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# Farmland Preservation and Ecological Footprints: A Critique

by
Peter Gordon
pgordon@usc.edu
School of Policy, Planning, and Development and
Department of Economics
and
Harry W. Richardson
hrichard@usc.edu
School of Policy, Planning, and Development and
Department of Economics
University of Southern California
Los Angeles, CA 90089-0626

Abstract

The paper analyzes two issues: the case against farmland preservation and the ecological footprint concept. With respect to the first, emphasis is placed on improving agricultural productivity, "highest and best use" land allocations, the reversibility of land uses in response to market conditions, the shift to more land-intensive crops, the environmental costs of agriculture, the comparative external economies and job creation impacts of urban vs. rural development, and the influence of private ownership on land stewardship. In addition, the world food problem is much more a distributional than an aggregate supply issue. The ecological footprint concept extends the land use per capita indicator both spatially (to cover the globe) and functionally (the land requirements to maintain all types of consumption). Global aggregates imply that land area requirements are greater than the world's available land, suggesting that current consumption patterns are "unsustainable." However, this idea is based upon severely limiting assumptions: no substitution of other factors of production for land; low rates of technological change; small countries with large populations are inherently bad; urban residents consume more natural resources than rural residents; gains from trade are negligible and/or undesirable; and price signals have little value.

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## I. INTRODUCTION

Many planners and policy makers now claim that "farmland protection" is their charge, that ongoing suburban development patterns "waste land" and that within sixty years, U.S. farmers will not grow enough food for the country to feed itself (for examples of the debate, see American Farmland Trust 1995, Nelson 1990, Peter 1990, Mittelbach, Fletcher, Moscove and

Wambem 1997). Many States have adopted a variety of farmland preservation measures that inhibit urban development (a useful Web source for the details of these programs is www.farmlandinfo.org). The rationale is based on several arguments, some of them specious. They include: threats to national food security (much less convincing in the United States than elsewhere); the "unproductive" character of housing compared with "productive" agriculture; the risk of more environmental degradation from pesticides if a smaller agricultural land stock is used more intensively; urban-biased policies such as the deductibility of mortgage interest and property taxes; the assumed imperfections of competitive land markets, particularly in the long run; the objective and sacrosanct value of "prime" agricultural land, inadequately defined; economies in public infrastructure costs if farmland preservation measures result in higher-density, more contained and compact urban development; the benefits of preserving open space; and the need to inhibit the growth of "ranchettes."

There are many arguments on the other side:

- U.S. cropland use peaked in 1930; we feed more people using fewer farmers and less land every year because of continuously improving productivity; we will feed even more people on even less land once we discard water subsidies and crop subsidies; even the USDA has retracted its own 1977 alarm about three million acres per year lost to cities.
- Land's highest and best use at urban boundaries can change from rural to urban; when it does, elementary models of land use show that markets will reallocate that land to its most valued use. Who would replace that mechanism? Those who implemented the wasteful water and crop programs now in place?
- This process (if left alone) may be reversible if and when society ever values the same land more highly in farm use.
- In many cases (including California's Central Valley), loss of acreage is less associated with urban development than with a shift from field crops to more productive and more land-intensive fruits, nuts and vegetables.
- The external economies and job creation impacts of urban development are discounted while similar impacts with respect to agriculture are overplayed.
- Land is the typical farmers' most important asset; farmers can be expected to see that their land is used in ways that are most socially beneficial; ownership creates stewardship; most forest lands are government owned but most reforestation takes place on private lands. Simon labels allegations that we are running out of farmlands: "... the most conclusively discredited environmental-political fraud of recent times" (1996, p. 139).

## II. FOOD, RESOURCES, AND PEOPLE

Almost everyone knows about the strong productivity gains of American farmers. This has made it possible for far fewer of them to feed many more of us. In the last 100 years, the proportion of the labor force engaged in agriculture has fallen dramatically, from 42.3 percent in 1890 to 1.8 percent in 1990 (Table 1).

**Table 1**

The U.S. Farm Population*

| YEAR | TOTAL (in millions) | AS PERCENT OF TOTAL POPULATION |
|---|---|---|
| **1880** | 22.0 | 43.8 |
| **1890** | 24.8 | 42.3 |
| **1900** | 29.9 | 41.9 |
| **1910** | 32.1 | 34.9 |
| **1920** | 32.0 | 30.2 |
| **1930** | 30.5 | 24.9 |
| **1940** | 30.5 | 23.2 |
| **1950** | 23.0 | 15.3 |
| **1960** | 15.6 | 8.7 |
| **1970** | 9.7 | 4.8 |
| **1980** | 6.1 | 2.7 |

| | | |
|---|---|---|
| **1990** | 4.6 | 1.8 |

*The definition of "farm" was changed in 1977, leading to a modest reduction in the size of the "farm population" after this date.

SOURCES: U.S. Department of Commerce, *Historical Statistics of the United States*, Part 1 (1975), p. 475; *Current Population Report, Series* P-23 (1991).

At the time of the American Revolution, 95 percent of workers were farmers. It took 19 farmers to feed themselves and one other. The agricultural population has fallen steadily in absolute numbers while farm output has skyrocketed. It is not surprising that all this takes place on much less land. Mechanized farming also works best on flat lands. The hills of New Hampshire are no longer farmed because it is no longer economic. Research by Frey (1995) documents the fact that U.S. cropland use peaked in 1930 (Table 2).

**Table 2**
Major Uses of Land, 48 Contiguous States, 1900 - 1987

| **Land Use (million acres)** | 1900 | 1910 | 1920 | 1930 | 1940 | 1950 | 1959 | 1969 | 1978 | 1982 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cropland[1]** | 319 | 347 | 402 | 413 | 400 | 409 | 393 | 384 | 395 | 404 | 399 |
| **Used for crops** | - | 324 | 374 | 379 | 363 | 387 | 359 | 333 | 369 | 383 | 331 |
| **Idle** | - | 23 | 28 | 34 | 37 | 22 | 34 | 51 | 26 | 21 | 68 |
| **Grassland pasture & range[2]** | 831 | 777 | 730 | 719 | 717 | 700 | 695 | 689 | 660 | 659 | 654 |
| **Forestland[3]** | 600 | 600 | 602 | 601 | 608 | 612 | 614 | 603 | 583 | 567 | 558 |
| **Urban and other land** | 153 | 179 | 169 | 170 | 180 | 183 | 200 | 221 | 259 | 266 | 285 |
| **Special use areas[4]** | - | - | - | - | - | 90 | 95 | 102 | 114 | 119 | 128 |
| **Miscellaneous areas[5]** | - | - | - | - | - | 93 | 105 | 119 | 145 | 147 | 157 |
| **Total land areas[6]** | 1903 | 1903 | 1903 | 1903 | 1905 | 1904 | 1902 | 1897 | 1897 | 1896 | 1896 |

1 Total cropland, excluding cropland used only for pasture.
2 Grassland and other non-forestland pasture and range including cropland used only for pasture.
3 Excludes forestland in parks and other special uses of land.
4 Includes uses specified in source.
5 Urban areas, miscellaneous uses of not inventoried, and land having little surface as marshes, swamps, bare rock areas, desert, and tundra.
6 Changes in total land area are due to changes in methods and materials used in remeasurements and to increase in the area of artificial reservoirs.

*Source:* Frey, "Land Use Trends in the United States," in Simon, ed., The State of Humanity, (1995).

Land used for recreation, forests and wildlife has been increasing even while the cities have been expanding (Table 3). In any event, the urbanized areas' share of total land use in 1992 was less than 4.76 percent (refers to "developed" which "includes all urban and built-up areas in units of 10 acres or greater and rural transportation;" Statistical Abstract 1996, Table 365).

**Table 3**
Land Cover / Use, 1987, 1992
(In thousands of acres; excludes Alaska and District of Columbia)

| | 1987 | 1992 |
|---|---|---|
| **Total Surface Area[1]** | 1,937,726 | 1,940,011 |
| **Federal Land** | 404,069 | 407,989 |
| **Nonfederal Land** | | |
| **Total** | 1,484,156 | 1,483,126 |
| **Developed[2]** | 77,305 | 92,352 |
| **Rural** | | |
| **Total** | 1,406,851 | 1,390,774 |
| **Cropland** | 422,416 | 382,317 |
| **Pasture Land** | 129,021 | 125,927 |
| **Rangeland** | 401,685 | 398,949 |
| **Forest Land** | 393,904 | 394,958 |
| **Minor cover / use** | 59,826 | 88,624 |

1. Includes water area not shown separately.
2. Includes urban and built-up areas in units of 10 acres or greater, and rural transportation.

*Source:* U.S. Department of Agriculture, Soil Conservation Service and Iowa State University, Statistical Laboratory; Statistical Bulletin No. 790, *Summary Report, 1987 National Resources Inventory*, December 1989. U.S. Department of Agriculture, Soil Conservation Service and Iowa State University, Statistical Laboratory, *Summary Report, 1992 National Resources Inventory.*

With respect to food and the world's population, Simon (1996, 5) says it best: "Contrary to popular impression, food production per capita has been increasing for the half-century since WWII, the only decades for which we have acceptable data. We also know that famine has progressively diminished for at least the past century. Average height has increased in developed countries in recent centuries, a sign that people are eating better. And there is compelling reason to believe that human nutrition will continue to improve into the indefinite future, even with continued population growth." In fact, population "bomb" doomsday scenarios were not only overblown but misdirected. Not only is world population growth slowing, it will probably start to decline relatively soon: "the world's population rather than continuing to increase will in our lifetimes peak, and then commence an indefinite decline in the generations immediately ahead" (Eberstadt 1997, 3). The United Nations' "low variant" projection, currently the most likely, predicts that the world population will peak around 7 billion around 2030, and then begin a long descent. A "birth dearth" that is likely to spread has been reported in developed as well as in 27 developing countries. Food does not reach all of the world's people because of war, inadequate redistribution mechanisms and inept or corrupt political practices in some countries. At the global scale, however, food is abundant and people are scarce, precisely the opposite of the popular view. More than 20 years ago, the late Roger Revelle estimated that if best-practice technology was adopted, the existing arable land in the world could feed 98 billion people. We do not know whether his numbers stand up to contemporary scrutiny, but they certainly accommodate a large margin of error. Higher standards of living are the proof that the terms of trade have shifted in labor's favor; relative scarcities have changed in ways that favor more consumption. The future of biotech and superior crops and larger harvests will only make things better. The demand for croplands will continue to fall. This prospect has been enhanced by the 1996 Federal Agricultural Improvement Reform Act (FAIR) which gradually eliminates Federal subsidies for keeping land idle, allowing farmers to plant whatever they like. Unfortunately, State subsidies to agriculture continue to flourish.

Data on these and other scarcity trends have been available since at least 1963 when Barnett and Morse published Scarcity and Growth. Not only food, but most resources are becoming much less scarce. Inventiveness and technological advance, powered by markets, deserve the credit. This illustrates once again how much faulty models cost us. It is commonplace to agree that the Earth and everything on it is "finite". Most go on to conclude that humankind must, therefore, be approaching the time when the cupboards will, indeed, be empty. Yet, simple economic analysis suggests that increasing scarcity pushes up prices. And, given enough time, all kinds of consequences follow. There are many responses to higher prices, including substitutions (conservation or even recycling efforts by consumers and producers) and expansive efforts by sellers. But the most important response is inventiveness (in pursuit of wealth, glory, a place in heaven or whatever) which pushes back the

effects of scarcity. In poultry production, for example, the "combination of good management and scientific development has produced the same amount of product, of higher quality, in half the time, using less barn space, less land, less electricity, less propane heat, and close to half as much food" ( Zinsmeister 1993, 94). "Finiteness" (not to mention appeals to the Second Law of Thermodynamics) becomes a meaningless concept in the face of continuously expanding opportunities.

The evidence is abundant and clear that the real world works this way. Known reserves of most natural resources keep growing and their prices keep falling, even as the world's demand expands. The most important scarcity is human talent. This is precisely why standards of living have been rising. It is when this mechanism is misunderstood that we get costly initiatives like 1970s-style energy policy. Blunders like this have consequences. They stifle the material advance of the human condition.

## III. LAND ECONOMICS

Land economics, like the other branches of the field, shows that free exchange within a system of private property rights leads to efficient resource allocation. The derivation of bid-rent curves and the demonstration that these can explain land uses and land values in urban areas was an early achievement in land economics. These devices are routinely used to teach students how scarce land is allocated and continuously reallocated in market economies. Just as markets allocate scarce resources in light of consumers' preferences, land markets allocate heterogeneous parcels of land to their highest and best uses in light of household consumption choices. It follows that these mechanisms maximize welfare (given that external economies and diseconomies from agriculture and urban development more or less balance out).. It also follows that abandoning these approaches in favor of command and control allocations is costly. "The dubious assumption that non-market mechanisms are equally or more effective than markets in allocating land to rural and urban uses raises serious questions concerning efficiency and equity." (Mittelbach et al. 1997, 45)

Circular reasoning is used to deny market logic. The American Farmland Trust identifies "prime" farmland as any land used for growing food, feed, forage, fiber and oilseed crops; "unique" farmland is "good for" growing vegetables, grapes and crops like fruits and nuts. The definitions are meant to settle the matter because current land use defines "primeness"; in turn, primeness is meant to determine what the land ought to be used for. Why bother with markets when "primeness" is decreed (even if misunderstood) and fixed and when resource uses are ordained?

There is significant concern over the loss of "prime" farmlands to urban use in California. In recent years, considerable amounts of farmland have been converted to other uses in a large expanse informally called Silicon Valley. The Economist (March 29, 1997, s5) recently reported that the GDP of the valley's 2 million residents was almost $65 billion, about the same as Chile. "Average pay in Silicon Valley last year rose by 5% in real terms to $43,510 ... Compare that with the figure for the rest of America which rose by less than 1% to $28,040. In the valley, workers are in such short supply that Cisco Systems, the leading supplier of Internet routers, has had to rent advertising space on billboards to find the 400 people a month it is adding to its payroll." No doubt, given the chance, land use planners would have prevented all this. They would have "protected" the farmlands that were used to create this bonanza. For example, Alterman (1997) argues that an Urban Containment Movement, as practiced in the Netherlands and the United Kingdom, is the only effective mechanism for preserving farmland. The big picture data for the United States, however, shows that in the ten states with the most prime farmland only 0.7 percent of the 1982 stock was developed in the decade 1982-92 (American Farmland Trust data, quoted in *The New York Times*, 1997). In any event, as pointed out above, the losses in agricultural land in many locations are more than offset by the shift to higher value crops, such as fruits and vegetables.

Those who would replace land markets do not understand them and /or they mistrust them. They do not understand planning because they are woefully ignorant of how they (or anyone) would go about discovering and predicting highest and best uses and allocating (and continuously reallocating) the uses of millions of parcels of land in some sensible way. Rather, they understand limits and prohibitions.

Of course, there are "externalities" in private land markets, but there are fewer of them where property rights are clear and enforced. The reduction of property rights favored by planners has the ironic effects of increasing "commons" problems and the likelihood of more externalities. There has been an attempt to assert the principle of "public property rights," but this is little more than an attempt to rationale the legitimacy of government interventions in land use, environmental and other conflicts.

Environmentalists frequently use farmland preservation as a buttress against adverse urban environmental impacts. Little attention is paid to the fact (most recently stated in a U.S. Environmental Protection Agency's testimony before the House of Congress Agricultural Committee on May 14, 1998) that agriculture is the biggest polluter, responsible for 70 percent of waterway pollution resulting from fertilizer use, animal waste runoff and erosion, and affecting 173,000 miles of waterways with negative impacts on aquatic life and human uses. These problems far outweigh urban-related water pollution (e.g. sewage plants, urban storm drains, air pollution deposits).

Many instruments to preserve farmland have been developed at the Federal, state and local levels. They include: urban growth boundaries; conservation and open space elements in General Plans; agricultural land reserves (see the next section) and other agricultural zoning devices (such as prescribing minimum parcel sizes for farms); farm subsidy programs (from agricultural price supports to water subsidies); property tax relief (e.g. assessing farmland at current income producing capacity rather than

at potential highest and best use); right-to-farm laws which exempt farmers from law suits and other attacks because of agriculturally-induced environmental nuisances; conservation easements in favor of non-profit organizations and local land trusts; and either the outright purchase of development rights, usually with the aid of bond issues, or transferable development rights. Undermining the market is not very difficult in a highly regulated world.

## IV. AN EXAMPLE: THE AGRICULTURAL LAND RESERVE IN VANCOUVER

The Greater Vancouver region provides an example of agricultural land preservation run riot. The bare facts are as follows. In 1972, the new New Democratic Party government passed the Agricultural Land Commission Act. Its primary objective was to create an Agricultural Land Reserve (ALR) that is beyond the regulatory powers of local governments. The initial ALR established in 1973-4 was 1,484 km2. Agricultural land losses in the Lower Mainland from 1973-96 were 19 percent of the initial reserve, and net losses in the GVRD (Greater Vancouver Regional District) were only equivalent to 7 percent of the initial ALR. Two-thirds of Lower Mainland losses were in the Fraser Valley Regional District (FVRD). Net losses provincial wide were only 2 percent. To put British Columbia's efforts in a comparative perspective, in the early 1980s British Columbia lost 1,200 hectares while Ontario lost 17,000 hectares of farmland to urban development. California's losses are about 20,000 hectares per year (Patterson 1997).

The rules have been tightened over the past decade. The ALR declined substantially after 1988, when an Order-in-Council established golf courses as a legitimate ALR use. The result was a proliferation of golf courses in Langley and Surrey, districts which account for 55 percent of the agricultural land in the GVRD. In consequence, the Order was rescinded in 1991. Later amendments removed cabinet appeals and elected politicians from the ALR process, and 1995 legislation introduced right-to-farming which protects ALR farms from municipal regulations.

The Agricultural Land Commission (ALC) did allocate some land for urban development, and 18 percent of the current GVRD (54,000 hectares) is classified as vacant. Thus, there is land available for urban development outside the ALR. Despite a trend towards denser development, more than 90 percent of residential land use in the GVRD consists of single-family housing. On the other hand, 51 percent of the housing stock consists of town homes and apartments, compared to 21 percent in Portland and Seattle. Also, about 35 percent of new urban development resulted from conversion of rural residential uses rather than undeveloped land.

In terms of stated policy objectives, Vancouver's ALR was quite successful. The rationale was that it was important to protect prime agricultural land in the Lower Mainland because 3 percent of the agricultural land produced 40 percent of British Columbia's agricultural output. But is this rational? Given that there is a world food market that is easily accessible to wealthy nations and regions, and that British Columbia accounts for a trivial proportion of world food output, why should a rapidly growing metropolitan region (a projected 65 percent increase by 2021) need to have any agricultural production at all? The only answer, and perhaps it is an acceptable answer, is that 85 percent of the electorate approves of the ALR. The only objection to this position is whether the electorate was fully informed about some of the costs of the ALR, in terms of higher house prices and other costs. If the remaining ALR was abolished, it could accommodate 3.6 million more people at current incremental densities!

## V. ECOLOGICAL FOOTPRINTS

The findings that urban development absorbs only a very small proportion of the available land, that on a macro-scale the loss of agricultural land is modest, and that, if market conditions justified it, the amount of cultivable land could easily be extended, has resulted in extensions of the urban land impact analysis down a broader path. One extension is the concept of the "ecological footprint." The ecological footprint is "the amount of land required from nature to support a typical individual's present consumption " (Wackernagel and Rees 1996, 11). The consumption activities include food, housing, transportation, consumer goods and services, while the land use categories include energy (more specifically, the fossil energy consumed expressed in the land area necessary to absorb the corresponding $CO^2$), degraded land (i.e. the built environment), market gardening, cropland, pasture and forests. If we add up the land use per capita estimates for the national population, we typically find that they exceed the land area of the country. Aggregating across the globe, we find that the land area required to sustain even the current world population is larger than the world's land area, by about 30 percent. If these arguments are accepted, it follows that present consumption patterns are "unsustainable." Thus, by broadening the scope to all consumption (not merely housing, transportation and other directly land-consuming activities) and to all land use, this approach converts the original agricultural land preservation argument from a modest problem into a colossal one.

However, the ecological footprint concept is based on certain unreasonable assumptions. Its accounting approach follows directly from the footprinters' assumptions of "non-substitutability" and "maximum rates of resource harvesting". Rees computes the size of the "personal planetoid" of a typical Vancouverite to be 4.27 hectares. He concludes that all of the countries that he studied, except for Canada and Australia, are "overpopulated in ecological terms" (207). The United States land requirement per capita is 5.1 hectares, the highest in the world, the Netherlands is 3.32, India's is only 0.38, and the world average is 1.8 hectares. The world is "already ecologically full" and "sustainable growth on this scale using present technology would require five to ten additional planets" (211). It is unclear how footprinters view a world in which increasing value added springs from computers on desktops powered by silicon chips made from grains of sand. What kind of a footprint is that?

A related concept to the ecological footprint is the "ecological fair share," i.e. the land requirement per capita that is sustainable in the sense of not using up more land than is available. The presumption of the analysis is that everyone, regardless of location or income, has an equal share. Thus, the ecological fair share concept is based upon the principle of equal allocation of resources to all individuals on the globe. It makes no pragmatic sense unless the rich are so committed to redistribution as to aim for the equalization of income and wealth. This is utopianism gone beserk.

It is interesting that more than one-half of the ecological footprint of Canada (and the same point applies to many other countries) is because of fossil energy consumption and the land requirement (in trees and plants) needed to absorb the excess $CO^2$. But the relationship between burning fossil fuel and $CO^2$ emissions is a technological one, as is the substitution possibilities between non-fossil sources of energy and fossil fuels. Hence, technological innovation has the potential to break the energy-$CO^2$-land consumption nexus, and significant progress on this front could undermine the unsustainability hypothesis in itself.

Wackernagel and Rees (1996, 97) present a sample of countries comparing their ecological footprints with their actual estimates of ecologically productive land per capita. Where the former exceeds the latter, the country has an "ecological deficit". Almost all the countries on their list are in deficit; the exceptions are Australia (with land per capita about 10 times its footprint) and Canada (3.5 times its footprint). Even India, with its substantial subsistence economy has an ecological footprint 38 percent larger than its productive land. At the other extreme are the Netherlands (with a footprint 19 times its land per capita), Belgium (14 times), South Korea (9.5 times), Germany (7.8 times), the United Kingdom (7.6 times) and Japan (7.3 times). Wackernagel and Rees describe the latter countries as having "a quasi-parasitic relationship," dependent on imports of energy and raw materials from elsewhere. As the authors admit, many of these countries are economic success stories. However, their analysis ends up with attaching a moral stigma to small countries with large populations (which, by definition, will have small amounts of land per capita) while looking favorably at large countries with small populations. However, at the subnational level (when we measure urban ecological footprints; by the way, it is unclear that urban residents consume more resources than rural residents, given the latter's preference for woodburning fires, more vehicle miles traveled in pickups and other fuel-consuming vehicles, etc)), even these countries have areas with ecological deficits; for example, in Canada the Lower Fraser Valley (i.e. Greater Vancouver) makes an ecological footprint 15 times larger than its land mass. The implication of their analysis is that trade is intrinsically bad, because it allows countries to escape the straitjacket of their land limitations. The result is a plea for autarky. But if small, densely populated countries were not allowed to import food, raw materials and fuels, their economies would truly be unsustainable. If the concept of sustainability has any merit at all, it can only be in global not national or subnational terms. Proponents of sustainable development, whether explicitly or implicitly, deny that there are substantial gains from trade. Hong Kong and Singapore are damned as global parasites.

Like all rationing systems that purport to replace markets' accounting of scarcity, this one has problems. (Energy accounting proposals of the 1970s were not very different.) The market is the only system that has the potential to solve the fundamental resource scarcity problem: to simultaneously account for all scarcities and to reveal the possible trade-offs that this implies. Footprint accountants are of a long tradition that sees trade and technology as dehumanizing. Not surprisingly, they see cities are "parasitic" to use Bert Hoselitz's famous epithet. In reality, city residents survive by producing and trading with rural residents, both intranationally and internationally. Once again, if voluntary exchanges are objected to, we are sliding down a very slippery slope. The footprint accountants join the chorus that wants to substitute its own priorities for those of the rest of humanity.

Like their Malthusian antecedents, footprinters emphasize the concept of "general" scarcity which supposedly differs from "relative scarcity" and does not yield to standard market responses, including substitution and innovation. They draw some of the following implications:

- "Carrying capacity" is defined in terms of maximum and fixed populations.

  The ability, indeed the record, of technological change to affect such relationships is dismissed; the suggestion is even made that any such process only makes things worse. In this logic, people are simply a drain. The fewer, the better. This is circular and denies the role of property rights. The great advantage of the modern market economy is that it takes place within legal structures that create a framework within which diverse market participants engage in mutually beneficial exchange. Private energies harnessed in this way have led to astonishing expansions of "carrying capacity".

  Everyone expects there to be problems in the case of common properties. These can be alleviated in a number of ways; the most important antidotes are private ownership and the assignment of property rights in common property resources. Property owners have strong incentives to conserve resources. Only when private property rights are threatened, are we faced with dire prospects, including the cessation of technological advance.

- Everything has an "environmental impact"; all such impacts affect the "global ecosystem" and/or the biosphere.

  The global rather than the local perspective ignores the fact that many environmental impacts occur among neighbors and can be resolved in the civil courts, at least in the cases when transaction costs are not prohibitive. The fundamental importance of institutions that define and enforce property rights is again the cornerstone.

- High standards of environmental purity are taken for granted; trade-offs and marginal considerations are avoided.

  The reasoning that people (footprinters included) use in their everyday economic lives is discarded as they proffer many different prescriptions for resources use. All-or-nothing comparisons and eschewing of trade-offs are equally useless in all walks of life.

- Non-zero-sum possibilities are denied; the developed countries are described as net importers of "carrying capacity"; since the latter is "finite", any more economic development is seen as a threat.

  This is another stunning denial of the historic record, not to mention elementary economic analysis. Malthusian principles ignore the possibility of shifts in technical progress that can dramatically increase the productivity of each unit of natural resources.

- Standard economic analysis rests on varying degrees of substitutability among factors of production; the ecological footprint analysis is based on the assumption of "non-substitutability".

  Elasticities of substitution between any pair of factors vary with technological advance and are usually identifiable empirically. Long-term economic analysis is pointless unless the nature and the role of (changing) substitution possibilities is recognized. Our increasing ability to find substitutes for physical labor has expanded over time, making it less valuable. Our seeming inability to substitute computing power for higher intelligence has made the latter much more valuable.

  Khalil (1997) points out that the distinction is often made between "general" (Malthusian) scarcity vs. "relative" scarcity mediated by scarcity pricing. The former gives rise to "sustainability" concerns. Yet, it is also seen in neo-classical economists' introduction of static aggregate production functions which include the "factors" of production capital, labor, and "environmental resources". Because the latter may be assumed to be limited (forgetting technological advance or even recycling possibilities), substitution possibilities involving the latter input must also have limits. Such static analyses necessarily focus on the "given" resources available now and end up suggesting strict substitution limits.

- The value of price signals is dismissed, focusing on unpriced "life-support services" such as the ozone layer.

  Dismissing all price data and misunderstanding their rationing role surrenders society's most important resource accounting mechanism. Indeed, prices are not simply a scarcity discovery device, they are also the font of entrepreneurial discovery and action. Ad hoc substitute accounting is hopeless. It evokes the consistent failings of centralized economic planning. Also obscured is the importance of extending property rights. Pollution or ozone consumption rights must be made explicit and rationed, rather than being made available at a zero price as most currently are. Making them tradeable is more efficient than allocating them by fiat, as Rees and others suggest.

Footprinters, of course, go far beyond these points. In the presence of "unregulated trade", "the wealthy already consume three times their fair share of sustainable global output" (Rees, 211). "Inter-regional dependency" must be replaced by "intra-regional ecological balance and relative self-reliance". And, "the human economy must be dematerialized in order to fit within global carrying capacity" (Rees, 212). This will all happen, it seems, once individuals surrender their wealth and freedom to the state and its planners.

## VI. CONCLUSIONS

The dramatic improvement in the human condition, with most of us leading longer and healthier lives, proves that we are creative problem solvers (Simon 1996). We have developed a variety of institutions that made this result possible. A key institution in this success story is the market mechanism which, in turn, rests on the foundation of laws and property rights. Critics deny the record and/or forecast a sharp U-turn in the near future. It is ironic that those whose forecasts have often been so wrong persist with dire and dramatic predictions. Where would we be now if their past policy recommendations had been adopted, e.g. oil import independence in the mid-1970s?

Once again, there is an alliance of special interests and true believers. Owners of farmlands have succeeded in obtaining federal as well as state legislation that limits farmland conversion and pushes up the prices that developers eventually pay them. Federal tax breaks on "conservation easements" have been available since 1980. More recently, Congress has authorized payments to state and local governments to be funneled to farmers who otherwise would sell to developers. Pittsford, New York, is one of many examples of localities that issue below-market municipal bonds to pay farmers not to sell to developers. Unwittingly calling attention to popular confusions over this issue, The New York Times (March 20, 1997, D1) noted all the payoffs: "environmental benefits, soul-soothing scenery, diversity for the local economy and especially tax savings."

Denying the historic record seems to absolve footprinters and their confederates from explaining or understanding it. They substitute their own stories. This leads them to troubling suggestions that property rights be expropriated rather than expanded. This is the environmentalists' fatal analytical error. Footprinters and other alarmists are not only wrong about the facts of our condition but their ignorance of markets shelters them from any understanding of how all this was accomplished.

They freely substitute homebrewed analyses and ad hoc accounting schemes. In the current climate, however, it matters little. Nelson (1997) has suggested that no less than a new religion is at stake. If so, then unexamined and lightly examined propositions will continue to flourish. These will be promoted by households, firms, institutions and local governments, all claiming and receiving public subsidies.

## VII. REFERENCES

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