

Rethinking Socio-Ecological Resilience: Lessons from the COVID-19 and the Degrowth Donut Model

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ABSTRACT This article develops a socio-ecological understanding of societal resilience by situating COVID-19 pandemic responses within broader configurations of cultural orientations, social foundations, and socio-metabolic pressures. Building on resilience debates from ecology and the social sciences, the paper argues that resilience cannot be reduced to “bounce-back” capacity or institutional preparedness alone, because societies may be resilient in undesirable states and because short-term crisis performance can coexist with long-term ecological vulnerability. To operationalise this perspective, the study applies a degrowth-based socio-ecological doughnut (“degrowth donut”) framework that maps countries’ positions relative to a safe and just operating space. Using a theory-driven comparative design, the analysis examines five European countries—Austria, Croatia, Germany, Italy, and Spain—through a selected subset of 18 indicators drawn from biophysical ceilings, socio-metabolic throughput, and cultural—in-

stitutional and social foundation dimensions. Results indicate that variation in pandemic performance aligns most clearly with differences in cultural and social foundation indicators (e.g., perceived democratic deficit, life satisfaction, health perception, and social equality), while countries showing stronger short-term pandemic performance often exhibit greater biophysical overshoot (notably CO₂ emissions and material use). The findings highlight a structural paradox at the centre of contemporary resilience debates: immediate adaptive capacity may be enabled by socio-metabolic regimes that undermine long-term socio-ecological stability. The paper concludes that the degrowth donut offers a heuristic, constraint-based tool for comparative resilience assessment that foregrounds trade-offs and supports a shift from crisis management toward deliberate socio-ecological transformation.

Key words: social resilience, socio-ecological systems, COVID-19, degrowth, doughnut model, safe and just operating space, socio-metabolism, cultural orientations.

1. Introduction

The notion of resilience in the last decades has become interesting within several academic disciplines. From biology and engineering to sustainability studies and natural disaster research and development studies. The discussion that launched the notion of resilience and its more intensive use into the core of scientific debates, raised the question of whether it is possible to describe societies with the concept of resilience. What would be a resilience of a society and how are societies resilient in general? Social scientists have emphasized the need to conceptualise social resilience as a concept that will help us understand the reactions and developments of societies to the emerging challenges of this century. The existing threats, but also the dangers that lie ahead, point us to the socio-ecological collapse that has already begun. That is why it is important to research and understand the extent to which societies can be (un)resilient to different types of collapse (natural disasters, economic crises, pandemics etc.).

Resilience as a word originates from Latin, meaning “to bounce back” and many authors define resilience as capacity of a system to return to a normal state (Xue, Wang, and Yang, 2018.). Understanding resilience as a mere capacity of the system to return to its initial state call for a critique from the perspective of social sciences. Not all initial states were worth preserving in totality, nor do we have a model of a fully ideal society whose inner workings must be kept intact at all times. Quite the opposite, our societies and their associated material and energy throughputs are known to be in need of a radical transformation. For the purposes of this paper, we define resilience as the capacity of socio-ecological systems to navigate disturbances while maintaining or transforming structures, functions, and processes in ways that preserve both ecological and social viability (Folke et al., 2010).

In social research and political ecology, in contemporary literature on strategies and change, there are increasing calls to prioritize a clear articulation of the vision for the

future desired end-state which can be communicated with the public and the stakeholders in advance (Kovacic and Giampietro, 2015.; Ernst et al., 2018.), even when not minutely delineated at every aspect. Therefore this paper's attempt is to present the holistic overview of societies in understanding resilience and (un)sustainability of their pathways. It serves as a foundation for a comparative insight into standardly unexpected potentials and hindrances of resilience to the COVID-19 pandemic, an exogenous shock, pointing to a better-rooted empirical exploration of its applicability.

The guiding hypothesis of this article is that societies' responses to the COVID-19 pandemic cannot be understood solely through institutional capacity or levels of development, but must also be interpreted through their broader socio-ecological conditions. The main objective of this article is to examine how societies' responses to the COVID-19 pandemic can be understood through their broader socio-ecological conditions, particularly the interplay between cultural orientations, institutional capacity and socio-metabolic pressures. By operationalising a degrowth-based socio-ecological donut model, the paper seeks to illustrate how structural features of contemporary societies shape both short-term adaptive capacity and long-term vulnerability.

To guide this analysis, the study addresses the following research questions:

1. How do key socio-ecological dimensions—cultural foundations, socio-metabolic pressures and ecological limits—shape countries' resilience to the COVID-19 pandemic?
2. How does the degrowth donut model help operationalise these theoretical dimensions in a comparative empirical framework?
3. To what extent do the empirical patterns observed in five countries confirm, challenge or nuance prevailing theoretical claims about resilience and socio-ecological stability?

This article is structured into four parts. In the next section we review the zoonotic spillover threat and notion of resilience from its origins in ecology to attempts to incorporate it into social science and humanities. Notably this includes the critique of identity and stability understanding of resilience, in light of the need for societies to transform from the present unjust and unsustainable metabolism-ideology nexus into states that can be described as resilient under a new paradigm. In the third section we present a visual analytical tool, the degrowth donut. In line with preceding requirements of vision articulation and a holistic perspective on the social and ecological resilience. The new tool provides the conceptual framework for an analytical paradigm of resilience evaluation in socio-ecological systems (SES). We illustrate the application of this tool to the case of COVID-19 pandemic resilience in five European countries. In the fourth and final section we conclude by interweaving the threads of each section's argument to offer final thoughts on the idea of resilience paradigm for combined socio-ecological systems.

2. Pandemics, resilience and socio-ecological transformation

2.1. Zoonotic spillover as a permanent threat to societies?

In the midst of COVID-19 pandemics, a group of scientists have underlined that “at least 10,000 virus species have capacity to infect humans but at present, the vast majority are circulating silently in wild mammals” (Carlson et al., 2022.). Fifteen years ago, in the same journal, another group of scientists wrote about emerging infectious diseases. They have analysed 335 emerging infectious diseases, for the period between 1940 and 2004, indicating that the number of infectious diseases has been increasing since the Second World War with its peak in the eighties and HIV pandemic. Those emerging infectious diseases are by 60,3% dominated by zoonoses stemming out from the wildlife and “increasing significantly over time” (Jones et al., 2008.). Since the HIV pandemic in the eighties the list of pathogens imported from other species has grown and became more visible in the public sphere. Viruses like Nipah, ebolavirus, SARS, H5N1, H1N1, MERS and many others emerged in various places and time spans with the potential of developing into global pandemics.

Global pandemic due to zoonotic spillover, based on the scientific insights and findings, was just a matter of time. It seems that the first case of COVID-19 disease was recorded on 17th of November 2019. According to the explanation that is currently most prevalent in the scientific community, SARS-CoV2 virus infection occurred as a zoonotic transmission of virus from bats to an anteater and then to humans. By the end of December 2019, the infection broke out in the Chinese city of Wuhan¹, by mid-January 2020 the virus spread throughout Asia and then to the end of January to other continents. So-called “lockdown” of societies and economies was introduced worldwide in just several months (Ančić and Cepić, 2021.). It seems that the pandemic of this scope and rate was just a realisation of trends in emerging infectious diseases. However, we are missing a clear narrative on why there is a significant increase in emerging infectious diseases and what are the driving factors behind those unprecedented rates.

In the last several decades science has been stressing that emerging infectious diseases were appearing due to social, demographic and environmental factors (Binder et al., 1999.) related to standard of health-care services and global transportation, ageing of the population and urbanisation, and to climate change and land-use change. However, these factors cannot be seen as factors with equal potential to influence increasing trends in viral sharing nor is the narrative on zoonotic spillover alone focused on the real underlying reasons of significant increase in emerging infectious diseases. Narra-

¹ Even for those who subscribe to the so-called ‘lab leak theory’, the infection still represents a zoonotic spillover event overall, only achieved by slightly different means. It is still a zoonotic virus originating in wild mammals leading to a pandemic in humans. The pandemic and its management, not the initial human infection(s), are of interest here.

tive that is more precise elaborates increasing zoonotic spillover within the context of a growth imperative of the current socio-economic system in which land-use change is occurring due to several commodities creating high revenues to privately owned entrepreneurial organisations. Intensive deforestation in forest biomes of Latin America and Southeast Asia is driven because of four commodities – beef, soya, palm oil and some products made of wood (Malm, 2020.). For millions of years humans have lived without being exposed to various forms of life deeply hidden in forested areas. Intensive destruction of forests and wildlife for the purpose of enabling economic growth, releases pathogens as dust particles exposing humans to new viral diseases for which the immune system has little or no answers (Quammen, 2012.).

Importantly, the COVID-19 pandemic needs to be understood as a direct manifestation of accelerating environmental degradation. The convergence of deforestation, biodiversity loss, land-use change and climate-induced species migration has created ecological conditions in which cross-species viral transmission becomes increasingly likely. As Malm (2020.) and Quammen (2012.) argue, the expansion of growth-driven socio-economic systems disrupts wildlife habitats and brings humans into closer contact with novel pathogens. Recent macroecological evidence also demonstrates that climate change is reshaping species assemblages in ways that significantly increase viral sharing across mammals (Carlson et al., 2022.). These intertwined processes make zoonotic spillovers not exceptional events, but systemic outcomes of an unsustainable socio-ecological regime. Understanding the pandemic as embedded in this broader ecology–economy dynamic allows us to conceptualise COVID-19 not merely as a biomedical crisis, but as an episode of socio-ecological destabilisation characteristic of the Anthropocene.

COVID-19 pandemic is one of the episodes in the 21st century in which environmental degradation creates worsening living conditions for humans and societies far beyond the initial spillover event. Therefore, it is of utmost importance to try to explore and learn as much as we can from the pandemic in order to have a better understanding of what the future can bring to societies and how societies can react. The Great Recession of the late 2000s created a need in social sciences to understand how and why some people, communities, and societies were able to weather the storm better and for longer during the global socio-economic crisis. Issues of vulnerability, resistance and resilience were brought to the centre of scientific interest thus creating more fruitful debates and intellectual re-conceptualizations of notions of those issues. COVID-19 pandemic situation with all social, economic, cultural and biophysical consequences and changes is by no means accidental and as such should be seen as an episode in the age of Anthropocene. An episode showcasing how the societies are facing various displays of societal and ecological collapse (Bologna and Aquino, 2020; Downey, Haas, and Shennan, 2016.).

Therefore, the focus of this paper is to theoretically explore the resilience of societies with understanding the need of empirical multidimensionality in the context of destructive forces of the current socio-economic system.

2.2. Resilience as a useful concept in understanding socio-ecological collapse

The notion of resilience most referred to derives from ecology and was later often compared to or opposed to the notion of sustainability (Fath, Dean, and Katzmaier, 2015.), and in recent years, it has become present within sociology and economics, now slowly taking on its hybrid forms. The definition of resilience both social and ecological sciences draw on today was described in the pioneering work of C. S. Holling who defined resilience as “a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables”² (Holling, 1973.:14). In this original definition, resilience is defined in the context of maintenance of populations at the ecosystem level, and its understanding is indivisible from notions of stability, equilibrium state and boundaries of domains of attraction. What followed are various attempts by ecologists to expand Holling’s definition to better-fit complex adaptive systems. Resilience came to be understood either through the magnitude of a disturbance that can be absorbed before the system changes its structure (Gunderson and Pritchard, 2002.), as the capacity of a system to experience shocks while retaining its identity (Walker et al., 2006.), or as the ability of a system to maintain its identity despite internal changes and external disturbances (Cumming and Collier 2005). However, there has hardly been any substantial *expansion* of the initial definition: in all three cases authors could as well be describing what Holling defined in terms of stability, or “ability of a system to return to an equilibrium state after a temporary disturbance” where “stability is the property of the system and the degree of fluctuation around specific states the result”. (1973.:17). The growing debate within ecological science has spread into social sciences and prompted new theoretical developments in resilience of complex socio-ecological systems. Following ecological definitions along with its vocabulary, Levin (1998.), hoping to find a thread that connects social and ecological systems, describes them as “nonlinear dynamical systems with resilience as a measure of their persistence” (1998.:224). In that case, both ecosystem’s diversity and social institutions alike are subjected to domain shifts, basins of attraction, and inclined to adapt through flexibility functioning far-from-equilibrium states. This has stirred extensive debate among scholars concerned with applicability and measurability of the concept in sociological terms. In the early 2000s, the concept of resilience was easily problematized within the social sciences, primarily within sociology, i.e. social ecology. Neil Adger believes that it is important to learn something from environmental debates about resilience

² In ecosystem models, typical state variables are the size or concentration of plant and animal populations, and resource (nutrients, organic materials) availability.

and apply these approaches in sociology, i.e. apply the concept of resilience to social systems and infrastructure (Adger, 2000.).

Exploration of social resilience is mostly focused on periods of crisis, even though it is shaped over a longer historical period through e.g. the development of the health system, the education system, the social welfare system; that is through society's investment in these systems. It should be kept in mind that some shocks, such as for example natural disasters, do not have to be directly related to the operation or faulty operation of the social system. Nevertheless, no matter where the shocks and adversities come from, they will shed light on how societies function. For example, the Great Recession was caused by excessive risk-taking in financial systems and should be seen as a crisis or for that matter a shock, which can be addressed through the creation of regulatory policies aiming to transform the political-economic system in such a way that crises of such magnitude do not occur again. However, when shocks are exogenous, such as natural disasters, disruptions and additional shocks result from social cleavages, which can only be eliminated or mitigated by adequate purposeful material interventions. Therefore, resilience is not an individual characteristic and feature but a contextual one, and should be viewed as a social and collective phenomenon (Revilla, Martín, and de Castro, 2018.).

Social resilience must take into account social rules and resources along with power relations in its analysis. Social rules can be formal and informal, while within the concept of social resilience they include civil and social rights, social privileges and rules on social protection and the way markets function (Dagdeviren et al., 2020.). The resource aspect of social resilience involves apostrophizing the distribution of useful energy, wealth and income to help people cope with shocks and crises, public investment in education to increase the potential for upward social mobility, and providing social protection to individuals until they recover. It is the configuration of these rules and the concept of resource distribution that depends on political power. Given how these three elements are configured, the potential of social resilience to maintain a society's identity will be lower or higher.

The concept of social resilience is useful in researching and understanding the effects, reactions and recovery from unexpected or expected but unpredictable systemic or large-scale disasters, whether natural, social, economic or political (Martin and Sunley, 2015.). In this sense, some authors would argue that resilience as a concept does not have the task of explaining the long-term trajectories of unfavourable life conditions (Estêvão, Calado and Capucha, 2017.), but is used in understanding the economic adversities resulting from the crisis and their transition dynamics. However, it is clear from the example of the Great Recession that hegemonic power relations led to the modification of rules and the allocation of resources in such a way that austerity programs introduced primarily harmed the working class and were facilitated through the socialisation of private risks and losses (Stiglitz, 2012.). Therefore, it becomes clear

that the shock of the Great Recession is a consequence of an intense process of market deregulation and a neoliberal economic hegemony that is characteristic of the age of late capitalism. Abandoning a standpoint in which resilience is understood from a perspective that focuses on the relevance of formatting effects of long-term trajectories creates a fallacy in understanding resilience. Therefore, there is a need to reconfigure an epistemological approach to the concept of resilience.

It also becomes apparent that when analysing a social system's resilience, it is important to include other sociological aspects into analysis, like (political) agency, values, culture. If resilience is a way to preserve the desirable state we should question the desirability of a social system that is (supposed to be) resilient; societies can be locked in undesirable states and systems like the one described above that has proven to be very persistent, i.e. resilient to both external and internal shocks. In that social system (late capitalism) growing inequality and ecological devastation are undesirable states, however, the system proves to be resilient despite growing unemployment rates and declining biodiversity. A broader outlook connecting more than economic output and techno-menagerial solutions seems to be required (Mikulewicz, 2019.).

2.3. Reconceptualising resilience as a frame for understanding society-nature nexus

It should be underlined that ecological and social resilience are directly related precisely through the dependence of social communities and their economic activities on the ecosystem services. Without this perspective, the concept of resilience, respectively social resilience, becomes a myopic theoretical and analytical tool. Socio-ecological theories of resilience also suffer from certain shortcomings (Sapountzaki, 2012.). Namely, observing the dynamics of resilience of societies from the analogy of society as biological system suffers from a lack of understanding of intentionality such as cognition, reflexivity and awareness in human action, all elements that are crucial in social relations, including social hierarchy and power relations and the historical development of society itself. On the other hand, if resilience is seen only from the perspective of socio-economic hardships and from how communities and societies react to those conditions, it loses out of sight the biophysical conditions upon which societies rely on and depend on.

Therefore, the discourse on resilience could be seen as an open discussion stream between natural sciences and social sciences within the narrative of sustainability (Keck and Sakdapolrak, 2013.). Proponents of the concept of resilience within social-ecological systems (SES) perspective call for the concept of transformability which can be understood as a capacity to cross the thresholds into new trajectories of development (Folke et al., 2010.). Similarly, Wilson (2012.) proposes conceptualising social resilience in the context of transition theory, putting strong emphasis on social, economic

and environmental capital. If we accept the idea that systems can possess various potential states in which they are stable that means that there is a “stability landscape” (Gallopín, 2006.), and that transformability understands capacity for creating an entirely new system when social, economic and ecological conditions are unsustainable (Fishman et al., 2014.). It is still worth noting the shortcomings of attempts to fit ecology-defined resilience into social systems composed of both metabolism and intentionality, as well as (democratic) power struggles. First, it is apparent that a growing number of definitions in both natural and social sciences have contributed to muddying the concept and weakening its normative power. Second, there are objections that concepts like non-linearity, feedback loops, or paradigm shifts are all well researched and recognised in social sciences (in explaining a social phenomenon) without “appealing to the idea of resilience”, and without imposing new definitions and new vocabulary that can render previous (useful) knowledge irrelevant (Hanley, 1998.: 247). The concept of resilience (or the explanation it can provide) is additionally dependent on other (established) concepts and definitions, whether they be ‘feedback loops’ or ‘vulnerability’ or flexibility, to describe what it phenomenologically entails in socio-ecological systems. It cannot function without defining what is a desirable state unless it is willing to make trade-offs between ecological and economic resilience, for instance.

Additionally, adaptability and vulnerability (concepts closely connected to ‘resilience’) have multiple implications when applied to social systems, creating more confusion around resilience. With regard to adaptability, which represents the ability of a system to enter another stability domain in the face of perturbation, a social system despite being resilient may not be able to adapt to a new domain, as in the case of run-away anthropogenic climate change (Lélé, 1998.). In that case it would be preferable to give advantage to mitigation over adaptation although mitigation does not necessarily increase resilience (Lélé, 1998.). Finally, the most important thing to recognize is that, resilience of socio-economic systems fails to consider environmental injustice and power relations between overdeveloped and developing countries when addressing a stability landscape. Horizontal inequalities both within and among societies are seldom accounted for in definitions of resilience – those inequalities are subject of (again) supporting concepts of vulnerability (Adger et al., 2009.; Mikulewicz, 2019.).

Furthermore, the overall lack of conceptual clarity causes operationalisation challenges for quantitative tracking of resilience – as there is no single and detailed definition of resilience, there is no set of universal indicators or variables (along with modes of quantification of those variables) that could help us measure how resilient a particular system really is. In the end, researching resilience comes down to case-by-case analysis where opposite results may occur for different social sub-systems (Puđak, 2021.; Wilson, 2012.) hindering straightforward attempts of comparative analysis, but opening up to broader and sturdier nascent theoretical model from a different paradigm altogether – a mental model not based on interaction of components but processes

constrained by a set of meaningful limits. To assess a system's capacity to recover from untenable conditions, we propose integrating natural and social elements within social-ecological systems (SES) frameworks, emphasizing the need for novel mental models and empirical approaches to quantify resilience, despite existing guidelines, thresholds, and functional insights.

3. New mental models as conceptual visualisations of society-natures nexus and their empirical potential

The empirical analysis that follows operationalises the theoretical framework presented above by translating key socio-ecological concepts into measurable indicators within the degrowth donut model. The donut enables us to capture, in a single comparative structure, the three dimensions central to our argument: (1) socio-metabolic pressures that reflect the ecological limits of growth-dependent systems; (2) social foundations and cultural orientations that inform societies' collective capacity to respond to shocks; and (3) biophysical thresholds that delineate long-term resilience. In this way, the empirical comparison of five countries does not stand apart from the theoretical framework but directly emerges from it, allowing us to examine how structural socio-ecological conditions relate to pandemic performance and long-term vulnerability.

3.1. From planetary boundaries to donuts

In 2009 Johan Rockström and associates developed the concept of planetary boundaries in which 9 processes relevant for functioning of the Earth-system³ were defined in terms of the critical values and thresholds for safe operating space for humanity (Rockström et al. 2009). Analysis has shown that 5 out of 9 boundaries have already been transgressed by now. Those are climate change, interference with biogeochemical flows, rate of biodiversity loss, land system change, and addition of novel chemical entities to the environment. However, as a humanity we are rushing towards overstepping the boundaries for global freshwater use, ocean acidification, change in land use and interference with the global phosphorus cycle. Planetary boundaries concept was visualised as a polar (or radar) graph divided in 9 areas in which if the numbers did not transgress the boundary the area of safe operating space would be coloured in green. For those that have transgressed red wedges would represent the current situation thus indicating to what extent did it overshoot the safe operating space. For the first time the complex knowledge and data on Earth-system trends were visualised in a manner that can be useful in creating new mental models for understanding the uncertainties and perilous trends of current life on the planet.

³ 9 processes of planetary boundaries: climate change; interference with nitrogen and phosphorus cycles; rate of biodiversity loss; stratospheric ozone depletion; ocean acidification; global freshwater use; change in land use; chemical pollution; and atmospheric aerosol loading.

Under the title of a doughnut economics this mental model inspired Kate Raworth to incorporate the planetary boundaries into visualisation indicating trends in societies and economies (Raworth, 2017.). Raworth's visualisation is shaped like a doughnut (in the North American bagel shape) or a lifebelt, where on the outer rim trends in (planetary) boundaries are presented while the central hole depicts social foundations for humanity in terms of insufficient access to essentials of life (water; food; health; education; income and work; peace and justice; political voice; social equity; gender equality; housing; networks; energy). For humanity it is important not to overshoot planetary boundaries while at the same time to achieve social and economic goals for good life in societies – to stay in safe and just space for humanity. As a mental model it juxtaposes humanity and nature in its interconnectedness and provides us with a new imagery of current issues/problems in unsustainable conditions in societies and ecology.

As a model it was criticized for the lack of the perspective of agency or for that matter it neglects the importance of socio-cultural determinants of good life and needed change. Societal values, norms and attitudes are crucial for changing the unsustainable developmental pathways of societies and as such should be taken into account (Brand et al., 2021.). Moreover, conceptually it is not just natural systems that limit contemporary resilience, but extractive and exploitative social systems and dominant attitudes too. Conversely, some ecosystem functions today need threshold upkeep (e.g. afforestation, wilderness reserves soil protection) just like the widely understood social foundations in the doughnut model (Domazet et al., 2020.).

New mental model, known as a degrowth donut model, was proposed with an aim of addressing these shortcomings. Degrowth as a concept and the degrowth donut mental model intends to be a helpful analytical tool in assessing the current state of a social-ecological system at the scale of nation states. They take a broad delineation of a stability landscape and map deviations from a desirable horizon vision to assess the unexpected obstacles and drivers of particular resilience outcomes. The visualisation contains, just as Raworth's model, biophysical and socio-economic domains, but with addition of cultural segment as well. It is a mental model of a safe and just operating space for combined society-nature units of equitably downscaled global boundaries and thresholds of resilience in the 21st century (cf. Domazet et al., 2020.). It does not aggregate the causal interactions between selected indicators into projections of future strategies, but constrains the overall abstract space of people's needs satisfaction in relation to energy sources and systems of distribution (Brand-Correa and Steinberger, 2017.). In fact, it goes even further by attempting to specify the enabling and limiting values and attitudes prevalent in a given society. The visualisation provides in a single image how far the biophysical impacts and social structures can go to stay fair and sustainable, an abstract space of the required stability landscape with different possible (and yet unknown) specific states. It recognizes that the contemporary sustainability and resilience of states and regions connects their biophysical manifolds,

socio-economic structures and cultural attitudes in a complex interaction. In order to leave the connection of human needs to resources democratically open to social debate and participatory approaches (Brand et al., 2021.) it does not specify the causal-mechanical (Salmon, 1990.) connection between elements, but only the direction of change of their intensity (decrease or increase). As such it does not assume causality since society-nature nexus is highly likely to be complex, nonlinear and difficult to confirm (Dearing et al., 2014.: 233).

In this article, we use the term “degrowth donut” to refer to a socio-ecological mental model that integrates caps and foundations in more-than-human, socio-economic and cultural domains in order to assess the long-term sustainability and resilience of societies. The donut is therefore not only a graphical visualisation, but a conceptual framework that helps structure thinking about how economic activity, cultural orientations, and ecological constraints interact. Its circular form represents a safe and just operating space: ceilings mark limits of burdens on resilient nature-society complexes, while foundations identify minimum conditions for more-than-human resilience and human wellbeing.

3.2. Performance and resilience of societies in pandemic – degrowth donut empirical comparison

In order to explore the analytical potential of a degrowth-based mental model for understanding socio-ecological resilience, we employ a purposive comparative sample of five European countries: Austria, Croatia, Germany, Italy, and Spain. The selection is theory-driven rather than representative and does not aim to capture geographical diversity per se. Instead, the cases were chosen to reflect contrasting socio-ecological configurations within a broadly comparable European context, characterised by shared institutional frameworks and similar biogeographical conditions. This strategy allows us to hold macro-regional factors relatively constant while isolating variation in socio-metabolic pressures, cultural–institutional orientations, and pandemic performance, which are central to the theoretical argument of the paper. The empirical analysis builds on a degrowth-based socio-ecological donut framework⁴ developed in

⁴ The degrowth-based socio-ecological donut framework used in this article was developed within the project *The Social Resilience of Croatian Society in the Midst and Aftermath of the COVID-19 Pandemic (SOCRES)* at the Institute for Social Research in Zagreb. The framework conceptualises resilience as emerging from the interaction of socio-metabolic pressures, cultural–institutional orientations, and biophysical limits, and operationalises this approach through an interactive donut visualisation comprising 33 structural indicators. The present article draws selectively on this framework to construct a resilience-focused analytical subset aligned with its theoretical aims. Further details are available at:

<https://www.idi.hr/socres/donut.html>

<https://www.idi.hr/en/projects/competitive-research-projects/the-social-resilience-of-croatian-society-in-the-midst-and-aftermath-of-the-covid-19-pandemic-socres>

earlier work (Domazet and Cik, 2023.). While the full donut model comprises 33 indicators across biophysical, socio-economic, and cultural dimensions, this article focuses on a theoretically selected subset of 18 indicators directly relevant to resilience under an exogenous systemic shock such as the COVID-19 pandemic. The reduction follows a theory-driven logic, prioritising indicators that (1) condition societies' immediate capacity to absorb and cope with disruption, (2) mediate collective action through legitimacy perceptions, value orientations, and inequality, and (3) capture structural socio-metabolic and ecological constraints shaping long-term vulnerability. Conceptually, the donut operationalises three interrelated domains of socio-ecological resilience: socio-metabolic pressures, social foundations and cultural–institutional orientations, and ecological ceilings defined by biophysical limits. Each indicator marks a threshold or boundary beyond which resilience is compromised, either through social shortfalls or ecological overshoot. The model is not intended as a predictive or causal tool; rather, it provides a holistic, constraint-based mapping of structural conditions within which societies enter, experience, and respond to systemic crises.

Given space constraints, we provide here a concise overview of the analytical logic, while detailed indicator definitions, thresholds and methodological rationale are available in Domazet and Cik (2023.). The indicators used in the model draw the latest available secondary data from publicly available databases, ranging from the year 2008 to 2020. They are listed in Appendix. The indicators used in the degrowth donut model originate from different years (2008–2020), reflecting the availability of harmonised cross-country data. This temporal heterogeneity represents an important limitation of the analysis. However, the donut framework is intended to capture structural socio-ecological conditions that tend to change slowly over time, rather than short-term fluctuations. Many of the variables employed—such as ecological footprints, material and energy throughput, carbon emissions, or institutional and cultural indicators—are characterised by high temporal stability and strong path-dependence.

As a result, although some indicators do not align perfectly around the year of the pandemic, they still provide an accurate representation of each country's broader socio-metabolic and cultural profile. While this heterogeneity restricts fine-grained temporal interpretations, it does not substantially alter the relative positioning of countries within the model. We therefore interpret the donut outcomes as structural patterns rather than precise year-specific diagnostics. Future research could address this limitation by employing harmonised time-series data to assess how changes in these indicators relate to evolving resilience dynamics.

Since the beginning of the pandemic in Europe, different attitudes and approaches were noted between different EU members regarding how to minimise the negative societal effects and contain the spread of the virus. This variation in defining strate-

gies and tactics of coping with pandemic (from herd-immunity to complete lockdowns) resulted in differing outcomes in official public health statistics related to the pandemic. For the preliminary grouping of countries, in order to explore potential differences in their resilience based on some aspects of their pandemic performance, we have used two measures. One measure is excess mortality indicating cumulative confirmed COVID-19 deaths per million inhabitants. It reports the cumulative difference between the reported number of all-cause deaths since 1st January 2020 and the projected number of deaths for the same period based on previous years. Second measure serves as a robust measure of the pandemic response of analysed countries. The multidimensional Global Health Security Index (GHSI) was used to further assess pandemic performance. The GHSI provides a score on a scale from 0 (worst) to 100 (best) of countries according to a comprehensive range of systemic attributes beyond those related to health system characteristics, such as, to an extent, the above-mentioned vaccination and mortality rates. It also includes dimensions like health system in general, prevention, detection and reporting, rapid response, compliance with international norms and risk environment.

Table 1 displays numeric values of those two pandemic performance measurements and provides an initial basis for the preliminary categorization of countries according to the assigned quality of their pandemic response into good (high) and bad (low) pandemic responders in Europe. Numbers concerning excessive deaths due to COVID-19 pandemic group Croatia and Italy together as bad pandemic responders since other three countries responded better than the EU-27 average. Same grouping pattern can be confirmed with a GHSI score. Based on the index score and rank of each of the countries better COVID-pandemic responders are Germany, Spain and Austria while Italy and Croatia are assessed to be worse in terms of the health security dimensions relevant in times of pandemic. In absence of a causal-mechanical model of overall resilience to exogenous shocks, no exact cut-off is applied to divide pandemic-resilient and non-resilient countries. In fact, no country is clearly resilient to a complex shock such as the pandemic but differences in pandemic performance is traceable.

Table 1.
Total excess deaths (pm) and GHSI scores

| Country | Austria | Croatia | Germany | Italy | Spain | Avg. (EU-27) |
|---|---------|---------|---------|-------|-------|--------------|
| Excess mortality per million (f) ⁵ | 2264 | 5450 | 1676 | 3649 | 2762 | 2790 |
| GHSI (0-100) | 56.9 | 48.8 | 65.5 | 51.9 | 60.9 | 56.6 |

⁵ Data retrieved on December 29th 2022 <https://ourworldindata.org/excess-mortality-covid>.

To situate the COVID-19 pandemic response into overall resilience understanding, seeking the broad socio-metabolic context of the present pandemic response, the degrowth donut visualisations of the five case countries are presented. Donut mental model can provide emerging alternative methodology for future detailed research in transdisciplinary understanding of resilience. Together with the pandemic response performance they combine the theoretical exploration of resilience of societies with understanding the need of empirical multidimensionality in the context of destructive forces of the current socio-economic system. The donut visualisations provide a graph for each analysed country with numeric input values of specific indicators visually mapped against the donut's safe and just operating space (SJOS; (Pulselli, Pires and Galli, 2016.) framework as either overshoots or shortfalls (conical red areas) (Figure 1.). Thresholds for the safe and just operating space were defined using established benchmarks from sustainability science (e.g., per capita CO₂ emissions targets for climate goals). Data normalization techniques were applied to ensure comparability across indicators and countries. The values and ranges, together with sources, for indicators are listed in Appendix A.

One way to explore whether the degrowth donut framework can reveal meaningful differences in resilience across countries with varying pandemic performance is to visually compare the patterns of social, biophysical, and socio-metabolic transgressions and shortfalls within the safe and just operating space (SJOS). When examined through the subset of 18 indicators used in this article, the most pronounced differences between better and worse pandemic performers emerge within the cultural and social foundation segment, rather than within biophysical or socio-economic dimensions alone. This suggests that societal responses to a zoonotic pandemic were strongly conditioned by socio-cultural orientations that shape collective action and public compliance during crises.

A comparative inspection of the donuts shows that the frequency and intensity of cultural transgressions and shortfalls increase systematically when moving from better to worse pandemic performers. While all five countries exhibit some degree of boundary overshoot within the cultural segment, the most salient differentiating indicator is the perceived democratic deficit (DP). Overshoots on this indicator become progressively more pronounced from Germany through Austria and Spain to Italy and Croatia. This pattern points to increasing dissatisfaction with democratic functioning and institutional legitimacy in countries that experienced poorer pandemic outcomes.

In contrast, the culturally most resilient case Germany displays minimal transgression on DP and comparatively favourable positioning across several cultural and social-foundation indicators, with most values remaining close to or within the defined SJOS. This finding aligns with broader evidence that perceived institutional legitimacy and democratic confidence play a critical role during moments of crisis, particularly when public cooperation and acceptance of restrictive measures are required. In this sense, cultural indicators such as democratic deficit perception, climate change denial-

ism (CD), and prioritisation of renewable energy (RP) do not function as predictors of viral transmission, but rather as structural expressions of value orientations that condition how societies collectively respond to systemic shocks.

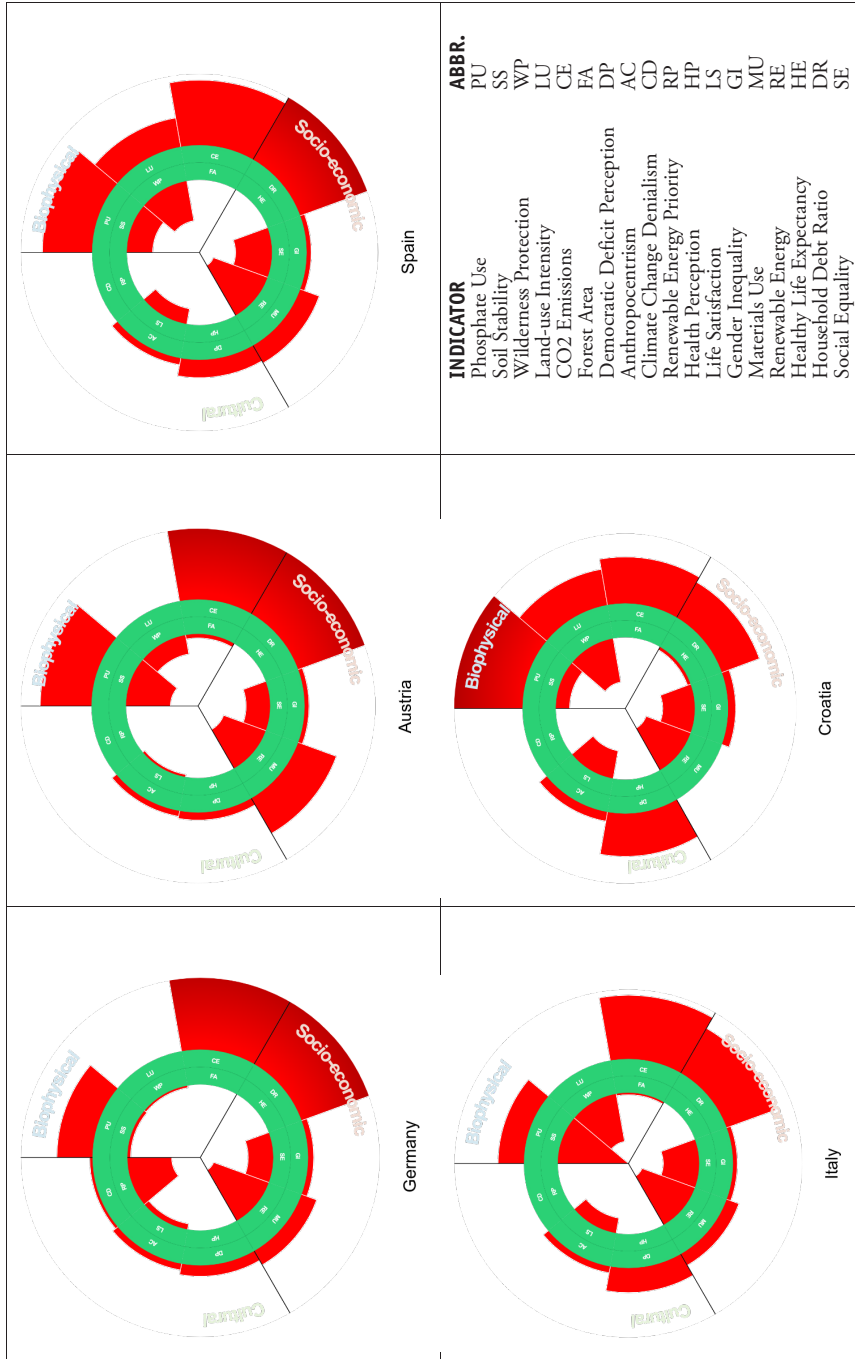
Consistent with this interpretation, countries performing better during the pandemic also tend to score more favourably on indicators related to social well-being and cohesion, including life satisfaction (LS), health perception (HP), and lower gender inequality (GI). Together, these indicators capture aspects of social stability and perceived fairness that support short-term adaptive capacity by facilitating trust in public action and compliance with collective measures. As demonstrated in earlier research, vaccination uptake and adherence to public-health interventions are shaped not only by access and infrastructure, but also by legitimacy-related and normative dimensions embedded in broader cultural contexts (Bagić, Šuljok and Ančić, 2022.).

At the same time, the donut visualisations reveal a structural paradox. Countries that perform well on cultural and social foundations frequently exhibit greater biophysical overshoot, particularly with respect to CO₂ emissions (CE), land-use intensity (LU), and material use (MU). This indicates that societies better equipped to manage the immediate social dimensions of a pandemic are often those whose socio-metabolic profiles contribute most strongly to ecological degradation. The donut framework makes this tension visible by juxtaposing cultural resilience with biophysical limits, thereby illustrating that short-term crisis responsiveness does not automatically translate into long-term socio-ecological resilience.

With regard to socio-metabolic conditions, Italy and Croatia display relatively low per-capita material use (MU), while Austria, Germany, and Spain exceed the defined threshold more substantially. This pattern reflects broader developmental trajectories of late-industrialised economies. These higher-throughput systems are further characterised by elevated household debt ratios (DR), especially in countries with more financialised welfare and credit regimes. While debt accumulation may partly reflect pandemic-related economic buffering, its precise role in shaping resilience remains ambiguous and warrants longitudinal investigation. Access to credit may have supported short-term coping during the shock, while simultaneously increasing longer-term vulnerability.

Finally, the combined configuration of biophysical and social foundation indicators reveals more pronounced shortfalls in lower-performing pandemic cases, particularly with respect to social equality (SE) and wilderness protection (WP). These patterns invite further research into how inequalities in social protection and environmental stewardship interact with crisis response capacities. Rather than identifying single causal drivers, the degrowth donut highlights how constellations of cultural, socio-metabolic, and biophysical conditions jointly shape both adaptive capacity and structural vulnerability in the face of systemic shocks.

Figure 1.
Degrowth donuts from best (top) to worst (bottom) pandemic performers



The degrowth donut visualisations reveal distinct patterns of divergence across the five countries included in the analysis. These differences are observable across cultural, social foundation, socio-economic and biophysical dimensions of the safe and just operating space (SJOS), and correspond broadly to variation in pandemic performance.

Within the cultural segment, Germany and Austria display the lowest levels of transgression, particularly on the indicator of democratic deficit perception (DP). Germany records a mean DP value of 3.58 and Austria 3.50, both remaining below the defined threshold. Spain occupies an intermediate position (DP = 4.17), while Italy (DP = 4.79) and especially Croatia (DP = 6.64) exceed the threshold, indicating pronounced cultural overshoot. This gradient is visually apparent in the increasing size of the red wedges in the cultural segment when moving from Germany towards Croatia.

Differences are also evident across indicators related to social foundations. Germany and Austria exhibit comparatively higher life satisfaction (LS = 7.08 and 7.29, respectively) and favourable health perception scores (HP = 2.31 and 2.01). Spain and Italy report lower life satisfaction (LS = 6.4 and 6.39), while Croatia displays the lowest value among the five countries (LS = 5.5). Social equality (SE) follows a similar pattern, with Germany and Austria showing smaller shortfalls than Italy, Spain, and Croatia. Gender inequality (GI) remains low across all countries but is slightly higher in Croatia (GI = 0.12) compared to the other cases.

In contrast to the cultural and social indicators, biophysical indicators display an inverse pattern. Germany and Austria exhibit the highest levels of overshoot with respect to CO₂ emissions (CE = 8.52 and 8.25 t/cap/year) and material use (MU = 21.8 and 31.99 t/cap). Spain shows intermediate values on both indicators, while Italy (CE = 5.6; MU = 20.72) and Croatia (CE = 4.62; MU = 14.54) remain closer to, or below, the defined thresholds. Similar contrasts are visible for land-use intensity (LU) and wilderness protection (WP), with lower-performing pandemic cases generally displaying greater shortfalls in protected areas.

Socio-economic indicators further differentiate the cases. Household debt ratios (DR) are highest in Spain (93.0%), Germany (84.7%), and Austria (82.7%), while Italy (61.6%) and Croatia (53.8%) remain below these levels. Healthy life expectancy (HE) exceeds the defined threshold in Germany, Austria, Spain, and Italy, but falls slightly below it in Croatia (HE = 68.6).

Overall, the results show that countries with stronger pandemic performance tend to cluster around lower cultural and social foundation transgressions, while simultaneously exhibiting higher levels of biophysical overshoot and socio-metabolic intensity. Conversely, countries with weaker pandemic performance display fewer biophysical overshoots but larger cultural and social shortfalls.

4. Discussion

The empirical patterns observed in the degrowth donut visualisations reinforce the central theoretical claim of this paper: resilience cannot be meaningfully understood through single dimensions such as institutional capacity or economic development alone, but must be situated within a broader socio-ecological configuration. The results demonstrate that differences in pandemic performance are most closely aligned with variation in cultural and social foundation indicators, rather than biophysical ones.

Countries exhibiting stronger pandemic performance—most notably Germany and Austria—are characterised by lower perceived democratic deficits and more robust social foundations, including higher life satisfaction and favourable health perceptions. These cultural and social conditions likely supported coordinated collective responses during the pandemic by shaping how public measures were perceived, accepted, and enacted. Rather than functioning as predictors of epidemiological outcomes, these indicators reflect deeper value orientations and legitimacy structures that condition societal behaviour under conditions of uncertainty and crisis.

At the same time, the results expose a structural paradox at the core of contemporary resilience debates. The same countries that appear culturally and socially well-positioned to manage an acute crisis are also those that most strongly exceed biophysical thresholds. High material use, elevated CO₂ emissions, and intensive land use in Germany and Austria indicate socio-metabolic regimes that rely on substantial ecological throughput. From a degrowth and socio-ecological resilience perspective, this configuration suggests that short-term adaptive capacity may coexist with, and even depend upon, patterns of resource use that undermine long-term sustainability and increase exposure to future systemic risks, including zoonotic spillovers.

Conversely, Italy and Croatia demonstrate that lower ecological pressure does not automatically translate into higher resilience. While both countries remain closer to biophysical limits, their larger cultural and social shortfalls—most prominently reflected in democratic deficit perception, lower life satisfaction, and weaker social equality—coincide with poorer pandemic performance. This finding challenges interpretations that equate reduced environmental impact with resilience, and instead highlights the importance of social cohesion, legitimacy, and perceived fairness as necessary conditions for effective crisis response.

Socio-economic indicators such as household debt further complicate the picture. Higher debt ratios in better-performing countries may have facilitated short-term economic buffering during the pandemic, but they also raise questions about the durability of such coping strategies. From a resilience perspective, debt-based buffering can be interpreted as a form of adaptive capacity that postpones, rather than resolves, structural vulnerabilities—a dynamic consistent with critiques of growth-oriented and financialised resilience strategies.

Taken together, these findings support the argument that resilience should be conceptualised as a multi-dimensional and temporally differentiated phenomenon. The degrowth donut model makes visible how short-term crisis responsiveness and long-term socio-ecological stability may diverge, revealing tensions obscured by narrower institutional or economic indicators. COVID-19 thus appears not merely as a stress test of governance capacity, but as an episode that exposes the contradictions of development trajectories in which cultural resilience is achieved through socio-metabolic arrangements that erode the ecological foundations of future resilience.

The findings presented here should be interpreted in light of the analytical logic of the degrowth donut framework. The model is employed as a heuristic and integrative tool, not as a predictive or causal model of pandemic outcomes. By focusing on a theoretically selected subset of 18 indicators, the analysis prioritises structural socio-ecological conditions relevant to resilience under an exogenous shock, while inevitably omitting other dimensions commonly addressed in resilience research. The selected indicators capture slow-moving cultural, social, and socio-metabolic characteristics that shape collective responses, rather than short-term behavioural dynamics.

The use of secondary data drawn from multiple sources and reference years introduces temporal heterogeneity, but this reflects the model's purpose of situating pandemic performance within longer-term socio-ecological trajectories rather than providing year-specific diagnostics. Moreover, the visual, non-aggregative nature of the donut avoids false precision by refraining from weighting or causal attribution, instead highlighting patterns of overshoot and shortfall across dimensions. Finally, the theory-driven comparative design limits generalisability but strengthens conceptual clarity by illustrating how different configurations of cultural, social, and biophysical conditions condition resilience. In this sense, the degrowth donut complements rather than replaces conventional institutional or epidemiological analyses, offering a reflexive lens on the structural tensions underpinning short- and long-term resilience.

Taken together, this reflexive reading of the empirical results shifts the focus from explaining pandemic performance toward identifying the deeper socio-ecological conditions and contradictions that must be addressed if resilience is to be rethought beyond crisis management and toward long-term transformation.

5. Concluding remarks

Interest in resilience has expanded across multiple academic disciplines as the risks of socio-ecological destabilisation and collapse have become increasingly evident over recent decades. This article contributes to these debates by advancing a transdisciplinary conceptualisation of resilience that situates pandemic responses within broader socio-ecological configurations, rather than treating them as isolated outcomes of institutional performance or economic development. By applying the degrowth donut

as an empirical and analytical framework to five European countries, the study adopts a different ontological and theoretical perspective on resilience in the society–nature nexus. The donut visualisations reveal distinct patterns of transgression and shortfall across cases, demonstrating that differences in pandemic performance are most clearly reflected in cultural and social foundation dimensions, rather than in biophysical or socio-economic indicators alone. This finding suggests that societal responses to zoonotic pandemics, despite their biophysical and infrastructural nature, are strongly conditioned by socio-cultural contexts that shape collective action and legitimacy.

At the same time, the analysis highlights that resilience cannot be reduced to a single desirable state or a simple “bounce-back” capacity. The safe and just operating space defined by the degrowth donut accommodates multiple potential configurations of resilience, reflecting different developmental pathways and trade-offs. The juxtaposition of cultural robustness with biophysical overshoot in higher-performing pandemic cases underscores the importance of adopting both synchronic and diachronic perspectives on resilience. While synchronic analysis draws attention to struggles over rules, resources, and power during moments of crisis, a diachronic perspective emphasises the path-dependent conditions that shape societies’ capacity to respond and transform over time (Archer, 1982.). This temporal differentiation helps explain why short-term adaptive capacity may coexist with longer-term socio-ecological vulnerability, complicating linear interpretations of resilience.

From a policy perspective, these findings underscore the need for integrated resilience strategies that address cultural, social, and biophysical dimensions simultaneously. Strengthening democratic functioning, reducing social inequalities, and improving social foundations such as health and well-being are not only normative goals, but also structural conditions that support coordinated responses to systemic shocks. At the same time, resilience policies that neglect socio-metabolic constraints risk reproducing development trajectories that intensify ecological overshoot and future vulnerability. In this sense, the degrowth donut provides a valuable epistemic and practical tool for envisioning and operationalising resilience beyond crisis management. By identifying specific patterns of transgression and shortfall, it can support context-sensitive prioritisation of interventions and inform future research through longitudinal analyses and participatory approaches. As zoonotic pandemics and other systemic disruptions are likely to recur, advancing resilience will require not only adaptive capacity, but also deliberate socio-ecological transformation toward sustainable and just modes of living and producing.

Appendix A

Table of Degrowth Doughnut themes, indicators, calculation parameters – input values for Austria, Croatia, Germany, Italy, and Spain, boundaries (B) and thresholds (T) – indicator unit, data source, and the input value reference year.

| INDICATOR | ABBR. | Germany | Austria | Spain | Italy | Croatia | B or T | UNIT (good>bad) | SOURCE |
|-------------------------------|-------|---------|---------|-------|-------|---------|--------|--|--|
| Phosphate Use | PU | 20.49 | 25.05 | 24.52 | 17.96 | 33.72 | 4.5 | kg/ha/yr | kg/ha/yr (5 yr. avg.) |
| Soil Stability | SS | 1.3 | 15.5 | 9 | 24.93 | 5.12 | 0 | % of area at risk of severe soil erosion | EUROSTAT |
| Wilderness Protection | WP | 31.8 | 24 | 14.51 | 10.37 | 12.38 | 33 | % of territory as protected area | The World Bank |
| Land-use Intensity | LU | 0 | 0.04 | 0.55 | 0.29 | 0.61 | 0.3 | ha/cap | European Environment Agency and The World Bank |
| CO2 Emissions | CE | 8.52 | 8.25 | 5.58 | 5.6 | 4.62 | 2 | t/cap/yr | European Commission (EDGAR) |
| Forest Area | FA | 33.9 | 30.9 | 36.9 | 31.8 | 49 | 33 | % of total land area | The World Bank |
| Democratic Deficit Perception | DP | 3.58 | 3.5 | 4.17 | 4.79 | 6.64 | 5.5 | Mean value (1>10) | Joint European Values Study/World Values Study (2017-2020) |
| Anthropocentrism | AC | 8.43 | 8.49 | 8.4 | 8.41 | 8.17 | 9 | Mean value (12>3) | European Values Study (2008) |

| INDICATOR | ABBR. | Germany | Austria | Spain | Italy | Croatia | B or T | UNIT (good>bad) | SOURCE |
|---------------------------|-------|---------|---------|-------|-------|---------|--------|--|---|
| Climate Change Denialism | CD | 35 | 33 | 26 | 32 | 24 | 33.3 | % of responses | The European Investment Bank Climate Survey 2019-2020 |
| Renewable Energy Priority | RP | 52.2 | 95.8 | 85 | 83.4 | 79.9 | 66.6 | % of responses | European Social Survey (2016) and International Social Survey Programme (2016) |
| Health Perception | HP | 2.31 | 2.01 | 2.28 | 2.17 | 2.15 | 2.5 | Mean value (1>5) | European Social Survey (2018) and joint European Values Study/World Values Study |
| Life Satisfaction | LS | 7.08 | 7.29 | 6.4 | 6.39 | 5.5 | 7.5 | Mean value (10>0) | The World Happiness Report (2020) |
| Gender Inequality | GI | 0.08 | 0.07 | 0.07 | 0.07 | 0.12 | 0 | UNDP GI index score | United Nations Development Programme (UNDP) |
| Materials Use | MU | 21.8 | 31.99 | 23.55 | 20.72 | 14.54 | 15 | t/cap | UN IRP Global Material Flows Database, adapted by Vienna University of Economics and Business (materialflows.net) |
| Renewable Energy | RE | 17.35 | 33.63 | 18.35 | 18.16 | 28.47 | 90 | % of total final energy consumption | EUROSTAT and The International Energy Agency (IEA) |
| Healthy Life Expectancy | HE | 70.9 | 70.9 | 72.1 | 71.9 | 68.6 | 70 | years | World Health Organization |
| Household Debt Ratio | DR | 84.7 | 82.71 | 93.01 | 61.56 | 53.83 | 25 | Average household debt-to-income ratio, as % | EUROSTAT |
| Social Equality | SE | 17.4 | 16.9 | 25.3 | 25.6 | 23.3 | 100 | % of population not at risk of poverty or social exclusion | EUROSTAT |

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Preispitivanje socio-ekološke otpornosti: pouke iz pandemije COVID-19 i modela odrasničke krafne

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Sažetak

Ovaj rad razvija socio-ekološko razumijevanje društvene otpornosti smještajući odgovore na pandemiju bolesti COVID-19 u šire konfiguracije kulturnih orijentacija, društvenih temelja i socio-metaboličkih pritisaka. Nadovezujući se na rasprave o otpornosti u ekologiji i društvenim znanostima, rad argumentira da se otpornost ne može svesti isključivo na sposobnost „povratka u prijašnje stanje“ niti na institucionalnu spremnost, budući da društva mogu biti otporna i u nepoželjnim stanjima, te da kratkoročna uspješnost u kriznim situacijama može koegzistirati s dugoročnom ekološkom ranjivošću. Kako bi operacionalizirao ovu perspektivu, rad primjenjuje socio-ekološki model odrasničke krafne („degrowth donut“), koji mapira položaje država u odnosu na siguran i pravedan prostor djelovanja. Koristeći teorijski utemeljen komparativni dizajn, analiza obuhvaća pet europskih zemalja — Austriju, Hrvatsku, Njemačku, Italiju i Španjolsku — kroz odabrani skup od 18 indikatora koji proizlaze iz biofizičkih granica, socio-metaboličkog protoka te kulturno-institucionalnih i društvenih dimenzija. Rezultati pokazuju da se razlike u uspješnosti odgovora na pandemiju najjasnije povezuju s razlikama u kulturnim i društvenim indikatorima (primjerice percipirani demokratski deficit, zadovoljstvo životom, percepcija zdravlja i društvena jednakost), dok zemlje s boljim kratkoročnim pandemijskim ishodom često istodobno bilježe veći biofizički prekoračaj, osobito u pogledu emisija CO₂ i materijalne potrošnje. Nalazi upućuju na strukturni paradoks u središtu suvremenih rasprava o otpornosti: neposredna sposobnost prilagodbe može biti omogućena socio-metaboličkim režimima koji dugoročno narušavaju socio-ekološku stabilnost. Rad zaključuje da odrasnička krafna predstavlja heuristički alat za komparativnu procjenu otpornosti, koji osvjetljava nužne kompromisne odnose i podupire pomak od upravljanja krizama prema promišljenoj socio-ekološkoj transformaciji.

Ključne riječi: društvena otpornost, socio-ekološki sustavi, COVID-19, odrast, model krafne, siguran i pravedan prostor djelovanja, socio-metabolizam, kulturne orijentacije.