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ESD Ideas: Positive tipping points towards global regenerative systems

J. David Tàbara

Department of Geography, Autonomous University of Barcelona, Campus UAB, Cerdanyola del Vallés (Barcelona), Catalonia, Spain

Correspondence: J. David Tàbara (jdt@sustainabilogy.eu)

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Abstract. Coping with the threats posed by multiple negative Earth tipping points calls for large coordinated actions conducive to creating long-lasting positive synergies between human and biophysical systems. Boundary concepts, engaging narratives and aspirational visions play a crucial role in coordinating the kinds of deliberate transformations needed to address global existential challenges. The regenerative sustainability vision and paradigm offers such an enabling cognitive and discursive capacity to integrate the insights from social and natural sciences so net-positive tipping points towards a safe and just space for humanity can better be operationalised, coordinated and enacted within and across multiple kinds of social–ecological systems.

1 Introduction

Our world is a world of systems of systems: energy systems, agrifood systems, financial systems, urban mobility systems, information systems, educational systems, religious systems and many others; each of them operates under its bounded rationalities – organisational and normative rules that justify its existence in different ways. Each system also has its effects on other systems, which can be detrimental or beneficial to the goals and development of these other systems. Given such complexity and heterogeneity, social scientists conceptualise each system change using different approaches and metrics from natural scientists. So when transdisciplinary teams meet together to try to find transformative pathways and solutions to cope with large and existential risks, like those posed by Earth tipping points, not only might different individuals look at different systems, but they might also look at a same system in different ways.

Hence, robust knowledge and actions aimed at dealing with the increasing threats of negative Earth tipping points not only require reflexive spaces conducive to mutual learning among such a diversity of perspectives, but also require engaging narratives and visions, of higher-order concepts, that are able to provide an actionable sense of the complexity entailed in understanding such threats. In this contribution, I argue that the regenerative sustainability paradigm offers such a cognitive, discursive and collective capacity to integrate the insights from diverse social and natural sciences in a way that *net-positive tipping points* can better be operationalised, coordinated and enacted within and across multiple kinds of social–ecological systems and actions.

2 From less harm to net-positive tipping points

A tipping point can be defined as the moment at which a relatively small additional force of change makes a complex system adopt a fundamentally different configuration and long-term dynamics, either by embarking on a new development trajectory or by evolving around a new system's attractor. In the case of positive tipping points that happen in social–ecological systems (Tàbara et al., 2018a; Lenton, 2020; Otto et al., 2020), we assume that the new dynamics contribute to improving the quality of life and long-term human sustainability and thus can help avoid existential risks derived from negative global environmental change.

Nevertheless, a major difficulty in conceptualising positive tipping points has to do with agreeing on what positive means. A dominant view in mainstream economics tends to assume and communicate to the larger public that an increase

in gross national product (GNP) is positive, while a reduction is negative. Such a narrow, short-term and exemptionalist (Dunlap, 1980) understanding of socio-economic development, however, tends to disregard the negative cumulative effects of past social–ecological interactions on the quality and quantity of life-support systems. Greenhouse gas emissions, biodiversity loss or the accumulation of persistent pollutants (usually not registered in corporate and national accounts as collective losses) also negatively affects future options and conditions for development. Hence, it is clear that a more nuanced and coupled understanding of wealth and development, that takes into account all the interactions and feedbacks – both positive and negative – with the natural world, is needed.

Alternatively, and using a whole-life systems' perspective, it can simply be argued that positive is what contributes to the maintenance, improvement and self-regeneration of social–ecological conditions that make human societies flourish and allow them to remain on Earth in the long term. On the other hand, negative simply constitutes the opposite, that which destroys life-support systems and degrades such basic sustainability conditions. A lot of the public discourses on sustainability, however, have focused on products and services that only contribute to generating "less harm" (< 0) or on policy commitments that aim at "neutral targets" ($= 0$), rather than actually improving social–ecological systems in net-positive terms (> 0). In this regard, *relative positive tipping points*, or those that focus on partial gains, may be associated with sectorial socio-technical transitions, while net-positive or *absolute positive tipping points* can be associated with those achieved by full-systems transformations; the latter tipping points entail changes across individual behaviours, social practices, relationships, and worldviews and eventually enhance the conditions for the self-regeneration of Earth life-support systems (Tàbara, 2023). Therefore, relative positive tipping points refer to those that are limited in scope, time and nature (e.g. either social or biophysical but not both) but that may eventually create rebound effects or further increase resource scarcities and inequalities. In contrast, absolute tipping points refer to those that contribute to improving both social and biophysical conditions or capitals and secure long-term sustainability in enduring, self-propelling synergistic ways.

3 Positive synergies between social and biophysical systems

Positive tipping points can occur in many social systems, for instance, when access to education, health services, or effective political participation and rights are granted to marginalised populations. But they also occur in biophysical systems, as happens when a previously degraded ecosystem eventually regains its properties and conditions for self-regeneration. Although social and natural scientists tend to focus on one or the other, a regenerative perspective of sustainable development means that positive synergies between both are required (see also Buckton et al., 2023; Smithwick et al., 2023). In a world moving towards possibly 10 billion people by 2050, coping with global risks will depend not only on the health of the ecosystems (e.g. the safe planetary boundaries; Rockström et al., 2021) but also, most importantly, on the possibility to improve the social conditions and institutions that ensure equity; social cohesion; mutual support; and effective, just, and trusted governance of the common good (Gupta et al., 2023).

Finding explicit, operational and visual means able to identify the requirements needed to move the present global development trajectory away from a degenerative attractor to a regenerative one is urgently required. This can be represented in Fig. 1, based on the SEIC (see subsystems below) conceptual model (Tàbara, 2023) in which all social–ecological systems and societies and individuals' interactions are seen to be inevitably conditioned by four kinds of subsystems of relations: structures and rules (S), energy and natural resource use (E), information and knowledge systems (I), and anthropogenic cumulative or depletive environmental change (C). In this guise, the model can also help to identify *the places to intervene* in a given social–ecological system, often referred to as leverage points. Thus, interventions aimed at improving social systems will mostly tend to focus on the S and I subsystems, whilst interventions seeking to improve biophysical systems interactions will namely concentrate on harnessing feedback and cumulative/depletive processes occurring in E and C subsystems and reorient them towards a regenerative trajectory. However, for a net-positive tipping point to be realised, transformations in all of the subsystem relations need to happen at the same time in a coordinated and synergistic way.

Thus, the two horizontal axes of Fig. 1 represent, on the left-hand side, variations in social system conditions and equity that make social cohesion, good governance, and agents' cooperation and collaboration possible as to take collective action, while the right-hand axis represents changes in the quality and quantities of the biophysical stocks necessary for the long-term integral functioning of life-support systems. Achieving partial gains – or relative tipping points – that only improve equity and social conditions but in ways that eventually lead to the depletion or degradation of biophysical conditions – ecological capitals or stocks – will eventually turn into a negative system tipping point (Q2). Similarly, gains in environmental protection, Earth system's safety or the improvement in the quality of ecosystems that are achieved at the cost of social equity and participation eventually are also likely to be rejected or undermined and result in a negative tipping point (Q3). Contexts or societies lacking fair and competent governance structures, as is the case for countries with rampant corruption or inequality, are also likely to deteriorate to further ecosystems degradation; thus, the whole social–ecological dynamics will descend and

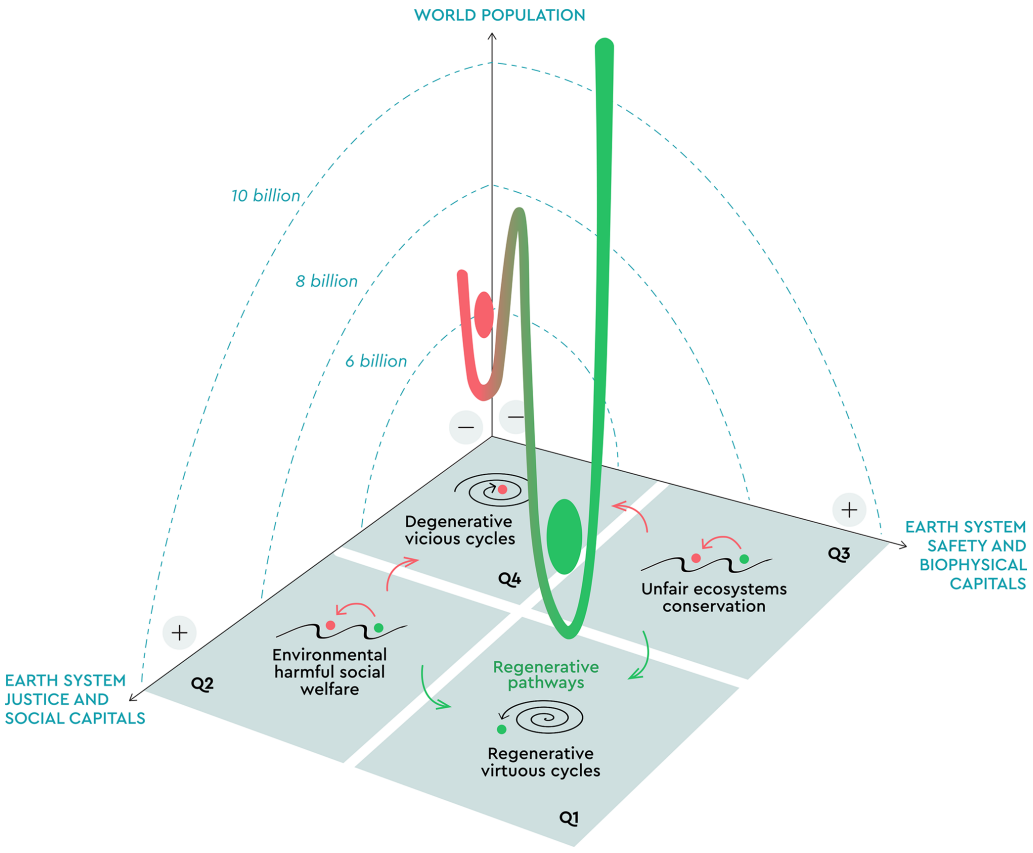

Figure 1. Achieving a global net-positive tipping point towards a regenerative attractor that increases the safe and just operating space for humanity in a world moving towards 10 billion people requires synergising fast improvements in global social conditions (or capitals) and biophysical conditions across multiple levels of individual and collective actions (Based on Tàbara, 2023).

propagate into a full-systems negative tipping point (Q4). It is only by creating self-propelling virtuous cycles that improve *at the same time* the just and safety conditions in multiple kinds of systems that net-positive absolute tipping points may be achieved (Q1), and in this mode, net-positive tipping points occurring at lower levels of human–biophysical interactions, e.g. at individual or organisational ones, may contribute to move the whole global system towards a regenerative system development trajectory. In this upper system attractor, the "ecospace" (or the just and safe space for humanity; Gupta et al., 2023) would expand, as represented by the growing green dot, contrary to what would occur in the lower system' attractor, represented by the shrinking red dot.

In a nutshell, Fig. 1 underlines in a very synthetic way that (1) equity issues are at the core of the dynamics on net-positive tipping points; (2) population trends cannot be omitted when thinking about global tipping points, as tipping points are also affected by the scale of the system of reference; and (3) moving towards a safe and just development corridor for humanity depends on transforming whole-system social–ecological interactions across all levels of human agency so that absolute, net-positive tipping points can be achieved.[1]

4 Conclusion

Coping with the large systemic risks posed by negative Earth tipping points needs the coordination of multiple kinds of systems in a way that all can contribute to the just improvement and renewal of the social–ecological conditions that make human life possible on Earth in the long term. Aspirational visions and narratives towards regenerative futures can play this role, because they are necessarily inclusive and engaging – as after all, the challenge of sustainability is a large-scale global engagement challenge. This is also so because

[1]Please note that the number of people that there will be in the world is not an indication at all about how much ecospace (Gupta et al., 2023) there will eventually be available to secure dignified life conditions for the future generations living then. Such an ecospace will mostly be dependent on the extent that just and synergistic necessary institutional arrangements and policies are able to move societies towards the upper attractor and how they can be implemented in a fair way, e.g. following principles of transformative and Earth systems' justice.

moving towards a global regenerative trajectory or regenerative global systems' attractor (and contrary to Malthusian positions) needs everybody's capacities and sources of transformative imagination (Galafassi, 2018) to expand and improve the social–ecological space in which everyone in a world of 10 billion people can potentially be better off. The regenerative sustainability vision and paradigm can contribute to coordinate the many kinds of transformations needed to achieve a net-positive tipping point at a global scale. In this regard, when goals conflict (e.g. between short-term individual interests and long-term collective ones) and impede achieving a better off whole-system situation, it may be useful to explore the role of inclusive win–win solutions able to turn defective strategies into collaborative ones (Jaeger et al., 2012; Tàbara et al., 2013; Hinkel et al., 2020). This may require reframing original perspectives, creating new coalitions of action, or finding new welfare metrics and processes able to reassess and redistribute wealth under strong equity principles that can be supported, again, by open transdisciplinary research.

The framework provided here underlines the fact, especially at the global social–ecological system level, that there are no neutral interactions: all have either positive or negative effects, or as argued by Fath (2007),

> all objects in an ecological network are related … and … interact with the others in the web: there are no null community-level relations.

Hence the regenerative narrative goes beyond ecological restoration, because it is mostly a relational social–ecological approach that can inspire transformative actions across individuals, organisations and large systems and encompasses many cultural, political and lifestyle dimensions. That is, it considers many social–ecological interactions that are not limited to those biophysical phenomena traditionally studied by natural scientists. Therefore, it does not disregard but instead also includes the urgent need to stop the destruction of the conditions and ecological links that ensure the integral functioning of the biosphere in the first place.

The overall argument behind the ideas of global regenerative systems and of a plausible positive tipping point toward a global regenerative development pathway is that, if it ever comes to happen, it must be built on the conditions generated by endless numbers of positive tipping points at lower system' levels (Tàbara et al., 2019). The quadrants at the base of the 3D figure intend to represent these complex system dynamics at lower levels: fundamental qualitative changes at higher systems' levels may result from relatively slow, nonlinear but cumulative dynamics building the conditions that at one point may create a window of opportunity for whole system's transformation. But without the constitution of such previous enabling conditions, even if one abrupt or potentially disruptive event occurs, such a transformation may not happen. And even when they happen, as is the case for extending and institutionalising human rights to marginalised populations, they may only endure in time to the extent that continuous reinforcing learning feedbacks are able to renew and improve original paradigms, mechanisms and practices in which such new institutions operate, e.g. through second-order sustainability learning (Tàbara and Pahl-Wostl, 2007; Pahl-Wostl, 2009). Hence, transdisciplinary science in this domain would not only be researching "what is the problem" but namely "who is part of the solution" and how can these agents be empowered (Tàbara et al., 2018b) through sustainability learning as to create positive synergistic interactions with the natural world at all systems' levels. All in all, this is a massive complex process which could be supported and reconfigured with the help of the proposed coordinating narrative.

However, much transdisciplinary and integrated research is yet lacking and still required to understand, operationalise and foster the potential synergies between improvements in global social–ecological conditions and biophysical capital regeneration so as to guarantee a safe and just space for humanity.

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