

On resilience. Notes for a sociology of socio-ecological systems.

Abstract

Like a virus making a species jump, the concept of resilience has been the protagonist of an impressive interdisciplinary spill over. This article focuses on the difficulties of including this concept in the epistemic plane of the social sciences, and proposes an analysis of the limitations encountered when it is applied beyond physical and natural systems, in contexts characterised by components and regulatory processes at a different level of ontological stratification, such as Socio-Ecological Systems (ESS).

The contribution is structured in three parts: the first focuses on the interdisciplinary genealogy of the concept and the reflections that have attempted to interpret the causes, modalities and effects of its growing relevance for the social sciences. The second addresses some interpretative problems and proposes possible theoretical and methodological solutions oriented towards the inclusion of resilience in the domain of the social sciences. The last part delves into the case of a peculiar ESS such as that of mountainous inland areas, in which the dynamics of resilience are observed from an inverted perspective compared to the traditional one, namely by conceiving repopulation phenomena as trauma, rather than depopulation.

Keywords: *Resilience Thinking; Socio-Ecologic Systems Theory; Risk Management; Collective Identity; Inner Areas.*

Like a virus making a species leap, the concept of resilience has undergone an impressive interdisciplinary spill over, undergoing mutations and adaptations as a result of interaction with the 'host' discipline.

This article focuses on the difficulties of including this concept in the epistemic plane of the social sciences (Olsson et al. 2015; Stark 2014; Esteveo et al. 2017; Alietti and Padovan, 2023), and proposes an analysis of the limitations encountered when it is applied beyond physical and natural systems, in contexts characterised by regulatory components and processes at a different level of ontological stratification, such as Socio-Ecological Systems (ESS).

The contribution is structured in three parts: the first focuses on the interdisciplinary genealogy of the concept and the reflections that have attempted to interpret the causes, modalities and effects of its growing relevance for the social sciences. The second addresses some interpretative problems and proposes possible theoretical and methodological solutions oriented towards the inclusion of resilience in the domain of the social sciences. The last part delves into the case of a peculiar ESS such as that of mountainous inland areas, in which the dynamics of resilience are observed from an inverted perspective compared to the traditional one, namely by conceiving repopulation phenomena as trauma, rather than depopulation.

1. Genealogy and evolution of the concept

In use since at least the first century A.D. (Alexander, 2013), the concept of resilience was first adopted in engineering (Pushpalal and Suzuki, 2020), psychology, ecology (Odum 1989; Holling 1973) and then landed in the domain of the social sciences where it is applied in anthropology (Vayda and McCay, 1975), human geography (Zimmerer, 1994) and the study of environmental disasters (Wilson, 2012).

In these early applications, a definition of the concept of resilience as a complex of social system skills, embedded by capacities/competences useful for adaptation and linked to the availability of material resources, including natural resources, and anticipatory skills, prevails. Sets of indicators are proposed to operationalise this social dimension of resilience (McLean et al. 2014; De Renzis et al. 2022), which is associated with social capital (Putnam, 2006), the integration of knowledge between science, industry and public administration (Cuthill and Fien, 2005), and the feeling of belonging towards the natural and man-made environment (Dale et al., 2008). Finally, applied to ESSs, resilience identifies the ability of people, communities, societies and cultures to live and develop in an environment where change is continuous and where there is no single, stable equilibrium (Folke 2006).

This 'administrative' perspective (Lazarsfeld, 1972), has been criticised because it would support an inherently functionalist view of social change, unable to grasp the dimension of historical and political conflict underlying the generation of institutions (Cote and Nightingale 2012). Qualifying complex social organisations as 'ecosystems', endowed, for instance, with an innate capacity for self-organisation, would facilitate the adoption of a governmental approach to change, and the acceptance as 'given' of partial visions of development, such as the neo-liberal one (MacKinnon and Derickson 2012). In particular, Alietti and Padovan (2023) have observed that linking resilience to intrinsic characteristics of a system conceived in a self-referential manner (with no capacity for transcendence with respect to its own historical condition), ends up referring all vulnerability to inevitable conditions to be adapted to, rather than as the product of reversible political and economic choices.

In the critical literature on resilience, it is not only the implicitly political use of the concept that is under scrutiny, but also its problematic inclusion with respect to certain orientations of social theory.

From a constructionist perspective (Endress 2015), the parallelism between the diffusion of the concept of resilience and the formulation of scenarios on the potentially destructive environmental impact of the capitalist development model (Harvey, 1990; Wallerstein, 2012) seems to have favoured its normalisation as a positive quality of a system, as opposed to trauma, as an essentially negative phenomenon and legitimising particular organisational devices that reflect the interests of the most powerful part of society. From the perspective of organisational theory on socio-technical systems, resilience is regarded as an immune system that increases its performativity through learning mechanisms fuelled by exogenous shocks and stresses. In this case, resilience should coincide with a systemic preparedness for change, rather than a single risk, to be implemented through the adoption of 'heterarchical' organisational devices oriented to expose (within certain limits) the system to vulnerability (Stark, 2012, 2014). Finally, Esteveo et al. (2022), propose to reread the concept of resilience through the lens of *habitus* (Bourdieu 1978): not as an attribute inherent to groups or individuals, but as a socio-ecological process, where practices oriented towards the containment of a negative impact or the regeneration of a balance by a community are limited by social and historical structures and the characteristics of the natural environment, although the practices themselves contribute to orienting and modifying them.

2. Spillover problems in the sociological field

From this quick overview, three issues emerge on the application of the concept of resilience in the domain of sociological analysis that deserve to be explored for their implications both theoretical and applicative.

2.1 State variable or emergent property

The first critique contrasts the idea of resilience as a system state variable, which is always observable and measurable, with that of resilience as a property emerging as a result of shock. In the literature referred to above, the prevailing approach considers resilience as the result of capabilities, characteristics and resources of the ESS that guarantee the restoration of equilibrium in reaction to a trauma without, however, specifying whether these capabilities qualify the system as resilient before or after the trauma itself occurs. This distinction is dense with operational implications for the identification of best practices in environmental risk management. If, in fact, resilience could be recognised *ex ante*, it would be the product of variables verifiable, at least in principle, even in advance of the traumatic event and would fall among the qualities and resources detectable *ex-ante*, as such permutable with other concepts already known and consolidated in the sociological vocabulary, such as that of social capital, risk prevention and preparedness.

The great analytical and interpretative limitation of this approach (Stark 2015) lies in the fact that training an organisation for the occurrence of an event does not mean seeing it in action during the event itself. In risk management there is a share of implantable uncertainty that refers, for example, to emotional reactions, to possible errors in assessment and prediction of the scale of events, as well as to the presence of latent resources made available or evident only in the face of a trauma: resilience is challenged by these components and should therefore only be recognised and possibly measured as an outcome that depends on a system's set of skills, resources and values, but also on the characteristics and scale of the event with which it is confronted.

The thesis argued here is therefore that there is a decisive hiatus between the ontological properties of the system in their becoming and the possibility of their knowledge: as variables - properties translated into defined and given elements within a theoretical framework - these properties (ontology) emerge, presenting themselves for analysis (epistemology) only following the trauma.

2.2 Equilibrium and Boundaries

The second criticism refers to the need to define the ESS both in its boundaries and distinctive features and in the notion of equilibrium that is useful to qualify the impact of the shock and the reaction processes implemented by the system itself.

The study of social complexity (Negri et al. 1983), criticising the purely functionalist approach, has defined contemporary social systems as 'acentred', i.e. characterised by several principles of social organisation (or equilibria) and the absence of interdependence relationships or principles of integration between all the elements of the system. This approach is consistent with that prevailing in the ESS literature (Folke, 2006), where multiple simultaneous local equilibria are admitted and resilience is recognised in the adaptation and even significant transformation of the system.

At this point, however, at least two problems arise: the first refers to the need to define the identity of the ESS as an aggregate of acting and interacting elements that is separate, distinct and distinguishable from other systems and the environment; the second refers to the identification of a limit to the outcomes of disturbance response processes, below which the original system retains its characteristics and therefore it is legitimate to refer to the word resilience and not transformation.

2.3 Diversification of trauma

The third criticism concerns the extent and dynamics of trauma. Pendall et al. (2010), propose to make a distinction between two categories of 'disturbances': shocks, discrete events of an exogenous nature, and slow burns, slow burning processes, linked to chronic events, sometimes even endogenous to the system. In the first case, the reference is to systemic events, essentially unforeseen at least in their timing and forms of manifestation, which attack the fundamental structures of the system (environmental disasters, economic crises, pandemics, etc.). In the second case, the reference is to events that, without a dramatic peak, are capable of profoundly destabilising the system and challenging its survival (global warming, de-industrialisation, population ageing, etc.). The latter kind of trauma is particularly useful for observing resilience in ESS where systemic changes occur gradually and through syncretisms, hybridisations, slowdowns (Barbera and Parisi, 2020). The distinction proposed by Pendal et al. (2010) then makes it possible to highlight the determining relationship between trauma and resilience, where it is the former, on the basis of its characteristics, that sets the conditions for those of the latter: would the same ecological system react similarly when faced with an acute or chronic disorder?

2.4 Proposals for a sociological analysis of resilience

These three criticisms can be addressed, in our view, within a theoretical framework built from the following considerations:

1. The resilience of a social-ecological system should be considered an emergent property and not a state variable. Although it is inevitable that resilience depends on *ex ante* conditions, it is only knowable *ex post*, when these conditions, not all and not all in the same way, are activated by the traumatic event and are incorporated into practices to restore a form of equilibrium;
2. Unlike purely physical systems, which have adaptive capacities limited to feedback dynamics, socio-ecological systems are reflexive systems: they have self-perception and are 'seen to act' as they operate by developing capacities for learning, anticipation and emulation. This characteristic makes them potentially predisposed to adaptation, but not adaptive: the concept of resilience should therefore not be used as a synonym for preparedness;
3. An ESS can be recognised, i.e. distinguished from other systems and the environment within which it is located, on the basis of a reference code (Luhmann, 1986) that has the function of selecting and decoding external stimuli and translating them into communication processes. In the case of functional systems, this logic relates to the way in which they institutionalise responses to permanent needs of their social system (e.g. the code of the scientific system mediates relations with the outside according to the true/false opposition, the legal system according to the

legal/illegal dichotomy) (Munch, 1994). ESSs do not correspond to a single functional system but contain several of them within themselves. The reference codes of ESSs must therefore be identified on the basis of their specific location and history;

4. In the case of ESSs, the reference code can be defined from different points of observation: identity, i.e. the set of values, beliefs and representations with which a community distinguishes itself from others and reproduces itself, in a relationship of reciprocal determination with the physical environment; its structure, i.e. the ecological, socio-economic and demographic characteristics that determine its relationship with the environment and allow it to achieve a form, albeit unstable, of equilibrium;
5. When a shock intervenes to disturb the identity and/or structure of an ESS, it upsets its equilibrium and then response mechanisms are activated to restore it. These mechanisms define an ESS as persistent, adaptive or transformational. An ESS undergoing a change is persistent if it isolates or contains it without changing any significant aspect of its reference codes; it is adaptive if it updates them without changing their deeper aspects; it is transformative when it changes them, i.e. as a result of the response mechanisms it has a new identity and/or structure. On the basis of these considerations, persistence and adaptation can be considered resilience mechanisms, while transformation only response mechanisms;
6. It is necessary to consider the determining relationship between the traumatic event and resilience in which, confirming point I, it is the former, with its intensity, duration and virulence, that configures the modalities and outcomes of the latter;
7. Balance and trauma are to be emptied of value judgements and expectations as much as possible. The survival of a socio-ecological system and the occurrence of a phenomenon that overwhelms it are not positive or negative in themselves, but can be either one or the other depending on the observer's attribution of value;

On an empirical level, these theoretical considerations can be reflected in an analysis following the following steps:

1. Definition of the observed system as socio-ecological: identification of boundaries, identification of social and ecological components, description of their interactions;
 2. Definition of the system's reference codes according to the observation perspective: qualifying aspects of identity and structure;
 3. Identification and characterisation of the traumatic event according to intensity, duration and virulence and qualification of its impact on the reference codes;
 4. Identification and characterisation of the responses to the disturbance, i.e.: modes of manifestation of strategies, behaviours, processes activated to restore a balance and explication of the relationship of determination with the disturbance;
 5. Evaluation of the outcomes of these responses and qualification of the system according to the emerging resilience mechanism.
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3. **Resilience in mountainous inland areas: a proposal for an empirical analysis of responses to the trauma of repopulation**

In this section we apply this path of analysis to internal mountain areas (tab.1), a particular type of ESS, which identifies those mountain territories, distant from the centres of supply of

essential services, rich in environmental and cultural resources, and diversified as a result of secular processes of anthropisation (Carrosio, 2019).

The proposal is to read the repopulation processes of such areas in a different frame than the literature. Instead of as a resilience instrument, demographic inflows are seen as a traumatic event that exposes inland areas to the risk of collapse and the need to activate processes of reaction, adaptation or transformation.

Table 1 - ESS resilience mountainous inland areas: application of the analysis pathway

Step	Application to SSE mountainous inland areas
1. Definition of the observed system as 'socio-ecological	<i>Correspondence between values, forms of governance of the commons, economic interdependence with the physical environment and its structuring function for social organisation.</i>
2. Definition of system reference codes	<i>Mountain self, at the level of the individual and the group, as a collective identity. Primary subsistence economy and tourist accommodation serving mass tourism as elements of socio-ecological structure.</i>
3. Identification and characterisation of the traumatic event	<i>Repopulation of inland areas that have adapted to depopulation and retained the deep aspects of their code</i>
4. Identification and characterisation of disturbance responses	<i>Four types of repopulation: commuters; amenities migration; new mountaineers; refugees and mountaineers by 'force'.</i>
5. System qualification according to emerging resilience mechanism	<i>persistence, adaptation and transformation in terms of collective identity and social-ecological structure (tab.2)</i>

Regarding the qualification of mountain areas as SSE, step 1, it is useful to refer to a consolidated theoretical tradition that defines them as "(..)social systems in which some of the interdependent relationships among humans are mediated through interactions with biophysical and non-human biological units" (Jansenn, Ostrom, 2010). In fact, inland mountain areas present significant evidence of interdependent relationships between social organisation and the natural environment, with a structuring role of the latter more evident than in urban or peri-urban poles. These territories are then 'fragile areas' (Osti, 2017), exposed to traumatic events of various kinds (climate change, depopulation...) that have been challenging for decades the reference codes of secular communities, characterised by the correspondence between values (Salsa, 2007), forms of governance of common goods and interdependence with the physical environment (Camanni, 2002).

With regard to the reference codes, step 2, the first is that of collective identity which in the inland areas can be recognised in the "mountain self": a socio-cultural construction with a wide variety of manifestations (Salsa, 2007), but united by the distinctive relationship that binds the human community and its actions to a selective natural environment towards which an instrumental approach prevails (Barbera et al.2020)¹. A second code is that of the socio-ecological structure, recognisable in an economy based on the prevalence of primary subsistence activities with weak openings to local markets in the event of overproduction, and in the development of a tourist receptivity at the service of urban loisir (Camanni, 2002).

¹ In the beautiful book 'The Eight Mountains', Paolo Cognetti has Bruno, who was born and lived in the mountains, say to a group of city friends who dream of moving to Val d'Ayas: 'In winter what do you plan to eat, polenta and potatoes like the old people? And he said: it is you from the city who call it nature. It is so abstract in your heads that even the name is abstract. Here we say forest, pasture, stream, rock. Things that can be used. If they can't be used, we don't give them a name because it's useless'.

These codes are put under pressure, step 3, by a complex demographic dynamic, the outcome of two migratory movements in opposite directions: depopulation and repopulation. The latter, often considered as a resilience mechanism, can instead be seen as a trauma, if we look at its effect on those inland mountain areas that have shown themselves to be 'resilient' to depopulation, i.e. that have preserved the fundamental elements of their own codes of reference (Corrado, 2014). Phenomena such as the increasing social and economic selectivity of urban environments and the adoption of sustainable lifestyles are generating an incoming migratory flow into these areas that brings different life and land-use projects from those of the 'remaining'².

Repopulation can trigger a wide variety of responses and outcomes depending in part on its intrinsic characteristics, step 4. Indeed, depending on the socio-economic, cultural and lifestyle characteristics of the repopulators, the type of response of the repopulated may change. At least four categories of repopulators, or *reverse migrants*, are identified: (i) city commuters who use inland areas as a form of peri-urbanism (Lanzani and Zaffi, 2018); (ii) the affluent, often elderly and from foreign countries, who buy houses and spend part of the year there (Perlik, 2006); (iii) the new mountaineers (Pettenati 2020) who decide to settle (or re-settle) and regenerate value through new or renewed land uses; (iv) foreign migrant populations (Membretti and Ravazzoli, 2020) who migrate spontaneously or attracted by the low cost of living or because they are forcibly relocated (e.g. refugees). The determining relationship between traumatic event and SEE response is illustrated in Table 2 where the resilience behaviours/processes observed in some of the case studies are given as examples.

Table 2 - Resilient behaviour of inland areas in the face of repopulation: a conceptual grid for

		ESS Reference Codes Internal Area	
		Identity	Socio-Ecological Structure
Response mechanisms	Persistence	Nativism / Assimilation	Regeneration /Conservationism
	Adaptation	Spontaneous/Induced Integration	Innovation/integration
	Transformation	Gentrification	Modification/Urbanisation

Table 2 also allows for the qualification of resilience processes, step 5. In the case of persistence, there is no relevant modification of reference codes. On the level of identity, the settled community stresses the cultural and symbolic factors of tradition, negatively sanctions practices and values that do not adhere to them, and marginalises new arrivals, or accepts them provided they assimilate completely (Betz, 2019). In terms of socio-ecological structure, homogeneous characteristics are maintained in terms of the use of buildings and land, protective regulation of resource extraction is consolidated, and a certain demographic balance is found. The real robustness of the elements of persistence must be assessed over the long term, considering that conservation allows for immediate survival but may succumb to the selective pressures of the external environment.

² It is a condition told well by two films, 'Il vento fa il suo giro' (2019) and 'Ab-Bestas' (2023), which recount two problematic experiences of micro-repopulation in Italy and Spain.

In the case of adaptation, a community is prefigured that is more open to change, or even less able, due to contextual and situational factors, to exclude or force assimilation. The trauma in this case is represented by spontaneous repopulations or those guided by public institutions capable of generating new forms of mutualism and social symbiosis between old and new inhabitants, new multicultural identities and new or renewed socio-economic arrangements. One example is that of Sadali in Sardinia (Bachis et al. 2018), where resilience to repopulation was played out on the level of socio-ecological structure with the settlement of a community of street traders of Moroccan origin. Another is that of Ostana (Porcellana et al. 2016), where resilience to repopulation was instead played out on the level of identity as a result of a regeneration process desired by the village but guided by public institutions, and which generated a new form of expression of the Occitan local collective identity.

In the case of transformation, its consideration as a form of resilience is problematic in our reading. If the community, as an ESS, profoundly changes both its codes, i.e. its ways of perceiving itself as such (identity) within a radically renewed socio-economic context, we are no longer faced with a resilient ESS, but with a new ESS, i.e. a new and different community. This is the case of the repopulation of completely abandoned hamlets or rural gentrification, understood as the replacement of the original inhabitants by others who have more income possibilities and have a land use adapted to their specific needs. This outcome could coincide, on the level of the transformation of the socio-ecological structure, with that of commodification (Brenner et al. 2012), i.e. the transformation of physical and social spaces into places of consumption, and with a profound mutation of traditional skills and trades, as well as the economic activities characterising the place.

Conclusions

In this contribution we have tried to focus on some of the limitations and contradictions of the sociological 'spill over' of the concept of resilience and have formulated some theoretical proposals and methodological suggestions for its application to the analysis of the mechanisms activated by ESSs in reaction to traumatic events.

The theoretical proposals cluster around four main profiles of possible innovation.

Firstly, we believe that resilience should be understood as an emergent property of an ESS that, although linked to pre-existing conditions, in confrontation with the traumatic event is determined in its contours and becomes observable.

Secondly, we believe it is necessary to problematise the very concept of a traumatic event: both in terms of its developmental dynamics (sudden shock or slow burn), and in terms of its de-normalisation, emancipating the sociological reading from the attribution of a priori negative value to what shocks and necessarily positive value to the mechanisms for restoring equilibrium.

With regard to ESS equilibrium, it seems important to us then to consider that, unlike physical systems, in social systems it is the concept of equilibrium itself that is problematic as it is often multiple and acentred.

Finally, we believe that even in the case of social systems there is a need to link resilience to some form of permanence, thus putting a brake on readings that give it an excessively transformative meaning. Indeed, whatever form of equilibrium is restored, for one to be able to speak of resilience one must trigger mechanisms to preserve the reference codes that qualify an ESS as such.

Consistent with these theoretical propositions, we then structured a five-step analysis process that, starting from the definition of the ESS and its reference codes, leads through the description of traumatic events to the qualification of the system as persistent or adaptive according to the emerging resilience mechanism.

The application of the proposed sociological perspective to inland mountainous areas not only allows us to test its validity but also suggests going beyond the disaster/catastrophe script and shifting attention to the social actors involved on both sides of the repopulation phenomenon (the host community and the migrant population) and their agency, understood as the ability to influence resilient behaviour thanks to the availability of resources and the ability to activate them. This refocusing thus allows resilience (or non-resilience) to be read not as a functionalist mechanism of restoring equilibrium but as an outcome of conflict. Adopting this interpretative framework, and remaining on the level of hypotheses which would deserve to be confirmed by further theoretical reflections and empirical evidence, in the case analysed it seems to us that we can recognise two different outcomes of this conflict: resilient behaviour in cases where the local agency of the community 'left behind' following depopulation prevails; processes of transformation towards new ESSs, when agency is predominantly in the hands of external subjects, endowed with considerable resources (economic, political, relational) and the capacity to activate them.

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