

AS I SEE IT

Will the real sustainability concept please stand up?**John Cairns, Jr.***

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The world we have created is the product of our thinking. It cannot be changed without changing our thinking.
Einstein

Decades ago, a popular television program in the US featured three guests who professed a particular occupation or unusual feat; one was authentic and two were well-coached pretenders. A panel then asked questions to determine who was authentic (real) and who were pretenders. At the end of the exercise, the 'real' person was asked to 'please stand up'. Humankind is now in a similar situation with regard to sustainability; many versions of sustainability have emerged, including sustainable development, sustainable use of the planet, smart growth, deep ecology, and sustainability (to mention the most prominent).¹

The most popular concepts are sustainable development (usually interpreted as growth) (The World Commission on Environment and Development 1987) and smart growth. Both concepts emphasize growth in human artifacts as opposed to growth in environmental literacy, intellect, wisdom, etc., which are mentioned only in a homocentric way. My choice for the primary goal of sustainability is staying within the carrying capacity of the planet for humans at an optimal (quality of life) rather than a maximum (lower quality of life) level. Staying at or below carrying capacity requires preserving the integrity of Earth's ecological life support system (natural capital and the ecosystem services it provides). Since carrying capacity does not

remain constant (due to cyclic climate change, etc.), a safety factor is mandatory.

Since sustainability requires a dynamic equilibrium between humankind and natural systems, mid-course corrections must be made when new information becomes available or when new sustainability concepts are validated. Some major concepts that have influenced me are briefly summarized here.

(1) Hardin's (1968) 'The Tragedy of the Commons', one of the most widely reprinted and cited *Science* articles, discusses a commons, which is a resource to which a population has a free and unmanaged access. Since most individuals seek to maximize their gain from a finite resource, the resource is degraded, even destroyed. Cairns (2003–2004) gives more detailed discussion of this issue.

(2) In his professional career, Hardin emphasized a number of themes essential to sustainability:²

- (a) Individuals will exploit anything that is free (the commons) in order to maximize their own gain, but the cost is paid by human society.
- (b) Humans can never do merely one thing.
- (c) By living unsustainably, humankind is stealing from both its descendents and those of other life forms.
- (d) There is no 'away' to throw things into. The biosphere is interconnected.
- (e) Exponential growth in the human population will damage the environment, deplete natural resources, and decrease the quality of human life.
- (f) Harsh penalties are the result of exceeding carrying capacity; therefore, some coercion is justified if humankind wishes to live sustainably.

¹A free source of some of the literature on sustainability has been assembled by Cairns. See Cairns J Jr (2002) *Goals and conditions for a sustainable world*. ESEP Book 1. Inter-Research, Oldendorf/Luhe, Germany. Available at www.esep.de/journals/esep/esepbooks/CairnsEsepBook.pdf; Cairns J Jr (2003) *Eco-ethics and sustainability ethics*, Part 1. ESEP Book 1. Inter-Research, Oldendorf/Luhe, Germany. Available at www.esep.de/journals/esep/esepbooks/EB2Pt1.pdf; and Cairns J Jr (in press) *Eco-ethics and sustainability ethics*, Part 2. ESEP Book 1. Inter-Research, Oldendorf/Luhe, Germany

²See www.garretthardinsociety.org/tributes/tr_cairns_2004mar.html

(g) Immigration exacerbates social conflict, especially when resources become increasingly scarce.

(h) Noble intentions do not justify stupid action. To leave a habitable planet for posterity, some unpalatable decisions must be made in the short term. Frequent clashes occur between ethical and sentimental values.

(3) In 1969, I had the honor of being seated beside economist KE Boulding, who greatly influenced my views of sustainable use of the planet. He wrote a ballad (Boulding 1969) to summarize the proceedings of that conference. Some Boulding insights follow.

(a) Boulding (1966, p. 3) once stated: 'Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist.'

(b) Boulding (1971) offered three theorems on human population limitations:

(1) The Dismal Theorem: If the only ultimate check on the growth of population is misery, then the population will grow until it is miserable enough to stop its growth.

(2) The Utterly Dismal Theorem: Any technical progress can only relieve misery for a while. As long as misery is the only check on population growth, the technical improvement will only enable population to grow, and will soon enable more people to live in misery than before. The final result of technical improvements, therefore, is to increase the equilibrium population, which is to increase the sum total of human misery.

(3) The Moderately Cheerful Dismal Theorem: Fortunately, it is not too difficult to restate the Dismal Theorem in a moderately cheerful form. This theorem states that if something else, other than misery and starvation, can be found that keeps a prosperous population in check, the population does not have to grow until it is miserable and starves; it can be stably prosperous.

I believe that ecological and sustainability ethics coupled with science, reason, and wisdom might accomplish sustainability. However, to be effective, a quick major paradigm shift will be essential. Of course, sustainable use of the planet is a moderately cheerful version of the dismal theorem. Whether humankind will have the will to change during the first half of the twenty-first century remains an open question. The initial stages of the new social contract are quite clear (e.g. cease unsustainable practices), but the resistance to change is formidable.

(4) Retired physicist Bartlett's many publications on exponential growth and doubling time have driven home the need for rapid social change (e.g. Bartlett 1997–1998).³

(5) Meadows and her colleagues (1972) have placed some numbers on issues that previously had been governed by emotion, circumstantial evidence or intuition. Although the publication on limits was a defining moment for a significant minority, strong opposition came from economists, such as Simon (1981). He believed that resources were not limiting and limits need not be placed on growth. This view is still dominant, but evidence disputing it is accumulating very rapidly.

(6) Ehrlich's (1968) much discussed book *The Population Bomb* demonstrated how serious exponential population growth is, as did many subsequent publications. His classic *Human Natures* (2000) makes a persuasive case for cautious optimism.

(7) Hawken's *Ecology of Commerce* (1993) and *Natural Capitalism* (Hawken et al. 1999) provide hope that industry could function sustainably.

(8) Costanza et al. (e.g. 1997) and Daily and Ellison (2002) made a preliminary study of the value of ecosystem services. Despite the large financial numbers generated, these pioneering publications may have underestimated the actual value of nature's services.

(9) The ecological footprint concept developed by Rees (e.g. Rees & Westra 2003) provides a simple, direct methodology to measure the ecological impact of individuals, cities, nations, and the global community. Some simple measures of personal ecological footprint size on the Internet illustrate how many Earths would be needed to provide resources if everyone on the planet lived like an average American. The concept of the ecological footprint is a superb way to bring up the ethical issues of sustainable living.

(10) The many publications of Wilson (e.g. 1998, 2002), which provide the philosophical basis for sustainable use of the planet, were pivotal to my ongoing thinking about these issues.

(11) For decades, Brown (e.g. Brown et al. 2002) has provided persuasive data in the annual *State of the World* books, *Eco-Economy*, and the like. Brown provides evidence on progress toward sustainability (e.g. windmills as alternative energy sources) and lack of progress (e.g. decreasing grain harvests).

(12) Toward the end of the twentieth century, I had the honor of chairing a committee on ecological restoration (National Research Council 1992). This

³See also 'Arithmetic, population, and energy.' With AA Bartlett. VHS video. University of Colorado Regents, Boulder, CO, 1994. Available from Kate Albers, Information Technology Services, University of Colorado, Boulder, CO 80309-0379, USA or telephone +1 303 492 1857

undertaking demonstrated the pride that ordinary citizens have in restoring damaged ecosystems. Numerous case histories involving a variety of aquatic ecosystems provided evidence that aquatic ecosystems could be restored with present knowledge if there was a will to do so.

SHIFTING DOMINANCE IN THE SCIENCES

The US's dominance of the sciences is being eroded by scientific improvements in other countries (Broad 2004). In terms of sustainable use of the planet, this change is, arguably, a good trend because sustainability must have a robust scientific foundation that is useful in all parts of the world. The 'brain drain' reported by Broad may result in a more equitable distribution of scientific talent globally. Initially, the new distribution doubtlessly will increase the difficulties of information exchange at the global level. As Broad notes, Europe and Asia are becoming increasingly dominant. Those countries that do not attempt to suppress scientific evidence that conflicts with political ideology will almost certainly emerge, long-term, at the 'cutting edge' of science. Lovelock (1988) calls attention to the influence of institutions (and one might add, grant funding) that channel scientific research into areas favored by conventional wisdom rather than encouraging scientific curiosity or inspiration. He also calls attention to the division of biology (which is not alone in this regard) into over 30 narrow specialties. Each takes pride in being illiterate in the major concepts of other disciplines, including other narrow specialties in biology. Nevertheless, transdisciplinarity is essential to the quest for sustainable use of the planet.

Finally, the news media and academicians who fail to criticize publicly such pronouncements as Simon's (1995, p. 131): 'We have in our hands now — actually in our libraries — the technology to feed, clothe and supply energy to an ever-growing population for the next 7 billion years' are failing to act responsibly. Such a statement is preposterous if one has even a modest understanding of exponential growth and doubling time. Physicist Bartlett (1996) tried to verify this statement on a moderately powered desk computer (for that time). Assuming a growth rate of 1% per year, Bartlett found that the population would soon exceed 9.99×10^{99} , the limit of his computer. Bartlett then assumed that a human population of nearly 6 billion that is growing at 1% per year would only take 17 000 years to equal all the atoms in the universe (estimated to be 3×10^{88}). Ignoring or even giving only modest attention to an error of this magnitude is folly. However, the news media gave much

attention to the original statement and virtually none to the criticism of it. Clearly, basing sustainability policy on faulty information will lead to disaster. Nevertheless, Simon was lauded by the financial community, and his critics were ignored. Such media work is investigative reporting at its worst. Ignoring science is a fatal mistake.

CONCLUSIONS

My mentor Ruth Patrick first acquainted me with sustainability issues in 1948 by involving me in research on the 'use without abuse' of natural systems. In 2004, over half a century later, I am still, at age 81, excited about the increasing number of major publications on sustainability issues, such as global climate change, biotic impoverishment, disruption of evolutionary processes, ethics, and the like. Sustainability is, arguably for humankind, the greatest ecological/evolutionary drama on Earth's finite stage. *Homo sapiens* may be able to remain 'on stage' for a considerable time into the future if it does not crowd other actors (i.e. species) off the stage. Perhaps one of the many sustainability proposals will work indefinitely, but the path forward will be clearer if humankind makes a substantive effort to live sustainably. There is, however, justification for believing humankind could live sustainably; but, humankind will not know it is living sustainably until it has done so for several generations. Getting rid of clearly unsustainable practices is the first essential step.

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LITERATURE CITED

- Bartlett AA (1996) The exponential function, XI: the new flat Earth society. *Physics Teacher* 34:342–343
- Bartlett AA (1997–1998) Reflections on sustainability, population growth, and the environment—revisited. *Renew Resour J* 15(4):6–23
- Boulding KE (1966) The economics of the coming spaceship earth. In: Jarrett H (ed) *Environmental quality in a growing economy*. Harper & Row, New York, p 3–15
- Boulding KE (1969) A ballad of ecological awareness. In: Farvar MT, Milton JP (eds) *The careless technology: ecology and international development*. Doubleday & Company, New York
- Boulding KE (ed) (1971) Foreword to T. R. Malthus: the first essay. In: *Collected papers, Vol II*. Colorado Associated University Press, Boulder, CO, p 137–142
- Broad WJ (2004) U.S. is losing its dominance in the sciences. *New York Times*, 3 May: A1
- Brown LR, Larsen J, Fischlowitz-Roberts B (eds) (2002) *The Earth policy reader*. Earth Policy Institute, WW Norton, New York

- Cairns J Jr (2003–2004) The unmanaged commons. *TSC Journal* 14(2):136–145
- Costanza R, d'Arge R, de Groot R, Faber S and 9 others (1997) The value of the world's ecosystem services and natural capital. *Nature* 387:253–260
- Daily G, Ellison K (2002) *The new economy of nature*. Island Press, Washington, DC
- Ehrlich PR (1968) *The population bomb*. Ballantine Books, New York
- Ehrlich PR (2000) *Human natures*. Island Press, Washington, DC
- Hardin G (1968) The tragedy of the commons. *Science* 162: 1243–1248
- Hawken P (1993) *The ecology of commerce*. Harper Business Publications, New York
- Hawken P, Lovins A, Lovins H (1999) *Natural capitalism*. Little, Brown and Company Publishers, New York
- Lovelock J (1988) *The ages of Gaia*. WW Norton, New York
- Meadows DH, Meadows DL, Randers J, Behrens WW III (1972) *Limits to growth*. Potomac Associates, New York
- National Research Council (1992) *Restoration of aquatic ecosystems: science, technology, and public policy*. National Academy Press, Washington, DC
- Rees WE, Westra L (2003) When consumption does violence: Can there be sustainability and environmental justice in a resource-limited world? In: Agyeman J, Bullard RD, Evans B (eds) *Just sustainabilities: development in an unequal world*. MIT Press, Cambridge, p 99–124
- Simon J (1981) *The ultimate resource*. Princeton University Press, Princeton, NJ
- Simon J (1995) The state of humanity: steadily improving. *Cato Policy Report* 17(5):131
- Wilson EO (1998) *Consilience: the unity of knowledge*. Alfred E. Knopf, New York
- Wilson EO (2002) *The future of life*. Alfred E. Knopf, New York
- The World Commission on Environment and Development (1987) *Our common future*. Oxford University Press, Oxford

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