**ARTICLES**

On Being an Anthrozoon
by MARY MIDGLEY // PAGE 11
Explores the link between attempts to define humanness and attempts to separate human beings from other species and to give humans greater ontological value or ethical superiority. As an antidote to this, we must “get ourselves in proportion—to see though our current absurd over-estimate of human separateness and superiority.”

What Does It Mean To Be Human: An Evolutionist’s View
by DAVID SLOAN WILSON // PAGE 17
Offers an evolutionary perspective on how species develop through various mechanisms of inheritance. Especially for human beings, this is not found in genetic inheritance alone, but requires consideration of social learning and symbolic thought.

Living Well: Explorations into the End of Growth
by PETER VICTOR // PAGE 24
Discusses a macroeconomic model of the Canadian economy, LowGrow, that indicates how ecologically beneficial lower growth is possible without unduly affecting employment or other essential aspects of human economic well-being.

Sustainability, Well-Being, and Economic Growth
by RICHARD B. HOWARTH // PAGE 32
Argues that as far as climate change is concerned, it would be possible to reduce GHG emissions substantially without having much of an impact at all on overall economic growth in the developed nations or worldwide. But it may not be so much the natural limits of growth that ought most concern us as its social limits.

**FEATURES**

From the Editor
Losing Our Concepts, Reclaiming Ourselves
by BRUCE JENNINGS // PAGE 4

CHN Bookshelf // PAGE 40

The Last Word
What Can Ecology Tell Us About the Nature of Reality
by BROOKE HECHT // PAGE 41
Let me begin with two propositions, which form a backdrop to the rich and probing articles in this issue of *Minding Nature*. The first is generally true of the human condition as such; the second has not always been true, but it is true of the situation of humans and nature at the opening of the twenty-first century—urgently true.

First, how we understand ourselves as human beings and our place in the web of life shapes what we do, not only to each other, but also to the natural environment as a whole. Second, the reality of ecological limits and bio-physical planetary boundaries will transform major forms of human activity—especially the intense resource and energy utilization and waste generation that passes through an economic system—and will turn upside down core concepts with which we now define meaning and purpose in our lives.

Environmental philosophers and conservationists have long stressed this first insight. Aldo Leopold, for instance, maintained that “We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.” From this point of view, then, there is an essential link between conceptions of humanness and economic activity. Broadly defined, economics concerns how we produce and reproduce the material requirements of our life over time. An economy is an institutional structure combining human creativity and labor with natural resources in the production and exchange of goods and services. Economics never forgets what philosophy sometimes does—namely, that human beings exist in a material world and are mortal, vulnerable, embodied creatures of need and want.

Yet this connection between the idea of humanness and economic activity, while found in all cultures and in all periods of human history, is never merely abstract but always takes on concrete conceptual and institutional forms. Leopold’s observation, made in the context of America in the mid-twentieth century, was grounded in a capitalistic market society in which the connection between ideas of humanness and economic practices pivoted around notions of commodity, private property, and ownership. When people understand who they are and what they can and should do through the lens of such categories, they tend to overlook the interconnected properties of living systems. They cannot see the land. Instead they dissociate natural reality into discrete resources and raw materials that have no value in and of themselves but are solely the potential instruments of fulfilling human needs and wants. This is one example of how humanness and economics may be connected, but it is not the only one. (Leopold evokes a vivid alternative conception: another humanness of membership and interdependence and another economics of caring, careful, frugal, and...
responsible.

Respectful use.) Yet it is the one that dominated Western society in Leopold’s day, and it continues to dominate, not only America, but much of the world today.

If how we understand our humanity shapes how we behave toward and use nature and how we meet our needs and wants through economic activity, is the converse also true? If our economic patterns of behavior and institutional practices were to be significantly transformed, would we be forced to rethink the fundamentals of our humanness?

I think the answer is yes, and this brings us to the second proposition above. Consider how many of our contemporary economic beliefs and behaviors are the foundations for our sense of a meaningful life, self-identity, and self-esteem, and then consider the proposition that those beliefs and behaviors are rapidly becoming ecologically untenable and unsustainable. Environmental science and testable modeling related to climate change and the thresholds of bio-physical systems all offer a warning about a way of living that is too much about power and control and too little about boundaries and patience. This warning calls our attention to a life that is too much about the bottom line and too little about moral lines that should not be crossed.

Such warnings seem to gain little traction. In large part this is because our societies are enthralled by a historical transformation, underway at least since the 1970s, that is restructuring economic systems and reinforcing a philosophy of humanness associated with the notion of *homo economicus*. This viewpoint takes humans as creatures of want and as rationally competitive and aggressive beings, strategically self-interested and oriented almost exclusively to extracting value from natural sources and from exchange with other individuals or groups. With a rapid pace and a global sweep, human institutions and relationships are being reconstructed on the basis of competitive advantage—making more. The goal of all this is essentially power, that is to say, the satisfaction of expanding wants and desires—having more.

The medium of these transactions is the market: the system of buying and selling. And currency—money—is the universal, fungible instrument of those market transactions. In the worldview to which I refer, now often called “neoliberalism,” market exchange is the paradigm of all human activities. Aristotle believed that human beings were political animals, most fully at home in political community deliberating about the common good. Stoics, like Seneca and Cicero, sought to achieve individual happiness by freeing oneself of the unnecessary fears and desires that tether one’s sense of self-worth to market-defined success or status. Neoliberalism roots the humanness of *homo economicus* in entrepreneurial discipline, precisely what Aristotle considered of secondary human importance.
and the Stoics sought to transcend altogether. For the great modern thinkers who helped to construct the “spirit of capitalism,” such as John Locke and Benjamin Franklin, this discipline is the vocation or calling given to humankind to transform natural creation into useful property. For post-religious and postmodern thinkers, this discipline has morphed into a kind of game, liquid and fluid, subject to essentially arbitrary combinations and significations. For those inclined to apply economic theory to social and legal studies, there is no area of human life that is not essentially economic. There is nothing that money cannot buy, nothing that more effective strategic decision-making cannot improve.

And there is a (sometimes suppressed) value judgment at the heart of this symbiosis between neoliberal capitalism and homo economicus. It is the idea that more is better. Economic life is always and everywhere in quest of more, and its (universal, no longer exclusively Protestant) ethic is pervasive and multidimensional.

The market economy is a powerful mechanism for channeling energy, skills, and creativity efficiently toward innovation and productivity. Yet the market mentality is not limited to one sphere or set of institutions, not something that we leave at the office or that stays in Las Vegas. Its logic and ethic are evangelical. The market economy is fast becoming—may already have become—the market society. Its metaphors and its dispositions are colonizing virtually all aspects of daily life. The single-minded pursuit of economic advantage and wealth can erode other valuable goods in our lives and debilitate them. In this way, wealth can become “illth,” as John Ruskin so nicely put it. The market takes natural and human capacities, uses them selectively and makes some of them grow, but discards the rest. The material waste products of this way of life are ecologically destructive. No less morally destructive is the discarding of people as so much waste—a growing population of marginalized men, women, and children, quite literally without market value, which is to say, without any value.¹

The dominant cultural force of our time is an unsustainable form of living and its correlative conception of humanness—a “restless desire of power after power, that ceaseth only in death,” as Hobbes said, not putting too fine a point on it. What then if we take seriously the possibility that it is so
deeply ingrained in our sense of meaning that we will lose our concepts without it? If this way of life cannot continue unchecked much longer—a generation or two at most—what new synthesis can emerge between our self-understanding and our mode of making a living?

When a society loses the concepts through which it has traditionally made sense of itself, it experiences a debilitating disorientation. In his book Radical Hope: Ethics in the Face of Cultural Devastation, Jonathan Lear presents a remarkable study of the experience of cultural devastation among the Crow people from the late nineteenth century. It provides a cautionary tale for any society facing a fundamental shift from one way of life to another in the span of one or two generations. Lear anticipates what could well be our coming situation:

...if a people genuinely are at the historical limit of their way of life, there is precious little they can do to “peek over to the other side.” Precisely because they are about to endure a historical rupture, the detailed texture of life on the other side has to be beyond their ken. In the face of such a cultural challenge, . . .there is ever more pressure to explain things in the traditional ways, yet there is an inchoate sense that the old ways of explaining are leaving something unsaid. And yet one doesn’t yet have the concepts with which to say it.

If we lose our capitalistic and entrepreneurial concepts of humanness and economy, what conceptions can take their place? What kind of person would be called forth in an ecological economy? How can selves be nurtured so as to become respectful householders and trustees of the natural world and the common good? How can the current neoliberal world of extractive liberty and possessive individualism be restored to a world of caring relationships, respectful of human dignity and the integrity of the land?

In this issue we present four articles by authors currently working with the Center for Humans and Nature as Senior Scholars for 2012. Earlier this year, Mary Midgley and David Sloan Wilson orchestrated an important series of commentaries on the question, “What does it mean to be human?” on the Center Web site, and Peter Victor and Richard Howarth did the same with the question, “How can we create a successful economy without continuous economic growth?” These discussions can be found at www.humansandnature.org. Here, their essays provide more in-depth and comprehensive discussions of these respective large questions.

Mary Midgley critically explores the link between attempts to define humanness and attempts to separate human beings from other species and to give humans greater ontological value or ethical superiority. As sources and examples of this, she alludes to religious traditions such as Christianity that offer hierarchical images of divine creation, with humans above other levels of mortal being. She also points out, however, that modern evolutionary biology and sociology, as developed by thinkers such as Spenser, Comte, and Julian Huxley, reinforced in a
secular way the superiority of *Homo sapiens* and the subject/object dualism of humans-above-the-rest-of-nature. As an antidote to this, she argues that we have to “get ourselves in proportion—to see though our current absurd over-estimate of human separateness and superiority.”

David Sloan Wilson provides a perspective on evolutionary theory that can avoid the pitfalls and blind spots of the earlier thinkers Midgley discusses. An evolutionary perspective on the questions of humanness involves understanding how species develop through various mechanisms of inheritance. Especially for human beings, the answer to this cannot be found in genetic inheritance alone but requires consideration of social learning and symbolic thought. Wilson brings together an evolutionary perspective on the phenotype of species, the diversity of individuals, and the functional capacities of groups and larger corporate units in adapting to their environments. Contained within the functional requirements of this account of adaptation and evolution are behaviors such as cooperation and caring. These ideas point the way beyond the falsely aggrandizing and destructive attitudes that, as Midgley notes, are proving to be ecologically and humanly self-destructive.

The articles by Victor and Howarth turn us to the problem of reorienting economic theory and practice. The market value of goods and services produced in an economy, gross domestic product (GDP), has long been a measure of economic success used by policymakers, businesses, lenders, and investors. But economic growth in this sense has many shortcomings and arguably does not do a good job of measuring either human well-being or of promoting ecological integrity. Developing better models and approaches has been the goal of ecological economics.

Peter Victor notes that contemporary economies increasingly depend on human land use, the consumption of materials and energy, and the production of waste. The volume, pace, and scale of this kind of economic activity is threatening planetary systems. Can a greater degree of economic stability, less economic growth, be achieved while still extending the benefits of economic prosperity? His answer is yes. His work has involved developing model simulations of an economy and analyzing the results of a reduction in growth on other factors and outcomes. In his article he describes the findings of the macroeconomic model LowGrow, that he and his collaborators have developed and refined over the past several years to simulate the Canadian economy. He finds that ecologically beneficial lower growth is possible without unduly affecting employment or other essential aspects of human economic well-being. However, in order to achieve this result, new

“If we lose our capitalistic and entrepreneurial conceptions of humanness and economy, what conceptions can take their place? What kind of person would be called forth in an ecological economy?”
public policies and social practices will be necessary in many areas of life, including consumption, investment, employment patterns (an emphasis on services and higher productivity, more shared work and leisure time), population stability, greater equality and the reduction of poverty, and the like. This is not exactly the social and public policy agenda that is currently being promoted by neoliberalism.

Looking historically at the debates over the limits to growth, Richard Howarth contrasts the limits to growth approach of the Club of Rome with the sustainable development approach of the World Commission on Environment and Development (WCED). He points out that both these perspectives have changed over time, but both continue to inform social debates and policy discussions on many fronts, including climate change. The empirical connection between economic growth and environmental effects is a complex problem, as are the value judgments involved in making trade-offs between different goals, properly gauging the social interests at stake, and dealing with intergenerational consequences. The benefits of growth in developing parts of the world are different from what they are in developed countries, where the social effects may be undesirable from the point of view of health and well-being. As far as climate change is concerned, it would be possible to reduce GHG emissions substantially without having much of an impact at all on overall economic growth in the developed nations or worldwide. Indeed, it may not be only the natural limits of growth that should most concern us, but rather its social limits. Howarth concludes that a draconian narrative concerning the limits to growth may actually reinforce the neoliberal denial of environmental values.

“In the pursuit of growth,” Howarth forcefully reminds us, “our society has told itself that our social and environmental values are too expensive to afford. The result is . . . an over-emphasis on growth, markets, and our identities as consumers that has crowded out our human roles as citizens, community members, caretakers, and friends. . . . A sustainable future will emerge if we build institutions that, on a practical level, sustain the natural environment and the social and technological conditions that will empower future generations to define and pursue their own conception of the good life.”

Citizens, community members, caretakers, and friends. Today the chasm is growing between the vision of ecological economics and the everyday lifeworld of individuals. The terms that people use to define a self-identity and to comprehend their situation are growing increasingly thin and impoverished from both an ecological and a humanistic point of view. People with
a consumer’s sense of relationship and a tourist’s sense of place cannot grasp that our well-being depends on healthy natural and social systems. We shall have to lose our concepts in order to reclaim our genuine selves. Somehow, the experience of relationship and place must be altered and enriched—from consumers to trustees; from tourists to householders and citizens. But the alteration of that ordinary experience—a transformation of the sense of self and the motivational bases of moral imagination—is not something that can be socially engineered or taken lightly, much less something that will emerge spontaneously from the invisible hand of the marketplace or the free play of signifiers in a liquid society.

At the close of his great work, Democracy in America, Alexis de Tocqueville expressed intellectual and moral awe in the face of an old world dying and a new world gradually being born. We need not feel that our lifeworld of meaningful agency has disappeared or that we are wandering in darkness, however, for there is much constructive intellectual (and political) work to do. The most urgent need, no doubt, is to stem the tide of the bio-physical degrading of our natural world. A second imperative task, related and also urgent, is to reclaim, restore, or reconstruct anew our conceptual world. We have lived for some time now with a conceptual vocabulary for describing our moral lives that is much sparser and less articulate than our actual lives themselves. Despite expressing ourselves for the most part individualistically, we nonetheless manage to tap into an underlying moral resiliency and thereby preserve pockets—no, actually rather expansive landscapes—of life lived caringly and communally. There are signs, however, that this fund of moral resiliency is becoming depleted, even as its natural counterpart of ecological resiliency is also being stressed beyond its tolerances.

Ecological economics and our philosophical understanding of the relationship between the human and the natural are symbiotic, and both need to articulate a sense of equal civic respect, parity of power and position, and a developmental, open-textured type of personal agency and identity formation. This is a recipe for rich lives in a socially and naturally thick and relational interdependent world. This sense has not been extinguished. This meaning has not been lost. It remains the perennial possibility of human life, even if historically fugitive and fleeting.

NOTES
1 For a humane and refreshingly non-condescending account of people living lives of inequality and injustice, see K. Boo, Behind the Beautiful Forevers: Life, Death, and Hope in a Mumbai Undercity (New York: Random House, 2012), a firsthand account of the lives of slum dwellers in Annawadi, a desperately poor shanty town near the international airport in Mumbai.
was lately asked to talk at a meeting of the International Society for Anthrozoology. I didn’t know that there was such a thing, but its existence strikes me as good news. Anthrozoons (or anthrozoa) are presumably humans who are also animals. Since no human has ever been anything but an animal, it seems odd that we should now find it hard to grasp this concept. Yet there is no doubt that it baffles people today. Learned scholars still keep asking, very gravely, “What is it that divides us from the animals?” Indeed, quite a lot of people who ask our present question—“What does it mean to be human?”—give this special twist to its meaning. It seems that what they are really searching for is this frontier—this clear, unmistakable mark that will finally prove our separate-ness. All sorts of candidates for this position have been considered—speech, laughter, use of tools, awareness of death, the upright posture. But none of them seems quite adequate, and many of them, of course, turn out to belong to other animals as well.

I once wrote a book (which is actually called Beast and Man, though people still keep calling it Man and Beast) that was meant to show the oddity of this whole quest. But that book doesn’t seem to have helped. Timothy Leduc tells me how often he still has to deal with the query, “What is it that makes us unique?” It seems that he usually says—as I do myself—“Yes, we are indeed in many ways fairly unique, but then, there’s a lot of uniqueness around. Elephants are rather unique, too, aren’t they? And so are termites and porcupines and wandering albatrosses. In fact, most of us seem to be pretty unique, so why would humans be any different?”

“Ah,” comes the reply, “But we are far more unique than all the others. In fact, we are uniquely unique.” What does this mean? To put the point crudely, no doubt the intention here is partly to establish that we have a right to exploit other creatures. But what peculiarity in us is it that is supposed to do this? It surely has to be a metaphysical difference. The thought is that we are entities of a different kind.

Perhaps, as Descartes rather surprisingly suggested, we are the only real subjects; everybody else is just an object? Some sages, such as Jacques Monod, say that this “postulate of objectivity”—this belief that everything except us is an object—is the foundation of modern science. Scientific reasoning, they say, is founded on firm belief in the “uncaring emptiness of the universe.”1 (This modern claim is, of course, chiefly intended to get rid of God, but it is just as fatal to the rest of the life around us. In fact, these two topics are more closely linked than is sometimes noticed.) And in Descartes’ day this “objectivist” story could be put in terms of Matter and Spirit, a metaphysical distinction that gave it a clear sense. But today no such handy system is available. Modern thought doesn’t distinguish varieties of entities in this way. And that is perhaps why the question is now so puzzling.
Charles Darwin himself quite rejected the hierarchical picture, considering that all the various evolving creatures ought to share the earth on equal terms.

But, as things turned out, the story about evolution that caught on was not Darwin’s but Herbert Spencer’s, which the temper of the times found much easier to take in. (Spencer, of course, was not a biologist at all but a political philosopher who had got excited about Darwin’s ideas, so his view has no particular scientific credentials.) This story is a strictly competitive one. It shows evolution as a zero-sum game, a competition determined by the “survival of the fittest”—a contest to be won by a single enterprising species. And since we humans have drifted into taking charge of so many earthly concerns, we are assumed to be that worthy candidate. In fact, it emerges that our intelligence, working through modern science, has effectively given us complete power over the earth and the right to use it as we please. As Julian Huxley put it in his striking essay, “Rationalism and the Idea of God,” scientific man has become the growing point of evolution, the guiding authority figure who is now in charge of the whole process. And Stephen Hawking has lately assured us that this person will eventually colonize the stars as well.

In this way our status has actually become much

“Man is But a Worm” Punch almanac of 1882

TWO CONVERGING MYTHS

It is surely worthwhile to ask why this conviction of separateness concerns people so much today. Part of its point, I’m inclined to think, is simple species loyalty—the spontaneous affection that we feel for the familiar beings around us and the partiality that goes with it. And, of course, we know from the inside what it is like to be a human, while we have only the vaguest notion of what it is like to be an elephant. This kind of partiality is indeed a quite proper and valuable element in keeping life going. Sheep, similarly, probably tend to think more highly of sheep than of pigs or cows and to take more trouble about them, and elephants may not think much of hippos. And we are all inclined to think that our fellow countrymen are better than foreigners. All this is quite in order, provided it doesn’t make us treat outsiders badly. But when this partiality is backed by myths—stories that claim to prove how much better we are than the groups around us—then there is real trouble. The unfortunate thing is that in our society two stories of this kind have been immensely influential. Though the worldviews that they express differ in almost every other respect these accounts agree completely on this one point of human exceptionalism.

The better-known of these stories is, of course, the Christian one—that we are here as God’s viceroy, put here by Him to rule other creatures, using all earthly things for our own purposes (under Him) till He finally takes us to join Him in Heaven. At the point that this story dates to, the Earth was thought to be destined for destruction, having no value of its own. In the last two centuries this account of things has, of course, lost credibility as many people have drifted away from Christianity and have turned instead to a belief in evolution. And this change might have been expected to shake their confidence in human superiority. Indeed,
grander under the supposed rule of science than it was under God. God, after all, used to be our superior. He might easily have had ideas of His own. And there are hints in the Bible that He might actually love and value other earthly creatures, as well as ourselves. In the Book of Genesis, He looks at all His creatures on each day when He has made them and He sees that they are all good. At the end of the week, too, He looks at the whole thing—not just at man—and sees that it is very good. In the Book of Job, too, He points out that we humans know absolutely nothing about most of the wonders of His creation. When this divine critic is removed, there is nobody to make revealing remarks like this about us—no higher power who can put us in our place. We are free to exalt ourselves as we please. Today’s humanistic imagery—which is still, rather oddly, described as “modern”—has thus become not just anthropocentric, but more or less anthropolatrous, or self-worshipping. It shows us as potentially omnipo-

chat with, so far without result. It is no comfort to him, apparently, that he lives among a crowd of relations whom he doesn’t bother to talk to, some of whom are quite communicative and might well be easier to understand than the denizens of Alpha Centauri. Francis Thompson surely offered the right cure for this in his poem, “The Kingdom of God”:

Not where the wheeling systems darken,
And our benumbed conceiving soars! —
The drift of pinions, would we hearken,
Beats at our own clay-shuttered doors.

Urban man, however, seems to know in advance that these relations can’t have anything interesting to tell him. And indeed, his devout humanism makes it very difficult for him to see them at all.

HUMANISM AND WORSHIP

Is humanism the right word for this? It is quite interesting to ask what that term actually means. It is a word that has always bothered me, so much so that I rarely use it. I am never sure whether it is meant to mean a new and better form of religion, or just a radical cure for religion—a way to get rid of it on Christopher Hitchens’s principle that “religion is poison.”

Plenty of people, of course, do agree with Hitchens about this. But it so happens that Auguste Comte, the father of modern humanism, was certainly not one of them. Comte called humanism “the religion of humanity,” and he devised ritual forms for it that were quite close to traditional Christian ones. He thought—and many people agree with him—that the trouble about religion was simply that it has a supernatural object, God, who doesn’t exist. Apart from this, Comte thought that religious habits and ideals were laudable—indeed,
the enlightened citizen would start each day by worshipping first, his mother, then his wife, and then his daughter, before, of course, ensuring that they all did exactly what they were told for the rest of the day. And the other occasions of life could be similarly hallowed.

But somehow these precepts didn’t work out. Comte’s new Christian-like institutions withered like transplanted vines, even though he carefully policed them and trained his priesthood in the newly discovered skills of sociology, a discipline he had recently invented. I once saw the still-extant Comtian Temple of Humanity in Paris, a well-built little Victorian church with round arches (not Gothic ones, of course), its walls lined with statues of the saints of humanity—Plato, Newton, Shakespeare, Beethoven, etc. I asked its gloomy concierge whether she thought anybody ever worshipped there but she replied, “Nobody, I think, never.”

Plainly, Comte’s simple recipe for grafting a new object onto traditional institutions—a new head onto an old body—didn’t produce the improved lifeform that he’d hoped for. Since his time, of course, much more effort has been put into rethinking the possibilities. Yet things are still very confused. Comte’s palace does not seem yet to have been built, nor is it clear even what should be the site for it.

**ON TAKING CHARGE OF EVOLUTION**

One person with very interesting views about this was Julian Huxley, who reworked humanism for our times in the 1930s. Like Comte, Huxley wanted to retain the concept of worship. He writes, “The most fundamental need of man [has always been] to discover something, some force or tendency, which was moulding the destinies of the world—something not himself, greater than himself, with which he yet felt he could harmonize his nature.”

There are echoes here of both Spinoza and Matthew Arnold, but Huxley’s conclusion is very different. The proper object of this worship is, he says, not exactly the human race but the evolutionary process that has produced it and, beyond that process, the evolving cosmos itself. Like Spinoza, Huxley retained the name God for this, effectively equating God with Nature:

> The proper object of this worship is, [Huxley] says, not exactly the human race but the evolutionary process that has produced it and, beyond that process, the evolving cosmos itself.

It is a simple fact that the conception which man has of the universe and its relation to himself exercises important effects upon his life. A name therefore is needed for this anthropological phenomenon. God is the usual name applied and we shall retain it in default of another, premising that . . . we apply it here in a peculiar and perhaps novel sense. God in this sense is the universe, not as such, but as grasped as a whole by a mind.

Within this divine universe, however, he sees the human race as having a quite peculiar role at the forefront of evolution. Huxley, in fact, goes to much trouble to explain what today’s theorists mostly just take for granted—the reason why he thinks humanity should be considered so central, and why science plays such a crucial role in this. The reason is, he says, that the mental qualities *Homo sapiens* is developing through emergent evolution—above all, his capacity for intelligent worship of the universe through science—are now the growing point of the whole cosmic process. They determine which way the whole concern shall go. In fact, we—that is, the body of responsible scientists among us—are now effectively in charge of steering the development of life.

In the 1930s, this was evidently stirring stuff. How much of it still remains with us today? Clearly, what does remain—and indeed, is now a dominant theme—is the concentration on human evolution. People who want to give a scientific explanation of anything puzzling in our current life now regularly do it by speculating about the very early evolution of our species. They are not discouraged from doing this either by lack of data about that period or by the thought that other kinds of explanation might be more relevant. We have also kept Huxley’s glorification of physical science above all other human achievements, though
without the reasoning that Huxley used to support it. The thing that has most obviously vanished is the element of worship that he saw as being central to that science, and to the outward-looking impulse that created it.

Huxley’s remarks about the universal religious tendencies of humanity are clearly sound anthropology, and they have been echoed lately from various quarters. But today’s humanistic theorists still seem sure that this human tendency, however universal, is one from which academics are luckily exempt. They usually see worship as just a quaint habit of other cultures and other times, not something that we ought to take seriously now. They do indeed treat evolution very much like a god insofar as they believe it created us and rely firmly on its still maintaining us. But this does not seem to involve any Spinozan reverence for it, and still less any duties toward it, or toward the rest of the evolving world. There is no emphasis on our kinship with the rest of creation or our dependence on it, and certainly no suggestion that, in directing the future course of evolution, we ought to consider any non-human interests. The gold medal that our species is held to have won by its evolutionary success apparently comes at no cost to us. It serves simply to encourage us to go on exactly as before.

This confidence in the secure standing—not just of our species, but of our present culture—surely plays quite a large part in causing the extraordinary contemporary habit of ignoring climate change. Deadly facts about things like global warming have been reaching us for more than half a century now—coming, of course, through science itself—but they seldom stir anyone to act. Such news clashes so badly with our self-concept that it can’t be heard. Accordingly, predictions of planetary disaster clearly don’t interest most of us now as much as economic alarms, or indeed as the football results. So it has become fearfully hard to divert resources to deal with them.

THE POWER OF HUMAN CHAUVINISM

What this shows is the extraordinary capacity that a myth—an ideology, an imaginative vision—can have to make empirical facts invisible, even to people who claim to be the most hard-headed of realists. The evolutionary escalator that is believed to support us is now so fixed in our imaginative landscape that we can’t hear even the most impressive evidence that it might fail us. This deep faith is surely what led Julian Huxley—who had started with a wide, inclusive, Spinozan reverence for the whole cosmos—to narrow his reliance down sharply to human evolution, and to center that evolution on our scientific activities.

The difference from Spinoza here is striking. Spinoza did, of course, equate God with Nature and say that the highest human activity was, quite simply, the intellectual love of this vast, inclusive God. But he clearly meant by this a reverent contemplation of Nature that was extremely comprehensive—a profound devotion to the Whole, flowing equally from mind and heart. Of course, pantheism of this kind has its own difficulties, but there is no doubt about its seriousness, nor about the huge scale on which it is meant to work. It is an ideal that aims to change our lives. But when Comte and Julian Huxley tried to redirect this same attitude toward a much smaller object, the human race, what they produced surely turned out to be a mouse rather than a mountain—and perhaps, indeed, a dead mouse, since the project of worship still does not work. Huxley’s preaching no more inspires eager and devout congregations than Comte’s did.

When Huxley decided to keep the word God for his authority figure, he hoped, I think, that this would enlarge the concept of God by applying it to something universal—evolution—rather than to a mere personal deity. But he then went on to point evolution sharply not just at Homo sapiens, but at a single strand in contemporary human activities, physical science. Plainly the awe, the wonder, the reverence, and, above all, the personal gratitude that have always been the roots of religion can’t possibly be redirected in this way. They do not point us toward an abstraction like evolution, and still less to something as sectional, something so far from universal, as human physical enquiry. The question why our species should have a different meta-physical standing from all others is a real one, and it surely here becomes pressing. If we now ask again, “What is it that divides us from ‘the animals’?” we may perhaps feel inclined to answer, as Darwin might have done, that this stark division owes most of its force to bad ideology, and that it wouldn’t hurt us to rethink it from scratch.
To conclude, I am suggesting that, if we want to make sense of our present situation, the first thing we have to do is to get ourselves in proportion—to see through our current absurd over-estimate of human separateness and superiority. When that over-estimate approaches self-worship—anthropolatry—as it seems inclined still to do today, it distorts both our vision of the world and our thinking about our own lives. Of course, we are not mistaken in glorifying human ideals and achievements. They are indeed glorious, and we do right to rejoice in them. But put on their own, without the vast planetary context that has created and nourished them and without which they would vanish like a dream, these human splendors simply don’t make sense.

Cutting down our overgrown self-image in this way does not clash at all with the admirable insights that thoughtful humanists in the West have long been developing. Indeed, those insights themselves demand it. Humanism has always centred on realism—on the need to attend to the immediate troubles of the world around us, rather than hoping for pie in the sky. It urges us to help our fellow humans directly rather than trying to reshape them to suit some flattering ideal of our own devising. And today, this surely means above all that we should stop destroying the biosphere on which we, like other creatures, entirely depend, and find ways of living that are workable enough to keep the species in business.

Thus, the challenge that faces humanists today has indeed changed, but it calls for just the same realistic virtues. The distracting fantasies that humanism now most needs to resist flow not so much from belief in God as from the fancies of ideologues, ranging from Herbert Spencer and Julian Huxley to Ray Kurzweil and even Freeman Dyson, who sell us seductive but quite implausible human futures. The myth of an evolutionary escalator carrying our species to omniscience and omnipotence has become meshed today with an undiscriminating trust in technology and a deep reliance on markets as the mechanism that will surely bring these things about.

THE ODDITY OF SPACISM

Devotees of this model expect a steady persistence in current business methods to lead us back to renewed prosperity that will trickle down and finally reach everybody. And, for people who want more excitement, the religion of technology even offers its own celestial rewards. What is oddly called “the conquest of space” is proposed both as the culmination of all previous human empire-building (the “last frontier”) and as a handy refuge in case, by some chance, we do accidentally wreck the planet and have to relocate elsewhere. This colonization of space is, however, also celebrated as something glorious in itself—the proper completion of whatever “upward” ambitions have always inspired human striving—in fact, literal pie in the sky.

Thus, to cite the still-influential views of another distinguished scientist who has been Dyson’s mentor, J.D. Bernal:

Once acclimatized to space-living, it is unlikely that man will stop until he has roamed over and colonized most of the sidereal universe [i.e. the stars] or that even this will be the end. Man will not ultimately be content to be parasitic on the stars, but will invade them and organise them for his own purposes. . . . The stars cannot be allowed to continue in their old way, but will be turned into efficient heat-engines. . . . By intelligent organization, the life of the universe could probably be prolonged to many millions of times what it would be without organization.6

How’s that for a proposal from a species that hasn’t even been able to stop itself trashing the biosphere in its own backyard, on the one modest little planet that it has so far had to deal with? It is surely to be hoped that nobody takes us up on Bernal’s offer until we have sorted things out a bit better down here.
The Center for Humans and Nature has identified the question “What does it mean to be human?” as important for its central mission of understanding the relationship between humans and nature. In the essays that were commissioned to address the question, the authors seemed irresistibly drawn to another question: How can we cope with the enormous problems threatening humans and the natural world, caused largely by the impact of humans on the natural world?

It is important to recognize these as separate questions before relating them to each other. We can begin by asking a third question—“What does it mean to be species X?”—where X is any biological species other than humans. What does it mean to be an E. coli, an oak tree, a monarch butterfly, or a polar bear? I am not referring to the interior experience of being such a species, which would be difficult or impossible for humans to apprehend. I am referring to the measurable properties of such a species—what an evolutionary biologist would call its phenotype—which is fully amenable to scientific understanding.

Answering the question “What does it mean to be species X?” is what evolutionary biologists do for a living. Each species is a product of evolution in relation to its environment. The process of natural selection adapts each species to survive and reproduce in its environment. E. coli has the properties required to survive and reproduce in the human gut. Monarch butterflies sequester the toxic compounds of milkweed plants for their own defense and undertake an amazing migration to survive the seasons. Polar bears are white to conceal themselves from their prey and have myriad other adaptations to survive the arctic environment.

No species is perfectly adapted to its environment, and all species bear vestiges of the far distant past, reflecting the fact that evolution is a path-dependent historical process. The first vertebrates were fish and all subsequent vertebrates, such as mammals, bear the marks of their fishy origin. In addition, all organisms are a product of development over the period of their lifetimes. Single genes typically affect many phenotypic traits, and single phenotypic traits are typically influenced by many genes. Any given phenotypic trait therefore cannot be analyzed in isolation from other traits, but rather as part of a genetically influenced developmental system. Nikko Tibergen, who shared the Nobel Prize in 1973 for helping to found the science of ethology, stressed that four questions must be addressed to fully understand any particular trait: (1) Why does the trait exist, compared to many other traits that could exist, often (but not always) based on the winnowing action of natural selection? (2) How does the trait exists in a physical sense? (3) How did the trait evolve over a period of generations? (4) How does the trait develop during the lifetime of the organism? Tibergen posed these questions in an article titled “The Methods and Aims of Ethology,” but they also describe the methods and aims of evolutionary...
In this fashion, evolutionary biologists provide answers to the question “What does it mean to be species X?” Now imagine placing any given species in a different environment than its past range of environments. There is no guarantee that it will be well adapted to its new environment. Perhaps it is so maladapted that it goes extinct immediately—like a fish out of water. Perhaps it survives and reproduces well enough to remain in existence as a population, in which case natural selection will begin to change its properties so that it becomes better adapted to its new environment. When this happens, the question “What does it mean to be species X?” will have a different answer than it did before.

This is why the question “What does it mean to be species X?” must be recognized as different than the question “How can species X cope with problems threatening its current existence?” The first question is inherently about the relationship between the organism and its past environments—what evolutionists call the “environment of evolutionary adaptedness”, or EEA. The second question is inherently about the relationship between the organism and its current environment and arises primarily when the current environment becomes different from the EEA. The second complication is based on the fact that the development of phenotypic traits typically involves an interaction between genes and the environment. Even traits that develop reliably in all individuals, such as the vertebrate eye, require environmental inputs over the course of development. Place a patch over the eye of a developing vertebrate, and the eye will fail to develop. This means that when a species is placed in a new environment, its phenotypic traits might immediately change, based on an altered gene-environment interaction. However, the new gene-environment interaction is no more likely to adapt the organism to its new environment than a new genetic mutation. Thus, the mere fact of gene-environment interactions does not solve the problem of mismatch any more than the mere fact of phenotypic plasticity does.

To provide a concrete example, imagine a lizard species adapted to live in the rainforest that is suddenly transported to the desert (alternatively, the lizard can stay where it is and the climate can change). The phenotypic properties of the lizard don’t change; they simply have different consequences in the new environment than they did in the old environment. The answer to the question “How can the lizard cope with the problems threatening its current existence?” is “It can’t without human assistance. Otherwise, only natural selection will cause it to cope better, at which point it will have different properties as a species.”

Actually, this example needs to be complicated in two ways to be fully relevant to the human case. All species have evolved by natural selection to respond to environmental change during the course of their lifetimes, a property that evolutionists call phenotypic plasticity. Continuing our example, rainforest habitats vary in their degree of wetness and dryness. Rainforest lizards are well adapted to seek out dry, sunny spots to bask, seek moisture when they become desiccated, and so on. Their phenotypic plasticity might serve them to a degree in the new desert environment, but there is no guarantee that the pattern of phenotypic plasticity that evolved in the rainforest environment will be equally well adapted to the desert environment. Thus, phenotypic plasticity by itself does not solve the problem of mismatch that arises when a species encounters an environment that differs from the EEA.

To summarize, the question “What does it mean to be species X?”—which I take to mean “What are the phenotypic properties of species X?”—must be answered on the basis of the past environments inhabited by species X. The question “How can species X cope with the problems threatening its existence?” must be answered on the basis of the current environment inhabited by species X. These questions are different to the extent that the current environment departs from past environments. The answer to the second question is “Species X doesn’t cope, and only natural selection in the new environment will enable it to cope better.”
A FOURTH QUESTION

So far, my path to answering the question “What does it mean to be human?” has involved a detour to answer the question “What does it mean to be species X?” where X is any biological species other than humans. Before I can address the human case, I must pose another question that is not focused on humans: “What is an evolutionary process?”

The standard answer to this question is that evolution requires four ingredients: (1) A population of reproducing entities that (2) vary in their phenotypic properties with (3) corresponding variation in survival and reproduction and (4) heritability, which is defined as a phenotypic resemblance between parents and offspring. When all four ingredients are present, then phenotypic traits that increase survival and reproduction accumulate in the population, adapting the entities to their environments.7

The most important observation to make about this standard answer for the purpose of this essay is that the definition of an evolutionary process says nothing about genes. Heredity is required, and genes enter the picture only insofar as they provide a mechanism of inheritance. By the same token, if other mechanisms of inheritance exist, then genes are not required for a process to count as evolutionary.

Even though the answer provided above is standard, there is also a sense in which it is new and even revolutionary. Darwin knew nothing about genes, but once genes were discovered, they became the one and only mechanism of inheritance for most evolutionary biologists. There is a tradition of thinking about evolution as a substrate-neutral process, but it needs to become more central to evolutionary thought than it has been in the past.8 An excellent recent account is provided by Eva Jablonka and Marion Lamb in their book Evolution in Four Dimensions.9 They provide a concise history of why evolution became so gene-centric and describe three additional mechanisms that are capable of creating a resemblance between parents and offspring. The first is epigenetics, which involves changes in gene expression rather than gene frequency. The second is social learning. The third is symbolic thought. These mechanisms are capable of producing trans-generational inheritance. In addition, the vertebrate immune system includes an evolutionary process that involves the random formation of antibodies and their selection based on their success at binding to antigens. This is trans-generational as far as the antibodies are concerned but takes place within one individual vertebrate. Individual learning and other neural processes can also be regarded as variation-and-selection processes taking place within single organisms, regardless of whether they are transferred to other organisms.10 I will have more to say about these mechanisms as we proceed. For now, the main point to keep in mind is that thinking in terms of heredity, rather than genes, vastly expands the domain of evolutionary theory.

THE HUMAN CASE

Now I am in a position to address the question “What does it mean to be human?” The answer is the same as for any other species, except that non-genetic evolutionary processes operate more strongly in humans than in other species. This is especially true for symbolic thought as an inheritance system.

Photograph of Charles Darwin, published by John G. Murdoch in 1874
them when they become unpaired. A symbol, such as a word, remains permanently associated with its referent and can even refer to entities that don’t exist in the real world, such as a “ghost.”

Associative learning is clearly adaptive, but what is symbolic thought good for? Even though any particular network of associations need not correspond to the real world, it still motivates action in the real world. If we coin the new word “symbotype” to refer to a particular network of associations, there is a symbotype-phenotype relationship similar to a genotype-phenotype relationship. In addition, symbotypes exist in almost infinite variety. They have the same kind of combinatorial diversity as genotypes and antibodies, giving humans a behavioral flexibility unmatched in any other species. Symbotypes can also be transmitted across generations, thereby qualifying as a full-blown inheritance system.

We can appreciate the importance of symbolic thought as an inheritance system for humans by stepping back and observing the panorama of human cultural evolution. Our distant ancestors once had a geographical range comparable to other great ape species. Then something happened that enabled them to spread over the entire planet, inhabiting all climatic zones, occupying hundreds of ecological niches, and speaking thousands of languages. For any given culture, survival and reproduction require an extensive physical and mental toolkit that must be learned and transmitted across generations. This is only possible thanks to language and other forms of symbolic thought. Emile Durkheim was prescient when he wrote: “In all its aspects and at every moment in history, human social life is only possible thanks to a vast symbolism.”

Our capacity for symbolic thought is connected to another hallmark of our species—our ability to cooperate in groups of individuals that need not be genetically related to each other. Our cooperative nature is easy to appreciate in the context of physical activities such as childcare, hunting, and warfare. In addition, we need to appreciate the cooperative nature of the most distinctively human mental activities such as symbolic thought. This has led a number of evolutionists to adopt a “cooperation came first” hypothesis for human evolution. The first event in the path to becoming human was the ability to suppress disruptive competition within groups, making succeeding as a group the primary evolutionary force. This watershed event led to a package of physical and mental cooperative activities, including the sharing of symbolically encoded acquired information.

If this hypothesis is correct, then the answer to the question “What does it mean to be human?” is that cooperation is the signature adaptation of our species. One manifestation of cooperation is a symbolic inheritance system that makes adaptation an extremely fast process, at least compared to genetic evolution.

ADDRESSING THE SECOND QUESTION

Like the other authors commissioned by the Center of Humans and Nature to write essays on what it means to be human, I am drawn to the second question: “How can we cope with the enormous problems threatening humans and the natural world, caused largely by the impact of humans on the natural world?” I believe that my answer to the first question provides an exceptionally powerful toolkit for addressing the second question.

To begin, the fact that we are capable of rapid adaptation means that we can potentially solve problems on timescales that matter, as opposed to the slow timescale of genetic evolution. An evolutionist is not required to point out that people are capable of rapid change, a fact that is established by every decision that is made, everything that is learned subliminally, and every social movement recorded by history. What’s new is to study these processes more explicitly as evolutionary processes, in ways that are currently largely restricted to the study of genetic evolution and the vertebrate immune system.

I and my colleagues have developed this thesis in more detail elsewhere. Here I will provide three vignettes to illustrate what it means to approach real-world problems from an evolutionary perspective.

WHAT DOES IT MEAN TO BE HUMAN SKIN?

Our skin provides a lesson in genetically evolved phenotypic plasticity and the concept of mismatch. Sunlight is important for the skin to manufacture vitamin D but also causes cancer. In sunny equatorial regions, constant exposure to the sun led to the genetic evolution of dark skin as a fixed trait. In the temperate zones, seasonal variation in exposure to the sun led to the evolution of skin pigmentation as a phenotypically plastic trait—sun-tanning. Dark-skinned people who move to temperate regions suffer from an inability to manufacture enough vitamin D, a clear

David Sloan Wilson
case of mismatch that luckily can be corrected with dietary supplements. People capable of sun-tanning can also experience mismatch in a variety of ways because their phenotypically plastic adaptation is calibrated to the particular pattern of variation that existed in their ancestral environment. A person from England who moves to Australia will never become as dark as the aborigines who have inhabited Australia for forty thousand years. A person capable of tanning who spends a lot of time indoors or covered with clothing will experience sunburn when his or her skin is suddenly exposed to the sun, a pattern of variation that seldom, if ever, occurred in his or her ancestral environment. This example illustrates that phenotypically plastic traits are as vulnerable to mismatch as phenotypically fixed traits whenever the patterns of environmental variation in the new environment depart from those of the EEA. It also illustrates that many aspects of our phenotype are a product of genetic evolution, just like any other species. We are capable of rapid adaptation in some respects, but not in all respects. The properties of our skin will not change except over a period of many generations. If we want to solve problems associated with our skin in relation to our current environment, we will need to create workarounds, such as clothing, sunscreen, vitamin D supplements, and so on. Many other examples of genetic mismatches could be provided involving our immune systems, diet, and exercise regimes.18

WHAT DOES IT MEAN TO BE MARY (OR ANY OTHER PERSON)?

The question “What does it mean to be human?” obscures the fact that individuals are very different from each other. If we restrict our thinking to human universals, we ignore the phenomenon of human diversity. Everyone acknowledges that people are a product of both their genes and their environment, but this generality lacks traction without more detail. One way to provide more detail is by noting that individuals are evolving systems in their own right, responding to the contingencies of their particular environments. This was the fundamental insight of B.F. Skinner, who termed it “selection by consequences,” which remains valid, however flawed the tradition of behaviorism was in other respects.19 Another way to provide more detail is by understanding the gene-environment interaction in more mechanistic detail, especially in relation to physiology and development. Mechanistic understanding was one of the main shortcomings of behaviorism, but it is richly provided by other branches of psychology and neurobiology.20

To appreciate the relevance of these ideas, many problem behaviors in individuals are associated with harsh environments during development. One interpretation is that children develop optimally in benign environments and abnormally in harsh environments, resulting in dysfunctions that need to be fixed, in the same way that a broken automobile needs to be repaired. Another interpretation is that benign and harsh environments have been part of the EEA for all species, including humans. When the going gets tough, the tough don’t fall apart—they behave adaptively in the context of the tough environments. That’s what adaptive phenotypic plasticity is all about.21

The idea that what counts as a problem from the standpoint of human and environmental welfare can be adaptive in the evolutionary sense of the word is a new concept for many people, including many formulators of public policy. Yet it is central to any evolutionary process, no matter what the mechanism of inheritance. Adaptations frequently benefit some individuals at the expense of others or promote short-term welfare at the expense of long-term welfare. Adaptations are also path dependent. As evolving systems, people can find themselves on tiny adaptive hills, unable to scale taller peaks because going up first requires going down.

It’s not as if all problem behaviors are adaptive in the evolutionary sense of the word; some are genuine malfunctions, as we have seen in the case of mismatch. However, it is essential to correctly diagnose any particular case to devise successful solutions. When a problem behavior is adaptive, the best way to change it is by finding less problematic strategies that are more adaptive and especially by changing the environment in a way that selects for less problematic behaviors. This is becoming the basis for enlightened intervention strategies for problem behaviors in a variety of contexts, such as risky adolescent behavior and psychotherapy for adults.22
WHAT DOES IT MEAN TO BE NORWAY (OR ANY OTHER GROUP)?

Individuals are not the only human entities that differ in their phenotypic properties. Groups differ at all scales, from neighborhoods to corporations to nations. Selection processes also operate at all scales, sometimes resulting in groups that function well as corporate units, but at other times resulting in dysfunctional groups, especially based on conflicts of interest within the groups.

I have already described how genetic evolution endowed us with a propensity to cooperate in small-scale groups, thanks largely to mechanisms that suppress self-serving behaviors within groups. The same dynamic has operated for cultural evolution throughout human history.23 A book titled *The Spirit Level: Why Greater Equality Makes Societies Stronger*, by Kate Pickett and Richard Wilkinson, documents variation in the functional organization of developed nations in impressive detail.24 The degree of equality within a nation emerges as a critical variable for just about every social welfare outcome that can be measured. Developed nations vary enormously in their degree of equality, from nations such as Norway, Switzerland, and Japan on the egalitarian end to the United States, Great Britain, and Portugal on the inegalitarian end. The same patterns of variation that exist among developed nations also exist among the fifty states of the United States.

Another book titled *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*, by Daron Acemoglu and James Robinson, adds a historical dimension to the analysis of contemporary nations offered by Pickett and Wilkinson.25 Acemoglu and Robinson contrast extractive cultures, where most members are exploited by a small group of elites, with inclusive cultures, where most members can profit from their own initiative. Inclusive cultures are much more innovative than extractive cultures, which results in large differences in how well they function as polities. According to Acemoglu and Robinson, England was the birthplace of the industrial revolution because it had become a more inclusive society than other European nations. The technological innovations that were implemented in England gave it an advantage in economic and military competition out of all proportion to its size. The first European colonies in Central and South America were extractive in nature and led to nations that still function poorly today. The very first British colonies in North America attempted to be extractive, first by attempting to exploit the Native Americans and then by attempting to import cheap British labor, but the laborers had too many other options in the New World, forcing their bosses to adopt more egalitarian relations. The relative equality that existed in the United States and Canada caused them to develop much faster as nations than the Central and South American nations. Differences in equality within the United States gave the North a competitive edge over the South during the Civil War.26

Notice that Britain and the United States were on the egalitarian end of the spectrum earlier in their histories, even though they are at the inegalitarian end of the spectrum today. Nations change during their histories, and these changes are consequential for how well they function as corporate units. Equality is vulnerable to subversion from within and must be supported by norms enforced by rewards and punishments. The suppression of dysfunctional forms of selection within groups was essential for our genetic evolution as a cooperative species, and it is just as essential for the cultural evolution of modern-day groups at all scales.

CONCLUSIONS

My three vignettes barely scratch the surface of real-world problems that can be addressed from an evolutionary perspective. I chose them to be different from each other: The first highlights the fact that some aspects of our phenotype are a product of genetic evolution and will not change over short timescales. If they pose a problem in our current environments, then workaround solutions comparable to sunscreen and dietary supplements are required. The second highlights the other end of the spectrum. Individual people are evolving systems in their own right, capable of adapting to their environments during the course of their lifetimes, but also capable of exhibiting the dysfunctional outcomes of evolutionary processes. The third highlights the fact that groups can evolve into corporate units capable of adapting to their environments, but only when certain conditions are met. Remarkably, these conditions apply to groups of all sizes,
from neighborhoods to nations, and even to the future formation of a global village.

Every major real-world problem has received the attention of many smart people representing dozens of academic disciplines. Most of them accept the theory of evolution and endorse the ideal of consilience, or unity of knowledge, which requires every branch of knowledge to be consistent with every other branch. Yet the human-related disciplines are famously isolated from each other, and many of them developed without reference to evolutionary theory for most of the twentieth century. Evolutionary theory was itself too gene-centric to accommodate the human-related disciplines, but once we expand the theory to include all mechanisms of inheritance, then it becomes possible to understand our species entirely from an evolutionary perspective. The integration that is currently underway for the human sciences will be comparable to the integration that took place for the biological sciences during the twentieth century (and continuing).

In this short essay, I have tried to convey these trends by supplementing the two questions “What does it mean to be human?” and “How can we cope with our current problems?” with two additional questions: “What does it mean to be any species?” and “What is an evolutionary process?” My conclusion is that addressing the latter two questions provides a novel answer to the first question, which in turn can provide novel solutions to our problems. I hope that I have piqued the interest of the reader enough to join the integration that is in progress.

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NOTES
Looking back over the twenty-first century, future historians may well see it as even more tumultuous than the century that preceded it. In the twentieth century the human population more than tripled, average life expectancy at birth more than doubled, and real gross domestic product increased nearly forty times. Huge numbers of people experienced very real improvements in living standards as economic growth spread around the world, yet huge numbers were living in extreme poverty when the century ended. Political systems from Nazism to Communism rose and fell, while democracy in its various forms survived. Well over 200 million people died in wars and conflicts, and nuclear energy was unleashed with the specific purpose of annihilating many tens of thousands in a flash. Seemingly magical technologies in transportation, communication, entertainment, and computation proliferated, as did enormous cities and corporations with global reach. Societies were transformed for better and worse, as was the planet itself.

Despite claims to the contrary, nature was not conquered. Instead, human societies and economies became ever more dependent on increasing quantities of materials, energy, and wastes (i.e., increasing “throughput”), as well as transformation of land as more and more was brought into direct use by humans. Toward the end of the twentieth century, attempts to gain a quantitative picture of these environmental changes yielded new indicators such as the ecological footprint, the human appropriation of the net products of photosynthesis (HANPP), and various measures of direct and total material throughput—all of which, with some local exceptions, point in the same threatening direction. In the second decade of the twenty-first century, humanity’s impact on the rest of nature is on the rise and shows little sign of reversing. In the language of planetary boundaries, we are exceeding the safe operating capacity of the planet to sustain us.\(^2\)

At the same time as we are being constrained by what earth systems can tolerate, incomes and wealth are becoming more unequally distributed, the global financial system is faltering, economies are struggling, and confidence in political systems to address these problems is in decline. These trends are more than disturbing; they portend catastrophe. But their continuation is not given. A brighter and genuinely more prosperous future may still be possible: one in which everyone lives well without depleting and degrading natural systems and where all humans and all nature flourish. However, such a future will only come to pass if we think hard about our predicament, examine a wide range of possibilities, and strive for what we want rather than just accepting what comes our way.

Among these possibilities, there needs to be a reconsideration of the priority given to the pursuit of economic growth, especially in developed countries, where, arguably, the costs of economic growth have
begun to outweigh the benefits. Biophysical constraints to continued growth are becoming more apparent. There is mounting evidence indicating that higher incomes do not make people happier beyond a level of per capita incomes far surpassed by many in developed countries, and, despite decades of substantial economic growth, many social and environmental problems remain. If adopted, a thoughtful strategy in

Despite claims to the contrary, nature was not conquered. Instead, human societies and economies became ever more dependent on increasing quantities of materials, energy, and wastes...

which economic growth became merely a by-product of other, more focused objectives would set a very different example for other countries to follow.

Not that economic growth itself is directly and inextricably related to increased throughput—although historically, the connection has been strong. But as long as economic growth remains, it will be the most important measure of economic success, either for its own sake or for the benefits it is presumed to bring, and efforts to reverse the rising impacts of humans on the biosphere will always take second place. This raises the question whether it is possible for people to live well in a society in which economic stability rather than economic growth is the norm, where all its members flourish, and social justice is served. Such a circumstance should not be confused with economic stagnation and societal decline, but should stand in sharp contrast to that dismal scenario so often touted as the only alternative to endless economic growth.

In *Prosperity without Growth*, Tim Jackson argues that developed economies require economic growth if they are to avoid the downward spiral of deflation, recession, and depression. He also argues that such growth cannot be sustained because of its resource requirements and the unacceptably high burden it places on the environment. He refers to this as the dilemma of growth. We can’t live with it and we can’t live without it, or so it appears, unless we open our minds to a broader range of alternative futures than is normally contemplated. The essence of my recent work and the main theme of both this paper and my collaborative work with Tim Jackson is to investigate how achieving the ecological benefits of lower growth is compatible with social justice and social welfare/equality objectives.

**EXPLORING ALTERNATIVES TO ECONOMIC GROWTH**

There are many ways of thinking about alternative futures. One that I have found fruitful is to develop empirically based simulations of national economies so that we can examine key trends and identify ways of strengthening desirable ones and of turning undesirable ones around. My work has been focused on national economies because most of the necessary data for analyzing economies is most readily available at that level. Having said that, it is clear that we also need to understand likely and possible futures at the sub- and super-national levels, a demanding agenda indeed.

The purpose of scenario analysis is not to develop a specific prescription for the future. Rather it is to see if the future—which will be very different from the past whether we decide to make it that way or not—could be attractive even in the absence of continued economic growth. Not that zero economic growth should replace continuous economic growth as the overarching objective of economic policy. But the prospect of reduced, zero, or even negative economic growth should not stand in the way of the increasingly urgent measures required to reduce the burden of our economies on nature. If we fail to reduce this burden, then the possibility of a good life for all will disappear.

**THE LOWGROW MODEL**

When I was a Ph.D. student at the University of British Columbia in the 1960s, I was most fortunate to be supervised by the distinguished progressive economist Gideon Rosenbluth. Under his guidance, I developed and applied a methodology for estimating the material “throughput” of an economy, based on the law of conservation of matter. The fundamental principle, which applies to all monetized economies, is that associated with each expenditure in the economy, there is a direct and indirect flow of material inputs, and ultimately, a disposal of an equal amount of wastes. This is true for all expenditures, whether they be on goods or services or for current consumption or investment, though the difference between throughput for equal expenditures varies tremendously according to what is purchased. For example, energy-intensive products such as transportation result in much greater
emissions of greenhouse gases than the services provided by hairdressers.

Over the years, I kept in touch with Gideon. Still, I was pleasantly surprised when, about ten years ago, he suggested that we collaborate on the “growth question.” I had just completed my term as dean of the Faculty of Environmental Studies at York University, having resumed my academic career in the mid-1990s, and I was ready to embark on a substantive research project. It was an opportunity and a privilege to work with Gideon again. Even in his eighties he was an intellectual force to be reckoned with.

Although it was not our original intention to build a macroeconomic simulation model, we found a common interest in doing so. We were skeptical of the mainstream view that endless economic growth was feasible, desirable, and essential for full employment, eradication of poverty, and significantly reduced impacts on the environment. We were also unsatisfied by critiques of such a view that did not also provide an account of how an economy might function in a radically different way. So we set ourselves the task of answering the following question: is it possible to have full employment, no poverty, fiscal balance, and reduced greenhouse gas emissions without relying on economic growth? We developed LowGrow, a simulation model of the Canadian economy specifically designed to answer this question. Our results suggested the possibility that an attractive set of social, economic, and environmental objectives could be met in the absence of economic growth. This led us to the conclusion that economic growth could and should be relegated to its proper secondary place as a policy objective.

All models are simplifications of whatever they represent. This is as true of computer models as it is of model aeroplanes and model villages. Whether they are satisfactory simplifications depends on their intended uses. A model plane may be designed to closely resemble a particular commercial or military jet but rest on a stand, unable to fly. Another model might be designed to fly powered by hand, an elastic band, or an onboard engine. Yet it may only vaguely resemble a full-size aircraft. Which of these two model planes is better depends on whether you want a visual replica of a real plane or something that flies. Building simulation models of an economy is not that different.

The overview of LowGrow that follows may appear tedious, but it is necessary to give some idea of what lies behind the scenarios that it generates. Figure 1 shows the simplified structure of LowGrow. Macro demand is determined in the normal way as the sum of consumption expenditure, investment expenditure, government expenditure, and the difference between exports and imports. Their sum total is GDP (gross domestic product) measured as expenditure. There are separate equations for each of these components in the model, estimated with Canadian data from about 1981 to 2005, depending on the variable. Production in the economy depends on employed labor and employed capital (i.e., buildings, equipment, software, and infrastructure). Changes in productivity from improvements in technology, labor skills, and organization are captured depending on time. Macro supply is shown at the bottom of figure 1, and it determines and is determined by employment and capacity utilization shown in the center of figure 1.

There is a second important link between macro demand and production. Investment expenditures (net of depreciation), which are part of macro demand, add to the economy’s stock of capital, increasing its productive capacity. Also, capital and labor tend to become more productive over time. It follows that, other things equal, without an increase in macro demand, these increases in capital and productivity reduce employment: as labor becomes more productive over time, less is required to produce any given level of output. On this basis, economic growth (i.e., increases in GDP) is needed to prevent unemployment rising as capacity and productivity increase.

Population is determined exogenously in LowGrow, which offers a choice of three projections from Statistics Canada. Population is also one of the variables that determines consumption expenditures in the economy. The labor force is estimated in LowGrow as a function of GDP and population.

A brighter and genuinely more prosperous future may still be possible: one in which everyone lives well without depleting and degrading natural systems and where all humans and all nature flourish.
LowGrow includes features that are particularly relevant for exploring possibilities for an economy that is not growing. It includes emissions of carbon dioxide and other greenhouse gases, a carbon tax, a forestry sub-model, and provision for redistributing incomes. It measures poverty using the United Nations’ Human Poverty Index (i.e., HPI-2 for selected Organisation for Economic Co-operation and Development, or OECD, countries). LowGrow allows additional funds to be spent on health care and on programs for reducing adult illiteracy (both included in HPI-2) and estimates their impacts on longevity and adult literacy with equations from the literature.

Expenditures on anti-poverty and environmental programs are automatically added to government expenditures in LowGrow. Other changes in the level of government expenditures can also be simulated in LowGrow through a variety of fiscal policies, such as an annual percentage change in government expenditure that can vary over time and a balanced budget. LowGrow keeps track of the overall fiscal position of all three levels of government combined (federal, provincial, and municipal) by calculating total revenues and expenditures and by estimating debt repayment based on the historical record. As the level of government indebtedness declines, the rates of taxes on personal incomes and profits in LowGrow are reduced endogenously, which is broadly consistent with government policy in Canada.

In LowGrow, as in the economy that it represents, economic growth is driven by: net investment, which adds to productive assets, growth in the labor force, increases in productivity, growth in the net trade balance, growth in government expenditures, and growth in population. Low- and no-growth scenarios can be examined by reducing the rates of increase in each of these factors singly or in combination.

A BUSINESS-AS-USUAL SCENARIO

It is convenient to start analyzing low- and no-growth scenarios by establishing a base case with no new policy interventions. This is the “business-as-
usual” case illustrated in figure 2 and describes what would happen in the Canadian economy if the trends in the years before 2005 were to continue for another thirty years. It is not a prediction of the future, but rather a benchmark against which to compare alternative scenarios.

In the business-as-usual scenario, between the start of 2005 and 2035, real GDP per capita more than doubles; the unemployment rate rises, then falls, ending above its starting value; the ratio of government debt to GDP declines by nearly 40 percent as Canadian governments continue to run budget surpluses; the Human Poverty Index rises, largely due to the projected increase in the absolute number of unemployed people; and greenhouse gas emissions increase by nearly 80 percent.

**A LOW- OR NO-GROWTH SCENARIO**

A wide range of low- and no-growth scenarios can be examined with LowGrow. One promising scenario is shown in figure 3. Compared with the business-as-usual scenario, GDP per capita grows more slowly, leveling off around 2028, at which time the rate of unemployment is 5.7 percent. The unemployment rate continues to decline to 4.0 percent by 2035. By 2020 the poverty index declines from 10.7 to an internationally unprecedented level of 4.9, where it remains, and the debt-to-GDP ratio declines to about 30 percent, to be maintained at that level to 2035. Greenhouse gas emissions are 31 percent, lower at the start of 2035 than in 2005, and 41 percent lower than their high point in 2010.

**Figure 3**
A Low- or No-Growth Scenario

![Graph showing a low- or no-growth scenario](Source: P.A. Victor, Managing without Growth: Slower by Design, Not Disaster (Cheltenham, U.K.: Edward Elgar, 2008).)

**Policy Directions for a Low- or No-Growth Scenario**

What does it take to achieve the kind of outcomes illustrated in figure 3? One advantage of a simulation model like LowGrow is that it helps answer this question. The scenario is based on a number of key changes in the model which could come about by the cumulative changes in autonomous behavior of individuals and organizations, by policy measures introduced by government, or, most likely, by some combination of the two.

The scenario in figure 3 results from a variety of changes, some more controversial than others, that would be required to transform the business as usual scenario in figure 2 into an attractive scenario in which economic growth is not required to meet economic, social, and environmental objectives. These changes include:

**Consumption**

Consumption is one of the main driving forces of the economy. In a successful economy not geared to growth, we would expect the pattern and level of consumption to be very different from a growing economy. For example, well-being would be enhanced with a greater emphasis on public goods, which includes the environment; on shared provision of private goods, as we are already seeing with cars and bicycles in many cities; and on services, rather than commodities. More controls on the content and placement of advertising would be helpful.

**Investment**

In economic terms, investment refers to the purchase of new infrastructure, buildings, and equip-
beyond some level of material well-being—different for each person, but likely within the range already surpassed on average in developed economies—more leisure makes a greater contribution to well-being than a higher income.

**POVERTY**

The idea that poverty can be eradicated through the trickle-down effects of economic growth has been shown wanting. Poverty is more than a matter of inadequate income. It is also about social exclusion, which is closely related to the distribution of income and wealth and not just their amount. Recent experience in many developed countries has shown little or no increase in real living standards for the majority of people despite economic growth, the gains from which have been enjoyed by a relatively small proportion of the population. It is clear that more focused anti-poverty programs that address the social determinants of illness and provide more direct income support are required to eliminate poverty. Such measures are included in the scenario shown in figure 3.

**TECHNOLOGICAL CHANGE**

Technological change has been an important aspect of human progress ever since the Stone Age. Today’s seemingly magical technologies in areas such as communications, entertainment, medicine, and transportation represent a rapid acceleration of trends that have been in play for millennia. To say that new technologies are often a double-edged sword is a cliché, itself a metaphor based on a technology that in

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**MINDING NATURE 5.2**

**PETER A. VICTOR**
previous times had considerable military significance. Our contemporary environmental problems are evidence of the second edge. The way forward will require novel technologies that reflect an approach to life in which social and ecological as well as economic consequences are considered in advance of their widespread adoption. This can be achieved through technology assessment, changes in the education of scientists and engineers, and the adoption of a broader range of objectives by those engaged in technology development than just financial gain.

GOVERNMENT EXPENDITURES

The scenario in figure 3 allows for some increase in total government expenditures followed by an eventual leveling off as the size of the economy stabilizes. The precise level at which this leveling should take place will be determined by the respective roles determined for the public, private, and not-for-profit sectors. The scenario on figure 3 corresponds to a level quite similar to the traditional role of the public sector in Canada.

TRADE

International trade can be mutually beneficial, but it can become destabilizing if a country’s imports and exports move significantly out of balance. The scenario in figure 3 is based on a small but positive trade balance in which Canada earns slightly more from its exports than it spends on imports. Eventually, if the economy is not growing, we should expect imports and exports to balance.

GREENHOUSE GASES

The emission of greenhouse gases would very likely diminish as the rate of growth slows, and this effect is captured in figure 3. In addition, the scenario assumes the imposition of a substantial revenue-neutral carbon tax in which there is a tax on energy use based on the carbon content of the energy. In the scenario, revenues from the carbon tax are exactly matched by a reduction in personal and corporate income taxes, so that there is no increase in overall government revenues from the carbon tax.

The scenario in figure 3 is based on all of these changes. In addition, there are other changes that would usefully complement those included in the LowGrow simulation but that are not directly provided for in the model. Among these is the adoption of better measures of success than growth in GDP to drive policy. There are several candidates, such as the UN’s Human Development Index and the Genuine Progress Indicator, both of which show that prosperity and economic growth are only loosely related. Climate change is only one of several environmental problems facing humanity in the twenty-first century. A comprehensive approach will require limits on throughput, comprehensive ecological fiscal reform where, for example, taxes are shifted from labor to activities that causes environmental damage and space is used less aggressively through better land-use planning and habitat protection.

LowGrow is a modest first step in the development of tools grounded in economics for describing alternative futures in which economic growth is not given priority. Numerous other models have been created with the clear intention of showing how economic growth can be sustained, even accelerated, while the burden on nature is reduced. And yet other models—such as World 3, which was used to develop the famous scenarios in The Limits to Growth—provide interesting, even inspirational scenarios without economic growth, but they were not designed according to established principles of economics. Furthermore, LowGrow was built with data for Canada and, while the broad conclusions that emerge from it apply to other developed economies, national differences would no doubt yield rather different numerical results. Since its publication a few years ago, there has been considerable interest in LowGrow in many parts of the world, and a few researchers in other countries (Sweden, New Zealand, Germany) have adapted LowGrow with mixed results.

During the past two years, Tim Jackson and I have been collaborating on GEMMA, a new macroeconomic model of a national economy designed to address the following questions:

1. Is growth in real economic output still required in advanced economies in order simultaneously to maintain high levels of employment, reduce poverty, and meet ambitious ecological and resource targets?
2. Does stability of the financial system require growth in the “real” economy?
3. Will restraints on demand and supply—for example, in anticipation of or in response to
ecological and resource constraints—cause instability in the real economy and or financial system?11

These important questions require better answers than are currently available, but for which credible answers are needed if we are to make the thoughtful, deliberate transformation of our economy that the mounting evidence of environmental degradation, financial instability, and increasing social and economic inequality indicates is necessary. We hope that GEM-MA will provide insights into these problems and will produce more comprehensive and detailed scenarios showing that we can live well in an economy that does not depend on economic growth. Most important of all, we will be able to free ourselves to think more broadly and more imaginatively as we contemplate the end of growth.

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**NOTES**


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INTRODUCTION

The relationship between economic growth, human well-being, and the achievement of a sustainable future has a long and complex intellectual history. In his 1910 book *The Fight for Conservation*, for example, the American conservationist Gifford Pinchot emphasized:

> the right of the present generation to use what it needs and all it needs of the natural resources now available [recognizing] equally our obligation so to use what we need that our descendants shall not be deprived of what they need.”

This language strikingly anticipates the seminal work of the World Commission on Environment and Development (WCED), which defined “sustainable development” as a process that “meets present needs without compromising the ability of future generations to meet their own needs.”

This approach is strongly bottom-up—it suggests that a sustainable future will come into being if the biophysical and social conditions needed to support economic activity and human flourishing are maintained from each generation to the next. In addition, it emphasizes meeting needs rather than promoting growth or satisfying consumer preferences as the defining characteristic of “development.” Importantly, the WCED attaches a strong emphasis to issues of equity, especially the goal of alleviating poverty in settings and societies where people’s objective needs remain unmet.

A contrasting perspective on the challenge of reconciling economic activity, social welfare, and the needs of future generations was put forward by Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens, III, in their 1972 book, *The Limits to Growth*. Based on a dynamic simulation model in which businesses and households make myopic decisions without regard for the long-run implications of short-run production and consumption, Meadows et al. predicted that natural resource depletion and environmental degradation would lead to an irreversible collapse of the global economy by the early twenty-first century. In this analysis, avoiding catastrophe would be possible if and only if:

1. Human fertility was limited to the replacement rate to stabilize population.
2. Natural resource use and pollution per unit of in-

If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or a happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it.

First, I will argue that the perception that there is a hard tradeoff between the goals of economic growth and environmental sustainability rests on a contestable empirical premise. While it is of course true that the transition from a high-carbon to a low-carbon energy economy would carry positive economic costs, a large body of literature in the fields of engineering and economics establishes that those costs would be too small to substantially affect the overall rate of economic growth. A good case can be made that failing to stabilize climate poses a major risk to the livelihoods of future generations. But capping growth may not itself be necessary to alleviate the risks posed by today’s production and consumption patterns.

Second, I will argue that the premise that economic growth necessarily leads to an enhanced quality of life and improved human flourishing in high-income societies is also problematic...
consumption that has occurred since World War II.\(^9\)

Taken together, these arguments suggest that the contestation over what Daly termed “growthmania” presents a rather delicate set of issues.\(^10\) On the one hand, a narrow emphasis on growth can and sometimes does lead to a failure to implement policies even in cases where the long-run benefits exceed the short-run costs as measured using conventional economic tools.\(^11\) On the other hand, presenting growth as the core problem and the cessation of growth as the solution may actually serve to reinforce the political influence of the pro-growth narrative, since it forces decision-makers to frame things in terms of an either/or choice. Instead, environmentalists may be better served by the WCED approach to sustainable development, which de-centers growth to focus more directly on the achievement of social justice and the conservation and protection of ecosystem services. This hardly implies that unlimited growth is possible or desirable, though it provides a framework for balancing the costs and benefits of growth and for directing goods and services to ends that best reflect society’s values.

**CLIMATE STABILIZATION AND “DEGROWTH”**

The notion that stabilizing climate might require reductions in the levels of material production and consumption is one facet of the rapidly evolving “degrowth” movement.\(^12\) This perspective notes (rightly) that greenhouse gas emissions tend to increase with the level of economic activity because higher income and consumption levels translate into increased demand for carbon-intensive goods. An analogous argument, however, is offered by analysts who favor free-market energy policies over the interventionist policies needed to put the economy on course towards the achievement of a sustainable energy system. The argument is that the production of goods and services requires energy and that cutting energy use—or shifting toward higher-cost forms of energy—necessarily threatens to reduce the level and growth of economic output.\(^13\) As one example of this line of reasoning, the U.S. Energy Information Administration (USEIA) predicted that implementing the Kyoto Protocol would reduce U.S. economic output by up to 4.3 percent in the year 2010.\(^14\) That estimate played powerfully into the anti-Kyoto rhetoric that was already prevalent in Washington political circles. In 2002 speech, for example, President George W. Bush argued that:

> The approach taken under the Kyoto Protocol would have required the United States to make deep and immediate cuts in our economy to meet an arbitrary target. It would have cost our economy up to $400 billion and we would have lost 4.9 million jobs.\(^15\)

Because claims of this sort have major policy implications, it is fair to ask whether they hold up under scrutiny. On this point, the research literature depicts a more complex and subtle set of relationships.\(^16\) For one thing, the USEIA study found that well-designed policies could achieve the goals of the Kyoto agreement at a substantially lower cost. The 4.3 percent output loss occurred in a single year based on the assumption that emissions cuts were implemented precipitously in a way that failed to limit costs through measures designed to achieve a smooth and efficient transition.

A more representative assessment is provided by the Stern Review on climate change,\(^17\) which found that stabilizing atmospheric carbon dioxide concentrations at 500–550 parts per million—a level sufficient to limit the future increase in mean global temperature to roughly 2 degrees Celsius—would impose costs equivalent to a permanent 1 percent reduction in the level of present and future economic output. This is a number that needs to be viewed in perspective. One key point is that achieving Stern’s stabilization target would require a gradual but also nearly complete transition away from today’s high-carbon energy economy...
to a mainly post-carbon energy system over the course of the next four decades. This is in line with the goal of reducing U.S. greenhouse gas emissions by 80 percent by the year 2050, which Barack Obama embraced during the 2008 presidential campaign. It also consistent with Daly’s concept of “scale,” which calls for limiting material throughput (i.e., the use of natural resources and the discharge of waste) to levels that are ecologically sustainable given the dynamics of biophysical systems.18

A second point is that a 1 percent reduction in economic output would involve an annual cost of roughly $150 billion per year in the context of the current U.S. economy. That is a substantial impact that should not be borne without good reason. On the other hand, Stern’s analysis implies that climate change policies would have almost no impact on the rate of economic growth. Because climate change policies would be phased in gradually over time, an economy that might have grown at a rate of 3.00 percent per year would instead grow at the lower rate of 2.95 percent per year if one assumed that climate policies had costs in the middle of the range described by the Intergovernmental Panel on Climate Change in its systematic literature review.19 This effect is so small that it would be difficult to distinguish from the year-to-year variability in growth that is driven by fluctuating trends in technology, human behavior, and other fundamental drivers. As the Nobel Prize winning economist Thomas Schelling once framed this point:

If someone could wave a wand and phase in, over a few years, a climate mitigation program that depressed [U.S.] GNP by two percent in perpetuity, no one would notice the difference.20

Why are the impacts of climate policies on the rate of economic growth predicted to be small? One reason is that engineering studies have shown that a wide variety of low-cost emissions abatement technologies are currently available or projected to become available given appropriate investments in research, development, and technology diffusion. A recent study by McKinsey and Company, for example, identified a set of specific technologies sufficient to reduce U.S. greenhouse gas emissions in the year 2030 by up to 46 percent at a maximum cost of $50 per tonne of CO2 equivalent, or 44 cents per gallon of gasoline.21 This cost is greater than zero but far too small to have major impacts on the overall level of economic activity. A carbon dioxide tax of $50 per tonne would favor lower-emission technologies and a shift towards low-carbon goods and services. The problem, then, is not a lack of technical potential but a lack of policies and price signals that promote the transition to a green energy system.

There is good reason to believe that efficiently designed policies that reduced private consumption in order to increase both leisure and environmental quality would serve to increase human well-being, at least in affluent societies where material goods are abundant and where social goods and environmental quality are scarce.

Second, energy economists have long stressed that the relationship between energy use and economic output is flexible and elastic, especially in the long run.22 It is certainly true that the production of all goods and services involves physical transformations that require inputs of energy as stipulated by the laws of thermodynamics.23 It is also true, however, that the current economy is far from its thermodynamic limits and that large reductions in carbon dioxide emissions could be achieved through changes in technology, the structure of the economy, and the mix of final products that consumers demand. We demand high-carbon goods because fossil fuels remain cheap and because current market prices do not reflect the costs that climate change will impose on ecosystems’ future generations. It does not, however, follow that transition to a low-carbon economy would require major changes in the standard of living, noting that gross domestic product (GDP), is a measure of subjective value and that the level of value per unit of energy or material throughput can be increased substantially within the limits set by human psychology and the laws of thermodynamics.

A related and important point is that climate stabilization may be viewed as an investment in ecological capital that will provide a stream of long-run economic benefits. While the Stern Review projects that stabilizing climate would reduce short-run economic
output by roughly 1 percent, it also concludes that failing to stabilize climate would impose long-run economic damages equivalent to a permanent 5–20 percent reduction in consumption and income, now and forever. This conclusion is controversial because it relies on the moral judgment that equal weight should be attached to the welfare of present and future generations. That said, Stern’s conclusion that climate stabilization would boost long-run prosperity is a common finding in the literature, even in models that do not account for the role that climate stabilization can play in reducing low-probability, catastrophic risks to future lives and livelihoods.

GROWTH AND WELL-BEING

I have argued that climate stabilization could be achieved without large impacts on the rate of short-run economic growth and that, in the long run, the result would be a world of enhanced life opportunities for members of future generations. But suppose, for the sake of argument, that we rejected this claim in favor of the proposition that achieving ecological sustainability would require substantial reductions in future economic growth. What could we then say about the likely impacts on human well-being?

From the perspective of mainstream economics, the answer seems clear-cut: The consumption of material goods and services satisfies people’s preferences and contributes to their happiness, and higher levels of consumption should—all else equal—contribute positively to social welfare. The “all else equal” caveat is quite important here. While non-economists sometimes assume that mainstream economics is concerned narrowly with the monetary value of market goods and services, in fact, economics textbooks very much stress the contributions that public goods and environmental quality make to human well-being. The question is, then, how the benefits of improved environmental quality compare with the costs of reduced private consumption.

On this front, authors such as Daly and John Cobb have produced a very striking conclusion. Building on the earlier work of William Nordhaus and James Tobin, Daly and Cobb’s Index of Sustainable Economic Welfare (ISEW) presents a monetary measure of social welfare that accounts for:

- the consumption of private goods and services bought and sold on markets;
- the social costs of inequality;
- the value of non-market production (household work, family care, and volunteer work);
- environmental degradation;
- “defensive expenditures” (i.e., the cost of protecting oneself from environmental harms);
- net capital investment; and
- natural resource depletion.

Focusing on U.S. data, Daly and Cobb found that trends in the ISEW closely paralleled changes in GDP per capita in the 1950s and 1960s. In later years, however, the relationship between income and welfare became de-coupled. While GDP per capita grew at a rate of 2.2 percent per year between 1970 and 2000, an updated version of the ISEW remained virtually unchanged.

The numerical aspects of the ISEW and related measures are not without controversy. Eric Neu- mayer, for example, argues that trends in the ISEW are driven disproportionately by rising inequality and greenhouse gas emissions and that Daly and Cobb’s approach to measuring these effects is ad hoc. In counterpoint, other authors have sought to ground the ISEW on a more refined theoretical and empirical foundation. The literature on this topic points to a widening gap between the ISEW and GDP growth in a broad range of nations.

Further insights arise from studies of subjective well-being—i.e., people’s self-reported life satisfaction as measured by comprehensive social surveys. In a landmark paper, Richard Easterlin considered data from a diverse set of industrialized and developing nations, finding that: (a) in any given country at any point in time, individuals with higher incomes report higher...
life satisfaction than those with lower incomes; but (b) there was no correlation between average income in a country and average life satisfaction. Subsequent research has shown that point (b) is only partly correct. In low-income societies, economic growth translates into large gains in life satisfaction if the resources generated by growth are used to satisfy people’s basic needs. But in high-income societies, economic growth generates diminishing marginal returns, so that large increases in production and consumption have almost no effect on average well-being in society. Still, a concern for relative economic status can lead people to pursue higher income and consumption levels even when, from a social perspective, these activities generate negative costs of the kind measured by the ISEW. Since these costs are excluded from the standard measure of economic output, it is not surprising that the economic growth that has occurred in the United States since 1970 has not been matched by a corresponding increase in ISEW or subjective well-being.

In standard economic theory, individuals’ preferences are assumed to be fixed and independent of social context. In his book Social Limits to Growth, in contrast, Fred Hirsch argued that private consumption generates social externalities that are analogous to the costs imposed by pollution. If individuals’ well-being depends on their relative consumption, then an increase in one person’s consumption serves to reduce (if by just a little) the welfare of all other members of society. Stated somewhat differently, all individuals face pressures to maintain high income and consumption levels to avoid falling behind in relative terms. The paradox is that nobody thereby gets ahead, while all of us would be better off if scarce social resources were reallocated to increased leisure, environmental quality, and the benefits of community life.

After reviewing the empirical support for this hypothesis based on data on subjective well-being, economic experiments, and observed behavior in labor markets, Robert Frank argues that the social costs of “conspicuous consumption” should be internalized through a graduated consumption tax with a top tax rate of 90 percent (meaning a tax of 90 cents for each dollar of private consumption). This tax is precisely analogous to the concept of a Pigovian pollution tax. It would provide an incentive signaling the full social cost of private decisions that would serve to align individual self-interest and community well-being.

What are the implications of Frank’s approach for balancing the economy, human welfare, and environmental quality over the long term? In answering this question in our book, Status, Growth, and the Environment: Goods as Symbols in Applied Welfare Economics, Kjell Arne Brekke and I analyze a numerical model in which a concern for relative economic status leads people to engage in excess private consumption at the expense of reduced leisure (a surrogate for time allocated to family life and other non-market activities) and the environment (measured in terms of long-run climate change). In this model, greenhouse gas emissions would more than double over the course of the twenty-first century in the absence of climate change mitigation measures. If one ignored the social costs of consumption externalities, then standard cost-benefit analysis would justify emissions reductions of no more than 9 to 15 percent relative to baseline levels, with no appreciable impact on economic growth or the amount of time allocated to paid labor.

Given plausible assumptions about the importance of social status in motivating behavior, however, Brekke and I found that substantially larger emission reductions were economically justified. More tellingly, the introduction of an optimal tax to balance the private benefits and social costs of consumption would support a 19 to 25 percent reduction
in consumption levels and a 25 percent increase in the enjoyment of leisure. These quantitative finds should be interpreted with care—following Nordhaus, the model is based on the contestable assumptions that climate damages are relatively modest and that society attaches a relatively low degree of weight to the welfare of future generations. Still, these results anchor an important, qualitative conclusion: There is good reason to believe that efficiently designed policies that reduced private consumption in order to increase both leisure and environmental quality would serve to increase human well-being, at least in affluent societies where material goods are abundant and where social goods and environmental quality are scarce.

CONCLUSIONS

In this paper, I have argued that accepting substantial reductions in the future rate of economic growth may be unnecessary to safeguard and sustain the biophysical systems that provide the basis and underpinnings for human livelihoods and well-being. In the long run, the growth of material production and consumption is limited by natural resource constraints, and achieving a sustainable future will require policies and institutions that maintain the economy within the bounds set by nature. But significant growth of GDP—a measure of the subjective value of goods and services—can nonetheless be achieved in the interim through a move to technologies and consumption patterns sufficient to sharply reduce the economy’s “ecological footprint.”

This finding is in one sense good news for environmentalists. In a growth-oriented society, it provides an answer to critics who warn that the costs of achieving ecological sustainability would put the economy at risk. On the contrary, authors such as Stern conclude that the benefits of stabilizing the earth’s climate will exceed the costs by a factor of five to twenty, even when the focus is on narrow economic benefits.

I have also argued that continued growth—while ecologically feasible up to a point set by ultimate thermodynamic and technological limits—may generate social costs that exceed the private benefits in affluent societies where the resources exist to meet people’s basic needs unless specific policies are implemented to address these impacts. This point is supported by data on trends in the Index of Sustainable Economic Welfare, subjective well-being, and a wide variety of social and environmental indicators. In the pursuit of growth, our society has told itself that our social and environmental values are too expensive to afford. The result is a systematic imbalance that, as John Kenneth Galbraith once argued, has brought into being a world of “private opulence and public squalor” through an overemphasis on growth, markets, and our identities as consumers that has crowded out our human roles as citizens, community members, caretakers, and friends.

The way forward is perhaps not so very hard to envision. A sustainable future will emerge if we build institutions that, on a practical level, sustain the natural environment and the social and technological conditions that will empower future generations to define and pursue their own conception of the good life. As the Nobel Prize winning economist Amartya Sen wrote in his book Development as Freedom, the path to enhanced human flourishing will be built by expanding the scope of choices and opportunities. While policies that promote sustainability may well lead to (some, but not unlimited) economic growth, the converse is certainly not assured. As the WCED framed this point, achieving sustainability will require an approach that de-emphasizes growth and that explicitly embraces environmental and social goals as a core and self-standing dimensions of “development.”

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NOTES


17. Stern, The Economics of Climate Change.


43. Stern, The Economics of Climate Change.


46. World Commission on Environment and Development, Our Common Future.
MINDING NATURE 5.2

CHN BOOKSHELF
A regular feature calling attention to important books and articles that CHN staff, board, and collaborating scholars are reading and recommend. *Quot libros, quam breve tempus.*


S. C. Rowe, *Overcoming America/America Overcoming: Can We Survive Modernity?* (Lexington Books, 2012)


WHAT CAN ECOLOGY TELL US ABOUT THE NATURE OF REALITY?

We are trying to get at big questions in this issue: Who are we? What are our economic activities for? While it may seem strange, these are questions that interest me as an ecologist. In my earliest days doing fieldwork, intently looking out into the woods—from the Australian rainforest to the Icelandic boreal woodlands—I wondered: How does all of this work? What does life mean? As I reflect on my studies as an ecologist, I see that I navigated my fieldwork with one big question in mind: What can ecology tell us about the nature of reality?

I took a lot of samples. I did a lot of lab analysis. I still dream of the thousands of leaves that I collected, measured, dried, ground, analyzed. What was to come of this process? My Ph.D. advisor, Kristiina Vogt, used to say to me, “You need to tell a story.” Clearly she was mindful of accurately reporting ecological processes and functions, not to mention incorporating the proper statistics. However, she was also aware that humans (even when doing science) are storytellers—we understand each other and the world around us not only through analysis, but also through story. This is because living systems are dynamic and temporal, and to understand their reality is to tell a story about them, to develop a narrative of the processes whereby ecosystems change, sometimes very rapidly, in response to human and non-human impacts. One of the points Kristiina underscored most was this: the enormous amount of ecological data that has been collected over the last several decades is perhaps no longer representative of current reality—largely because we humans are shifting the fundamental processes of life that quickly.

Given these ecological realities, would the data I was collecting be a snapshot of a swiftly changing ecosystem? (Yes.) Would my research soon become irrelevant as ecosystem change hurried ahead? (Perhaps. I would have to see.)

One thing I wanted to understand is what happened to an ecosystem under stress. If ecological patterns and processes were changing so fast, perhaps I could understand signals and dynamics of ecosystem stress. And, true to my scientific discipline, I had the urge to harness some kind of predictive power: Could I find clues to impending shifts in ecosystem stress? Could I find early warning signs of ecosystem collapse?

To find out, I took myself to Iceland. There, I clambered up to the treeline every day during the better part of a string of cool, crisp summers, startling birds and sheep, and drinking pure water straight from the streams. At the treeline, the woodland ecosystem is—quite naturally (and even without human interference)—stressed. In fact, at the treeline, an ecosystem is at its threshold of existence.
People often remark on the beauty of Iceland; it is a haunting, dramatic landscape. What most people don’t realize is that the landscape looks that way largely because it has been shaped by a history of interactions between humans and non-human nature. We know this for a number of reasons, one of which is that the Vikings were prolific and skilled writers who (in addition to their sagas) wrote detailed records of the changes in their landscapes.

One of the most important elements of the human-nature history in Iceland was the introduction of grazing animals (horses, sheep, cattle, goats, and pigs) at the time of the Viking settlement in the 870s CE. The introduction of these grazers dramatically changed Icelandic ecosystems. In short, grazers ate sprouting tree seedlings and other vegetation. As a result, woodlands did not have a chance to regenerate as the older trees died. In some heavily grazed places, little to no vegetation persisted at all, leading to widespread erosion—and ecosystem collapse. Without vegetation, the soil simply blew away, leaving only glacial till—and little to no chance for seedlings to sprout. Where vegetation did exist, the ecological structures and functions were dramatically altered.

What was the upshot of my research? Ecosystems remember. That is, the biotic communities that were still present gave expression to their histories. Realizing this, I revisited my earlier questions: Could I find clues to impending shifts in ecosystem stress? Could I find early warning signs of ecosystem collapse? Yes. I saw signals in the landscape that were markers of past and present (cumulative) stress. I saw these markers fluctuate with the presence and absence of human-introduced grazers, which in turn, caused a cascading series of feedback loops that permeated the biotic communities of the Icelandic woodlands. Furthermore, I saw that the more cumulative stressors there were, the less the ecosystem was able to handle additional, present stresses.¹

Perhaps one of the most interesting things to me, as a scientist, was that these ecosystems had emergent properties that told a different kind of story than could be told by their evolutionary history—or by the genes, organisms, or populations alone. Ecosystem-scale research can tell an additional narrative about the landscape—namely, that the landscape is both an expression of the past and an insight into the future. It was intriguing to me to think that humans are not the only ones who tell

Human-made cairns mirroring a landscape with little to no vegetation, Northeast Iceland.
stories about nature. Nature tells us stories right back—stories about its own reality, and about our human reality, our past and future prospects, too.

Understanding that I was only touching on that reality, my scientific curiosity was nonetheless deeply fulfilled as I did this work. As I wrote in the acknowledgements to my Ph.D., “It is a gift to have the freedom to pursue a question of your own making—with the ultimate goal of learning how to think independently about its possible answers.” Even so, another can of worms had been opened.

We ecologists speak of “ecosystem change,” a phrase that can refer to relatively minor changes in ecosystem patterns and processes, or major changes in ecosystem state, such as a change from a woodland to an arctic desert. Additionally, we tend to be more than cautious about making explicit moral judgments in association with “ecosystem change.” (Our aim would be different at a divinity school.) But what about the story I was to tell? I didn’t see how I could separate knowledge of ecosystem stress and thresholds, much less ecosystem collapse, from moral judgment, particularly if humans were the primary cause. “Ecosystem change” does not seem descriptive enough to capture the inherent moral questions that are raised by such “change.” The founder of the Center for Humans and Nature, Strachan Donnelley, put it more bluntly:

Scientists have failed to help us to face human ignorance with respect to the effects of large scale corporate, economic, and public policy initiatives. In the main, the scientific community has fed our economic and technological boosterism and left us bulls in the China shop of nature. Here evolutionary biologists and ecologists should particularly feel the moral sting. They have failed effectively to grab us citizens by the throat and forcibly make us understand and take to heart that human communities and their activities, economic and other-wise, are nestled within wider and vulnerable living systems.2

I started my fieldwork with a largely ecological interest in thresholds. The questions it raised—and that I continue to wrestle with—are ethical ones: What can ecology tell us about what it means to be human? What are our responsibilities, given the ecological knowledge we have? There is no Last Word on any of these big questions. But I do have a place to start: We humans are storytellers. Ecosystems are too. It is our moral obligation to listen deeply and to respond with care.

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NOTES
1. Foliar nitrogen levels in the birch woodlands act as an expression of the cumulative “memory” of grazing and climatic stressors. See Brooke Hecht, “The Edge Paradox: An Icelandic Case Study Investigating Impacts of Multiple and Novel Disturbances on Forest Ecosystem Thresholds” (PhD diss., Yale University, 2003).
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