Resilience in Political Networks

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Abstract

Resilience can be broadly defined as the capacity of a system to recover quickly after a shock. Given that shocks such as natural disasters or political regime change can fundamentally affect political systems, the concept of resilience can be important in this context. We conceptualize political systems as political networks consisting of several interconnected political actors tackling issues on the political agenda. We investigate here political networks' ability to recover from shocks. To do so, we first identify different types of shocks that have the ability to impact political networks. Second, we review the literature on resilience and discuss concepts related to political resilience. Third, we outline network measures and models able to capture the reaction of a political network to a shock, so that we can operationalize the level of resilience of such a system. Throughout the text, we illustrate our theoretical concepts with selected case studies and empirical examples. We conclude that the accurate measurement of political networks is contingent on the valid capture of change following a shock. We must recall that a resilient political network does not have to exhibit the same structure ex post, but would have to be able to perform the same functions to be considered resilient. We conclude by outlining pathways to future research.

Introduction

Resilience of social systems is often defined in line with the definition of ecological resilience: The ability of an (eco-)system to adapt in the face of disturbance (Adger 2000; Berkes et al. 2000). Political systems are specific types of social systems, including different types of actors, such as formal decision-makers, citizens, or specific organized interests. These actors all have different levels of political power, resources, status and interests. Their options for political participation and opportunities for influence vary while they contest and collaborate via their political networks. Political systems are framed by rules and institutions that guide the behavior of actors (such as federalism, or access to vote), and they produce different types of outputs, such as policies, laws and regulations. A discussion of the resilience of political systems can thus focus on different elements of those systems (Humbert and Joseph 2019) such as the (same or different) configuration of actors, or the maintenance of a network structure (and thus stabilize interactions) among those actors. Generally, however, a resilient political system is in a first place not (only) able to maintain its structure, but rather to still keep its function and ability to produce its outputs (e.g. collective decisions and policies) and outcomes (larger societal or environmental impact).

In this chapter, we conceive of a political system as a network, that is, a network of actors that are tied to each other, in the process of conflict or collaboration. Political networks are specific

types of networks with nodes being political actors, and ties representing the different politically relevant interactions (Victor et al., 2017; Lubell et al. 2012). Similar to many studies in management, geography, or climate adaptation (Bresch et al. 2014; Le Blanc and Nicolas 2013; Ingold 2017), resilience for political systems is associated to the potential for innovation, while structural recovery is associated to the degree to which actors and ties "recover" from a shock. At a fundamental level this is about whether the political system is capable of maintaining continuity of outputs, while retaining the legitimacy associated with accountability and good governance. A resilient political network is capable to produce new policy outputs in order to realize societal transformation such as those posed by challenges of climate change, energy transition, or biodiversity loss. This would likely require "output innovation" where new policy products are introduced. But one could also imagine a "process" or "network innovation" where actors and ties are not reproduced in identical governance structures. For example during the Covid 19 pandemic, many scientific actors entered the political decision-making network and became co-producers of policies and regulations.

Political network studies most often rely on survey data and interviews, and thus on the perception of ties rather than observational evidence (see Weible and Sabatier 2005; Henry 2011; Leifeld and Schneider 2012). Shocks or disturbances in political systems are conceived to originate externally or to be part of pweriodic change of the wider political system. We can conceive of predominantly external shocks, to be natural disasters, migration waves, or other socio-economic or ecological events beyond the governance power of a political network under study (Birkland 1997; 1998; Baumgartner and Jones 2013; Alexandrova 2015).

In this chapter, we discuss how political networks react to shocks. We do so by breifly reviewing the literature on political networks, before highlighting the consequences of different dimensions of political network resilience (e.g. robustness, transformation, or integration). We then introduce prominent network concepts and theories and illustrate their ability to grasp the "resilience concept" of political networks, before we propose different research designs that progress this research agenda forward.

Politics and political networks

Although political networks can have many different meanings depending on the specific context, they can often be considered to be at the heart of politics (see Victor et al. 2017). Political networks, in this chapter, are defined to consist of a set of political actors such as individuals or organizational actors (Huxham et al. 2000) connected to each other for governance of a specific issue sector or in the process of policy making (Fischer 2017). Organizational actors can be interest groups, political parties, administrative units, research centers, or other entities involved in collective political decision-making processes. Individuals can be representatives of these organizations, or individually important political actors. These

nodes are then related to each other by different types of politically relevant network ties, such as those of cooperation, coordination, information exchange, venue co-participation, conflict, or formal cooperation based on contracts (Ulibarri and Scott 2017; Victor et al. 2017). For example, different types of political actors cooperate in order to form coalitions with like-minded actors, and finally influence policy outputs (e.g., Henry 2011). Within policy processes, actors also co-participate in specific venues and forums, which again creates networks and allows them to negotiate and coordinate (Lubell, 2013; Fischer and Leifeld, 2015). Finally, governance and policy process situations, and political systems more generally, are full of conflictive relations between actors that do not agree on worldviews or preferred policy outputs. Conflict can thus also be regarded as an important network contact, as it describes a quality of a relation between actors that is – among others – dependent on the broader network and context.

Examples of such networks are the regional planning network in California (Henry 2011); the Irish climate policy network (Wagner and Ylä-Anttila, 2018), or the network regulating unconventional oil and gas extraction (e.g. fracking) in Switzerland and the United Kingdom (Ingold et al. 2017). Such political networks, and their dynamics of coalition formation, co-participation, and conflict, produce politically relevant outputs such as collectively binding rules, policies, and programs. Network structures relevant to understanding how such collectively binding rules are produced in political networks are, e.g., clusters in the network (representing coalitions that fight each other and negotiate over policy outputs), core-periphery structures (describing the power structure within the political system), central nodes (representing influential actors in a policy process), or nodes bridging structural holes (representing actors able to negotiate and broker compromises among opposing coalitions, and therefore potentially facilitate policy outputs). These traditional measures for the analysis of political networks can be useful for assessing different conceptualizations of resilience of political systems.

Resilience in Political Network Research

The stability or precariousness of political systems depends on properties of their structure, i.e. the network of relations among political actors that coalesce a system in a given structure. We can thus examine defining qualities of a political network in order to establish its relative robustness to shocks and adaptability to change. In what follows, we first define what we mean by shocks, and then outline different network measures, as used in political network studies, that might react to such shocks, and thus operationalize different aspects of resilience. We thereby borrow from other resilience studies (see Bresch et al. 2014) that define three different, though complementary resilience aspects: structural, transformative and integrative.

We try to come up with concepts and illustrations from political networks that fit those three perspectives.

Defining shocks

Internal shocks are typically associated with political contestation and are rarely revolutionary to the structure of political systems. External shocks (Birkland 1997), are understood as events that can challenge political system. Examples of such shocks are externally engineered changes to institutional autonomy (i.e. centralization or devolution of power in a federal state); externally imposed changes in the rules of interaction within a political system (i.e. new norms in the use of science in informing policy making); and changes in the external context (i.e. new international or intergovernmental organizations with regulatory roles). Such changes can have positive or negative effects to representation, equality or coalition dynamics within political systems, or on the stability or structure of political networks.

Resilience and the capacity of re-establishing the same function

Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al. 2004). The defining quality of interest is whether a system maintains its ability to perform the functions expected of it under duress. The question in a political network thus becomes whether the political system is still able to produce and implement policies in order to respond to stakeholder demands. This does not mean, for example, that power sharing among political parties needs to be the same, but that the network is still able to produce similar policy outputs and thus manage exceptional situations such as a pandemic or long term policy goals such as energy transition.

In this context, the assessment of resilience is therefore inextricably tied to the performance of the political system, and not to the structure of the political network. A measure of resilience is therefore the ability to adapt to a new political context. For political networks, this could mean that maintaining structural equivalence of actors is important, even though the overall network structure changes, or if individual nodes or individual networks ties change. Given that the structure of a political network is expected to affect its capacity to produce outputs, we are interested in how changes to political network structure affect the function of a political network.

Structural resilience and density

Structural resilience consists of measuring network recovery. This concept, rooted in organizational or managerial studies (Bresch et al. 2014), is rather complex and includes a temporal aspect. Structural resilience refers to the degree to which a system recovers "better"

and quicker from a shock (Martin-Breen and Andries 2011). In other words, it is not only about "bouncing back into the old shape" of actors and ties, but "bouncing back faster". Thus, the relevant aspect is whether the system is stable, before and after a shock, e.g., whether the system bounces back into its old structure. In network terms, the probably simplest measure of "stability" is density and "the probability that a tie exists between any pair of randomly chosen nodes" (Borgatti et al., 2013, p. 150). It is defined as "the share of ties existent within a network compared to the amount of ties theoretically possible within this network" (Wassermann and Faust, 1994). Herzog and Ingold (2020) compared three sub-catchment areas of the Rhine River in Europe and investigated their ability to tackle the issue of micro-pollutants in water. The issue of micro-pollutants is not new, but suddenly arrived on the political agenda, be it through chemical accidents, media attention, or scientific evidence. So the authorities in the three catchments were asked to rapidly address the issue with new policy or with water management innovation. Even though the collaboration networks of the three catchments were different in size (37 nodes for Basel, 31 nodes for Ruhr, and 26 nodes for Moselle), the densities were about the same (from 20-25%). So compared to its size, Basel is the densest network and is also the one with highest water management performance. So the authors were able to compare network size and density, but also other network features and come to the conclusion that higher density and interconnectedness among the actors and across decisional levels lead to a better performance in how to address this new policy issue. But more quantitative and longitudinal (before and after shock scenarios) would be needed to assess the degree of structural resilience of these networks.

### *Transformative resilience and the quality of ties*

Some authors have used resilience to denote not only the bouncing back to a presumed past "normalcy", but also to be "bouncing forward" to a new state (Vuori 2021). This is termed transformative resilience, where a system is assumed to proactively adapt. In political networks, this can for example be assessed through the quality of ties, and the assumption that ties over time can be strengthened, and transform from weak to strong ties (Granovetter 1973). Studying six climate change adaptation projects in Switzerland over time, Ingold (2017) has observed the creation of social capital and a tendency for transformative resilience. The study investigated regional areas hit by floods or droughts and how the affected municipalities as well as responsible authorities at the higher decisional level (i.e., national and sub-national units) maintained or changed interaction patterns after those shocks. In a first phase, information exchange (conceived as weak, one directional ties) was quicker and more easily established as compared to more substantive collaboration relations (conceived as bilateral engagement of both partners in a strong tie). Over time, however, information relations lead to collaboration, and study regions became better prepared to face extreme events such as

floods or heat waves. A shock can thus lead to transformative resilience by initializing dynamics that lead to a strengthening of ties over time.

Integrative resilience and social-ecological fit

All political systems are embedded in larger social-ecological systems. Integrative resilience considers how well the political network "connects" to this broader system (see also Hollway, this book). The approach of social-ecological networks (SEN), is most suitable to coupled human-environment systems and challenges arising therein (see Bodin and Tengö 2012; Bodin et al. 2019). A SEN approach can take very different forms as outlined by Barnes (2022 this book; see also Sayles et al. (2019)) and Figure 1).

Figure 1: Social-ecological network interactions
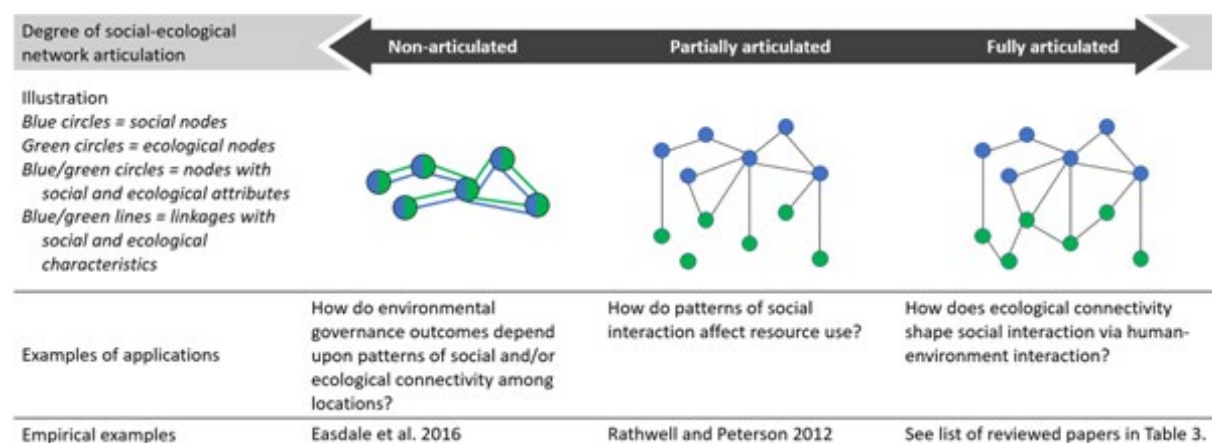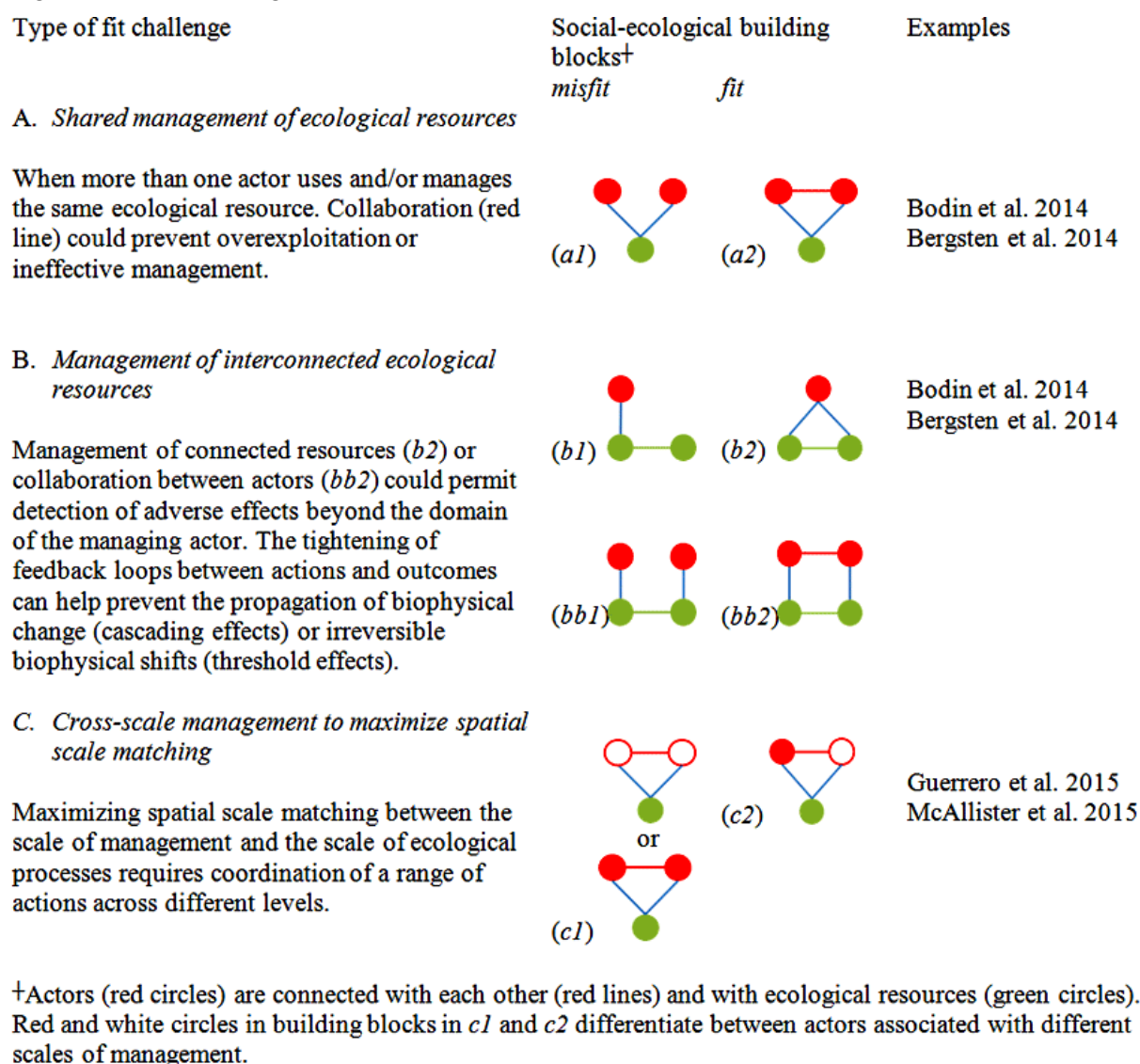

Source: Sayles et al. 2019

Depending on the context of the specific study, the social network in the SEN can be conceived of as a political network (Widmer et al. 2019; Ingold et al. 2018). This means that the social component of a social-ecological system (blue in Figure 1) is conceived of as a political system where actors manage and govern[1] goods and services that stem from the ecosystem.

One important concept to evaluate integrative resilience of social-ecological networks is the level of fit and misfit. Social ecological misfit occurs when the structure of the ecological network (e.g. forest patch and their relations e.g. in terms of species movement) are not congruent with the structure of the political network (Ingold et al. 2018; Sayles and Baggio 2017). As illustrated in Figure 2, if two ecological units are connected to each other (motif bb1), social-ecological fit is reached if the corresponding political units are also connected to each other (motif bb2). If we take the example of two protected areas such as wetlands and their connection through bird migration, a resilient network would be the one where political

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[1] For a distinction between management and governance, see Ingold et al. 2018.

authorities responsible for each of the wetlands would also collaborate, or at least communicate about bird migration with each other (see Barnes 2022 in this book for how this relates to resilience in social-ecological governance contexts).

Figure 2 Social-ecological fit and misfit

Type of fit challenge	Social-ecological building blocks+		Examples
	misfit	*fit*	
A. *Shared management of ecological resources*			
When more than one actor uses and/or manages the same ecological resource. Collaboration (red line) could prevent overexploitation or ineffective management.	(a1)	(a2)	Bodin et al. 2014 Bergsten et al. 2014
B. *Management of interconnected ecological resources*			Bodin et al. 2014 Bergsten et al. 2014
Management of connected resources (*b2*) or collaboration between actors (*bb2*) could permit detection of adverse effects beyond the domain of the managing actor. The tightening of feedback loops between actions and outcomes can help prevent the propagation of biophysical change (cascading effects) or irreversible biophysical shifts (threshold effects).	(b1) (bb1)	(b2) (bb2)	
C. *Cross-scale management to maximize spatial scale matching*			
Maximizing spatial scale matching between the scale of management and the scale of ecological processes requires coordination of a range of actions across different levels.	(c1)	(c2)	Guerrero et al. 2015 McAllister et al. 2015

+Actors (red circles) are connected with each other (red lines) and with ecological resources (green circles). Red and white circles in building blocks in *c1* and *c2* differentiate between actors associated with different scales of management.

Source: Guerrero et al. 2015

Network Theories and Power Concepts related to Resilience

Among the most prominent theoretical ideas and concepts in political networks are those relating to the density and sparsity of network structures, and to the uniformity of the distribution of relations between actors in the network (Victor et al., 2017; Light & Moody, 2021). We present the most prominent concepts and measures in Table 1, including their relationship to politics and assumptions on power, network structure and agency. Related to

studying resilience, we focus on how the structure of a system of agents affects the distribution of power and their potential to exercise this power, but also on how power differentials reflect on resilience per se (see also Christopoulos, 2017; Christopoulos 2018). In other words, we directly associate resilience to the distribution of political power. We assume that high levels of systemic resilience will be evident when agent power and structural power are in concordance.

TABLE 1: NETWORK THEORIES & POWER ASSUMPTIONS INVESTIGATING RESILIENCE

Theory	Key network concept	Locus of power	Systemic power assumption	Operationalizing political resilience
Granovetter's weak ties	Serendipitous access to information	Access to information	Mediators do not exact rents for valuable information	In evidence of diffuse ties
Burt's structural holes	Agents strategize to occupy advantageous positions	Brokers	Mediators exact rents and actively attempt to maintain structural holes	Measure of bridge decay
Eisenhardt's principal agent theory	Mediating political agents act in the name of the principal	Information asymmetry	Mediators exploit principals by taking advantage of an information advantage	Uncertain
Ostrom's collective action model	Agents may have diverging interests from principals	Agents roles	Informed principals can optimize common resource use	Uncertain
Simmel's cliques	Embedded transitive ties	Tertium gaudens	Tertium gaudens, a mediator can benefit from the conflict of their alters	Path length
Keyplayer	Network fragmentation contingent to elimination of certain nodes	Key nodes	Maintaining cohesion	Ratio of fragmentation to distance attenuation

For example, Granovetter's weak tie theory (1973) assumes that access to information reaches a principal agent, in a serendipitous manner, through intermediaries that disseminate it without attempting to control it. Here resilience is evidenced by how susceptible to disruption such a network is, i.e. under what conditions this information will not transmit; while evidence of resilience would be reflected on the level of transmission redundancy. So, employing weak ties in political science we further assume that the power of political agents is assumed diffuse (a); the system is egalitarian (b); and its robustness and resilience will be reflected on key metrics of diffuse networks, such as density or average path length (c). By comparison in Burt's structural holes (2005) theory agents strategize their position in networks and have an interest in maintaining the structural holes between others. Here resilience can be reflected in what Burt (2002) has called bridge decay with their structural position reflecting the power of agents. A network system with evidence of structural holes will reflect substantial power inequalities between agents, while resilience is reflected on what happens when brokers are removed, i.e. does the system remain a single robust component and can information or collaboration persist beyond these disruptions.

To examine whether political systems are cohesive or fragmented and whether they exhibit properties associated to resilience we have to query the generative mechanisms to the creation, maintenance and utilization of ties. Similarly we have to consider whether different mechanisms lead to conflict or the dissolution of ties. Multiple research questions can be envisaged. For instance, do distant and weak ties offer informational advantage which improves structural cohesion (Granovetter, 1973)? Do political brokers, by bridging or maintaining structural holes have a positive or negative effect to structural cohesion (Burt 2005)? Do mediating political agents affect cohesion by taking advantage of information asymmetries and therefore exploit their principals (Eisenhardt 1989)? Are political agent interests served by discord, which explains their promotion of structural fragmentation (Ostrom 1994; 2005)? The locus of power for individual agents varies among these theories. It can be determined by access to diverse information (Granovetter 1973), by being privy to unique information (Burt), by enjoying information asymmetry (Eisenhardt 1989), or by taking advantage of their unique roles (Ostrom 2005). At the level of the political system mediators can be perceived as facilitators of information flow (Granovetter 1973), seekers of brokerage rents (Burt 2005), or exploiters (Eisenhardt 1989; Ostrom 2005). At the same time evidence of resilience could be in the presence of diverse ties (Granovetter 1973), high levels of brokerage (Burt 2005), embeddedness (Eisenhardt 1989) or cohesion (Ostrom 2005). Evidence of resilience implies looking at these effects across time to consider whether network properties like core-periphery, bridge decay or clustering change as the result of changes to the political environment or other internal or external shocks.

Finally, it should be recognized that we limited our theoretical frame to unimodal and uni-layered networks for reasons of expedience. Resilience, seen as a property of systems, should by definition encompass all dimensions, modalities and layers of the interaction of agents with structure. A multimodal or multilayered consideration of resilience is however beyond the theoretical ambition of this short exposition. A simple example outlined in table 2 demonstrates the challenge in capturing resilience, given high levels of systemic complexity. This draws from research on deforestation in Argentina as presented by Inguaggiato et al. (2021a; 2021b). To consider all dimensions of deforestation entities with agency, such as sociopolitical actors and entities without agency, such as the ecosystem, have to be considered interdependent in their duality (Breiger, 1974) in a model where ties within and between modes would ideally be examined in tandem. At the same time the robustness and resilience of each of these networks would have to be evaluated and associated with all other networks. A key theoretical insight on multilayered networks (Lazega, 2020) is that the clustering of vertical linchpins constitutes a social niche. This can be assumed to promote network resilience as these vertical ties facilitate a 'multilevel synchronization' (ibid). Looking for the prevalence of such linchpins could be a proxy of multimodal resilience. One analytic

frame on multimodal analysis (Knoke et al. 2021) has been to use clustering and rank ordering techniques to identify associations between modes. Again, clustering coefficients can be seen as proxies to the level of resilience. A major challenge remains the incorporation of time and external events to such analysis. So, while systemic resilience across levels and modes are critical to understanding network processes, analytic complexity makes this a wicked problem. At least for the time being.

TABLE 2: Multimodal Analysis of Environmental Policy, drawing from Inguaggiato et al (2021)

	Entities with agency	*Entities lacking or having limited agency*	*Networks*
Socio-Political actors & modes	Agribusiness, farmers, NGOs, environmental groups, citizens	Indigenous communities, events, legislative acts, ecosystem	policy networks, economic, social, ecosystem
Relational power	Overt influence, covert influence, legislative, decisional	Indirectly via other modes, Indirectly via other entities	Within and between network modes
Ties	Interact, lobby, co-attend, co-sponsor etc	Across modes, across layers	Within and between modes and levels: i.e. International, Federal, regional, local, ecosystem, etc

Investigating resilience: Options in Research Design

In terms of research design, there are a number of options available for detecting resilience in political networks after a shock. First, evidence of a strong core-periphery structure would indicate robustness to a good percentage of random deletion of ties and nodes, while the system would likely retain its core-periphery structure, and average path length. Second, cohesion evident in the presence of Simmelian ties would also indicate relative robustness to random (i.e. non-targeted) shocks. Finally, evidence of the potential for fragmentation as captured through key player (c) metrics (Borgatti 2006; Everett and Borgatti 1999) can provide an indication of susceptibility to targeted attacks and the sensitivity to the elimination of certain nodes or ties.

In future research, these elements for assessing resilience of political networks could be linked to research on exceptional agents and key actors in policy studies and network analysis. In this context, recent studies showed that actors change roles in political networks: not all actors are similarly involved in the same (or different) policy issues or political network positions over time (Ingold et al. 2021; Angst et al. 2018). Yet, while some actors change network positions over time, it has also been observed that the core of most central actors tends to stay and keep their central position in political networks, not least based on self-reinforcing mechanisms

of central actors benefitting from more (relational) resources that allow them to create further network contacts (Ingold et al. 2021; Sciarini et al. 2015). Such a network core can thus be relevant to understanding and analyzing resilience of political networks. Knowing this, we ask: if the random deletion of nodes leads to the fragmentation of a political network, does this indicate low robustness and susceptibility to ideological fragmentation? Thus, is the robustness to change beyond the role of key connectors an aspect of a political system? In terms of political resilience, can we associate the adaptability of specific political agents, what Christopoulos and Ingold (2015) and Burt and Merluzzi (2016) have termed network oscillation, as a property of political systems? In other words, are political systems where agents flexibly adapt between a variety of brokerage and closure roles more resilient?

In general, the analysis of political system resilience consists of considering the impact of external events, targeted or not, on the ability of a political system – in our specific case a political network – to function efficiently in its transmission of information and support to its members, in providing coordination and cohesion, in producing policy outputs, and in being a coherent focus of political power and legitimacy. Therefore, not only researchers, but also decision-makers or authorities such as urban or regional planners might be interested in how the resilience of political network of actors looks like so as to know who should be integrated in the planning or implementation phase of a project or policy process (see also Duygan et al. 2022 for an example).

The theoretical concepts and descriptive measures discussed in this chapter could help studying the concept of resilience from a perspective of political networks, but they provide only a first input. Further reflections about the relations between resilience and political networks are however likely to be crucially important, given changing contexts of political systems due to political turmoil or environmental crises. Importantly, the descriptive measures discussed in this chapter provide a static picture of resilience, whereas the study of the consequences of a shock on a political network would obviously require a dynamic research design. However, in research reality, political networks are often only assessed at one specific point in time, mostly for practical reasons of data gathering or project duration, especially when based on interview and survey data. Assessing political networks through document or media data provides an opportunity for dynamic and long-term description and analysis of political networks. We thus encourage further research to explicitly and critically discuss these concepts and measures related to resilience, and apply them in dynamic situations where networks are described dynamically or at least at several points in time.

References (to be adapted)

Adger, N. (2000). *Social and ecological resilience: Are they related?* .Progress in Human Geography.

Alexandrova, P. 2015. "Upsetting the agenda: the clout of external focusing events in the European Council." Journal of Public Policy 35 (3): 505–30.

Angst, M.; Widmer, A.; Fischer, M.; Ingold, K. (2018). Connectors and coordinators in natural resource governance: insights from Swiss water supply. Ecology and Society, 23(2), 1. DOI: 10.5751/ES-10030-230201.

Baumgartner, F. R. 2013. "Ideas and Policy Change." Governance 26 (2): 239–58.

Berkes, F., Colding, J., & Folke, C. (2000). Introduction. In F. Berkes, J. Colding, & C. Folke (Eds.), *Navigating social-ecological systems: Building resilience for complexity and change* (pp. 1–29). Cambridge: Cambridge University Press.

Birkland, T. A. 1997. After disaster: Agenda setting, public policy, and focusing events. Washington D.C.: Georgetown University Press.

———. 1998. "Focusing Events, Mobilization, and Agenda Setting." Journal of Public Policy 18 (1): 53–74.

Borgatti, S. P. (2006). Identifying sets of key players in a social network. *Computational & Mathematical Organization Theory*, *12*(1), 21-34.

Bresch, Berghuijs and Kupers (2014) A resilience lens for enterprise risk management. In: Kupers. A Corporate Perspective on Collaborating for Resilience. Amsterdam University Press.

Burt, Ronald 2005. Brokerage and Closure. Oxford University Press, New York

Burt, R. S., & Merluzzi, J. (2016). Network oscillation. Academy of Management Discoveries, 2(4), 368-391.

Cozzo, E., De Arruda, G. F., Rodrigues, F. A., & Moreno, Y. (2018). *Multiplex networks: basic formalism and structural properties*. Berlin: Springer.

Christopoulos (2017) "Robustness and Resilience in Governance Networks" *International Institute for Applied Systems Analysis*, 12 December 2017, Laxenburg. https://iiasa.ac.at/web/home/research/researchPrograms/AdvancedSystemsAnalysis/Governance_Agency_DEC_2017_VIENNA_IIASA_R.pdf

Christopoulos, D. (2018) "Network Governance: Exploring the Limits of Governance Robustness and Resilience" International Institute for Applied Systems Analysis, 27 February 2018, Laxenburg, https://iiasa.ac.at/web/home/research/researchPrograms/AdvancedSystemsAnalysis/news/180227-christopulos.html

Christopoulos, D., & Ingold, K. (2015). Exceptional or just well connected? Political entrepreneurs and brokers in policy making. *European political science review*, 7(3), 475-498.

Dahl, R. A. (2005). *Who governs?: Democracy and power in an American city*. Yale University Press.

Della Porta, D., & Rucht, D. (Eds.). (2013). *Meeting democracy: power and deliberation in global justice movements*. Cambridge University Press.

Duygan, M., Fischer, M., Pärli, R., & Ingold, K. (2022). Where do smart cities grow? The spatial and socio-economic configurations of smart city development. Sustainable Cities and Society, 77, 103578 (12 pp.). https://doi.org/10.1016/j.scs.2021.103578

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, *14*(1), 57-74.

Everett, M. G., & Borgatti, S. P. (1999). The centrality of groups and classes. *The Journal of mathematical sociology*, *23*(3), 181-201.

Fischer, M., & Leifeld, P. (2015). Policy forums: Why do they exist and what are they used for?. Policy Sciences, 48(3), 363-382.

Granovetter, 1973 The strength of weak ties. American Journal of Sociology 78 (6) (1973), pp. 1360-1380

Guerrero, A. M., Ö. Bodin, R. R. J. McAllister, and K. A. Wilson. 2015. Achieving social-ecological fit through bottom-up collaborative governance: an empirical investigation. Ecology and Society 20(4):41.

Henry, A. D. (2011). Ideology, power, and the structure of policy networks. Policy Studies Journal, 39(3), 361-383.

Herzog, L; Ingold, K. (2020). "Collaboration in Water Quality Management: Differences in Micro-Pollutant Management Along the River Rhine." In: Networks in Water Governance, ed. M. Fischer and K. Ingold. Cham: Palgrave Macmillan, 203-238.

Humbert, Clemence, & Jonathan Joseph (2019) Introduction: the politics of resilience: problematising current approaches, Resilience, 7:3, 215-223, DOI: 10.1080/21693293.2019.1613738

Ingold, K. (2017). How to create and preserve social capital in climate adaptation policies: a network approach. Ecological Economics, 131 (January 2017), 414-424. DOI: 10.1016/j.ecolecon.2016.08.033

Ingold, K.; Fischer, M.; Cairney, P. (2017). Drivers for Policy Agreement in Nascent Subsystems: An Application of the Advocacy Coalition Framework to Fracking Policy in Switzerland and the UK. Policy Studies Journal, 45(3), 442–463. DOI: 10.1111/psj.12173.

Ingold, K.; Moser, A.; Metz, F.; Herzog, L.; Bader, H.P.; Scheidegger, R.; Stamm, Ch. (2018). Misfit between physical affectedness and regulatory embeddedness: The case of drinking water supply along the Rhine River. Global Environmental Change, 48, 136-150. DOI: 10.1016/j.gloenvcha.2017.11.006.

Ingold, K.; Fischer, M.; Christopoulos, D. (2021). The roles actors play in policy networks: Central positions in strongly institutionalized fields. Network Science, online. DOI: 10.1017/nws.2021.1.

Inguaggiato, C., Ceddia, M. G., Tschopp, M., & Christopoulos, D. (2021a). Collaborative Governance Networks: A Case Study of Argentina's Forest Law. *Sustainability*, *13*(18), 10000.

Inguaggiato, C., Ceddia, M. G., Tschopp, M., & Christopoulos, D. (2021b). Codifying and Commodifying Nature: Narratives on Forest Property Rights and the Implementation of Tenure Regularization Policies in Northwestern Argentina. *Land*, *10*(10), 1005.

Knoke, D., Diani, M., Hollway, J., & Christopoulos, D. (2021). *Multimodal Political Networks* (Vol. 50). Cambridge University Press.

Katzenstein, P. J., Keohane, R. O., & Krasner, S. D. (Eds.). (1999). *Exploration and contestation in the study of world politics*. MIT press.

Lazega, E. (2020). Networks and neo-structural sociology. *The Oxford Handbook of Social Networks*, 50.

Le Blanc, Antoine and Thierry Nicolas, « Politics and practices of resilience », *EchoGéo* [Online], 24 | 2013, doi.org/10.4000/echogeo.13480

Leifeld, Philip and Volker Schneider (2012).Information Exchange in Policy Networks. American Journal of Political Science 53(3): 731–744

Lubell, M. (2013). Governing institutional complexity: The ecology of games framework. Policy studies journal, 41(3), 537-559.

Lubell, M., Scholz, J., Berardo, R., & Robins, G. (2012). Testing policy theory with statistical models of networks. Policy Studies Journal, 40(3), 351-374.

Light, R., & Moody, J. (Eds.). (2021). *The Oxford Handbook of Social Networks*. Oxford University Press.

Ostrom E. 1994. Constituting social capital and collective action. Journal of Theory and Politics 6. 527-562.

---. 2005. Understanding Institutional Diversity. Princeton University Press, Princeton, USA

Sayles, J. S.; Mancilla Garcia, M.; Hamilton, M.; Alexander, S. M.; Baggio, J. A.; Fischer, A. P.; Ingold, K.; Meredith, G. R.; Pittman, J. (2019). Social-ecological network analysis for sustainability sciences: a systematic review and innovative research agenda for the future. Environmental Research Letters, 14(9). DOI: 10.1088/1748-9326/ab2619.

Sciarnini, P., Fischer, M., & D. Traber (2015). Political decision-making in Switzerland: The consensus model under pressure. Palgrave Macmillan, 291p,ISBN 978-1-137-50859-1Ulibarri, N., & Scott, T. A. (2017). Linking Network Structure to Collaborative Governance. Journal of Public Administration Research and Theory, 27(1), 163–181. https://doi.org/10.1093/jopart/muw041

Victor, J. N., Montgomery, A. H., & Lubell, M. (Eds.). (2017). *The Oxford handbook of political networks*. Oxford University Press.

Vuori Juha. 2021. Politics of Resilience. International Relations. DOI: 10.1093/OBO/9780199743292-0297

Wagner, P. Ylä-Anttila, T. (2018) Who got their way? Advocacy coalitions and the Irish climate change law. Environmental Politics 27 (5), 872-891

Wasserman, S. and K. Faust (1994). Social Network Analysis. Methods and Applications, Cambridge: Cambridge University Press.

Walker, B., C. S. Holling, S. R. Carpenter, and A. Kinzig. 2004. Resilience, adaptability and transformability in social–ecological systems. Ecology and Society 9(2): 5. [online] URL: http://www.ecologyandsociety.org/vol9/iss2/art5/

Weible, Christopher, and Paul Sabatier. (2005). Comparing Policy Networks: Marine Protected Areas in California. Policy Studies Journal 33(2).

Widmer, A.; Herzog, L.; Moser, A.; Ingold, K. (2019). Multilevel water quality management in the international Rhine catchment area: how to establish social-ecological fit through collaborative governance. Ecology and Society, 24(3), 27. DOI: 10.5751/ES-11087-240327.