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THE SUSTAINABILITY REVOLUTION

portrait of a paradigm shift

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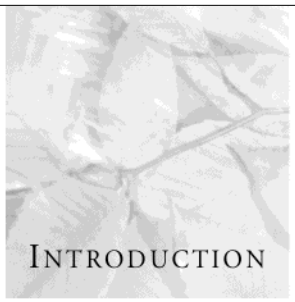

INTRODUCTION

Portrait of the Sustainability Revolution

Every generation needs a new revolution.

—Thomas Jefferson

We must not be afraid of dreaming the seemingly impossible if we want the seemingly impossible to become a reality.

—Vaclav Havel

IN BORNEO, villagers are replacing polluting diesel generators with small-scale hydro-generators and tapping local streams to produce clean and affordable electricity for their communities.[1] In Astoria, Oregon, local government, businesses and residents have used ecological design practices to transform an abandoned toxic mill site into a convivial community.[2] In Bavaria, Germany, the world's largest solar power plant, a 30-acre facility generating 10 megawatts of electricity — enough to meet the demand of 9,000 German homes — is online.[3] And in Curitiba, Brazil, city planners have created a model public transportation system covering eight neighboring cities and carrying 1.9 million passengers a day.[4] Although these events may appear to be isolated incidents, they represent thousands of initiatives taking place worldwide that are the vanguard of the Sustainability Revolution.

Not since the Industrial Revolution of the mid-18th to mid-19th centuries has such a profound transformation with worldwide impact emerged onto the world stage. Like its industrial counterpart, the Sustainability Revolution is creating a pervasive and permanent shift in consciousness and worldview affecting all facets of society.

The Sustainability Revolution draws its significance and global impact from a wide spectrum of interests with common fundamental values. Like the Industrial Revolution, the Sustainability Revolution is far-reaching and is having a profound impact, shaping everything from the places we live and work to the foods we eat and the endeavors we pursue as individuals and as communities.

Though still largely underground and misunderstood, the Sustainability Revolution is affecting the economic, ecological and social aspects of societies worldwide. Amid the invasion of SUVs, Costcos, Wal-Marts and supermarket chains, we see glimpses of this transformation in the increasing numbers of hybrid cars, wind turbines and solar panel installations; the resurgence of farmers' markets and organic foods in cities and towns across Europe and the US; the introduction of ecoliteracy curricula in some schools and universities; the building of cohousing projects that restore community ties; and the large number of grass-roots groups from around the world working on issues such as habitat restoration, climate change, labor rights, local currencies and the protection of local economies. These changes, though inconspicuous, are blazing a trail toward a new awareness that treats the fabric of life of our planet with respect and seeks to balance economic goals and ecological health.

The present unsustainable path marked by an unrelenting economy that methodically depletes the Earth's ecosystems will have to change. In 2003, for example, 11,000 cars were added to China's roads every day, a total of 4 million new cars in one year. At this pace, by 2015, 150 million cars are expected in China — 18 million more than were driven in the United States in 1999.[5] As Lester Brown points out, if Chinese car ownership and oil consumption were to equal US rates, 80 million barrels of oil a day above current

world production would be needed; and if Chinese per-person paper consumption were to match the US level there would not be enough paper (or forests) available.[6]

Clearly the Chinese, together with the rest of the over six billion people in the world, face a predicament that calls for a significant ecological, economic and social shift. The Sustainability Revolution presents an alternative that supports economic viability and healthy ecosystems by modifying consumption patterns and implementing a more equitable social framework.

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Anatomy of Social Revolutions

To better understand the structure of the Sustainability Revolution, we turn to the anatomy of social revolutions. From 1750-1850 the Industrial Revolution caused a lasting shift from an agricultural and commercial society relying on animals and simple tools to an industrial society based on machinery and factories. The Industrial Revolution was marked by technological innovations, increased production capacity and economic specialization. As with other social revolutions, the changes in the Industrial Revolution and the current Sustainability Revolution involve three distinct phases: genesis, critical mass and diffusion.

Genesis

The genesis of the Industrial Revolution was in the accumulation of precious metals brought back to Europe from the New World. These commodities stimulated the creation of industry, expanded trade and established a money economy in Great Britain. The Sustainability Revolution dates back to the concepts first explored in 1972 at the United Nations Conference on the Human

Environment in Stockholm, Sweden, and gained prominence in the 1987 Brundtland report, *Our Common Future.*

The Brundtland report created a framework for addressing ways of protecting the Earth's ecosystems while taking into consideration economic and social justice concerns. Sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[7]

Critical mass

The critical mass phase of the Industrial Revolution involved the use of power resulting from the improvement of the steam engine by James Watt in 1769. This development had a profound impact on the efficiency of factory production, transportation services and the economic infrastructure of nation states. Although the Sustainability Revolution's critical mass has yet to fully materialize, key milestones were the 1992 Earth Summit in Rio de Janeiro, Brazil, and the development of the personal computer and the Internet.

The Rio summit brought together 182 world leaders and propelled sustainability onto the international stage. Through the Rio Declaration and Agenda 21, the summit developed frameworks for charting future actions. The personal computer and the Internet have had a significant impact on the Sustainability Revolution by facilitating the dissemination of information and the organization of sustainability-oriented groups, which now have better access to media outlets traditionally controlled by well-established institutions.

Diffusion

Although the Industrial Revolution began in Great Britain, it spread throughout Europe and then to the United States and beyond. The use of electricity, the gasoline engine and factory-based production methods was rapidly adopted by other cultures. These changes resulted in urban centers that today are found worldwide.

The Sustainability Revolution emerged in the United States and European Union countries as they grappled with the limits of natural

resources and is quickly spreading to developing nations, though it has yet to become a pervasive mainstream phenomenon. Some of the most innovative projects in areas such as renewable energy, agriculture and finance are taking place in the developing nations. One example is a national biogas program in Thailand that converts animal waste into methane for electricity production.[8] Another project is the Grameen Bank in Bangladesh, which in 1976 through collateral-free loans to the very poor sparked the microcredit movement, which has spread to over 40 countries and proven to be a successful anti-poverty program for developing nations and for the inner cities of industrialized countries.[9]

In addition to such initiatives, there now is worldwide awareness of issues such as climate change, pollution, ozone depletion and habitat destruction that are international in scope and will require a concerted effort by all nations to resolve.

Movements and Revolutions

Whereas movements tend to have narrower objectives and are led by a charismatic leader, such as Mahatma Gandhi in the non-violence movement and Martin Luther King in the civil rights movement, social revolutions have wider objectives and are led by a large and diverse number of individuals. The anti-globalization, organic foods, green building, renewable energy and other "green" movements all are working within the broader context of the Sustainability Revolution. Though including aspects of social movements, sustainability is in fact a revolution with a new value system, consciousness and worldview.

The Industrial Revolution was defined by technological breakthroughs including James Watt's improved steam engine (1769), Edward Cartwright's power loom (1783) and Eli Whitney's cotton gin (1793). These inventions contributed to increased production and economic growth in the textile, iron, rail and steamship industries that have left an indelible mark on our current society. The impact of the Industrial Revolution has been broad and lasting.

The developments that have shaped the Sustainability Revolution have transformed the fields of communications (computers, the Internet, e-mail, wireless phones, digital cameras); finance (global trade, international stock and commodities markets); transportation (hybrid cars, overnight parcel delivery, lower-fare jet travel); building (green building, renewable materials, solar energy); and medicine (imaging technology, human genome decoding, cloning); and led to the organization of citizens' groups working on causes such as stream restoration, pesticide control, renewable energy and organic produce.

Although sustainability often is marked by environmental causes and protest campaigns, its values represent a broad context of issues that have spread underground in all sectors of society throughout the world.

The Sustainability Revolution evolved as a reaction to the Industrial Revolution's degradation of the environment and our well-being. The rampant environmental impacts and the recognition of the limits of natural resources combined to produce a new ethos embodied in the Sustainability Revolution. Government environmental clean-up programs such as Superfund and protection programs such as the Clean Air Act, Clean Water Act, Safe Drinking Water Act and Endangered Species Act were created as a result of concern for the damaging effects of the Industrial Revolution.

The Five Characteristics of the Sustainability Revolution

The Sustainability Revolution has five key characteristics or dimensions. These are: (1) remarkable similarities among sustainability groups in overall intentions and objectives; (2) a large and diverse number of such groups; (3) a wide range of issues addressed by these groups; (4) leadership by a group of decentralized visionaries rather

than a single charismatic figurehead; and (5) varying modes of action: oppositional and alternative.

Similar Intentions and Objectives

The mainstream often confuses sustainability with ecological concerns, pitting conservation groups against business interests. This situation leads to a deadlock, with polarized viewpoints and inability to compromise. Sustainability has thus been framed in a narrow perspective, often associated with a single issue backed by proponents with a liberal mindset. Although sustainability often is marked by environmental causes and protest campaigns, its values represent a broad context of issues that have spread underground in all sectors of society throughout the world.

Although there are some disagreements among sustainability groups, there are remarkable similarities in their intentions and objectives. These include: concern for the environment, the economy and social equity; understanding of our dependence on the health of natural systems (clean air, clean water, healthy soils and forests, biodiversity) for our survival and well-being; knowledge of the limits of the Earth's ecosystems and the detrimental impact of unchecked human activities (population, pollution, economic growth); and a long-term, intergenerational perspective in actions and goals.

Large and diverse

The Sustainability Revolution is international in scope. Its ideas are promoted by environmental and social service groups, nongovernmental organizations, foundations and loosely organized community groups. All facets of society, including government, industry, the private sector, education and the arts, and all socioeconomic backgrounds, nationalities, religions and cultural affiliations are represented.

Paul Hawken estimates that there are 30,000 sustainability groups in the US and tens of thousands of groups worldwide.[10] Social researcher Paul Ray describes sustainability advocates as "Cultural Creatives" and estimates there are 50 million in the US

and 80 to 90 million in the European Union, with a $230 billion market in the US and $500 billion worldwide.[11]

Range of issues

The Sustainability Revolution has no single ideology but instead a collection of values centered around healthy ecosystems, economic viability and social justice. Sustainability encompasses a wide array of issues including: conservation, globalization, socially responsible investing, corporate reform, ecoliteracy, climate change, human rights, population growth, health, biodiversity, labor rights, social and environmental justice, local currency, conflict resolution, women's rights, public policy, trade and organic farming. These issues cross national boundaries, socioeconomic sectors and political systems, touching every facet of society and driven by life-affirming values that influence policies and initiatives at the local, regional, national and international levels.

Decentralized leadership

As with other social revolutions, the leadership in the Sustainability Revolution is made up of hundreds of thousands of citizens and community leaders from around the world. As Hawken reminds us, "No one started this worldview, no one is in charge of it, no orthodoxy is restraining it …. [It is] unrecognizable to the American media because it is not centralized, based on power, or led by charismatic white males."[12]

The strength of the Sustainability Revolution lies in its decentralized, nonhierarchical organizational pattern, which encourages diversity and alternative approaches to the ecological, economic and social challenges of our time. The Sustainability Revolution has spread remarkably quickly and effectively into cultures worldwide.

Oppositional and alternative actions

While some sustainability groups oppose trends seen as detrimental to their core values, others present alternative models. Oppositional actions focus on areas such as globalization,

biotechnology and habitat destruction, while alternative actions include voluntary simplicity, supporting local economies and community-building.

The oppositional component of the Sustainability Revolution is increasingly visible through demonstrations at conferences such as the G-8 Summit in Genoa, Italy (2001), the World Trade Organization (WTO) in Seattle, Washington (1999) and Cancun, Mexico (2003) and the Free Trade Area of the Americas (FTAA) in Quebec, Canada (2001) and Miami, Florida (2003).

Nevertheless, important shifts are occurring in a much less dramatic fashion through alternative approaches ranging from local renewable energy projects to Community Supported Agriculture (CSA) programs to corporate initiatives implementing sustainable frameworks such as The Natural Step, which provides a scientifically based organizational model.[13] At the international level, in 2004 the World Social Forum attracted over 80,000 social activists from 132 countries to Mumbai, India, to discuss issues from globalization to patriarchy, militarism and racism, challenging participants: "Another World is Possible! Let's Build It."[14]

A Revolution of Interconnections

The Sustainability Revolution provides a vital new approach to tackling the issues confronting the world today. By taking a comprehensive look at the interconnections among ecological, economic and equity issues ranging from global warming to pollution, health and poverty, we are more likely to seek and implement lasting solutions.

The Sustainability Revolution marks the emergence of a new social ethos emphasizing the web of relationships that link the challenges we currently face. As Carolyn Merchant points out, "An ecological transformation in the deepest sense entails changes in ecology, production, reproduction, and forms of consciousness …. In the ecological model, humans are neither helpless victims nor arrogant dominators of nature, but active participants in the destiny of the webs of which they are a part."[15]

By understanding the characteristics and intentions of the Sustainability Revolution, we will be better prepared to tackle complex problems requiring an open-minded and cooperative approach.

McGarity, Thomas O. 2002. "Seeds of Distrust: Federal Regulation of Genetically Modified Foods." *University of Michigan Journal of Law Reform* 35: 403–510.

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Gregory N. Mandel

SUSTAINABILITY

The word *sustainability* has become ubiquitous in environmental affairs since the 1987 World Commission on Environment and Development (WCED) report *Our Common Future* popularized the concept of sustainable development. The idea, however, has a long history. The term *sustainability* has a range of definitions running into hundreds, making any preliminary definition necessarily highly abstract, but all cluster around the core idea that some system, process, range of welfare, or set of items can be maintained at a certain rate or level for the long term; the ingredients of this formulation and its applications, however, vary widely, as do their disciplinary roots and practical implications.

POLITICAL ECONOMY

The earliest clear example of the concept of sustainability in economic thought is in John Stuart Mill's (1806–1873) treatment of the "stationary state" in Book IV of his *Principles of Political Economy* (1848). In this work Mill argues that an end to economic growth is ultimately unavoidable but that this limitation need not imply a rejection progress; rather, he anticipated significant moral and emotional human improvement through a more egalitarian distribution of wealth and reduced economic competition. Although this prescription was original to Mill, in making it he acknowledged debts to Thomas Malthus's (1766–1834) earlier writings on natural limits, especially "An Essay on the Principle of Population," which had gone through six editions between 1798 and 1826 and significantly influenced opinion among Mill's utilitarian philosophical bedfellows in England. Malthus's argument, however, did not share Mill's optimism about prospects for social improvement, and was originally motivated precisely by Malthus's opposition to doctrines of human progress advanced in the wake of the French Revolution.

Malthus argued that unchecked population increases geometrically (e.g., 1,2,4,8) whereas food supply increases only arithmetically (e.g., 1,2,3,4); hence there is a constant tendency for demand on necessities to outstrip supply when population rises, along with a permanent likelihood of poverty and starvation for some section of the population, a circumstance that undercuts arguments for social improvement. This focus on population rather than differences in wealth and consumption was underscored by Malthus's opposition to contraception and was further emphasized by his supporters' tendency to concentrate on (possibly compulsory) birth control, but only for the poorer classes, priorities that were sharply condemned by the nineteenth-century radical left (e.g., Friedrich Engels's 1844 work *Outlines of a Critique of Political Economy*) and that still fuel suspicions of Malthusian influence on thinking about sustainability today.

Mill's idea of the stationary state presented a contrast to Malthus's views not only in its optimism and advocacy of contraception—Mill served two nights in prison for distributing advocacy literature on birth control methods in 1823—but also in the conditions he envisioned. Whereas Malthus saw the changes of population and resource base as a potential source of chronic instability, Mill's stationary state is stable and loosely egalitarian, and thus a progenitor of notions of a "steady-state economy" that have been popular among contemporary advocates of sustainability.

Both Malthus's outlook and Mill's utilitarian schemes grew increasingly irrelevant to mainstream political economy in the latter nineteenth and early twentieth centuries as technological improvements, along with increased agricultural and industrial productivity, appeared to dispel Malthusian gloom about an unavoidable disparity between a sprinting population and a crawling resource base. Cornucopian technological and productionist optimism were the prevailing ideas in economics at the turn of the twentieth century. Developments within economic theory also contributed, for the marginal-utility theory that arose in neoclassical economics at the nineteenth century involved a new scarcity postulate worked out simultaneously by Carl Menger, W. S. Jevons, and Leon Walras. This postulate saw need in radically subjective terms, as an internal human state rather than as the naturalistic, interactive phenomenon postulated by Mill and Malthus, and maintained that internal human desires defined need, and that satisfying these desires/needs, which themselves are stimulated by seeing desirable objects, drives human activity. This in turn means that individuals choose between satisfying various needs, with each person having an internal hierarchy of needs and endeavoring to calculatively obtain the best possible result in relation to goods that are in short supply. The existence of an infinite number of these needs places limits on any given single need at any particular moment; accordingly aggregate needs are infinitely expandable, but are rendered calculable by individuals making hierarchical choices that limit particular needs, This desocialized model of need also incorporated optimism about the functional substitutability of goods, assuming on the basis of this model that scarcity of a given

good (e.g., oil) would generate incentives to develop resource substitutes for that good (e.g., ethanol) and so absolute external scarcity could be kept at bay. This new theory came to dominate twentieth-century academic economics, pushing the consideration of external limits into the background (Xenos 1989).

The concept of hard external limits to economic expansion of a sort not amenable to technological fixes or resource substitution resurfaced with the Club of Rome's 1972 *Limits to Growth* report (Meadows et al. 1972). This report examined five variables—world population, industrialization, pollution, food production, and resource depletion—and ran these through successive computer simulations to explore possible outcomes of exponential growth combined with finite resources. The simplified models, though not aimed at explicit predictions, consistently manifested feedback loops producing dire consequences before 2100, suggesting a rate of nonrenewable resource depletion rapid enough to portend exhaustion within a little more than a century, with no likelihood of any technological rescue. The book popularized the idea of physical limits to growth and paved the way for concepts of sustainability based on that prospect. This work was still haunted by the specter of population growth, but since that time most sustainability-oriented environmentalists have increasingly emphasized the dangers of overconsumption and downplayed those of overpopulation. Nevertheless, the argument that continuous population increase will eventually place strains a depleting natural resource base, even in the most egalitarian social arrangements, remains part of environmentalist discourse. Accordingly, cornucopian and market-based critics of environmentalism such as Julian Simon (1996) and Bjorn Lomborg (2001) have characterized sustainability arguments as neo-Malthusian.

FORESTRY AND SUSTAINABLE YIELDS

Forestry has also informed modern ideas about sustainability. The work of the American forester-conservationist Gifford Pinchot (1865–1946) has been a major influence. Echoing Mill, Pinchot combined theories of resource scarcity with an anthropocentric utilitarian moral concern for human welfare. For Pinchot the forester's mission was "based on the elimination of waste, and directed toward the best use of all we have for the greatest good of the greatest number for the longest time" (Pinchot 1914, p. 25). In his autobiography *Breaking New Ground* (1947) Pinchot recounts that, upon his return to the United States in 1890 after a period of forestry training in Europe, he was horrified at American lumbermen's wastefulness. He and his allies, pointing to the dangers of timber famine, established a national U.S. Forest Service based on principles of efficient harvesting of resources through scientific forest management and replanting, and the prevention of fire, theft, improper use, and destruction. These practices aimed at preserving the resources in perpetuity. This mandate came to include economic and longterm social-justice concerns, as manifested in Pinchot's concerns about the theft of timberland land from Native Americans and his campaign in 1908 and 1909 to introduce systematic forestry on American Indian reservations. He claimed that this last measure, within eighteen months, "saved large sums of money to the Indians, gave many of them profitable employment, and by the introduction of Forestry promised to make that employment permanent" (Pinchot 1947, p. 412). Although these arrangements were truncated in 1909 by political dispute, they were resurrected in the mid-1930s under Forest Service head Ferdinand A. Silcox as the Indian New Deal, reviving ideas of social service in forestry that are still influential.

Thanks in large measure to the precedents set by Pinchot's work, the range of functions included as legally mandatory in forest planning have expanded. The Multiple Use Sustained Yield Act of 1960 formalized the U.S. Forest Service range of duties by requiring forest planning to consider issues such as outdoor recreation, location in relation to human settlements, watersheds, and fish and wildlife preservation in addition to the more familiar concerns about timber and grazing. In each case the operative principle is "sustainable yield"—the amount of a resource that can be extracted without undermining the natural system's core capacities to maintain or improve upon its full range of services.

Pinchot's original conception of forestry was anthropocentric and geared to economic development; a raft of other issues, however, has arisen in the past forty years. One major source of controversy is clear cutting, the clearing and replanting of an entire area of forest as opposed to selective felling in a given area. This practice, which had become dominant in the U.S. Forest Service by the late 1950s, is supported by timber interests (for whom it can be more profitable) and by many foresters, but most environmentalists regard it as abusive to forestlands, especially because of habitat loss, even if the species affected may be ecologically unimportant to the system's productivity. This controversy is an example of how anthropocentric and nonanthropocentric conceptions of nature's value can result in practical differences even when there is agreement among the parties about the goal of sustaining the long-term use of natural resources. The problem is most pronounced in areas where clear cutting might affect vulnerable species; not surprisingly, then, the first wave of organized opposition to Forest Service clear cutting occurred around the same time as the passage of the Endangered Species Act (1973) and the 1975 Convention on International Trade in Endangered

Species of Wild Fauna and Flora (CITES), which sought to integrate balanced species use with conservation. The latter was the first major international agreement in which the idea of sustainable use was implicit, though the phrase was not used; the convention does not expressly promote sustainable use by defining the term or demanding particular practices, but it does seek to prevent destruction and unsustainable use.

SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT

Both political economy and forestry were prominent influences on the ideas sustainable development discussed in the 1987 WCED Report *Our Common Future* (often known as the Brundtland Report after its chair, the former Norwegian prime minister Gro Harlem Brundtland). Though it did not coin the phrase "sustainable development," the report furnished its basic definition as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 8). It drew upon earlier precedents by linking sustainable use of resources to intergenerational, intragenerational, and international distributive justice and poverty relief, noting the extent to which poverty causes ecological depletion and linking these points to conservation concerns. The WCED sustainable-development model is, however, clearly anthropocentric, embracing technological optimism and suggesting a new kind of economic growth rather than questioning or rejecting the very idea of growth. The 1992 United Nations Conference on Environment and Development in Rio de Janeiro built upon this report in forging the Convention on Biological Diversity, the first treaty to expressly promote the idea of sustainable use as an international ideal.

A concern with yield is an important but not sufficient element of a practice of ecologically sustainable development. Ecological sustainability implies the satisfaction of three conditions in human interactions with nature: (1) Rates of use of renewable resources must not exceed their rates of regeneration; (2) rates of use of nonrenewable resources must not exceed the rate at which renewable substitutes can be developed; and (3) rates of pollution emission must not exceed the assimilative capacity of the environment (Jones 2003). Human impacts in these areas may be measured by using ecological footprint analysis, as developed by Wackernagel and Rees (1996).

VARIETIES OF SUSTAINABILITY

The concept of sustainability poses two major questions: What is to be sustained? Who or what should be the beneficiary of sustainability? In anthropocentric theories the sustaining of ecological systems aims at the flourishing of humans; indeed, some argue that a sufficiently broad conception of human fulfillment coupled with a recognition of human ignorance may lead to a policy convergence between anthropocentric and nonanthropocentric views (Norton 1991). For example, the loss of a species in a given ecosystem might superficially appear unimportant within an anthropocentric view of policy, but if the complexity of ecosystems and the possibility of human error are used to mandate caution, the sensible policy course may still be to avoid risking any possible unforeseen impacts of the loss, thus mandating the same policy as that which would come from a nonanthropocentric perspective. Alternatively it can be argued that, if some species are unnecessary to human continuity and one allows some resource substitutability (for example, moving away from consuming scarce Atlantic cod supplies and towards using more plentiful and functionally equivalent European haddock), then only natural capital critical to human survival need be sustained for future generations (Dobson 2000); such a view might call for the complement of a nonanthropocentric perspective to justify the protection of areas of nature not critical to human well-being.

A quandary of intergenerational justice is that granting equal resource access to every generation without calculating an endpoint yields absurd conclusions: Finite resources must be divided among an infinite number of claimants, and so "no one gets anything at any time" (Laslett and Fishkin 1992, p. 6). Some argue, therefore, for a compromise between discounting the future (i.e., measuring the entitlements of future people as becoming progressively smaller and less important the further away they are from us in time) and the need to impose legitimate limits on the present generation.

One option is a "just savings" solution in the manner of John Rawls's justice theory (Wissenburg 1998), whereby people of all generations are regarded as morally equal and equally entitled to a particular basic set of opportunities, thus creating an obligation for each generation to pass on that set of opportunities to the next generation. Alternatively, a moral appeal may be made to future generations' vulnerability, arguing that this vulnerability creates obligations for the current generation (Goodin 1985; Cowen and Parfit 1992; Dobson 2000). Even in purely anthropocentric terms the details of such options still need calculation, and here the distinction between weak and strong sustainability becomes significant. Weak sustainability espouses the substitutability of natural capital (i.e., naturally occurring goods that have beneficial economic effects, such as the ability of forests to produce oxygen and absorb carbon dioxide) for human-made capital (i.e., human products that may have

functionally similar economic effects to such naturally occurring goods). Weak sustainability maintains that so long as an even stock of total capital is maintained, economic growth can be beneficial and consumption rates maintained. In some formulations an even stock of welfare functions is to be maintained, and so the issue becomes still clearer: a choice between sustaining either a particular list of goods or a particular level of human welfare.

Strong sustainability insists on treating natural capital independently of human-made capital, rejecting the idea that natural capital (i.e. naturally occurring economically beneficial goods) can always in principle be substituted by man-made equivalent goods, and so strong sustainability theory advocates sustaining particular natural goods and processes (i.e., physical "stuff") rather than undifferentiated total capital or welfare (i.e., abstract measurements of welfare held at a particular level). Although weak-sustainability has been more popular among thinkers stressing the range of future individual choices, Bryan Norton has supported the strong-sustainability perspective by a series of highly ingenious arguments concerning future human options and collective goods, maintaining that future people's opportunities for living fulfilling lives mandates strong rather than weak sustainability (Norton 2005).

SEE ALSO *Brundtland Report; Convention on Biodiversity; Environmental Law; Future Generations; Intergenerational Justice; Limits to Growth; Norton, Bryan; Pinchot, Gifford; Population; Resource Management; Sustainable Development; U.S. Forest Service.*

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Piers H. G. Stephens

SUSTAINABLE AGRICULTURE

At the beginning of the twenty-first century there are renewed threats of the starvation of millions, not due to warfare but to straightforward imbalance between food production and consumption. As seen frequently in Bangladesh, starvation will occur not first in overcrowded inner cities but in the very fields where food is grown. *Sustainable agriculture* is the technical name given policies and agricultural systems whose bottom-line goal is the prevention of such systemwide failures of agriculture.

Agricultural sustainability is defined as the ability to provide sufficient, healthful, and accessible food supplies into the indefinite future for the populations that depend on the systems. Agricultural sustainability has two more particular meanings: 1) sustainability in the goal of agriculture, where it implies a permanent ability to feed its constituent populations; and 2) sustainability in the means (or tools) that actual agricultural systems use to

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Sustainable Development: Mapping Different Approaches

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ABSTRACT
Sustainable development, although a widely used phrase and idea, has many different meanings and therefore provokes many different responses. In broad terms, the concept of sustainable development is an attempt to combine growing concerns about a range of environmental issues with socio-economic issues. To aid understanding of these different policies this paper presents a classification and mapping of different trends of thought on sustainable development, their political and policy frameworks and their attitudes towards change and means of change. Sustainable development has the potential to address fundamental challenges for humanity, now and into the future. However, to do this, it needs more clarity of meaning, concentrating on sustainable livelihoods and well-being rather than well-having, and long term environmental sustainability, which requires a strong basis in principles that link the social and environmental to human equity. Copyright © 2005 John Wiley & Sons, Ltd and ERP Environment.

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Sustainable Development: A Challenging and Contested Concept

THE WIDESPREAD RISE OF INTEREST IN, AND SUPPORT FOR, THE CONCEPT OF SUSTAINABLE development is potentially an important shift in understanding relationships of humanity with nature and between people. It is in contrast to the dominant outlook of the last couple of hundred years, especially in the 'North', that has been based on the view of the separation of the environment from socio-economic issues.

For most of the last couple of hundred years the environment has been largely seen as external to humanity, mostly to be used and exploited, with a few special areas preserved as wilderness or parks. Environmental problems were viewed mainly as local. On the whole the relationship between people and the environment was conceived as humanity's triumph over nature. This Promethean view (Dryzek, 1997) was that human knowledge and technology could overcome all obstacles including natural and environmental ones. This view was linked with the development of capitalism, the industrial revolution and modern science. As Bacon, one of the founders of modern science, put it, 'The world is made for

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man, not man for the world'. Environmental management and concern amongst most businesses and governments, apart from local problems and wilderness conservation, was at best based on natural resource management. A key example was the ideas of Pinchot in the USA (Dryzek, 1997), which recognized that humans do need natural resources and that these resources should be managed, rather than rapidly exploited, in order to ensure maximum long-term use.

Economics came to be the dominating issue of human relations with economic growth, defined by increasing production, as the main priority (Douthwaite, 1992). This was the seen as the key to humanity's well-being and, through growth, poverty would be overcome: as everyone floated higher those at the bottom would be raised out of poverty.

The concept of sustainable development is the result of the growing awareness of the global links between mounting environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity. It strongly links environmental and socio-economic issues. The first important use of the term was in 1980 in the World Conservation Strategy (IUCN *et al.*, 1980). This process of bringing together environmental and socio-economic questions was most famously expressed in the Brundtland Report's definition of sustainable development as meeting 'the needs of the present without compromising the ability of future generations to meet their needs' (WCED, 1987, p. 43). This defines needs from a human standpoint; as Lee (2000, p. 32) has argued, 'sustainable development is an unashamedly anthropocentric concept'.

Brundtland's definition and the ideas expressed in the report *Our Common Future* recognize the dependency of humans on the environment to meet needs and well-being in a much wider sense than merely exploiting resources: 'ecology and economy are becoming ever more interwoven – locally, regionally, nationally and globally' (WCED, 1987, p. 5). Rather than domination over nature our lives, activities and society are nested within the environment (Giddings *et al.*, 2002). The report stresses that humanity, whether in an industrialized or a rural subsistence society, depends for security and basic existence on the environment; the economy and our well-being now and in the future need the environment. It also points to the planetwide interconnections: environmental problems are not local but global, so that actions and impacts have to be considered internationally to avoid displacing problems from one area to another by actions such as releasing pollution that crosses boundaries, moving polluting industries to another location or using up more than an equitable share of the earth's resources (by an ecological footprint (Wackernagel and Rees, 1996) far in excess of the area inhabited). Environmental problems threaten people's health, livelihoods and lives and can cause wars and threaten future generations.

Sustainable development raises questions about the post-war claim, that still dominates much mainstream economic policy, that international prosperity and human well-being can be achieved through increased global trade and industry (Reid, 1995; Moffat, 1996; Sachs, 1999). It recognizes that past growth models have failed to eradicate poverty globally or within countries, 'no trends, . . . no programmes or policies offer any real hope of narrowing the growing gap between rich and poor nations' (WCED, 1987, p. xi). This pattern of growth has also damaged the environment upon which we depend, with a 'downward spiral of poverty and environmental degradation' (WCED, 1987, p. xii). Brundtland, recognizing this failure, calls for a different form of growth, 'changing the quality of growth, meeting essential needs, merging environment and economics in decision making' (WCED, 1987, p. 49), with an emphasis on human development, participation in decisions and equity in benefits. The development proposed is a means to eradicate poverty, meet human needs and ensure that all get a fair share of resources – very different from present development. Social justice today and in the future is a crucial component of the concept of sustainable development.

There were, and are, long standing debates about both goals and means within theories dealing with both environmental and socio-economic questions which have inevitably flowed into ideas on sustain-

able development. As Wackernagel and Rees (1996) have argued, the Brundtland Report attempted to bridge some of these debates by leaving a certain ambiguity, talking at the same time of the priorities of meeting the needs of the poor, protecting the environment and more rapid economic growth. The looseness of the concept and its theoretical underpinnings have enabled the use of the phrases 'sustainable development' and 'sustainability' to become *de rigueur* for politicians and business leaders, but as the Workshop on Urban Sustainability of the US National Science Foundation (2000, p. 1) pointed out, sustainability is 'laden with so many definitions that it risks plunging into meaninglessness, at best, and becoming a catchphrase for demagogy, at worst. [It] is used to justify and legitimate a myriad of policies and practices ranging from communal agrarian utopianism to large-scale capital-intensive market development'.

While many claim that sustainable development challenges the increased integration of the world in a capitalist economy dominated by multinationals (Middleton *et al.*, 1993; Christie and Warburton, 2001), Brundtland's ambiguity allows business and governments to be in favour of sustainability without any fundamental challenge to their present course, using Brundtland's support for rapid growth to justify the phrase 'sustainable growth'. Rees (1998) points out that this allows capitalism to continue to put forward economic growth as its 'morally bankrupt solution' to poverty. If the economy grows, eventually all will benefit (Dollar and Kraay, 2000): in modern parlance the trickle-down theory. Daly (1993) criticized the notion of 'sustainable growth' as 'thought-stopping' and oxymoronic in a world in which ecosystems are finite. At some point, economic growth with ever more use of resources and production of waste is unsustainable. Instead Daly argued for the term 'sustainable development' by which he, much more clearly than Brundtland, meant qualitative, rather than quantitative, improvements. Development is open to confusion, with some seeing it as an end in itself, so it has been suggested that greater clarity would be to speak of 'sustainable livelihoods', which is the aim that Brundtland outlined (Workshop on Urban Sustainability, 2000).

Another area of debate is between the views of weak and strong sustainability (Haughton and Hunter, 1994). Weak sustainability sees natural and manufactured capital as interchangeable with technology able to fill human produced gaps in the natural world (Daly and Cobb, 1989) such as a lack of resources or damage to the environment. Solow put the case most strongly, stating that by substituting other factors for natural resources 'the world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe' (1974, p. 11). Strong sustainability criticizes this, pointing out that human-made capital cannot replace a multitude of processes vital to human existence such as the ozone layer, photosynthesis or the water cycle (Rees, 1998; Roseland, 1998). Deep Greens would go further in arguing that non-human species, natural systems and biodiversity have rights and values in themselves (Naess, 1989). The debate between strong and weak sustainability is, however, conducted mainly around environmental issues rather than taking account of socio-economic consequences.

The concept of sustainable development represents a shift in understanding of humanity's place on the planet, but it is open to interpretation of being anything from almost meaningless to of extreme importance to humanity. Whatever view is taken, it is clearly an area of contention. Whilst recognizing the deep debates and ambiguities about the meaning of sustainable development, this paper uses the phrase 'sustainable development' to describe attempts to combine concerns with the environment and socio-economic issues.

Haughton (1999) has usefully summarized the ideas of sustainable development in five principles based on equity: futurity – inter-generational equity; social justice – intra-generational equity; trans-frontier responsibility – geographical equity; procedural equity – people treated openly and fairly; inter-species equity – importance of biodiversity. These principles help give clarity to the ideas of sustainable development, link human equity to the environment, challenge the more bland and meaningless interpretations and provide a useful basis for evaluation of the different trends of sustainable development.

Mapping Sustainable Development

The many different interpretations of sustainable development are confusing. To help make sense of them we are suggesting a mapping methodology based on combining environmental and socio-economic issues. O'Riordan (1989) in his widely used categorization of environmental views, from strong ecocentric to strong technocentric, pointed out that these often combine with socio-economic viewpoints so that ecocentrics tend towards social and economic equity and redistribution while technocentrics are more likely to support the economic and political status quo. However this is not always the case: as Marcuse points out, 'sustainability and social justice do not necessarily go hand in hand' (1998, p. 104), with sustainability masking injustice or on the other hand social justice masking environmental damage (Dobson, 2000). In many cases the linking of environmental and social concerns is based on a moral (Blowers, 1993) or sympathetic outlook rather than seeing the two as materially and socially related and inseparable. Others (Merchant, 1992; Dryzek, 1997) have also outlined useful ways of analysing environmental concerns; however, there has been less effort in mapping the many viewpoints on sustainable development.

To provide a generalized view of the trends within the sustainable development debate, O'Riordan's original mapping can be expanded by considering environmental and socio-economic views on two separate axes (Figure 1). The socio-economic axis covers the level of importance given to human well-being and equality and the environment axis covers the priority of the environment from low environmental concern through technocentred to ecocentred. The central shaded area of the map indicates the range

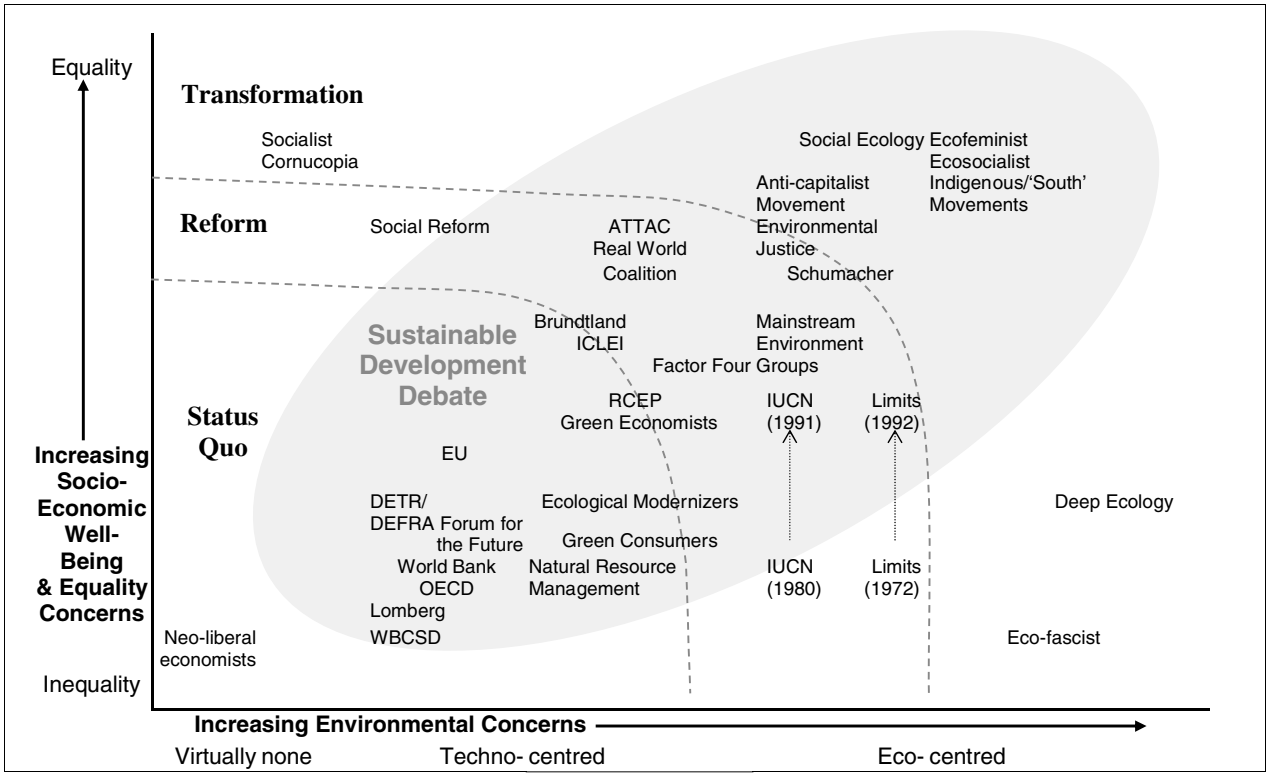

Figure 1. Mapping of views on sustainable development

of views within the sustainable development debate; combining socio-economic and environmental issues. There are views outside this area, concerned with either environmental or socio-economic issues while ignoring the other.

Overlaid on this map are three broad views on the nature of the changes necessary in society's political and economic structures and human–environment relationships to achieve sustainable development: that it can be achieved within the present structures – status quo; that fundamental reform is necessary but without a full rupture with the existing arrangements – reform; and that as the roots of the problems are the very economic and power structures of society a radical transformation is needed – transformation (Rees, 1995).

This is inevitably a broad conceptual framework rather than a precise mapping and exact locations are open to challenge. All classification into groups is a simplification and there can be debate about where the boundaries are drawn as well as how sharp or blurred they are. Individuals and groups change their views over time. There are also major debates within all these outlooks. To illustrate the mapping, some of the major trends within sustainable development are outlined.

Status Quo

Supporters of the status quo recognize the need for change but see neither the environment nor society as facing insuperable problems. Adjustments can be made without any fundamental changes to society, means of decision making or power relations. This is the dominant view of governments and business and supporters of the status quo are most likely to work within the corridors of power talking with decision makers in government and business. Development is identified with growth and economic growth is seen as part of the solution. The UK Department of the Environment, Transport and the Regions argues that 'to move towards more sustainable development, we need more growth not less' (DETR, 1999, para. 3.31). Supporters of the status quo are sympathetic to the changes in the role of government over recent decades with the reduction in the progressive nature of taxation, cuts in the social wage, privatization and reduction in regulation. They argue that business is the driver towards sustainability. Increased information, changing values, improved management techniques and new technology all operating through the market are the best means to achieve sustainable development.

Simon and Kahn see markets and technology as producing a future world that will be 'less polluted, more ecologically stable . . . and the world's people will be richer' (1984, p. 1). The World Business Council for Sustainable Development (1998) sees no conflict between the growth of the global market and environmental stability: 'we can have an open vigorous and healthy trading system and achieve sustainable development'. The OECD (2001) urges fiscal changes to taxation and subsidies and increased private ownership of resources to make markets work for sustainable development as well as confidence that globalization does not weaken social and environmental protection. Lomborg (2001), in the tradition of Pangloss, challenges most of the claims of those concerned about the environment, poverty and hunger. He states that to improve the 'environmental quality of the developing world, securing growth so as to lift these people out of hunger and poverty is of the utmost importance since . . . only when we are sufficiently rich can we start to . . . deal with environmental problems'.

Most Ecological Modernizers (Beck, 1992; Mol and Sonnenfeld, 2000) support the status quo, although some see the need for reform. They support the market, 'the key to ecological modernization is that there is money in it for business' (Dryzek, 1997, p. 142), and technology in a partnership of government, business, moderate environmentalists and scientists with much less concern for equity, justice or human well-being (Alier, 2003). Jacobs (1999) argues that the environment and sustainable development are not central to New Labour but that environmental modernization (or ecological modernization as called in Europe) would be an environmental approach in sympathy with New Labour's outlook.

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Supporting the reduced role of government, supporters of the status quo are reluctant to use laws and regulations. Instead, consumer power, informed about sustainability issues and based on lifestyle choices, will combine with 'green' capitalists who practice 'corporate citizenship' and ethical business to achieve sustainable development (Elkington and Burke, 1987). There is little discussion on governance other than references that in some countries the rule of law (usually meaning defence of property rights) should be strengthened and outright bribery diminished. The need to increase wider democratic rights, especially on economic decisions, is hardly mentioned. It is assumed that the existing governmental and commercial systems can be nudged towards improvements with use of management techniques such as EIA (environmental impact assessment), EMAS (eco-management and audit system), cost/benefit analysis, BATNEEC (best available techniques not entailing excessive cost) and BPEO (best practicable environmental option). In parallel, technical economic tools such as modest environmental taxes, pollution trading permits and ethical shares will encourage the move to sustainable development.

Any classification has its difficulties and Garrett Hardin well illustrates some of these. In his 'Tragedy of the commons' (1968) he advocates widespread private ownership of resources to protect the environment, which puts him in the status quo group in economic terms. On the other hand his 'lifeboat ethic' (1974), which argues that the poor should be left to starve, and his support for 'coercion' (1968) put his social views towards eco-fascism.

Most supporters of the status quo have a weak commitment to environmental sustainability, although for some such as Solow (1974) it is barely needed at all, as technology can replace nature. There is a similar weak concern with poverty and the lack of equity in political power. Generally the status quo argument is that growth is the way to overcome these problems. The World Bank (2000, p. vi) states that the 'traditional elements of the strategy to foster growth – macroeconomic stability and market-friendly reforms – are essential for reducing poverty'.

Reform

Those who take a reform approach accept that there are mounting problems, being critical of current policies of most businesses and governments and trends within society, but do not consider that a collapse in ecological or social systems is likely or that fundamental change is necessary. They generally do not locate the root of the problem in the nature of present society, but in imbalances and a lack of knowledge and information, and they remain confident that things can and will change to address these challenges. They generally accept that large shifts in policy and lifestyle, many very profound, will be needed at some point. However it is assumed that these can be achieved over time within the present social and economic structures. The key is to persuade governments and international organizations, mainly by reasoned argument, to introduce the needed major reforms. They focus on technology, good science and information, modifications to the market and reform of government. This group covers a range of people, some in government and public agencies, but it is largely dominated by academics and mainstream NGO experts. Interestingly, some governmental bodies such as the Royal Commission on Environmental Pollution (RCEP), and some areas of local government, such as the International Council for Local Environment Initiatives (ICLEI), have a more radical view than the UK government.

A common theme is the benefits that technology can bring to protecting the environment. Weizsacker *et al.* (1997) for example call for a large reduction in the use of materials in the economy, by at least a factor of four. There is widespread support for a dramatic increase in energy efficiency and change in energy use from fossil fuels to renewable sources (Flavin and Lenssen, 1994). It is argued that these changes will offer market opportunities for businesses and they should grasp the changes, both for the

environment and profits (Hawken *et al.*, 1999). In general it is claimed that the new technologies will provide wider economic and social benefits for humanity as well as protecting the environment.

Green economists argue that the market needs modification to redress market failure and regulation to achieve ecological sustainability. Pearce *et al.* (1989) urge the internalization of hitherto externalized environmental costs and a recalculation of environmental benefits. Hawken *et al.* (1999) and Roodman (1996, 1997) argue for government action to change the balance of tax and subsidies to favour employment and environment rather than energy consumption and to encourage business to change production technology. Daly and Cobb (1989) look to a combination of strong sustainability with market modification to include social and environmental costs. Korten (1996) believes that the global corporations and the international agencies such as the World Bank and IMF need to be controlled so that capitalism is able to protect the environment and raise living standards for all.

Reformers recognize that government has a key role in moving towards sustainable development as business will need pushing, and in some cases controlling, taxes and subsidies changing, targeting of research and disseminating of information. Most reformers also assume that there will be reform of the political system to increase democracy and participation. Girardet (1999), a leading figure in urban sustainability, puts the emphasis on the city level, arguing that a combination of best practice, enlightened civic leaders, active partnership with local business and public determination are the best way to success. The Real World Coalition (Christie and Warburton, 2001), which represents 25 UK campaigning NGOs, links environmental and socio-economic concern. It points out that the present 'business as usual' 'is itself a source of our greatest dangers' (p. 184) due to mounting inequality and poverty, environmental degradation and world instability. They believe 'radical reform' (p. viii) is needed to produce a 'democratic revitalization' (p. 184) so that government and society produce 'sustainable, accountable and equitable forms of capitalism' (p. 184).

The growing environmental concerns of the 1960s and 1970s had by the 1980s became part of the mainstream debates on development and economics. The *Limits to Growth* report (Meadows *et al.*, 1972) and the *World Conservation Strategy* (IUCN *et al.*, 1980) both helped to push environmental issues up the world's political agenda. Interestingly, the sustainable development debates encouraged the authors to embrace more socio-economic issues.

The *Limits to Growth* report (Meadows *et al.*, 1972) challenged head on the idea that growth, as defined by capitalist economics, was the way to improve environmental quality; in fact they argued it was damaging the environment. The Brundtland report rejected the idea that there were environmental limits to growth (Kirkby *et al.*, 1995). When the authors of *Limits to Growth* revisited the issue in 1992 (Meadows *et al.*), while they maintained that there are limits to growth, they opened a bridge towards the ideas of Brundtland, although they talk about a 'sustainable society'. They also refer to social issues including tackling poverty.

The World Conservation Strategy (IUCN *et al.*, 1980) was one of the first to use the term sustainable development. The 1980 report, concerned with human needs, concentrated entirely on environmental changes without discussing changes in socio-economic structures or distribution. The 1991 report, (IUCN *et al.*, 1991) although still concentrating on environmental issues, shows a greater recognition of social issues proposing changes in socio-economic structures, increasing participation in decisions, improving the quality of human life and modifications to the world economy.

The mainstream environmental groups such as Friends of the Earth, Greenpeace, WWF and Sierra Club are largely in the reform group and increasingly have moved from grass roots activism and mass protest to political lobbying and working with business and government (Bullard, 1994; Rowell, 1996). They have given less focus to linking with social issues of poverty or even the disproportionate share of pollution and other environmental issues suffered by the poor within the developed world (Bullard, 1994; McLaren *et al.*, 1999).

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Some of the reformers edge towards the transformation group, such as Schumacher (1973), who argues that the economy should be run 'as if people mattered', with the implication that small and local is more sustainable than large and global, although he envisages small as being privately owned and operating in a market economy. Other reformers lean much more towards the status quo. The Brundtland report is generally reformist in broad tone but leans towards the status quo in proposed details.

Transformation

Transformationists see mounting problems in the environment and/or society as rooted in fundamental features of society today and how humans interrelate and relate with the environment. They argue that a transformation of society and/or human relations with the environment is necessary to avoid a mounting crisis and even a possible future collapse. Reform is not enough as many of the problems are viewed as being located within the very economic and power structures of society because they are not primarily concerned with human well-being or environmental sustainability. While some may use the established political structures and scientific arguments they generally see a need for social and political action that involves those outside the centres of power such as indigenous groups, the poor and working class, and women. The transformationists include those who focus either primarily on the environment or the socio-economic, and those who synthesize both.

Transformation without Sustainable Development

As sustainable development is a human-centred view of the inter-relations between environmental and socio-economic issues, some transformationists are not concerned with sustainable development.

Deep ecologists' primary concern is the environment, with the emphasis on the intrinsic value and needs of nature and the environment, while human needs come very much second. In the eight points of the deep ecology platform (Naess, 1989) there is little on human needs and nothing on equity. Bradford (1989), in a critique of deep ecology, points to the trend towards racism and support for imperialism as well as an anti-human outlook behind their 'nature first' rhetoric. David Foreman, one of the founders of Earth First!, was notorious for saying of the famine in Ethiopia that 'the best thing would be to just let nature seek its own balance, to let the people there just starve' (quoted by Bradford, 1989, p. 33). As Bramwell (1989) argues, there is an association between some green and fascist thinking. Of course not all deep ecologists have such a low concern for humanity. Although Lovelock (1988) sees the earth's ecosystem as self-sustaining Gaia, he urges humanity to act in its own interest. Gaia will survive human actions but humans may not survive the damages we inflict or Gaia's need to save itself. Other deep ecologists, such as Earth First! in Scotland (Cock and Hopwood, 1996) and Eckersley (1992), combine ecocentrism with a commitment to socio-economic equity. For some this is expressed as a desire to return to the 'simple life' (Devall, 1990) or a subsistence perspective (Bennoldt-Thomsen and Mies, 1999).

In contrast to deep ecologists, socialist cornucopians prioritize the need for social transformation to overcome social and economic inequality. Some hardly address environmental issues, believing that human skills, freed from capitalism, can overcome all problems (Zazubrin in Cock and Hopwood, 1996). Others, while acknowledging environmental concerns, believe they can be laid firmly at the feet of capitalism and will be solved by social ownership of the means of production (Grundmann, 1991).

Transformation and Sustainable Development

Those who adopt a transformatory approach that embraces both social and environmental questions cover a range of different viewpoints although all share the view that the mounting crises in the envi-

ronment and society are interconnected and that the social and environmental systems risk breakdown if radical change does not occur (George, 1999; Rees, 1995). Some, such as grass roots environmental justice and indigenous environmental movements, may not use the same vocabulary of sustainable development as used in official and academic circles but are addressing the issues of how to live within the environment without great inequality or poverty. Transformationists see the fundamental problems as rooted in our present society, which is based on the exploitation of most people and the environment by a small minority of people.

A transformation view of sustainable development has a strong commitment to social equity, with a view that access to livelihood, good health, resources and economic and political decision making are connected. In the absence of people having control over their lives and resources, inequality and environmental degradation are inevitable. The Soviet Union, in its statist and undemocratic version of public ownership, damaged the environment and had entrenched inequality because people lacked real power (Sarkar, 1999). Similarly, the large global corporations and many governments are not under public control. Organizations of popular action and control (radical political parties, community groups, environmental campaigns, trade unions, etc) are the main restraints on unsustainable actions. Transformationists argue that these currently limited restraints need to be extended to real control (Pepper, 1993; Dryzek, 1997).

Social Ecology or Dialectical Naturalism is a perspective associated with the ecoanarchist Murray Bookchin. In his view humanity and nature are in a dialectical relationship and environmental concern needs to be 'rooted in social criticism and a vision of social reconstruction' (1989, p. 13). His main concern is the power of the state and he puts forward government through local municipalities based on direct democracy through local assemblies.

Ecofeminists see a relationship between the degradation of the environment and the subordination of women (Buckingham-Hatfield, 2000; Mellor, 1997a). There is a range of approaches from cultural/biological associations of women with nature (Collard, 1988) to more social analysis (Salleh, 1997). Mies and Shiva (1993) combine the two approaches, arguing that women have a special affinity with nature, which capitalist 'maldevelopment' is destroying as well as undermining many sustainable social structures and increasing poverty. Mellor has developed a version of ecofeminism that is linked closely with ecosocialist analysis, which argues that capitalism attempts to detach production and social life from nature through gender and class divisions (1992, 1997b).

Much of ecosocialist thinking draws on the writing of Marx and Engels on the nature of human society and its relation with the environment: 'We by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature – but . . . we, with flesh, blood and brain, belong to nature, and exist in its midst' (Engels, 1968). These link inequality and environmental damage to capitalism's exploitation of people and the environment (Cock and Hopwood, 1996). Ecosocialists argue for the need to change material conditions and the social structure of society to overcome both environmental crises and injustice (Pepper, 1993). This leads them to see a common linkage between many struggles for justice and environmental protection. James O'Connor launched the journal *Capitalism, Nature, Socialism* in 1988 with the analysis of a 'second contradiction' for capitalism that links environmental and social crisis in a material and class analysis (O'Connor, 1988).

As well as these transformational ideas there are also a range of campaigns and actions that seek to transform society. Many of the campaigns in the 'South' around sustainable development, in all their variety, closely link environmental, social, economic and anti-globalization struggles. These are some of the most energetic challenges to status quo and reformist approaches to sustainable development. Leff (2000) argues that indigenous environmental movements are not only challenging the failure of environmental and social justice within global development processes, but also offer a clear alternative environmental rationality. Their grassroots struggles covering 'social equity, cultural diversity and

environmental democracy define new political values and a new social rationality for sustainability' (p. 70) which develops 'sustainable productive projects and give meaning to their lives' (p. 69). The struggle of the Brazilian rubber tappers, formerly led by Chico Mendes, started on trade union rights (Hecht and Cockburn, 1990). The campaign of the Ogoni people of Nigeria, led by the murdered Ken Saro-Wiwa, began on social justice (Rowell, 1996). The Chipko movement in India, mainly of women, began by protecting trees (Guha, 1989). The Zapatista uprising in Chiapas began on issues of land reform (Weinberg, 2000). All these struggles and many others had their roots in local circumstances of oppression and have spread both to embrace wider environmental, social and economic justice issues and internationally.

In the developed world as well, there are growing struggles for environmental justice, which unite social and environmental issues. Although too often ignored by mainstream environmental groups, these actions, especially of the poor, racial minorities and those without political power, all point to a more sustainable society. Hofrichter (1993, pp. 4–5) states that 'Environmental justice is about social transformation directed toward meeting human need and enhancing the quality of life – economic equality, health care, shelter, human rights, species preservation and democracy – using resources sustainably' and that achieving it 'demands major restructuring of the entire social order'. Gibbs (1993, p. x), a leader of the battle of Love Canal, explains that battles for environmental justice usually starts with a local single issue but people 'realize the root of their problem is the lack of organized political power, deteriorating neighborhood conditions, poverty and race . . . recognize the international dimensions of the problem . . . build an even broader coalition for change . . . with civil-rights and labor organizations, housing groups, women's groups and healthcare advocates . . . these new alliances and cooperative work can achieve real democracy'.

The worldwide growth of the anti-globalization and anti-capitalism protests that have greeted meetings of the world's powerful politicians and businesses leaders links struggles across the world and addresses many of the issues of sustainable development. The ideas in this movement range from reform of the world financial system, such as the ideas put forward by ATTAC, to outright opposition to capitalism.

Within the broad range of transformative perspectives on sustainable development there is a constant interchange of ideas and cross-fertilization, which sometimes makes classification difficult, but enriches both ideas and practice.

Conclusion: Towards Sustainable Development

All proponents of sustainable development agree that society needs to change, though there are major debates as to the nature of sustainable development, the changes necessary and the tools and actors for these changes. There is no such thing as a single unified philosophy of sustainable development; there is no sustainable development 'ism'. In most cases people bring to the debates on sustainable development already existing political and philosophical outlooks.

Further confusion about sustainable development arises as people use the same words to mean a wide divergence of views on the goals, routes and the methods of moving towards sustainable development. This is further complicated because, as in many political issues, some people may say one thing and mean another. On some occasions reformers and transformationists will tone down their arguments to persuade a government or business to move along the sustainable pathway. On the other hand some may use more radical rhetoric than they actually believe or practice to deflect criticisms.

There is a fundamental divide between the supporters of the status quo and a transformation in their concept of and approach to sustainable development. The status quo approach sees change through

management, top down and incremental, of the existing structures of decision-making. The transformation view is that change will be mainly through political action working both in and outside the existing structures. The sustainable development discourse at present is dominated by the managerial outlook.

In most of the world the issues of sustainable development are not at the top of the world's policy agenda; even issues such as climate change or mass starvation do not dominate the news or political debate. However, the challenges at the core of sustainable development, the environment and equity, will force it up the political agenda.

The usual model for sustainable development is of three separate but connected rings of environment, society and economy, with the implication that each sector is, at least in part, independent of the others. Defenders of the status quo see the root cause of a lack of sustainable development in the lack of knowledge and appropriate mechanisms, rather than a fundamental linkage. This view allows for trade-offs between environmental and social issues, whether it is that some pollution is acceptable to increase growth, or loss of some pastureland for a park, or jobs for cleaner air. These trade-offs indicate a continued conceptual divide between the environment and humanity. The reality is that humanity is dependent on the environment, with society existing within, and dependent on, the environment, and the economy exists within society. Humans live within the environment (Giddings *et al.*, 2002) and depend on it for survival and well-being; we cannot ignore the environment.

There is growing evidence of human caused climate change, both scientific study (Sample, 2003) and more anecdotal such as the fires across the northern hemisphere in the summer of 2003. The loss of biodiversity and the salinization of soil continue, largely due to the present production and marketing methods.

If the status quo vision of world development were true and at some future date the poor of the world had the same living standards as those of the USA or Europe, could the world cope? The USA with 290 million people has over 210 million motor vehicles, while the world today has 6000 million people and 520 million vehicles. If the entire world were at same level as the USA there would be 4400 million vehicles. Is there enough petroleum to run them or could the world's atmosphere cope with the carbon dioxide and pollution releases?

Even in the area of economic growth, to which supporters of the status quo give priority, the trend is away from sustainable development (Middleton *et al.*, 1993), there is no sign of an increase in global equity; in fact the world is becoming more unequal. The USA, compared with its share of the world's population, continues to greatly over-consume resources and release pollution. In the last 50 years world trade has grown 17-fold, but the share of the poorest nations has collapsed. The gap between the richest 20% and the poorest 20% has widened substantially; from a factor of 30 in the 1960s to 86 in 1997, with the three richest people having more assets than 600 million people (UNDP, 1999). Even within the richest countries, inequality has increased (Jacobs, 1996; Christie and Warburton, 2001). Far from the promised trickle-down, wealth, unlike water, is rushing uphill. Malaria, a disease that is linked to poverty both in the likelihood of being infected and in its impacts, kills 5000 African children a day, yet could be controlled with modest expenditure (Rabinovich, 2002). The UN states that two problems, poverty and child mortality, are 'intractable' (UNDP, 2002).

How will society deal with the growth in inequality and mounting environmental problems? Can we continue as we are? At present the status quo view dominates policy, but their policies are an inadequate answer to the needs of sustainable development; it is argued that they have used the phrases of sustainable development to continue with and justify business as usual (Kothari, 1990). Embracing the status quo is not a viable option for society if we are to move towards sustainable livelihood for all, now and in the future, within an abundant and diverse environment. The future is likely to be dominated by choices between more radical views.

Reading 2

Mapping Different Approaches

One option is that advocated by Hardin (1974), that the rich and powerful of the world have a lifeboat ethic of extreme gated communities to ensure their own privileged survival. The outcome would be increased inequality, environmental degradation and probably wars. This trend is reflected in the thinking of the US government, which has turned concerns about security in dealing with environmental risks, mostly due to human actions (Beck, 1992), into a programme of security based on military action to protect unsustainable policies such as the USA's oil consumption (White House, 2000; Dalby, 2003).

The alternative suggested by the Deep Greens would share out the reduction in living standards more fairly in a world that drastically reduces consumption and, they usually suggest, population. However, who will decide which of the world's billion shall die? A return to low technology and living on the land would risk a return to the poverty and high infant mortality of the past for the west and continuation of the nightmarish present for many of the poor of the world. This too might well be a recipe for social conflict and wars. It certainly would not be a future based on the ideas of sustainable development.

Reformers would reject the grim views of Hardin or deep greens while acknowledging that 15 years after Brundtland many trends are still getting worse. The challenge for them is how and why governments and big business will self-reform to challenge the powerful vested interests that act in ways contrary to sustainable development.

The future envisaged by transformationists takes a different view, starting from the view that environmental degradation, poverty and a lack of justice are not a historical coincidence. The linkage is not simply moral; it is rooted in a society of domination and exploitation of the environment and most people. In what O'Connor (1989) describes as combined and uneven development, some communities and people are rich because others are poor and vice versa. O'Riordan states that 'wealth creation based on renewability and replenishment rather than exploitation . . . is a contradiction in terms for modern capitalism', so that real sustainable development requires a 'massive redistribution of wealth and power' (1989, p. 93). Transformationists emphasize justice and equity, believing that if these are not central to any analysis the ecological problems will be blamed upon a common 'us', who are held equally to blame. This trend is evident in some deep ecologists' thinking that holds all humanity responsible for the ecological crisis, thus masking divisions of race, class and gender. In an unequal society it is those who are least powerful who suffer poverty and lack of access to resources. The poor also have to bear the heaviest burden of ill-health, war and ecological problems (Sachs, 1999; UNDP, 2002; Agyeman *et al.*, 2003).

Transformationists' view of the connection between environmental degradation and human exploitation encourages the building of alliances between environmental and social justice movements. The challenge they face is how to mobilize a coalition that is powerful and cohesive enough to realize the needed changes. The core values of sustainable development as outlined by Haughton are environment protection and justice. The issues that transformationists are facing, of how to combine these two, will increasingly become main stage as society faces the challenges of the future.

Although open to many interpretations, sustainable development has gained wide currency. It crucially embraces the key issues for humanity of how to ensure lives worth living and our relation with the planet and our relations with each other.

Rather than discarding the concept of sustainable development, it provides a useful framework in which to debate the choices for humanity. We have argued that sustainable development needs to be based on appreciation of the close links between the environment and society with feedback loops both ways, and that social and environmental equity are fundamental ideas.

Given the need for fundamental change, a deep connection between human life and the environment and a common linkage of power structures that exploit both people and planet, we would argue that transformation is essential. However, we do not see it as necessary or sensible to make an exclusive commitment to transformation. Reform now is better than nothing and transformation may not be immediately feasible. However, whilst engaging with government and business for reforms, the main

focus should be to raise the issues, successful mobilization of the media and to build coalitions linking researchers, popular protest and direct action.

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Sustainability: Virtuous or Vulgar?

JOHN A. VUCETICH AND MICHAEL P. NELSON

Progress in understanding and achieving sustainability requires addressing it as both a scientific and an ethical issue. If sustainability is defined as "meeting human needs in a socially just manner without depriving ecosystems of their health," most of the words in its definition are normative or value laden. Depending on how critical normative terms such as "human needs" and "ecosystem health" are defined, sustainability could mean anything from "exploit as much as desired without infringing on the future ability to exploit as much as desired" to "exploit as little as necessary to maintain a meaningful life." We suggest that there are five key areas of sustainability. By examining how recent university cluster hires in sustainability compare with these five areas, we show not only how hiring has been radically lopsided but also how ethics has been entirely ignored. Lack of attention to the ethical dimension of sustainability is stifling progress toward sustainability.

Keywords: anthropocentrism, ecosystem health, environmental ethics, sustainable harvest, virtue ethics

Achieving sustainability has become a central issue of our time. Aside from the challenges of how we can become sustainable, contention continues to simmer over basic issues such as what it even means to be sustainable, and what new knowledge is required to become sustainable. One manifestation of this contention is the exclusive manner in which various academic quarters sometimes portray the nature of sustainability: Too many environmental scientists think sustainability is primarily about documenting and protecting ecosystem health, whereas too many engineers think sustainability is primarily about more efficiently meeting human needs.

Sustainability scholars continue to debate whether sustainability is more about economics, ecology, or social science (e.g., Ott 2003, Adams 2006). This debate, however, has almost entirely neglected a fundamental dimension of sustainability: the ethical dimension. Exclusive perspectives and a lack of concern for ethical issues can be ameliorated by considering sustainability as a framework that would begin by defining sustainability as "meeting human needs in a socially just manner without depriving ecosystems of their health." This framework builds upon existing notions of sustainability insomuch as this definition is closely related to other widely appreciated definitions of sustainability (e.g., WCED 1987, Callicott and Mumford 1997, NRC 1999). The framework arising from this definition is composed of five critical dimensions (see figure 1):

a. Development of efficient technologies and markets for meeting human needs, which is generally the purview of engineering, physical science, biotechnology, economics, and business;
b. Understanding the state and nature of ecosystems, which is generally the purview of ecology and environmental science;
c. Understanding how exploitation affects ecosystems, which is generally the purview of applied ecology and environmental science;
d. Understanding how exploitation affects human cultures, which is generally the purview of sociology, political science, policy, law, anthropology, and the arts and humanities;
e. Understanding the meaning of normative concepts such as human needs, socially just, depriving, and ecosystem health, which is generally the purview of ethics and philosophy.

Dimensions (b) and (c) in practice are closely related, and many researchers would self-identify with both dimensions. Also, a more detailed framework might further specify dimension (b) by, for example, prioritizing the subdisciplines, taxa, and geographic regions most important for understanding sustainability. One could also argue that another significant dimension of sustainability includes the fields of basic human medicine and psychology. These fields of inquiry are necessary to understand human needs, much the same way that dimension (b) is necessary for understanding ecosystem health.

This framework highlights how every academic discipline is necessary for realizing sustainability. The nature of the first four dimensions of sustainability are (we hope) self-evident, but the last dimension—the ethical dimension—requires some explanation. Although fields such as sociology and political science provide descriptive (i.e., scientific) accounts of how values relate to sustainability, they do not evaluate,

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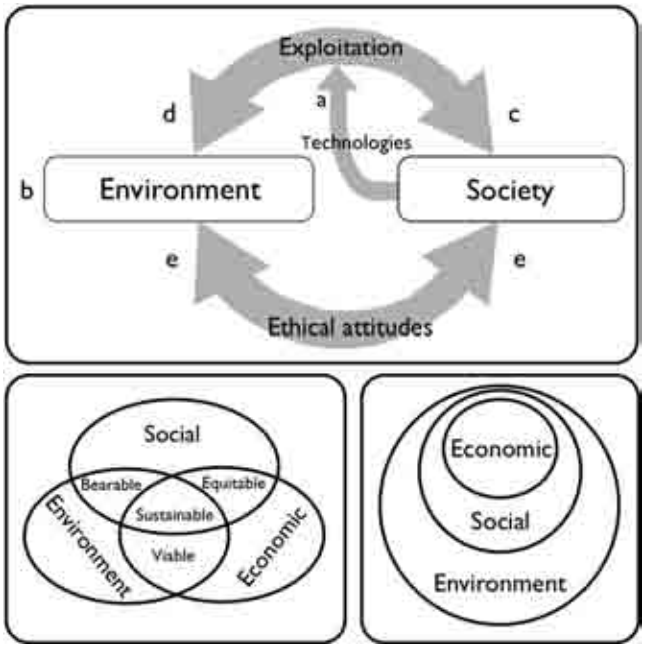

Figure 1. Sustainability is essentially the relationship between the environment and society. That relationship involves a physical aspect (exploitation) and an ethical attitude (upper panel). The relationship is affected by (a) our technologies, (b) understanding of the environment, (c) understanding how exploitation affects society, (d) understanding how exploitation affects the environment, and (e) how we understand our ethical attitudes about ourselves and nature. History provides plenty of evidence that dimensions (a)–(d) are inadequate for achieving sustainability. Ethical attitudes are a critical aspect of any relationship involving humans (e), and are the neglected dimension of sustainability. This model emphasizes that technology is conceptually secondary to exploitation, determining only our capability and efficiency of exploitation. Ethics determines how we use technologies. Previous conceptual models of sustainability (lower panels; Ott 2003, Adams 2006) are silent about the role of technology, which has become a central focus, and ethics, which ought to become a central focus.

for example, the logic, consistency, and robustness of the normative concepts upon which sustainability rests. Among academics, such evaluation is the purview of ethics.

Without developing the ethical dimension of sustainability, we will never even know what sustainability means, and will therefore be ignorant about how to achieve it. For example, consider the concepts of human needs and ecosystem health. Depending on how societies understand these concepts, sustainability could mean anything from "exploit as much as desired without infringing on future ability to exploit as much as desired" to "exploit as little as necessary to maintain a meaningful life." These two attitudes seem to represent wildly different worlds—one might be called vulgar sustainability and the other virtuous—yet either could be considered "sustainable," depending on the meaning of the normative concepts that define sustainability. Ultimately, 7 of the 11 words (excluding articles) in our definition of sustainability are tied to fundamentally normative concepts.

Indeed, society will never come to an eternal consensus about the meanings of normative terms that comprise sustainability. This circumstance recalls contention about the concept of justice. Our understandings of justice are varied, indefinite, and evolving. However, by continuing to tend its meaning at all levels of society (i.e., academics, professionals, politicians, and the general public), we have developed viable legal systems that evolve with societies' conceptions of justice. Achieving sustainability requires tending its ethical dimension across all levels of society, even though we cannot ever expect to arrive at a final determination of its meaning.

With these principles in mind, consider a specific (and narrow) illustration: the sustainable harvest of ungulate populations in North America. In this case, the human need (or perhaps merely desire) may be to maximize the harvestable surplus for an indefinite period of time. Moreover, the most common notion of a healthy ungulate population is one with a skewed sex ratio and young age structure, which lives on a landscape that produces enough vegetation to yield the largest possible harvestable surplus of ungulates. That is, population health is defined in terms of human needs or desires. However, other reasonable notions for population health of an ungulate population entail "more natural" conditions, such as balanced sex ratios, age structures, and abundances that are temporally dynamic and include older individuals; vegetative communities that support fewer ungulates; and wolves, whose viability requires us to share some of the "harvestable surplus."

These principles also apply to our most general concerns about sustainability. For example, in recent years, humans have produced and used something close to 12 terawatts (TW) of energy annually. Are Earth's ecosystems healthy if they continue to produce 12 TW of electricity, or if they possess an undiminished variety of flourishing habitats and species, but perhaps cannot produce 12 TW of energy? Does human need define ecosystem health, or does ecosystem health define the limits of human need?

Although many scientists and engineers consider these issues intractable and distracting, they represent critical obstacles to achieving sustainability. Moreover, these are issues that ethicists are trained to handle and to which others from the humanities would have much to contribute.

Essentially, we do not understand the extent to which sustainability represents an anthropocentric or nonanthropocentric attitude. Do we care about ecosystem health because ecosystems are intrinsically valuable, or do we care about ecosystem health only because it serves human interests? Many scientists and engineers are certain that sustainability is an anthropocentric concern. That certitude may be misplaced, as many of our colleagues in the humanities have offered rigorous, well-reasoned explanations for what nonanthropocentrism is and why it is essential for conservation (Plumwood 1993). For a gentle introduction to these

topics, see Callicott (2006) and Goralnik and Nelson (2010). Embarrassingly, most scientists and engineers are almost entirely unaware of these explanations.

We do not suggest that sustainability should be primarily an anthropocentric or nonanthropocentric concern. Our point is that discussion of the issue among all academics is critical to achieving sustainability. It is as important for scientists and engineers to know these arguments as it is for environmental ethicists and philosophers to know the basic principles underlying climate change, habitat destruction, and species extinctions.

Using these five critical dimensions of sustainability, we assessed hiring patterns of universities conducting cluster hires focused on sustainability. We used Google and the keywords "cluster hire," "sustainability," and "university" to identify universities that were currently or had recently conducted cluster hires. When university sites did not report the names and areas of expertise of new hires, we contacted the universities directly to request this information. We also asked these contacts and our colleagues about their knowledge of other cluster hires. Additionally, we contacted the Association for the Advancement of Sustainability in Higher Education and the Association for Environmental Studies and Sciences about their knowledge of cluster hires. We did not learn of any cluster hires from these sources that we had not already found through Internet searches. For this reason, we do not think we missed any cluster hires focused on sustainability between 2008 and 2010, and we have not learned of any cluster hires occurring before 2008. The results of our search suggest that university cluster hires focused on sustainability have not evenly represented the dimensions of sustainability and have particularly neglected sustainability's ethical dimension (see figure 2).

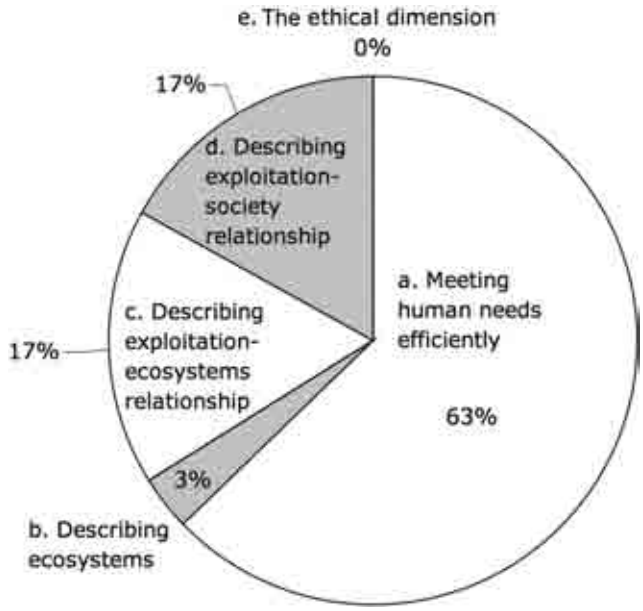

Figure 2. Recent university cluster hires in sustainability. The percentage of faculty associated with each dimension (a–e, which correspond to the letters in the upper panel of figure 1) of sustainability hired by several universities in recent initiatives to hire clusters of sustainability faculty. These data represent 59 positions from nine universities. The universities are Cornell University; Iowa State University; Michigan Technological University; Ohio State University; Portland State University; Rochester Institute of Technology; the State University of New York College of Environmental Science and Forestry; University of California, San Diego; and University of New Hampshire.

Academia's general neglect of sustainability's ethical dimension is also reflected in the National Science Foundation's Environmental Sustainability program, an interdisciplinary funding program. That program's 570-word synopsis, found on its Web site, makes no reference to the ethical dimension of sustainability, but concludes: "All proposed research should be driven by engineering principles, and be presented explicitly in an environmental sustainability context." Moreover, the word "ethic-" appears in the title, keywords, or abstract of just 1 of the 119 projects funded since this program's inception.

University contributions to sustainability need to include deeply interdisciplinary collaborations. Deep interdisciplinarity involves collaboration among, not merely within, the five dimensions of sustainability. According to this view, deep interdisciplinarity is not represented by, for example, an engineer and an economist working to develop more efficient means of meeting human needs. However, an ecologist researching the ecological effects of biofuel production in coordination with the sociological dimensions of biofuels may be an example of deeply interdisciplinary collaboration, or it may be an example of disciplinary research coordinated to focus on the same problem—a problem defined by dimension (a). An example of deep interdisciplinarity would be an ecologist and an ethicist collaborating to better understand the nature of ecosystem health. Another example of deep interdisciplinarity is the collaboration between evolutionary ecologist E. O. Wilson and social scientist Stephen Kellert, which gave rise to the biophilia hypothesis. Such collaboration would be facilitated if university cluster hires were better balanced in terms of the dimensions of sustainability they represent.

Where are we, and how did we get here?

The ethical dimension is better understood by considering how literature on the meaning of sustainability has developed over the past three decades. Key developments are summarized in a set of easily accessible papers (e.g., Jamieson 1998, Thompson 2007, Kajikawa 2008). An early development, marked by the phrase "sustainable development," was the appreciation that sustainability involved concern for both ecosystem health and economic development. From this, a distinction developed between what has come to be known as weak sustainability and strong sustainability (Beckerman 1994, Daly et al. 1995). Weak sustainability is generally concerned with sustaining human welfare, and is

thought to be more commensurable with economic principles. Strong sustainability is generally concerned with sustaining natural capital, and is thought to be more aligned with traditional conservation values. Much of the discourse on the distinction between strong and weak sustainability has sought to assess the logical rigor of each vision and has attempted to anticipate the outcome of adopting one vision or the other (Jamieson 1998, Neumayer 2003, Ayres 2007). This distinction also serves as a vehicle for better understanding how ecosystem health and economic development should relate to one another: Which value is more important? Under what conditions should concern for one value override the other?

Today, sustainability is broadly thought to require valuing not only ecosystem health and economic development but also social justice (e.g., Douglass 1984, Allen and Sachs 1992, Dobson 1999, Kastenhofer and Rammel 2005, Zimmerman 2005, Hay and Mimura 2006, Koehler and Hecht 2006, Rapport 2007). Although the connection between sustainability and social justice is widely appreciated, and although social justice is certainly a worthy ambition, the logical necessity for connecting sustainability and social justice may be yet unspecified (Thompson 2007). Moreover, the meaning of social justice has been defined about as precisely as the meaning of ecosystem health (i.e., not very well). Nevertheless, the essential idea is that a sustainable society cares about social well-being. That is, a sustainable society has concern for poverty, racism, political marginalization, the opportunity to make a livelihood, and how social interactions should be fair and equitable.

As these philosophic aspects of sustainability have developed, they have been eclipsed by an explosion of attention now given to sustainability science (see Kajikawa 2008 for a review). With the domination of sustainability science, philosophers have been evaluating new ideas about the deep nature of sustainability.

One idea is that the most basic framework for understanding sustainability does not rely on understanding the interrelationship between its principal values (ecosystem health, social justice, and human needs); rather, the most basic framework for understanding sustainability may be the interrelationship between its technical and philosophical dimensions. These dimensions were dubbed by Thompson (2007) as the substantive and nonsubstantive aspects of sustainability, respectively. By this assessment, the technical dimension seems valuable for its ability to define problems precisely and to be usefully applied to many specific cases that differ greatly in circumstance (e.g., achieving a sustainable harvest of some particular population, or achieving sustainable water use in some local community). This value is clearly demonstrated by the framework that supports sustainability science (see Kajikawa 2007).

The assessment goes on to conclude that the philosophical dimension, by contrast, seems too general and vague to be usefully applied to any specific problem. In this sense, some philosophers of sustainability seem to explain how the philosophic aspects of sustainability are not all that important (Thompson 2007, see also Jamieson 1998). This thought is problematic, however, because although it certainly represents a description of how we have been treating sustainability, it does not explain how or why thinking about sustainability in this way is wise (Davison 2001).

Perhaps the appropriate primary distinction is between the "end goals of sustainability" and the "means by which to achieve sustainability" (see also Kothari 1994). Neither aspect can be pursued independently of the other because the two are inextricably entwined. Moreover, this distinction is applicable to the most general and vague discussions about sustainability, and also applicable to the most specific cases of sustainability (e.g., What does it mean to sustainably harvest a particular population? or, What does it mean to sustainably use water in a particular local community?). At every scale, the ethical dimension of sustainability is inescapable (though underappreciated).

Another criticism of the ethical dimension of sustainability is that though it may be useful for characterizing and identifying various philosophic attitudes about sustainability, it is largely unable to effectively motivate sustainable actions or change attitudes about sustainability (Jamieson 1998, Thompson 2007). This belief is also misguided. Once a group or person has determined what the appropriate end goals of sustainability should be, those end goals are, in an important way, the motivations underlying sustainable behavior. The challenge remains as it always has: to assess the appropriateness of various motivations and end goals of sustainability.

Some think that the philosophic dimension of sustainability may be, despite its purpose, of limited value in more deeply understanding the ethical or philosophical aspects of sustainability (Jamieson 1998, Thompson 2007). This criticism rests on the observation that "being sustainable" has become more-or-less synonymous with "being good." The question, "What does it mean to be good?" has been the central issue of Western ethics for more than two millennia. The concern is that inserting this ancient and enduring question into sustainability discourse offers little assistance in achieving answers (Thompson 2007).

The value of equating "goodness" with "sustainability" is that the meaning of goodness has varied tremendously over time (MacIntyre 1981). In the Homeric period, being good meant being a good warrior, and that involved a set of virtues including bravery and cunningness. For ancient Athenians, being good meant being a good citizen, which Aristotle thought included a set of virtues including temperance and magnanimity. In the Dark Ages, being good meant being subservient to God's will, and involved virtues like hope, humility, and faith. Today, sustainability defines what it means to be good. Each epoch in our ethical history is associated with different sets of virtues that provided strong, but flexible, guidance as to what it meant to be "good."

More specifically, sustainability may well be the primary schema for describing and evaluating what it means to be a good person or good society in today's world. That schema

involves understanding how to balance sustainability's three primary virtues: concern for human needs, ecosystem health, and social justice. The flexibility, universality, and guiding force of sustainability's philosophic dimension lend this approach strength (see also O'Neill et al. 2008). What counts as sustainable or good, even for the most specific management scenario (e.g., harvesting or water use), requires knowing whether proposed management actions satisfy the guiding virtues of sustainability. Being able to make the connection between management and values requires collaboration between science and ethics.

Another recent thought related to sustainability, rising in the wake of science's domination of sustainability, is the mootness of debate over whether sustainability should be derived from anthropocentric or nonanthropocentric values (Norton 1991, 2005). The basis for such thinking is the belief that both sets of values will lead to the same outcome. Moreover, because the moral relevance of humans is not controversial and the moral relevance of the nonhuman world is controversial, we should simply proceed as though we were all anthropocentrists. These perspectives certainly seem to limit the perceived value of assessing the ethical dimension of sustainability in general.

However, many scholars have offered rigorous explanations for why anthropocentrism and nonanthropocentrism represent an important distinction (Callicott 1999, McShane 2007, Nelson 2010). These authors have argued both *why* the goodness of an action rises primarily from the motivation and values that motivate an action, and *how* anthropocentric and nonanthropocentric motivations will lead to profoundly different outcomes. For example, recall that sustainability could mean anything from "exploit as much as desired without infringing on future ability to exploit as much as desired" to "exploit as little as necessary to maintain a meaningful life." These plainly represent different motivations, and they would clearly result in different worlds.

Conclusion

Perhaps a research priority for sustainability should be providing the knowledge necessary to determine whether we will, or ought to, follow the virtuous or vulgar path of sustainability, or some path in between. Similarly, the academy should commit itself to deeply interdisciplinary research to assess the consequences of deciding whether sustainability should be considered anthropocentric or nonanthropocentric. This goal is no more audacious than trying to achieve sustainability with science and technology alone.

More generally, the sustainability framework we describe (figure 1) is also valuable for placing ethics alongside science and technology in efforts to develop sustainability; highlighting the importance of resolving the extent to which sustainability represents an anthropocentric or nonanthropocentric attitude; helping universities develop strategic plans related to sustainability research initiatives; framing syllabi for general education courses on sustainability and providing a general and practical venue for teaching students how ethics relates to the real world, which is also an independently appreciated need; and being simple enough to motivate a more enlightened discourse among the general public.

If we attain sustainability, it will not only require critical changes in technology, but also the most profound shift in ethical thought witnessed in the last four centuries. While we devote tremendous resources to develop "sustainable" technologies, ethics remain almost entirely neglected.

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"Quit complaining about erosion. It's made you look ten years younger."