1), 123-138.