

Surviving progress: Managing the collective risks of civilization

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Abstract

As is becoming ever more apparent, progress carries with it both promise and pitfalls. Though it is quite natural for humans to take an optimistic view of life, this optimism must at the same time be tempered with realism. We cannot therefore let a focus on average, or expected, outcomes cause us to ignore possible high-stakes (existential) risks associated with what is becoming an increasingly complex world. In this article, we argue that a more complete view is necessary for the proper assessment and management of human-induced risk. This includes not only the technical aspects of high-stakes risk management, but also the social, political and economic framework within which it is carried out. Unfortunately, attention to such crucial details is not often the case.

Keywords: Survival; human-induced risk; precautionary principle; alternative socio-economic systems.

Introduction

Awareness of the potential dangers associated with technological/ material advancement (“progress”) is growing. We have become especially concerned about the preservation of our ecological support systems in the face of increased industrial production and resource usage. At the same time, many continue to downplay these concerns by emphasizing the virtues of progress based on observed *average* outcomes. As a result the possibility of negative extremes is ignored. The severe nature of possible negative outcomes calls for a more precautionary approach to managing the high-stakes risks that may accompany technological change, based on the need to preemptively deal with complex threats. Yet, precaution is often portrayed as an *impediment* to progress to the extent that it interferes, or is perceived to interfere, with higher achievement levels – *on average*.

To put societal risk management on a sound footing we need to assess the extent and nature of increasing exposures to catastrophic risks associated with progress and take proper action. *The ability to really do something about these risks, however, depends on the development of proper institutional structures – social, political and economic.* Depending solely on optimistic estimates merely reinforces acceptance of the *status quo*. Behind this *status quo* lie powerful institutional influences, including the advancement of the increasingly concentrated (and self-serving) superstructure of capitalism.

Many aspects of our current economic and political structures, world-wide, are at odds with a more precautionary approach to high-stakes risk simply because it threatens the heady optimism that fuels further material growth. Global capitalism today, and the power structure that underlies it, deemphasizes precisely those collective interests which must be addressed if precautionary risk management is to achieve its goals. It builds a false optimism by intentionally concentrating public attention on myopic indicators of progress. In the mean time, the potential for disaster builds.

Prudence, however, is not the enemy of technological change. In fact, precaution does not require that we forego the gains of progress. Rather, it suggests that that we must advance

safely. That is, genuine progress proceeds by paying careful attention to the high-stakes risk potentials involved. It is only with the proper recognition of the threats that face us, along with the construction of suitable frameworks for doing so, that we can help assure our long run survival and that of the ecological system that we share with other living beings.

As the threats of untoward outcomes associated with material progress capture the collective interest, public concern increases. Increased perception of threats – ecological, financial, social and political – leads to an altering of our collective consciousness that suggests that reliance on assurances of positive progress “on average” may hold some very unpleasant surprises. This societal awakening to a more dangerous world can itself have serious repercussions in terms of social uneasiness about such conditions and what to do about them. Such unrest is liable to create problems of its own. The task at hand is to forestall the need for sudden reaction, a reaction that may itself be too little or come too late. To do so requires that an informed public resist powerful institutional influences and establish the proper course of action in anticipation of future risk issues.

The distribution of the “good” and “bad” of progress

Technological change is by its very nature a complex, probabilistic phenomenon. A realistic appraisal of the positive and negative potentials of progress is represented by a *probability distribution* across possible outcomes. Only a distribution of probabilities, or likelihoods, over all possible outcomes can give us a realistic picture of the risks we face. On the other hand, discussions of progress often assume we can reduce the results of scientific and technological change to some single indicator, perhaps itself an amalgam of suitable measures. Often, such indicators are biased toward material outcomes such as dollar value of goods and service produced by the society over the course of some time period. The most cited of these is the *gross domestic product*, or GDP. A nation's GDP has become an almost universal indicator of progress, both temporally and measured against other nations.

Figure 1 shows the trend in U.S. GDP since the Great Depression. It is on this impressive track record and similar results in other world economies that many of us base considerable optimism about the future. Yet, at the same time we cannot ignore the potential for negative social effects of increased inequalities in the distribution of material wealth, the threat of destruction from biological and nuclear weapons, increased instability of a complex financial system and the increase in serious environmental threats represented by the shear volume of industrial production.

More recently, the GDP has come under criticism for focusing solely on the dollar value of final output of goods and services. As a result, indicators that include a wider array of outcomes, including human and environmental health have been proposed.¹ Most of these, however, continue to rely on averages and related point estimates and do not consider distributions over all possible outcomes. This continued reliance on fixed estimates is an indicator of how strongly we psychologically desire determinism in our perceptions of where our society is heading. While estimates that incorporate a wider variety of dimensions of well-being may impart some needed degree of conservatism to the results, probabilistic outcomes continue to be ignored.

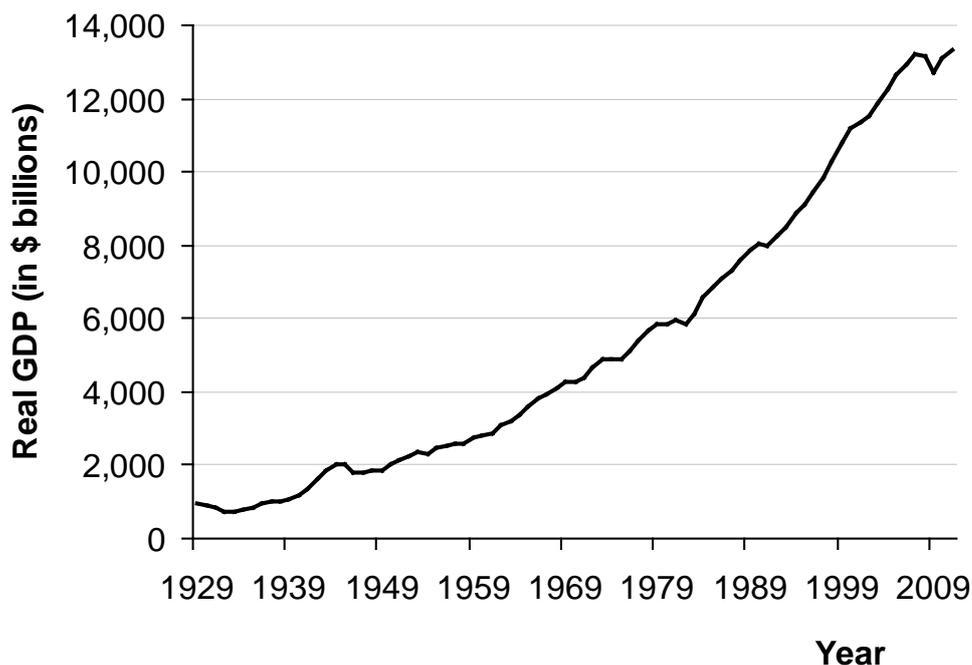


Figure 1. Growth in U.S. GDP, 1929-2011 (Source: U.S. Bureau of Economic Analysis)

A wider appreciation of the distribution of outcomes we face, both positive and negative, that incorporates all appropriate dimensions of progress is the first step toward achieving a more realistic appreciation of our world. Figure 2 shows three possible distributions of outcomes assessed over some segment of historical time (usually represented as one year). Also shown in the diagram is a lower safety level below which well-being cannot fall if we are to avoid large-scale detriment (including possible extinction). The lower safety level, which may itself be imperfectly known to us, bounds what we might call the “danger zone”. This retrograde may occur as a result of some untoward probabilistic event, such as a global epidemic, nuclear accident or war. Survival of our civilization depends on our being able to achieve some minimal (subsistence) level of progress. While survival is not the only goal of human-kind, it is obvious that without some assurance of continuity further goals cannot be obtained.

Of course, we can never achieve a genuinely zero level of risk. Destruction by age-old natural perils, such as a catastrophic asteroid strike, is always a possibility. Some positive acceptance level of risk must be set, in terms of likelihood or relative annual probability of occurrence. A reasonable representation is the *natural background level* of risk. This level could be represented concretely by observing the typical period of species survival on earth. We might note for example that vertebrate species have survived on this earth for some million years, suggesting an annual probability threshold level based on the inverse of this epoch, or roughly “one in a million”.²

Distribution (a) shows the outcomes faced by an emerging civilization or society. On average it can expect a positive standard of living while still struggling for evolutionary survival (as indicated by a negative risk level above that considered “natural”). Distribution (b) represents a civilization that has attained some higher level of achievement. At the same time it has managed to tame the high-stakes risks it faces, or at least reduced them to (or below) the

natural background level. In this sense, this civilization blends in with those living things that have achieved some degree of long run success in preserving their existence (either via evolutionary adaptation or conscious control). This distribution provides an operational definition of sustainability in terms of reducing risk to natural levels while still providing at least some modest level of progress. Last but not least, distribution (c) shows a relatively advanced level of progress (at least compared to the other two distributions), indicated by the concentration of probability at higher achievement levels. It is nonetheless haunted by the potential for disaster (that is, a likelihood of catastrophe above the natural level).

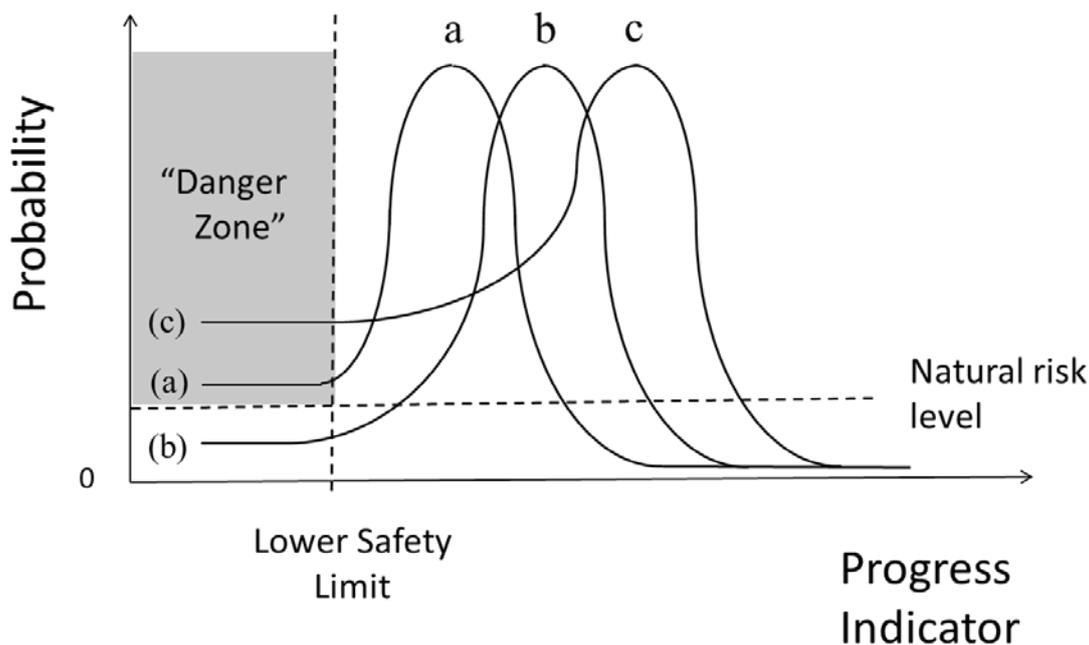


Figure 2. Probability distributions of the outcomes of human progress

The importance of a precautionary stance

Statistical risk assessment deals with average outcomes that simplify the comparison of probabilistic costs and benefits. The problem is that statistical estimates *over-simplify* the analysis when costs can be terminal – i.e., *catastrophic*. So while such cost/ benefit assessment may be perfectly sound in the statistical domain (i.e., that in which the “law of averages” functions), it makes no sense when faced with the fundamental problem of catastrophe (...*in the long run, there may be no long run*). In this situation, we must consider *precautionary avoidance*.³ When large-scale risks threaten the existence of the system we should avoid them or at least reduce them to natural background levels. Blinded by the promise of increasing gains “on average” we fail to see the increasing potential for disaster. This realization, if we rely on statistical analysis alone, may very well come too late.

Precaution is particularly relevant today because of the mounting evidence suggesting that our society faces something like distribution (c) in Figure 2. That is, the likelihood of human-induced catastrophe is rising far above natural levels. The same scientific and technical

discoveries that promised a rise in the average standard of living have brought with them the prospects for serious adverse consequences. These include the potential for sudden large-scale catastrophes such as those associated with nuclear technologies for energy production as well as intentional releases of radiation under conditions of nuclear warfare.⁴ More insidious is the slow build-up of catastrophic threats. Among these are increases in environmental chemical pollutants associated with expanding industrial output. Sometimes referred to as “creeping catastrophes”, they may be unstoppable once serious enough to be recognized.⁵ Fast or slow, precaution enters when we cannot reasonably exclude the possibility of disaster.

If dependence on averages is excluded, by logical principle, have we any other option? With respect to the high-stakes threats to our existence the only other rational choice besides precaution is *fatalism* – we can’t do anything about it, so why try? Though the fatalistic attitude makes perfect sense when we are faced with irreducible natural risks it amounts to mere acquiescence, or giving-up, in the face of human-induced risks. As a result, it is a position that is easily taken advantage of by those who would incur such risks for the purpose of increasing individual, short-term gain. Fatalism is, therefore, a conclusion we must not jump to without properly exploring the alternatives.

Socio-Economic structures for survival

While fatalism with respect to high stakes risk is an extreme position, many of us believe, or are led to believe, that there is no alternative to the acceptance of high-stakes risk. We rely on assessments based on average outcomes and statistical cost/ benefit comparisons of technological advancements, calculated by various “experts”, thereby promoting a false sense of optimism. What will be, will be – but it will all turn out for the best. By not recognizing, or not being allowed to recognize, the entire distribution of potential results (including the very bad ones) we become indifferent toward large scale risks by default. Those who focus exclusively on statistical aspects of risk may find themselves supporting a *status quo* which could spell disaster.

To avoid misplaced emphasis on average outcomes we need socio-economic systems that recognize the importance of absolutes. With absolutes however come perceived restrictions on individual initiative. Instead, we cling to the alleged freedom of *tradeoffs* in the form of market-based, cost/ benefit comparisons. This faith in market outcomes, however, only helps hide the risks at the root of the problem of unfettered progress. Absolutes, including safe ecosystem function, cannot be traded for material gain in any real sense. Attempts to place a monetary value on human life and environmental quality only show just how insensitive we have become toward the preservation of these absolutes.⁶

The concern for increased private profit over social wellbeing represented by the suppression of consideration of extreme outcomes has fueled the growth of big business, global finance and the government structures that support them. In the process, it creates conditions for our ultimate destruction.⁷ The *paradox of progress* that results is that we achieve a material utopia only under the threat of annihilation. Survival, both of ourselves and the ecological system we are a part of, requires that self interest must at some point give way to public awareness, and a framework under which environmental absolutes are recognized and maintained.

The concentration of economic and social power in private hands has also been linked to a variety of social ills. Among these is the intentional mal-distribution of incomes and opportunities among the population. As a result, various socialist alternatives to the system of capitalism have been proposed with an emphasis on redressing worker exploitation (in the sense developed by Marx). However, programs of economic and political socialization that aim to “spread the wealth” do not *automatically* guarantee risk issues will be addressed. These programs often focus on increasing the *overall* level of material gain at an unabated pace. The socialism of the Soviet Union and China, for example, fared as poorly at natural preservation as did the capitalist systems of the West. Of course, to the extent human beings are subject to exploitation via strong class divisions, the perils of progress are bound to be unequally distributed. While not ignoring social issues, our socio-economic framework must explicitly include *both* human and natural autonomy.⁸

Concern for the wider risks of human and ecological existence requires recognition of an extended community, or *e-community*, of life that respects the absolute conditions for the preservation of our living environment. The idea is captured in the comprehensive bioethic based on natural balance associated with environmentalists Aldo Leopold and Arne Naess. Leopold was a pioneer of natural conservation. The basis of his environmental ethic was simple and direct: “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”⁹ The concept of natural balance also figures prominently in the thought of the Norwegian ecologist and philosopher Arne Naess. He captures the notion of an ethic of natural balance in his vision of *ecosophy*: “... a philosophy of ecological harmony or equilibrium.”¹⁰

It is on these foundations that the movement for a *deep ecology* which demands proper respect for the entire eco-sphere is based. We may contrast this with the *shallow* approach which tends toward political expediency and the preservation of an anthropocentric *status quo*. The natural balance inherent in the extended view is based on a metaphor for system completeness in which the conditions for survival and growth are to be found in the search for interconnectedness in the world. It cannot be made to depend exclusively on science, biological or otherwise, to “prove” what is morally correct. For that, as Naess suggests, we need search no further than the system that sustains us and the world around us.¹¹ The influences of deep ecology on political economy suggest that rational alternatives to the capitalist *status quo* must rely as much (or more) on the thought of Leopold and Naess as that of Marx and Engels.

The precautionary approach to high-stakes risks holds that system integrity is preserved by minimal interference with natural performance when the full potential outcome(s) of any such interference is (are) unknown. The ecosophy of extended community is inherently precautionary in the sense suggested by Gregory Cooper: “If we are unsure about the cognitive lives of other organisms, about the extent to which there is a teleology beyond intentionality, about the existence of a natural balance in ecosystems, then we should conduct ourselves as if the possibilities are true until we have established otherwise.”¹² In terms of natural risk levels, it suggests that genuine progress is measured by how far we get beyond subsistence, *safely*.

Planning for balance

The market systems on which development in the modern capitalist world is based cannot deal with absolutes – only tradeoffs. To assure a safer future, markets must be subordinated to a coordinated system of planning in survival critical areas of our existence. Only through deliberate planning on the *public scale* can we anticipate and deal with existential risks in a properly precautionary fashion. Planning can in this way be viewed as a process in harmony with nature: *Organism* implies *organization*.¹³

The precautionary approach suggests that system integrity is preserved by minimal interference with natural performance when the full potential outcome(s) of any such interference is (are) unknown. In turn, safe progress is about preserving balance, in this wider sense. Risk management that shows the proper respect for complex natural system function is in line with the ecological philosophies of environmentalists like Leopold and Naess. Absolute constraints thereby bound assessments in terms of tradeoffs, or cost-benefit. This does not mean we abandon cost-benefit. It only means that it must be subordinated to absolutes. When necessary, average gains must be sacrificed for safety (that is, distribution (b) in Figure 2 is *absolutely* preferred to distribution (c)).

Effective planning against risk must therefore go beyond mere *regulation* of markets. Regulation assumes that markets functioning under private ownership of critical infrastructure remain primary in creating and distributing the fruits of progress, as well as in dealing with their negative impacts. In the case of risk it attempts to discipline these markets after the fact, relying mostly on statistical observations of harm and the implementation of financial incentives for its redress. Taking action once the potential for large scale risks has already become entrenched leads to risk dilemmas of the “doomed if we do, doomed if we don’t” variety. To avoid dilemmas of this sort we need to act collectively by assessing safe alternatives early on in a process of planning for safe progress.

While planning incorporates the satisfaction of human needs, it recognizes that we must do so while protecting environmental conditions for survival. Using a multi-criteria approach, planning can incorporate proper constraints on human activities that may result in long-term harm.¹⁴ Direct public participation also becomes essential for the proper direction of future investments for safe development. Decisions based on the profit motive alone are bound to distort allocations as they are invariably based on average returns. While risk may be considered in such investments, it is only the chance of failing to achieve sufficient *monetary* returns that is usually considered.

Properly articulated, planning will require increased social stewardship and direct control of vital natural resources, their processing and distribution. This calls for a reversal of trends toward privatization and the (re)surgence of *public* enterprise, at least in survival critical industries. It is hard to envision, for example, effective coordination for cleaner energy on the scale necessary to promote long-term survival based on private interests alone. It is our duty as members of the extended community to tend these resources responsibly. We must come to the realization that we have abandoned too much to private economic control in the name of short-term gains (“efficiency”). We may eventually pay a greater price than we can now even imagine.

Of course, some degree of decentralization is necessary for effective articulation of the requirements of the extended community. Commitment must be able to work its way from the

“bottom up”, not just the “top down”. There exist many approaches to decentralized planning for achieving public purpose which have the ability to genuinely improve our standard of living. These include various versions of *participatory economics* in which human beings at all levels of society participate democratically in choices about both resource allocation and preservation.¹⁵

Markets are valued for providing *consumer sovereignty*, or “freedom of choice”. Very often, however, the process is subverted in the name of private gain, forcing us to make the *wrong* choices with respect to long term risk. Under these conditions, markets cannot be expected to undo the damage that they themselves have contributed to.¹⁶ Continued reliance on fossil fuel energy sources, preference for private over public forms of transportation, low recyclability of product packaging, disregard for the carcinogenic properties and other health risks of consumer products; all of these increase the potential for bad outcomes on a large scale. Coordinated public planning, applied as necessary, can help us overcome the shortsighted bias of *both* producers and consumers when it comes to preserving our existence and that of the natural world around us.

On guidance “from above”

Any suggestion for the need for comprehensive planning with regard to socio-economic objectives is bound to raise age-old suspicions of authority, or control “from above”. The threat of loss of individuality remains perhaps the biggest hang-up in a popular acceptance of any genuine vision of coordinated community. It is unlikely, however, that the promotion of the necessary sense of purpose can proceed without the exercise of at least some degree of central authority for its guidance. Human autonomy (non-alienation) is perhaps itself best conceived as a concomitant of natural autonomy. Autonomy in turn does not mean complete independence, but rather a respect for the value of individual lives.¹⁷ Humans need to recognize the autonomy of all living things, as well as the natural system they represent to appreciate and achieve our own.

Of course, the idea of a benevolent potentate has lost much of its luster in modern times. Many still cling to some vestiges of it in religious observance, though most of these remain symbolic. Gone is the genuine faith in a spiritual body that can help guide us through troubled times. It is precisely this faith that is needed to guide us through to a better end. Unfortunately, most of us cannot envision any form of authority beyond the human kind, with all its limitations and frailties. As a result we flounder under the distrust of any central authority that holds itself out as acting through a human polity for the public good. At the same time, we readily succumb to the influence of those whose private fortunes give them the power to control our lives via economic means. As long as there is at least something in it for us, individually, then we are willing to play along (i.e., acquiesce). It turns out that the guidance we seek is not to be found in human form but rather in nature itself. We need to respond to the *authority of nature* as reflected in, among other things, the absolute limits it imposes on species survival.

Nature’s guiding role for moral action need not imply that nature is itself moral, or presents a model for such actions wholly independent of human reason. Instead, in the words of ecologist Edwin Partridge, nature presents us with a “moral resource”.¹⁸ Through its workings (“laws”) we identify guidelines for action. A Global Constitution and associated Bill of (Natural) Rights would include the duties imposed by maintaining a balance of nature in addition to the

human-based rights of free speech, freedom of assembly and so on. The duty of human leaders is to properly interpret and apply these natural edicts.

To be sure, the idea of centralized authority has been abused by a variety of false prophets who promoted it with only *self-interest* in mind. On the other hand, an enlightened individualism cannot be depended on to achieve truly global goals where this wider outlook includes diverse geographic societies, life forms and their future generations as well. Practically, at least some degree of centrality of overall purpose may depend on the establishment of a strong group (the *e-vanguard*) that can instill and promote this wider sense of purpose within the community.

Ultimately, we seek to transcend the coercive mechanism of the state altogether. To do so requires that we integrate the commitment to extended community in our individual lives and our institutions. In the mean time a properly constituted *eco-state* remains simply an expedient. It is a necessary transition mechanism that can help shape and guide our consciousness toward wider natural goals, while helping build the appropriate institutions. The transition eventually leads to a *state of nature*, perceived now as a natural *condition* of being and not as a coercive mechanism.

Conclusions

Optimism is a very positive trait of human beings. It can help us maintain our vigor and resolve in the face of hardship. It provides the impetus for great scientific and technical discoveries, and gives us hope for the future. Failure to be realistic in the process of assessing the way forward can hold severe drawbacks of its own. Our existence is one that is to a great extent ruled by randomness. However, we often downplay the effects of chance by focusing on expected, or “average”, outcomes when faced with a spectrum of probabilistic outcomes of human-induced change. This can obscure serious threats to our ecological existence. A progressive society must recognize the potential for existential catastrophe along the way and work towards managing such untoward, yet crucial, outcomes. If it is optimism with which we are to face the world, let it be driven by reality – not fantasy.

Given the existence of high-stakes risks associated with progress we need to take a precautionary approach that considers not just the most likely outcomes but also the negative *extremes*. Achieving effective precautionary risk management is not simply a matter of awareness. We need to establish a system of social governance suited to its challenges, including the recognition of the absolutes entailed in maintaining environmental integrity. Any such system of social institutions will include the ability to plan ahead while recognizing itself as part of the wider natural world. This means keeping the preservation of environmental integrity in the forefront. Systematic risk management is about maintaining this balance, not reacting to bad outcomes after they occur. When faced with catastrophic loss potentials *we don't get a second chance to get things right*.

Our duty to society and the world around us is to properly recognize the challenge that we face with respect to high-stakes (existential) risks and take appropriate actions *as a society*. We know that real-world complexities shroud this determination in uncertainty. This means that the any signals we receive will be only very weak ones. The greater challenge we face is acting on them before it becomes too late.

Notes

1. See for example J. Talbot, C. Cobb and N. Slattery, *The Genuine Progress Indicator: A Tool for Sustainable Development* (Oakland, CA: Redefining Progress, 2006). In actuality, the difference between GDP and extended measures is likely to be one of the *rate* of change, not its directionality. It is hard to make a case that human progress has, on average, been retrograde through time.
2. Reasonable bounds of species survival are set here based on observations of E. O. Wilson in *The Diversity of Life* (Cambridge, MA: Belknap Press, 1992).
3. For more on the theory and application of precaution see M. Jablonowski, *Precautionary Risk Management: Dealing with Catastrophic Loss Potentials in Business, the Community and Society* (Basingstoke, UK: Palgrave Macmillan, 2006)
4. See Nick Bostrom and Milan M. Cirkovic, *Global Catastrophic Risks* (London: Oxford University Press, 2008).
5. Issues of latency and delayed manifestation are usually associated with risks to human health arising from human-induced chemical disruption of the environment. See McCally, Michael, ed., *Life Support: The Environment and Human Health* (Cambridge, MA: MIT Press, 2002).
6. See Ackerman, Frank and Lisa Heinzerling, *Priceless: On Knowing the Price of Everything and the Value of Nothing* (New York: The New Press, 2004).
7. The link between unbridled capitalist development and ecological destruction is developed in J. Kovel, *The Enemy of Nature: The End of Capitalism or the End of the Earth?* (London: Zed Books, 2002).
8. So-called *ecosocialism* is based on attempts to find deeper connections between socialism and environmentalism. Typical among these is Derek Wall's *The Rise of the Green Left: A Global Introduction to Ecosocialism* (London: Pluto Press, 2010). While presenting a cogent argument that modern capitalism is *inherently* destructive toward nature, Wall does not sufficiently demonstrate why socialism (traditionally viewed as a purely humanistic program) is not. In a similar vein, portrayals of Marx as a proto-environmentalist have met with considerable skepticism from the eco-centric Left. See, for example, Hwa Yol Jung, "Marxism and Deep Ecology in Postmodernity: From Homo Oeconomicus to Homo Ecologicus", *Thesis Eleven* 28 (February 1991), pp. 86-99.
9. A. Leopold, *A Sand County Almanac* (New York: Oxford University Press), pp. 224-5. Leopold's bioethic of community - what he called the "land ethic" - has been further developed in the contemporary writings of J. Baird Callicott, including *In Defense of the Land Ethic* (Albany: State University of New York Press, 1989).
10. Arne Naess, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary", *Inquiry* (Oslo) 16/1 (1973), pp. 95-100.
11. Arne Naess, "From Ecology to Ecosophy, From Science to Wisdom". *World Futures* 27 (1989), pp. 185-190.
12. Gregory Cooper, "Teleology and Environmental Ethics", *American Philosophical Quarterly* 35/2 (April, 1988), pp.195-207.

13. The idea of social and economic planning in concert with natural balance is developed in M. Jablonowski, *Planning for Balance: Making the Choice for a Safer Future* (SwiftRiver Press, 2010). See also Melville C. Branch, *Planning: Universal Process* (New York: Praeger 1990).
14. Aspects of multi-criteria planning applied to achievement of a safer future are discussed in P. Bartelmus, "Limits to Development – Environmental Constraints of Human Satisfaction", *Journal of Environmental Management*, 9 (1979), pp. 255-269.
15. See, for example, Michael Albert's *Parecon: Life After Capitalism* (London: Verso, 2003).
16. See J. O'Neill, "Markets and the Environment: The Solution Is the Problem", *Economic and Political Weekly* 36 (May 26, 2001), pp. 1865-1873.
17. See Thomas Heyd, *Recognizing the Autonomy of Nature*, (Columbia University Press, 2005).
18. Ernest Partridge, "Nature as a Moral Resource", *Environmental Ethics*, 6 (Summer, 1984), pp. 101-130.

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