

## Book Reviews

**SMIL, VACLAV (2013):**

**Harvesting the Biosphere. What We have Taken from Nature.**

**Cambridge, Mass. and London: The MIT Press, pp. 312.**

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In 1948, the Cambridge astronomer and mathematician Fred Hoyle believed, “Once a photograph of the Earth, taken from the outside, is available ... a new idea as powerful as any in history will be let loose.” The believe turned into fact 20 years later when in December 1968 Apollo 8 astronauts brought back from space color photos of our small, green, blue, and white earth travelling through a vast empty and dark space. STEWART BRAND, who campaigned for the release of the photos and who put one of them on the title page of the first issue of the legendary Whole Earth Catalog, later described the impact of the photos in these words: “Those riveting Earth photos reframed everything. For the first time humanity saw itself from outside. ... Humanity’s habitat looked tiny, fragile and rare. Suddenly humans had a planet to tend to. The photograph of the whole earth from space helped to generate a lot of behavior – the ecology movement, the sense of global politics, the rise of the global economy, and so on. I think all of those phenomena were, in some sense, given permission to occur by the photograph of the earth from space.” (BRAND, undated).

An important idea that the photos of Earth from space made plain to see was the finiteness of the Earth. Finiteness has two important implications that are relevant here. For one, finiteness is a necessary but, as all economists know, not a sufficient condition for something to be scarce. Nevertheless, the mere fact that some earthly thing is not available in infinite quantities and that it therefore has the potential to become scarce, is bound to have motivated Earth scientists to measure many such things. Moreover, as the distinction between necessary and sufficient conditions is easily blurred, the finiteness of some earthly things is sometimes dramatized into their actual or imminent scarcity in order to attract public attention, and perhaps research funding too.

Vaclav Smil’s “Harvesting the Biosphere” is a book that has been given permission to occur by the now aged photos of Earth from space. It is a scholarly summary of measurements, estimates, and some plain guesses that environmental sciences have produced about the human specie's growing demands on the Earth's limited biosphere. Smil interprets the quantifications from a historical perspective of the evolution of human food provisioning ranging from its foraging origins to today's agriculture and fishery.

Smil prepares the stage for his review of the “entire spectrum of harvests” by humans of the biosphere with two observations. First, “... no species has been able to transform the Earth in such a multitude of ways and on such a scale as *Homo sapiens* – and most of these transformations can be traced to purposeful harvesting or destruction of the planet’s mass of living organisms and reduction, as well as improvement of their productivity” (p. vii). And second, “... the metabolic imperatives of human existence remain unchanged, and harvesting phytomass for food is still the quintessential activity of modern civilization” (p. viii). Smil’s objectives for his book are to “... present the best possible quantifications of past and current global removals and losses as a way to assess the evolution and extent of human claims on the biosphere” (p. viii).

Smil has organized the twelve chapters of his book into three parts. The first part with the title “The Earth’s Biomass, Stores, Productivity, Harvests” comprises six chapters that may be understood as warm-up chapters for the rest of the book. The opening chapter defines basic terms – many or all of which are likely to be familiar to ecologists but some of which may be somewhat unfamiliar to readers with a disciplinary background other than ecology. Smil acknowledges that definitions are not “a captivating way to start a book” but he does it nevertheless “for the sake of clarity” (p. 3). In chapter 2 Smil identifies phytomass and biomass stores and he quantifies biomass densities of various biomes, ecosystems, and organisms ranging from bacteria and earthworms to elephants. Also in this chapter is a useful table of the historical evolution of estimates of global terrestrial phytomass from the years 1937 to 2008. Measures of biomass productivity and the relationships among them are presented and discussed in chapter 3. The specific measures discussed in the chapter are gross primary productivity, autotrophic respiration, net primary productivity, and net ecosystem productivity. Phytomass harvests, in particular crops and their residues, and the harvests of forest phytomass are the contents of chapter 4. In chapter 5 Smil then moves on to zoomass harvests, either by means of hunting, use of domesticated animals, or fishing. In the last chapter of this section, Smil turns to changes in land cover brought about by burning vegetation, by plowing land, by deforestation, by converting land to residential, industrial or transport uses, or by gardening. The chapter closes with a discussion of the effects on biomass productivity of land conversions.

The “History of the harvests: From foraging to globalization” is the theme of part II of the book. The three short chapters of this part are particularly attractive for agricultural scientists and for economists with an interest in the evolution of agriculture. In chapter 7 Smil provides his account of the evolution of foraging phytomass as well as zoomass. Also included in this chapter is a section on “Aquatic harvests”, an issue of minor interest to agricultural economists but of high interest to food economists. In chapter 8 on “Crops and animals” Smil quantifies biosphere harvests, productivities, and carrying capacities in terms of people per unit area of land use systems ranging from

shifting cultivation and pastoralism to traditional and modern cropping. Also in this chapter, Smil describes in quantitative terms the dietary transition that accompanied the technological evolution of biosphere harvesting from foraging to modern agriculture. This transition involved a reduction in meat consumption when agriculture replaced hunting and gathering, a very long period of low meat consumption that lasted about until the onset of the industrial revolution, and finally a period of rapidly rising meat consumption in all countries where incomes are rapidly rising. Harvesting the biosphere for biomass fuels and raw materials is the topic of the last chapter in part II of the book. One section of this chapter deals with “Fuelwood in traditional societies”, a use of biomass that is still widespread in many developing countries. Another section of the chapter is concerned with modern liquid biofuels, which Smil, who has also written a book on global energy policy, holds in low regard because, “A combination of environmental, agronomic, social, and economic impacts [thus] makes modern liquid biofuels a highly undesirable choice” (p. 143). The sections of the chapter that are concerned with uses of charcoal and with wood as a raw material are probably of minor interest to readers with an interest in agriculture.

Part III is the core of the book. Here Smil is “Adding up the claims: Harvests, losses, and trends”. In the first chapter of this part of the book Smil quantifies long-term changes in global phytomass, and changes in land used for food production as well as for other uses. In chapter 11 Smil discusses estimates of the human appropriation of net primary production (HANPP), something which is of high interest for ecologists. Agricultural economists and food scientists are likely to be more interested in the sections in this chapter on the “Evolution of Terrestrial Food Harvest” and on “Aquatic Species”. The chapter’s final section on “Harvesting Wood Phytomass” caters for the interests of foresters. The book closes with chapter 12 where Smil sums up biomass changes, productivities and harvests, and where he discusses current attempts to call our epoch the “Anthropocen”. Smil closes his book with a list of “conditions needed to minimize human claims on the biosphere’s productivity” (p. 251). The reasons for minimizing the human claims are not provided nor does Smil, a man of quantities, say by how much the claims should be reduced. Smil, like many ecologists, seems to believe that either ecological imperatives are self-evident and overrule all other human concerns, or that “ought” can be derived from “is” alone.

Smil is a master of assembling, assessing, synthesizing, and interpreting many numbers from many sources. Moreover, Smil makes his readers aware of the limitations and sometimes large error margins of the data that he presents. Some readers of the book are, however, likely not to be able to benefit from this mastery to the full because of the way in which Smil presents quantitative information. Smil’s favorite way to present his numbers – many of them are very large numbers, like billions, trillions and more – is to embed them into text. This approach is not conducive to the ready

apprehension and retention of quantitative data and the relationships among them. Moreover, when the ratio of numbers to words in a sentence grows high, the readability of the sentence suffers.

I suspect that text with a liberal dose of many large numbers is likely to induce severe number numbness in many readers. There are ways to alleviate number numbness. Hofstadter (1968) suggests the use of powers of ten in place of names like billion, trillion, or some other unfamiliar “dinozillion”. Moreover, tables and data graphs are useful tools for assisting data comprehension. Smil, however, is oblivious of his readers’ bounded capacity for comprehending huge numbers. He uses abbreviations like “M”, “G”, “T” or “E” for various “dinozillions” and he provides the associated powers of ten only in the appendix. Moreover, Smil uses tables only sparingly and data graphics not at all.

Irrespective of these weaknesses of presentation, when you want to know in quantitative detail why, “Harvesting the biosphere is as quintessential for us as it was for our primate ancestors, for the Paleolithic hominis, for the first sedentary societies engaged in perfecting annual cropping eight millennia ago, or for the first great empires of antiquity” (p. 223), Smil’s “Harvesting the Biosphere” is the book to turn to. The book is scholarly and rich in illuminating quantitative data. Readers who want to use the book as a research tool may therefore prefer the searchable Kindle-edition to the not so easily searchable print-edition. By necessity, a scholarly book lacks the cerebral appeal which the first mind-widening photos of Earth from space had for all who had never seen such photos before. But this does in no way diminish the contribution that Smil has made with his quantitative synthesis of the growing harvest that humanity takes from the biosphere.

## References

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