

The decade ahead: science, power, resources, health, time. With or without a narrative.

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The following most plausible scenario for the next 40 years: capitalism (it persists, but changes strongly); economic growth (weak because affected by access to resources); democracy (still standing, with variations of authoritarianism imposed by the degradation of ecosystems); intergenerational relations (bad, because young people struggle to change their condition); climate stability (very altered, especially after 2050). According to Randers (2011).

The selective and even capricious acceptance of science and knowledge and the mistrust in public policies go sometimes hand in hand. They have frequently ended up in the avoidance or rejection of most, though rather shy, attempts to embark on ecological transition trajectories: departing from business as usual turned out a go-and-stop affair in public policies since decades. All this suggests that we are far from understanding the depth and extent of the downturn / swing over we are supposed to go through at this high time for a civilization bifurcation. Except for local spots of empowerment initiatives (Bennet et al, 2016), little or nothing in sight to tell when and where such a bifurcation is going to happen. And whether it would occur in a consented and coordinated manner.

Problems and facts being generally open, indeterminate, contested (Hulme, 2020), together with structural obstacles to overcome, what could be the actual ratchet or lever?

Let us assume that the mission of science is working for the benefit of mankind and its life support systems. Today, science is expected to define where we stand and how and by what means can societies achieve sustainability. Is Science the ignition point of change? But is it in the capacity to take on / up THAT challenge?

Otherwise, narratives could be the answer, with values and science as the common language of trust and sens. We are not short of great narratives, but rather of clarification on the intrinsic goals of world readings, and the explicit overlaps and gaps between such theories and conceptions of society and the world.

Three issues and questions to better grasp the difficulty of the task and a dilemma - why or how ideas and initiatives are born, and subsequently thrive or die.

Q1 – Human history, according to one of the fathers of the economy science, Alfred Marshall, has shown that human needs expand with knowledge, technology, and material richness. Since perpetual growth (economic, demographic, etc.) on a finite planet is a fiction, what narrative and ethics for a livable world?

Q2 – Power systems (i.e. the multidimensional logic of unbridled competition, immoderation, prestige; Kissinger, 2014) are the combined control on resources: physical + informational / data + institutional (Ottersen et al, 2014). What narrative and ethics to counteract the melting down of the common good?

Q3 – Is mainstream science (beyond its perpetual exploration of the frontiers of knowledge) being concerned by the same nature as the one we see being exhausted, looted, commodified? The same question holds true for the human condition, with emphasis on tech-innovation and social dumping. Thus, does mainstream science (economic studies, in particular) address – through the consolidation and articulation of systemic knowledge and integrated approaches - the social, environmental, and diplomatic / geopolitical emerging challenges (Goodall and Oswald, 2019)? What narrative and science with half of mankind in bad shape and fundamental human rights out of reach (Colombet et al, 2020; Laurent, 2020; Collart Dutilleul, 2021)?

The above entitles questioning what the meaning and definition of progress, growth, development, and wealth are. This is not new debate. Darwin, for example, was cautious about the term progress and rather spoke of progression. Growth has been challenged since the report to the Club of Rome (Meadows et al, 1972). Because progress and innovation are ambivalent, reversal of hierarchies and contexts in societies are common place in history (Acemoglu and Robinson, 2013). Turkey and China are in that perspective examples of choice. Or the drafting of the post-2008 crisis Icelandic constitution, combining the drawing of lots, election, participation and referendum, that provided an opportunity to reflect on democratic institutions (Buge, 2020).

Below we attempt exploring the connections between the raised questions and issues. By focusing on food and health, primary resources, equity and thus justice, we posit that addressing these issues first will trigger a cascade effect in other areas of societal change (Negrutiu et al, 2020; Herrero et al, 2020).

1. The time of consequences is also a time of confusion

Major alterations and state shifts in socioecological systems have been predicted to take place from 2030 on (Meadows et al, 1972 and 2005; Barnoski et al, 2012), with social systems being, according to our understanding, more vulnerable than ecosystems (also see Butzer, 2012). And socially fairer societies being more resilient than less egalitarian ones (Motesharrei et al, 2014). With mankind exposed to the so called *perfect storm* (the cumulative, interacting, and accelerating effects of current crises), an ambient existential confusion and dissolution of the critical sense ensued: alienated consumers replaced concerned citizens. The existential disruption builds on information saturation, acceleration of time, competition.

With science getting trans-disciplinary and systemic, social and technological issues and innovations have jointly been considered: they constitute the two sides of the same coin. The most powerful innovation of human societies likely resides in social organization making. Which in turn supports innovation capacities to create objects and produce them (Latouche, 2004). More and more scholars argue that at present social innovations are more pressing and should play an increasing role in sustainable transitions as compared to technological innovations alone (see for ex. De Schutter, 2014; Herrero et al, 2020). Bernard Stiegler (2001) put it more bluntly: the inevitability of sometimes beneficial contributions of technology.

While the reciprocal interplay between social and technological factors has been a constant over time, we enter the era of sociotechnical trade-offs that necessarily involve a host of sociocultural, economic, ethical, and political mediators. These aspects should be addressed through “impact pathways” analysis to evaluate the processes by which a technology or bundles of technologies create change (Herrero et al, 2020). For example, socioeconomic factors mediate the effect of novel technologies via a cascade of responses across various parts of the food system with multiple incremental contributions across private, public, and civil sectors.

At the same time, socioecological approaches to development gained influence (Binder et al, 2013; Mote et al, 2020; Laurent, 2020), being driven by both ecological and ethical values with deep trans-generational implications. Also, trends in the evolution of the individual and the social (collective) “brain” have been highlighted (Harari, 2017; Bohler, 2020) in the perspective of a civilization shift. A civilization in which society and nature make one and in which development is seen more in terms of justice and health rather than the progression of GDP (Acunzo et al, 2018; Laurent and Jouzel, 2018).

To those various ends, science is encouraged to support social and resource justice (no ecological and social dumping) and concentrate efforts on technologies that help address the environmental limits (or planetary boundaries) (Mote et al, 2020; Negrutiu et al, 2020).

1.1 The triple trap of primary strategic resources: land/soil, water, biomass.

Land, water, and biomass are rapidly degrading and so does the capacity to face shocks and risk. Geopolitics and demography show that the underlying stressors are not expected to relax in the future (Negrutiu et al, 2020).

Food security is critical in societal transitions because food (a biomass component) is the physiological equivalent of other energy concerns and a major constituent of health. Since half of mankind is under food distress, one can argue that this problem is a risky gap in policies dealing with energy transitions. Similarly, land use change – considered as the largest geo-engineering achievement of the human undertaking on earth (Verburg et al, 2015; the great “wander” on top of the designated ones?) is another gap on disjoint agendas and policies: any further increase in ecosystem anthropisation is expected to result in uncontrolled state shifts in the biosphere (Barnosky et al, 2012; Steffen et al, 2015). The water problem is on par with the land and biomass issues.

This triple trap clearly is a vicious triangle in which the ultimate global life factor, photosynthesis, is handicapped by the deterioration of the three terrestrial resources. Photosynthesis is part of the solar cosmic economy and drives biomass production. In turn, biomass is operating as water reservoir and is contributing to soil formation. Together, they function in water cycling and climate buffering.

But there is more about photosynthesis and the sun as cosmic capital. See our exercise on photosynthesis rate as limit to business profit building (<http://institutmichelserres.ens-lyon.fr/spip.php?article543>). Also, as Vera Bühlmann (2020) puts it when considering two “workshops” of nature that literally “treat” solar light, albeit in different ways: nuclear physics and organic chemistry. *While the splitting (and perhaps soon fusing) processes of nuclear physics produce light with matter, the processes of photosynthesis incorporate light through materiality. Of the two, only one, that of nuclear fission, has widely troubled philosophical discourses throughout the twentieth century. The other, that of photosynthesis, must be said to have been mastered in terms no less stunning than the latter, but with much less excitement,*

astonishment, and awe. She concludes on photosynthetic organisms that absorb and treat solar energy: *with them, and by them, the earth produces its atmosphere and lets the beings that populate its surface breathe.* And eat the biomass.

Now we know why, if not addressed properly, the triple trap could become a perfect crime: the combined health and life conditions of the biosphere, of human societies, and of terrestrial living beings depend primarily on the indivisible triangulation (land, water, biomass). That shared health is called one-health or planetary health (Whitmee et al, 2015). The systemic health approach is supposed to convince us that the demographic challenge and the carrying capacity of life support systems (i.e. the equilibrium between human demand and nature supply of ecosystem services and resources; Mota et al, 2020) are the foundations of the socioecological thinking to policy design and good practices.

The narrative for departing from the triple trap has been formulated and has the planetary health toolbox at its core (Negrutiu et al, 2020).

1.2 Reversing the food system logic is called food democracy for a shared health

It was important to first explain why change will have to start with food (see also UNEP, 2016). In developing countries such as China and Brazil, the top down policy approach to food had positive, fast, and large scale consequences (Acemoglu and Robinson, 2013). In OECD countries, the food issue will likely operate the other way around: the bottom up approach is expected to experiment change through food democracy.

Food democracy is a change of paradigm in food system governance (Bernard et al, 2019) as it reverses the socioeconomic and political perception of food: food as commodity (Vivero Pol, 2013) is becoming a public service and health issue. The current “from field to fork” strategy is shifting to “from fork to field” democratic practice. In consequence, the food systems (including farmer and rural smallholder rights) and the supporting core resources (land, water, and biomass) must be jointly addressed (Negrutiu et al, 2020; Herrero et al, 2020). The expected social and ecological implications are remarkable: voting with the fork means reclaiming the food people want to eat and thus what food and agriculture policy they support.

The food democracy narrative has recently been reviewed and enriched with a draft proposal under the auspices of the UN General Assembly and the WTO: *International convention on the protection and the promotion of food and agricultural diversity* (Collart Dutilleul, 2021). Enacting such a convention would have extensive effects on institutions, finance, economy, environment, and – more broadly - fundamental aspects of daily life.

1.3 The transgenerational strategic alliance – getting the long view and productive narrative(s).

The social condition of old and young people makes them open to a cordial and productive alliance. The elder have less power than they used to have, while the young generations are struggling to have their say. The former missed the sustainability momentum and eventually became wiser. The latter see that the options for a safe Earth to live on are far from obvious and are impatient to stop things go wild. Also, they are complementary on many other aspects of life. These two powerless groups should therefore be tempted to join forces and work in intelligence toward a new civilization contract. First by tackling contemporary inequalities and the issue of the commons, a precondition in addressing future generations concerns (supposing that this is something one can properly conceive, and unless the baseline is to sustainably stewardship the planet anyway). That understanding clears the path to shared responsibility and possibly stimulates a more collective anticipation capacity (Bohler, 2020). How rigorous science can help both understanding and anticipation is illustrated through chosen readings in the **Appendix**.

Assuming that the elder-younger tandem is the best we have to achieve a collective resolution for the future, that society-to-science experience is expected to source positive and productive narratives and impulse more readily the acceptance of changes to come.

2. Resources, justice, technology, and civilization

Global resources are at the core of personal, family, community, business, and state matters. Regionally and globally, resources are drivers of history’s ups and downs, of geopolitics. Be it military or soft power design, institutions with their political instruments (monetary, informational, etc.) are to the maneuver. Below, two issues that matter most.

(1) With 8 billion people in sight and the rush on global resources, the market, the exclusive property rights regimes and the associated conflicts on the one hand, and the Common Pool Resources and the preservation of the regeneration capacity of the biosphere on the other hand, raise concerns about resource justice ever becoming reality. For the latter, rights, duties, and responsibility are indivisible core principles, and that makes the real difference with the

former. Imagine a symbiotic society with balanced carrying capacity through adjusting resources with vital and sober needs (Serres, 1992; Mote et al, 2020; Collart Dutilleul, 2021; *Appendix*).

(2) Resources and technology are the tandem drivers of the Great Acceleration in the Anthropocene (Steffen et al, 2015) that put a heavy burden on the planet. On that one planet, with finite physical resources and no plan B option left, the leading threat of our time is the physical and chemical disruption of the biosphere (UNEP Chemical Outlook I and II, 2012 and 2019; Brooks et al, 2020), i.e. the global pollution. An externality resulting from the combined outputs of resource extraction, production, consumption, demography and inequality (Arguello and Negrutiu, 2019; Mote et al, 2020). It constitutes the leading determinant of non-communicable diseases and premature death in humans. Obviously, the global pollution generated by the 350,000 synthetic compounds released by human activities (Brooks et al, 2020 and refs therein) is the very landmark of the Great Acceleration and feeds all the other threats of the present (climate, biodiversity, water, air). Current agendas work in silos so there is no political and diplomatic design to tackle the problem at the root. Contrary to other challenges, science has no silver bullet to address the issue, the main reason being the difficulty to evaluate the cocktail effect of chemical mixtures and its dynamics. In consequence, all living beings are exposed in real time to cocktails that change over space and time. Unlike the rapid effects of epidemics such as Covid 19, the physico-chemical disruption is a slow systemic process and risk with long range consequences on planetary health. It is like indiscernibly suffering and slowly dying. However, pandemics and global pollution are synergic.

In its 2030 vision, “The Green Pact for Europe” (COM, 2019), the EU commission announced the adoption in 2021 of a “zero pollution” action plan for air, water, and soil. We quote: *The measures aim to combat pollution from urban runoff and new or particularly harmful sources of pollution, such as microplastics and chemicals, including pharmaceuticals. There is also a need to address the combined effects of different pollutants.* In addition to the awaited silver bullet of science and R&D (i.e. a revolution in chemical design), the legal and financial frameworks to be foreseen would constitute an unprecedented *tour de force* in the face of the current legal coding (Bourmeau and Pistor, 2020). The zero pollution narrative is a political fairy tale. Therefore, it goes without saying that a socioecologically sustainable and resilient civilization would necessitate reorienting and/or arresting chemical industry activities (the second largest manufacturing sector) that are societally superfluous and harmful to planetary health. The immediate start would consist in pricing the industry’s commodities at their real socioecological costs. Take a minute to imagine that world.

3. Bifurcations and time scales

Measuring what matters is strategic in science-informed decision-making in general, and critical at times of bifurcation. Never before have our societies benefited of monitoring technologies of such extent and precision; the real time is no longer a fiction. The era of digital governance is a reality, but that reality is matching business as usual most of the time. Two problems need to be solved before having things done right. First, management and governance by numbers does not make sense unless in balance with government by law (Supiot, 2015). Second, while we “swim” in an ocean of data, most of the data do not fulfill quality and periodicity criteria, and usually accumulate with no clear meaning and destination: the socioecological costs of data bases and digital instruments in use are disproportionate with the actual benefits. Thus, defining data needs is a matter of public policy design meant to answer well defined questions and aims. Those conditions are not met at present for most socioecological dimensions.

This situation is frustrating because all warning signs of science and society at large discussed above put the timeline of state shifts within the next decade (see *Appendix*). No doubt, coordinated and coherent decisions and actions are to be made now.

Lessons from failed political bifurcations in (recent) history (Chapoutot, 2020) are therefore useful.

1. In the 19th century, the awareness of an alternative modernity for a desirable future was on the rise (e.g. nature protection societies in the US and France). World WarI has put an end to that option.
2. The Havana Charter (1948), Roosevelt’s political legacy for peace and well-being, was buried by the US Congress.
3. The post-1968 awareness of consumerist alienation and generalized pollution translated in institutional innovation, namely the foundation of Ministries of Environment in the US and France. The fall in profit rates and the neoliberal revolution of the 70ies put a sharp end to this openness.
4. The movements of the objectors (Podemos, Occupy WS, Standing Night, etc) at the time of the 2007- 08 crisis and the ongoing climate youth movements represent the recent reaction to business as usual. But are they a real bifurcation momentum?

4. Conclusion: narratives, planetary health, and shared justice

Again, the question is: changing for what purpose and destination? Who decides on priorities and their coherent articulation so that limited resources be beneficially allocated (Lomborg, 2001)? What great narrative to switch civilization at the critical stage we are? The current inflationist effervescence of visions and narratives, in parallel with do or not do lists of propositions and current planetary health indicators (<http://institutmichelserres.ens-lyon.fr/spip.php?article632>), is characteristic of what we called the time of consequences at a time of confusion.

Since often humans base their activities on the stories they tell to themselves (Harari, 2017; Wyborn et al, 2020; Bohler, 2020), narratives are obviously important. It is certainly relevant to start from reality in order to better apprehend it, but should the ideal, which is about what should be and will never happen, be abandoned (Pénigaud, 2020)? As a matter of fact, narratives are often used to provide the assumptions and arguments for future pathways and technological trajectories. The great emancipation-oriented narratives of modernity have been able to give meaning to events, guide practices, legitimize ethics, institutions and social actions (for example emancipatory political projects). Despite their divergence on the nature of emancipation or their material differences, they all seem to have been invalidated by history because they generated securitization rather than emancipation (Amadiou, 2017). And the issue is even more elaborate: the conquest of freedom has largely been built on the idea of the abundance of resources (Charbonnier, 2020), a colonial and industrial era lasting imprint.

In brief, the narratives of modernity have been questioned and are vanishing (de la Vega, 2007). How can we rethink the modern ideal of emancipation? Sustainability and justice for the benefit of all requires visions that make the world livable and societies peaceful. Is livable sufficiently desirable, as far as desirability is still an option? We may need to think livable in terms of plausible. Societal acceptability comes next. Here the difficulty stems from the fact that there is no apparent interest in creating momentum and having narratives confronted and debated in the same room and at the same date. The likely reason is that we do not have clear enough working protocols to do this.

The diagram below sketches the situation and suggests the way forward. It shows that top-down and bottom-up work is needed. The bottom-up contributes incremental and multi-scalar initiatives and activities with diverse local outcomes. The top-down generates a frame of shared values and principles necessary to have the myriad of initiatives networked, achieving synergy and critical mass, thus accelerating the pace of change. The time factor is determinant, as the time of consequences becomes the time of a tangible bifurcation.

Epistemologies of the Anthropocene

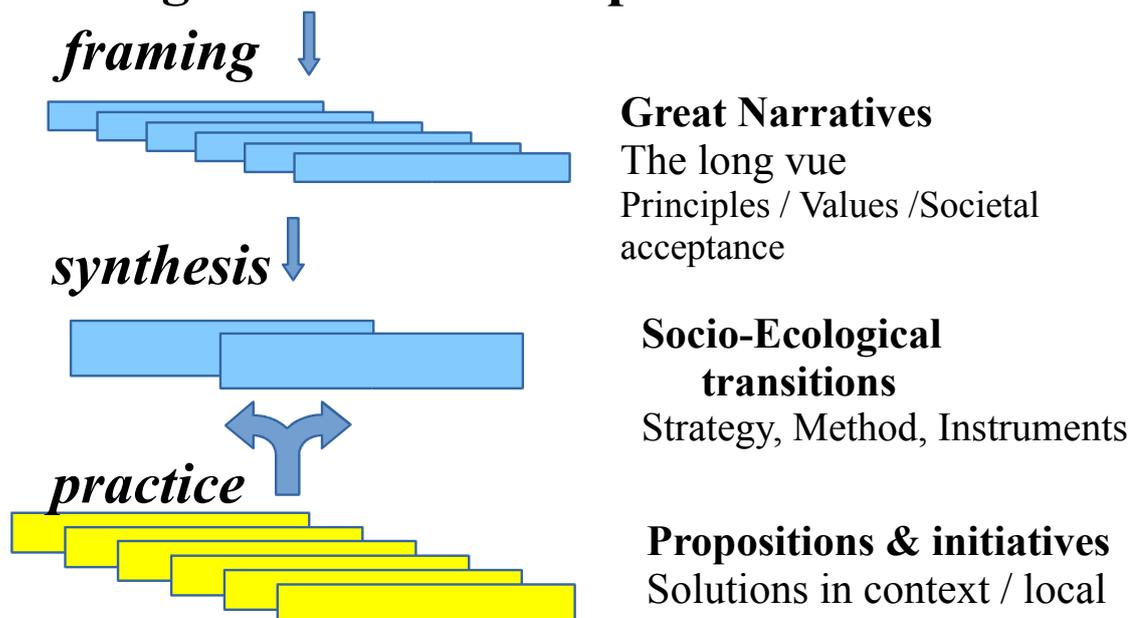


Diagram Legend. The actionable frame to a coherent societal change. Integrating the top-down and bottom-up scheme provides the link and creates synergy between the long view (unifying narratives, visions, utopias) and local initiatives and specifics (do and not do things). In context solutions and options, according to place-based cultures, resources or

governance, are now supported by shared principles and values with expected outcomes for the commons and vital needs of populations. The two levels would explore a shared methodological core through workshops and conversations to facilitate convergence and societal acceptance.

To conclude, it is very likely that the cement of the forthcoming great narrative will strongly rely on the planetary health concept and methodology (to read more - Serres, 1992; <http://institutmichelserres.ens-lyon.fr/spip.php?article624>; see also Laurent, 2020) and have the resource justice and stewardship challenge at its foundations.

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Appendix – The anticipatory power of science (a very limited selection of works out of many)

Ordway Jr, 1956, in *Libby Robin, Sverker Sörlin et Paul Warde, The future of Nature : documents of global change*, 2013

In June 1955, the symposium "Man's role in changing the face of the Earth" in Princeton underlined the global nature of the problems and proposed an interdisciplinary approach to the problem of resources. The question was whether better management was enough, or whether a fundamental change in lifestyles was needed. The answer was: to avoid wasting resource capital, we must stop consuming more resources than nature and humans create each year.

Loren Eiseley, *The invisible pyramid* (1970) Charles Scribner's Sons

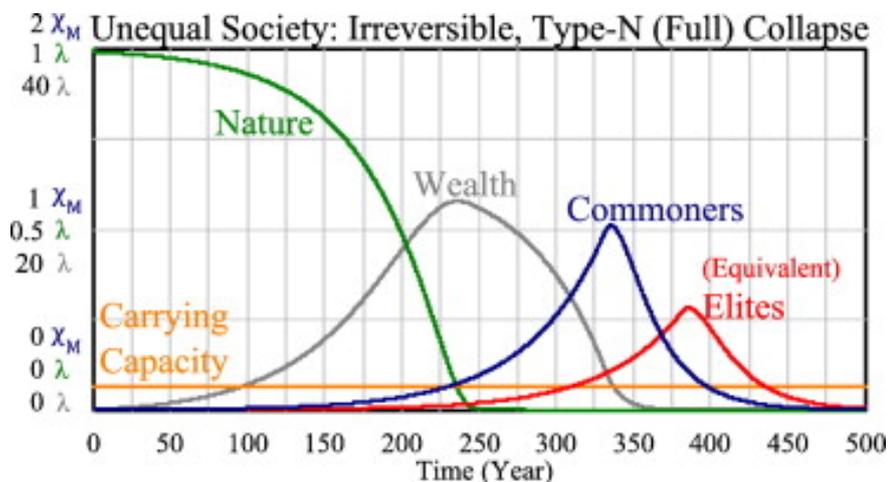
Essay on wisdom by introspecting Western civilization which, by addiction to innovation, mutated into Faustian culture. Of a nature that has long remained sacred, modernity spends its time sacralizing technology, that is a driver and amplifier of social evolutions. At the same time, men seem to have a long memory when it is draped in the clothing of myths. Yet myths and technology close some doors and trap humans in prisons of their own words, putting possible options for change out of reach. By over-objectivating the world, the West has imagined and achieved immoderation. With a poignant tale of how science has played its part.

Donella Meadows et al, *The limits to growth* : a report for the Club of Rome's project on the predicament of mankind, 1972. Meadows D, Randers J, and Meadows DL (2005) A synopsis: *The Limits to Growth: The 30-Year Update*. London, Earthscan Editions.

First exploratory modeling approach integrating population growth, resource consumption, industrialization, food production and pollution to sketch trends using a dozen scenarios. Innovation and technological progress alone would not be able to ensure sustainable development. The 1993 and 2004 updates remain consistent with the idea that persisting with current trends is an unsustainable path. Rather, the authors rely on the capacity of social, political, and cultural factors to change these trends. The approach shows that the predictive power of science can operate on the long term. Whether contingencies or critical junctures alter or accelerate change is a matter of updating that anticipatory work.

Mote, S., Rivas, J., Kalnay, E. (2020) *A Novel Approach to Carrying Capacity: From a priori Prescription to a posteriori Derivation Based on Underlying Mechanisms and Dynamics (Review)*. *Annual Review of Earth and Planetary Sciences* Volume 48, May, Pages 657-683

HANDY is a 4-variable thought-experiment model for interaction of humans and nature. The focus is on predicting long-term behavior rather than short-term forecasting. Carrying Capacity is developed as a practical measure for forecasting collapses. A sustainable steady state is shown to be possible in different types of societies. But over-exploitation of either Labor or Nature results in a societal collapse (cf. Graph below).



Graph legend. High inequality and depletion produce a collapse due to both overdepletion of Nature and overexploitation of Labor. Neither Nature nor Population recovers. *According to Motesharrei et al. (2014), <https://doi.org/10.1016/j.ecolecon.2014.02.014>.*