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Perspective

Transformational change: creating a safe operating space for humanity

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ABSTRACT. Many ecologists and environmental scientists witnessing the scale of current environmental change are becoming increasingly alarmed about how humanity is pushing the boundaries of the Earth's systems beyond sustainable levels. The world urgently needs global society to redirect itself toward a more sustainable future: one that moves intergenerational equity and environmental sustainability to the top of the political agenda, and to the core of personal and societal belief systems. Scientific and technological innovations are not enough: the global community, individuals, civil society, corporations, and governments, need to adjust their values and beliefs to one in which sustainability becomes the new global paradigm society. We argue that the solution requires transformational change, driven by a realignment of societal values, where individuals act ethically as an integral part of an interconnected society and biosphere. Transition management provides a framework for achieving transformational change, by giving special attention to reflective learning, interaction, integration, and experimentation at the level of society, thereby identifying the system conditions and type of changes necessary for enabling sustainable transformation.

Key Words: *behavioral change; connectedness; innovative leadership; societal values; transformational change; transition management*

INTRODUCTION

The cumulative effect of human activities, driven by human population growth and consumption patterns, is exceeding the sustainable limits of the Earth's biosphere (Rockström et al. 2009, Steffen et al. 2015). There is strong evidence that the Earth is approaching, or may already have passed, one or more tipping points (Lenton et al. 2008, Barnosky et al. 2012, Lenton 2012), leading to major problems for civilization. These are related to how humans are rapidly damaging ecological life-support systems, especially as related to climate change (IPCC 2013, 2014), extinctions of biological populations and species (Pimm et al. 2014), including the largest carnivores at the top of the food web (Ripple et al. 2014*a*), wholesale loss of diverse ecosystems, global spread of invasive species (Crowl et al. 2008) and toxic substances (Cribb 2014). There is an increasing global struggle for vital supplies of energy mineral resources, and arable land (Klare 2012, Ehrlich and Ehrlich 2013, Barnosky et al. 2014). At some point in the not-too-distant future, environmental changes will compel adjustments in how societies function, forcing many people to reassess business as usual (Moore and Nelson 2010, Barnosky et al. 2014). To prevent these changes being catastrophic, the global community must begin now to develop more sustainable alternatives in which humanity might operate within the limits of rapidly changing and increasingly variable natural systems, with associated adjustments in social systems. The critical question then is: how to initiate self-correcting feedback loops that will enable the transition to a more sustainable and equitable society?

UNSUSTAINABLE PRESSURES ON THE EARTH SYSTEM

The so-called Anthropocene has passed through two stages marked by increasing impacts on the biosphere (Crutzen 2006). The first, from the late 1700s – 1945, started with the harnessing of steam power and thereafter a rapid increase in mechanization and concurrent demand for energy resources. Human population growth increased because of improved public health and use of nonrenewable natural resources (Fig. 2 in Steffen et al. 2007), placing greater strains on the biosphere. The second stage, from 1945 to the present, was marked by human domination of Earth increasing at an unprecedented rate (Steffen et al. 2011). The core beliefs of this era are the continuation of material progress and economic growth, with the limitations of nature overcome by technology; and the primacy of the individual in competition with other individuals for a share in the wealth derived from nature (Hamilton 2010). These values are expressed through institutions such as political parties, financial systems, trade agreements, and private equity investment funds. Because of the multiple levels of interaction and mutual financial reward for many individuals from the "market knows best" belief system, these core values are further reinforced and imbued with an entrenched inertia, even though many question them as a route to widespread human well-being (Ehrlich and Ornstein 2010). The growth of emerging market economies such as China and India is further accelerating industrial production, consumption, and pollution on a global scale, but there also is an increasing gap between the rich and poor within and between countries. The top 1% of wealthiest people in the world, who account for almost 15% of the world income, and the middle classes of the emerging market economies, seem to be the main winners of economic globalization (Milanovic 2012). The losers include many people in Africa, and in some Latin American and post-Communist countries. The greatest income disparities are due to income gaps between nations rather than within nations, with nationality explaining over 50% of the variation in global incomes (Milanovic 2012).

Society is now at the beginning of the third stage of the Anthropocene (Crutzen 2006, Steffen et al. 2007, 2011), and close to the point where people must either become stewards of the Earth system, or gamble on unproven and potentially extremely dangerous geoengineering fixes to climate change with likely deleterious effects on the Earth's atmospheric processes and

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hydrological system (Matthews and Caldeira 2007, Hamilton 2013, Tilmes et al. 2013). The probability of catastrophic climate change is becoming more likely because of increasing greenhouse gas emissions from the burning of fossil fuels (World Bank 2012, Hansen et al. 2013, IPCC 2014), deforestation (Pielke et al. 2011), and the production and consumption of meat, especially from ruminants (Ripple et al. 2014*b*). The future remains uncertain because population and economic growth are decoupled from the externalities they create and continue to drive accelerating environmental degradation and loss of biodiversity (Daly 2005, 2014, Meadows et al. 2004, Pimm et al. 2014).

The world urgently needs counterbalancing mechanisms (Meadows 2008) to redirect global society toward a more sustainable future: one that moves the importance of intergenerational equity and environmental sustainability to the top of the political agenda and to the core of personal and societal belief systems (World Commission on Environment and Development 1987, Meadows et al. 2004). This will require major adjustments to social and economic systems, and incur immediate costs. However, although expensive and potentially creating upheaval in economic and social systems, early interventions are essential to avoid a real risk of economic, social, and environmental collapse (Brown 2011, World Bank 2012). Early interventions involve radically reducing environmental pressures and building resilience and adaptive capacity in social-ecological systems (Walker et al. 2004, Folke 2006, Olsson et al. 2006).

Science and technology have important roles in addressing environmental problems, but they alone cannot solve them. The 1992 Population Summit of the World's Scientific Academies recognized that science and technology may not be able to prevent either irreversible degradation of the environment or continued poverty for much of the world (National Academy of Sciences USA 1993). To have any effect on how society operates in terms of sustainability requires a transformation of human behavior rather than "fiddling around the edges" (Fischer et al. 2012) or "muddling through" (Lindblom 1959). This necessitates a realignment of societal values, i.e., the ideas, motivations, and actions of the actors in the system (Meadows et al. 2004, Moore and Nelson 2010). Achieving equitable, sustainable solutions involves a fundamental shift away from the view of humans as isolated agents in a competitive world, to one where individuals know themselves to be an integral part of an interconnected society and biosphere (Ehrlich et al. 2012). It particularly emphasizes a role where the individuals accept that they are responsible for creating a caring and sustaining social environment in which we all must live.

TRANSFORMING SOCIETAL VALUES

Transformational change in societal values needs to occur at three levels by: (1) being responsible and ethical in our dealings with other people and our environment; (2) better integrating ourselves into our communities; and (3) reconnecting with and valuing nature.

Personal integrity is at the core of behavioral change in individuals and ultimately societal transformation. Integrity builds a sense of purpose and conviction, which, combined with respect for others and personal responsibility, promotes ethical behavior. These qualities are currently lacking in many institutions (both private and public) and political systems today (Meadows et al. 2004, Fischer et al. 2012). The power of personal integrity is that this motivation transcends utilitarian calculation, whereby individuals do not act because they believe that their personal action does not change the world. What can this mean for individuals? It means an active decision to reduce one's environmental footprint through actions such as restricting reproduction to "replacement level" (Murtaugh and Schlax 2009), minimizing fossil fuel use (World Bank 2012, Hansen et al. 2013), reducing meat consumption, especially from ruminants (Ripple et al. 2014*b*), and generally reducing levels of material consumption. Collectively, individual actions can make a huge difference.

This leads to our second point: the need to build strong, interconnected communities, where compassion, mutual aid and cooperation are the norm (Meadows et al. 2004). The ability of organizational groups to generate creative solutions to problems has been recognized in business for over 20 years (Wenger 2000), and now also in wider social communities in real or virtual space (Amin and Roberts 2008). There is a clear need for broader economic and political changes, such as removing harmful economic subsidies or incentives that lead to unsustainable decision making, and raising public understanding of environmental issues. However, it also requires recognizing that the human value system is currently unsustainable, and that through individual behavioral change, societies ultimately can become more caring and sustainable. This requires a change in emphasis from personal goals linked to a higher material standard of living to a lifestyle that values equitable, sustainable community values in conjunction with the development of individual aspirations. Perhaps an immediate goal here is for people to donate a proportion of their time to society, for instance, by participating in community activities, caring for the local environment, connecting with the elderly, or building strong neighborhood networks.

Finally, at an even larger scale, connectedness is a core value of becoming a globally responsible citizen. It is multifaceted, with actions at the local scale contributing to improving the local environment and community, while maintaining a strong global awareness of the need for better, more resilient life-support systems (Arnocky et al. 2007). Connectedness motivates individuals and communities to conserve and restore local ecosystems, to be aware of the environmental impacts of their lifestyle and behavior, and ultimately to strive toward reducing their ecological footprint on the planet. It is also highly beneficial to the individual, irrespective of the scale of one's actual physical effect on the environment (Arnocky et al. 2007).

Despite the highly commercialized focus of westernized societies, the values outlined above are latent in many cultures, and often come to the fore as responses to emergencies when the problem is immediate, real, and tangible. The beneficial actions of like-minded individuals can lead society toward sustainable futures and are a key plank for transformation. These values also offer a way to achieve ecological sustainability in the face of what Gardiner (2011) calls the "perfect moral storm" of ecological sustainability, that is, how to deal with the tragedy of the commons across space and time.

ACHIEVING TRANSFORMATIONAL CHANGE

There are three feasible ways of changing individual behaviour: (1) coercion by social stigma or legal sanction; (2) change of mind,

being convinced intellectually that a broader definition of self-interest is required; and (3) change of motivation, coming to feel a sense of being part of the "web of life" and having a sense of self and unity with others and the global environment.

Coercion and regulation can work in some instances, but the drawback is that they are imposed from an external source and are rarely adaptive or suitably flexible at the local level. Social stigma sends the wrong message from the community, increasing fear and division. Change of mind is being achieved within some parts of society, including in the scientific community and various institutions, and among concerned individuals. It is potentially more effective than coercion because there is acknowledgement of the problem, but still may not lead to behavioral change by a significant number of people. Simply providing more information, or more accurate information, does not, by itself change behavior, though good information is certainly important (Boykoff and Yulsman 2013). Obviously there is a role for governments to educate the public on issues that are larger than the individual in scope, but the government must be willing to embrace change and be brave enough to adhere to longer term policies that may be expensive up front and take years to come to fruition (Gardiner 2011).

Change of motivation is real and achievable, but will come through personal belief rather than through rational understanding. There are several issues that this pathway of behavioral change must overcome: (1) it is partially reliant on a rational change of mind; (2) the persistence of belief within an individual means one tends to seek information that supports current beliefs while ignoring discomfiting information (Weiten 1994); and (3) to overcome the persistence of nonsustainable current beliefs, the weight of evidence must be obvious, imminent, and significantly threatening to challenge these entrenched beliefs. If evidence is not pressing enough for daily lives to be abruptly and significantly changed on a large scale, particularly where the basic needs of individuals are not directly under threat, then beliefs may not necessarily be reconsidered.

There is an urgent need to change our society, particularly because of impending and potentially catastrophic climate disruption (Hansen et al. 2013) and degradation of ecological life-support systems. The global community, i.e., individuals, civil society, corporations, and governments, collectively need to change their values and belief systems so that global sustainability becomes the new reality (Planet Under Pressure 2012). This requires a fundamental shift in human behavior, to live more ethically and efficiently and to radically rethink the concept of progress and economic development in our societies. It requires a sense of urgency to collectively work toward solutions that will make a real difference in people's lives and promote human dignity for all. We are all part of one planet; our well-being depends on working together for a sustainable, more equitable society.

There is a growing understanding that building resilience and adaptive capacity are not enough to avoid societal collapse (Meadows et al. 2004, Butzer 2012, Pearson and Pearson 2012). Transformational change is a formidable challenge but is necessary. Transformation requires proactively changing the structures and processes when conditions make the existing social-ecological system untenable (Walker et al. 2004). It requires constructing self-correcting feedback loops based on a shared vision of global sustainability, building networks based on a common purpose, learning new ways of doing things, and acting ethically and compassionately (Meadows et al. 2004). There is an increasing concern among those people who understand the scale of current environmental change about the potentially disastrous consequences of climate change, and the institutional and societal inertia in addressing the problem. Societies need to learn from history (Diamond 2005). In a historical analysis, Butzer (2012) concludes that the collapse of past civilizations was a consequence of multiple factors, reinforced by various feedbacks and partly balanced by resilience, with societal factors such as ideological differences and institutional inertia more important than environmental factors.

Transformative change can unfold in many different ways, depending on the system dynamics. There is an increasing recognition that alternatives to top-down governmental control for governing social-ecological systems are needed (Gunderson et al. 1995, Olsson et al. 2006). Transition management provides a framework for achieving transformational change, exploring new opportunities and systems of governance and management, and developing strategies to identify alternatives (Loorbach 2010). As with the adaptive cycle of resilience theory (Holling and Gunderson 2002, Walker et al. 2004), transition management is based on complex adaptive systems theory, with "transitions" being multilevel, multiphase processes for achieving long-term (at least 25 years) structural change in society (Loorbach 2010). Transition management gives special attention to reflective learning, interaction, integration, and experimentation at the level of society. Its conceptual foundations are at the microlevel, and have been empirically tested in water resource management in the Netherlands and Belgium (Loorbach 2010). One limitation is a failure to systematically reflect on interplay with the macrolevel, such as overall political structures or societal power relations, which may reduce the viability of governance ideas stemming from transition management processes (Voß and Bornemann 2011). Ferguson et al. (2013) propose integrating transition theory with the adaptive cycle of resilience theory (Holling and Gunderson 2002), to create a more a multilevel systemic framework for analyzing the dynamics of transformative change. The addition of institutional theory provides a building block for identifying which type of multilevel mechanisms are likely to be most effectively employed, through strategic initiatives, to enable a transition toward a desired future.

Changing normative societal values is critical for achieving transformational change. Old suspicions, conflicting interests, a narrow focus, and lack of trust can derail open discussion and lead to failure. Governments and self-interest groups often resist change because they cannot control or predict the outcome and fear losing power and influence. There are two key elements that make transitions more likely to overcome these system constraints (Olsson et al. 2006). First, is the existence of informal networks which link different groups. Informal "social" networks allow freer exchange of ideas than those limited by agency rules (Meadows et al. 2004). The second is the emergence of innovative leaders who can align people, motivate and inspire them, reconceptualize issues, generate and integrate different ideas, and connect different networks (Olsson et al. 2006).

CONCLUSION

The future of the modern civilization is increasingly uncertain. Most ecological and environmental scientists recognize the enormity of the predicament society faces, and the consequences of not changing how societies around the world operate. This paper is a call to action for fellow ecologists and environmental scientists to participate in the transition to a more equitable, sustainable society. This requires a stronger engagement among scientists in the codesign, coproduction, knowledge sharing, and in the broader dialogue of developing innovative alternative futures in transition management. Ecological and environmental scientists need to present a united front, a convincing message, and strong leadership in building collaboration and knowledge, first within academic communities and with other disciplines, such as social scientists, political scientists, humanities, and economists, and then across networks of family, friends, and wider social and business networks. There are many moral arguments for doing what is right and for meeting obligations to achieve a sustainable biosphere that ensures the welfare of future generations (Moore and Nelson 2010). Living and acting with integrity, as members of communities and strongly connected with nature, will help protect Earth's life support systems, and at the same time deliver the rewarding cobenefits of happiness and personal well-being.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/issues/responses.php/7181

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