

University of Piraeus

Tragedy of the Commons



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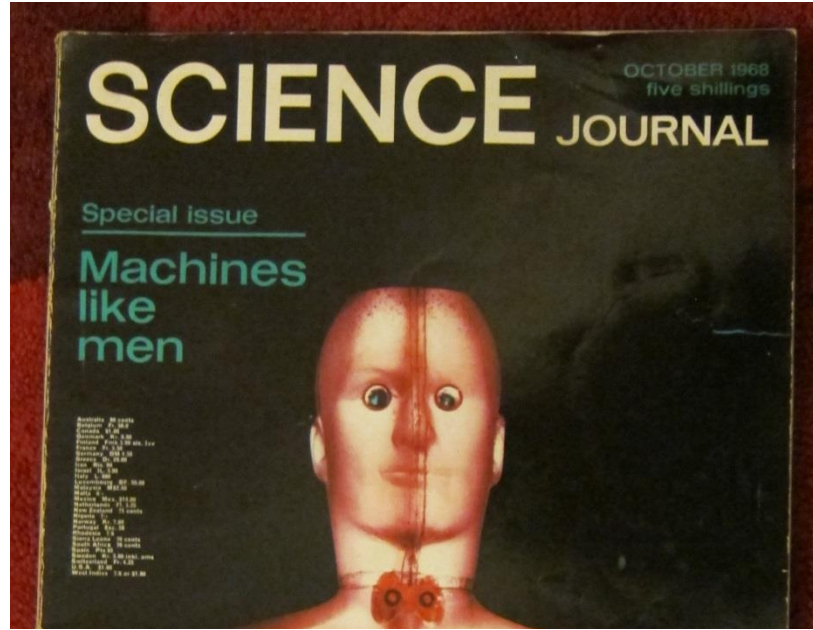
May 2021

The author is professor of biology, University of California, Santa Barbara. This article is based on a presidential address presented before the meeting of the Pacific Division of the American Association for the Advancement of Science at Utah State University, Logan, 25 June 1968.



"A finite world can support only a finite population; therefore, population growth must eventually equal zero. "

Garrett Hardin



The Tragedy of the Commons

Author(s): Garrett Hardin

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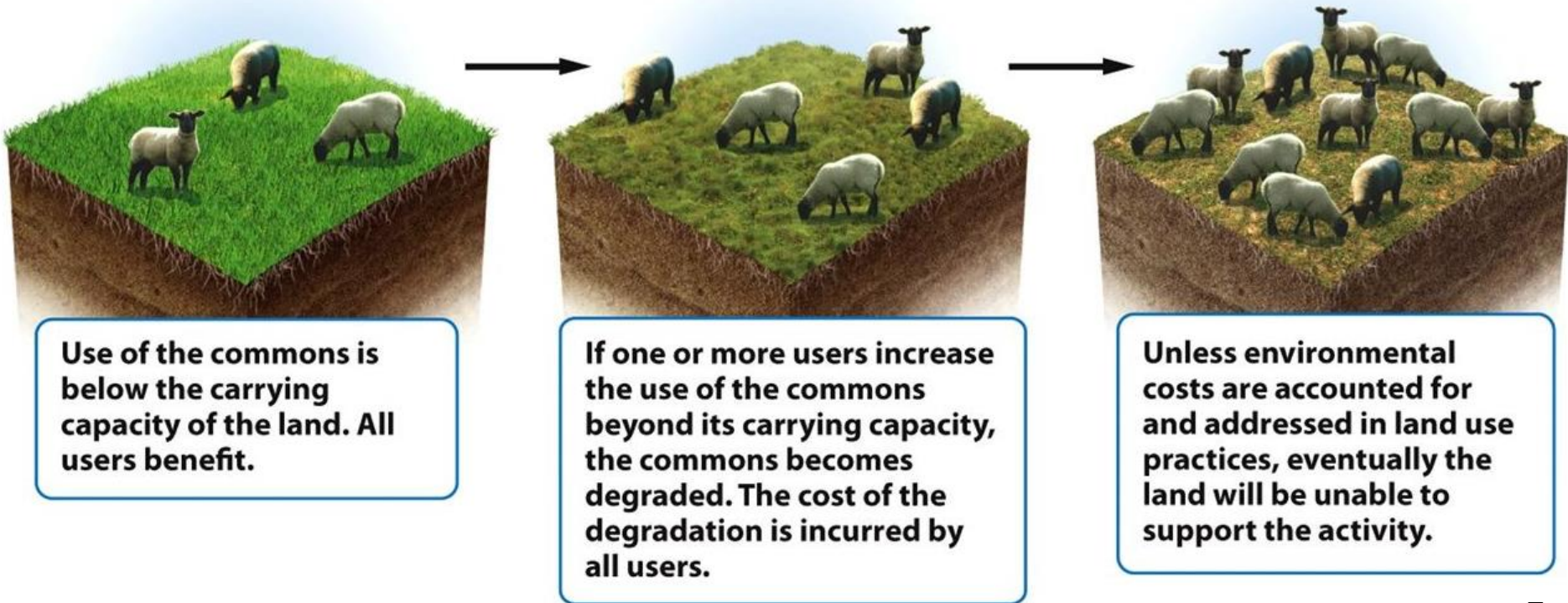
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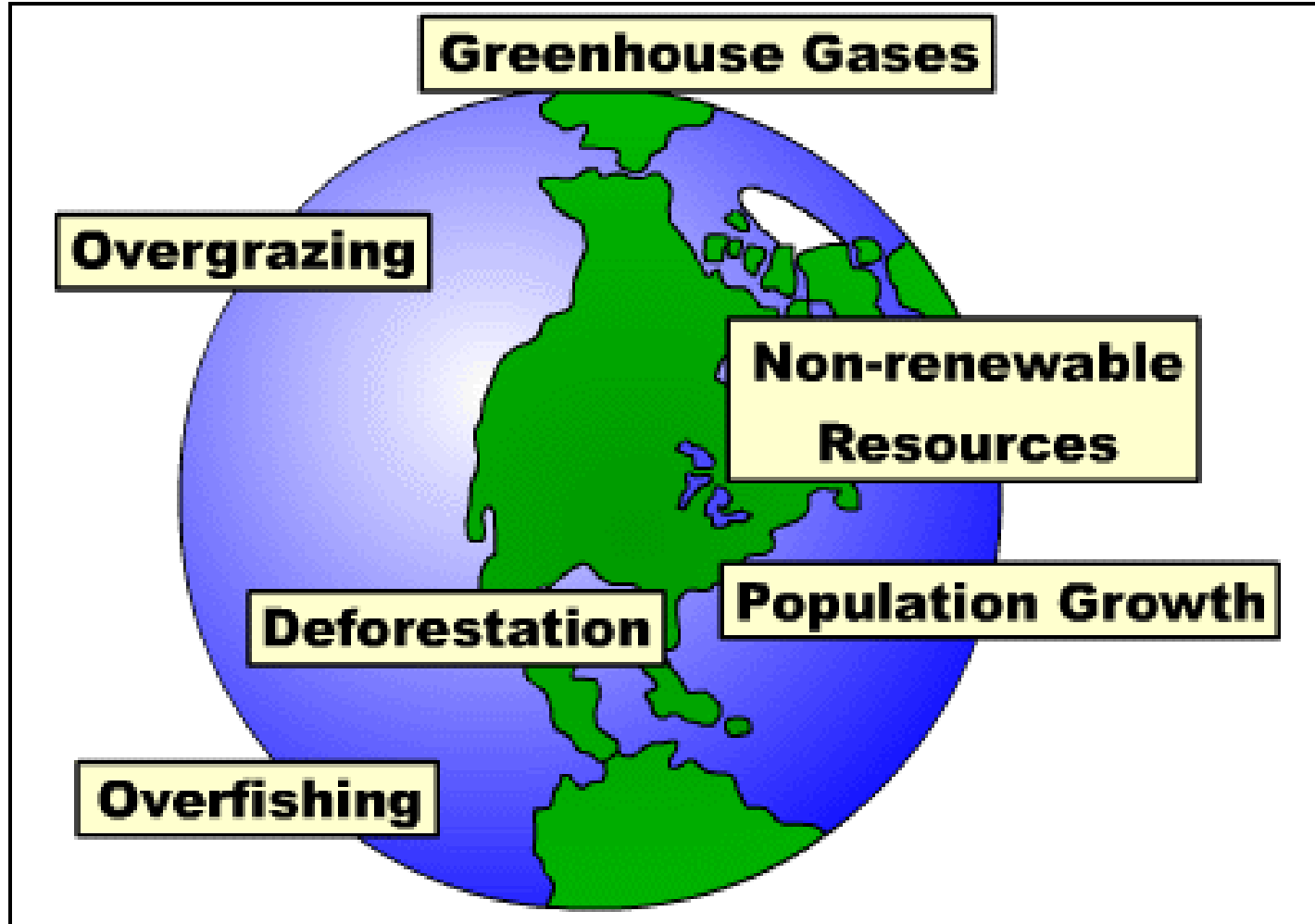
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The Tragedy of the Commons







TRAGEDY OF THE GLOBAL COMMONS

I would like to focus your attention not on the subject of the article (national security in a nuclear world) but

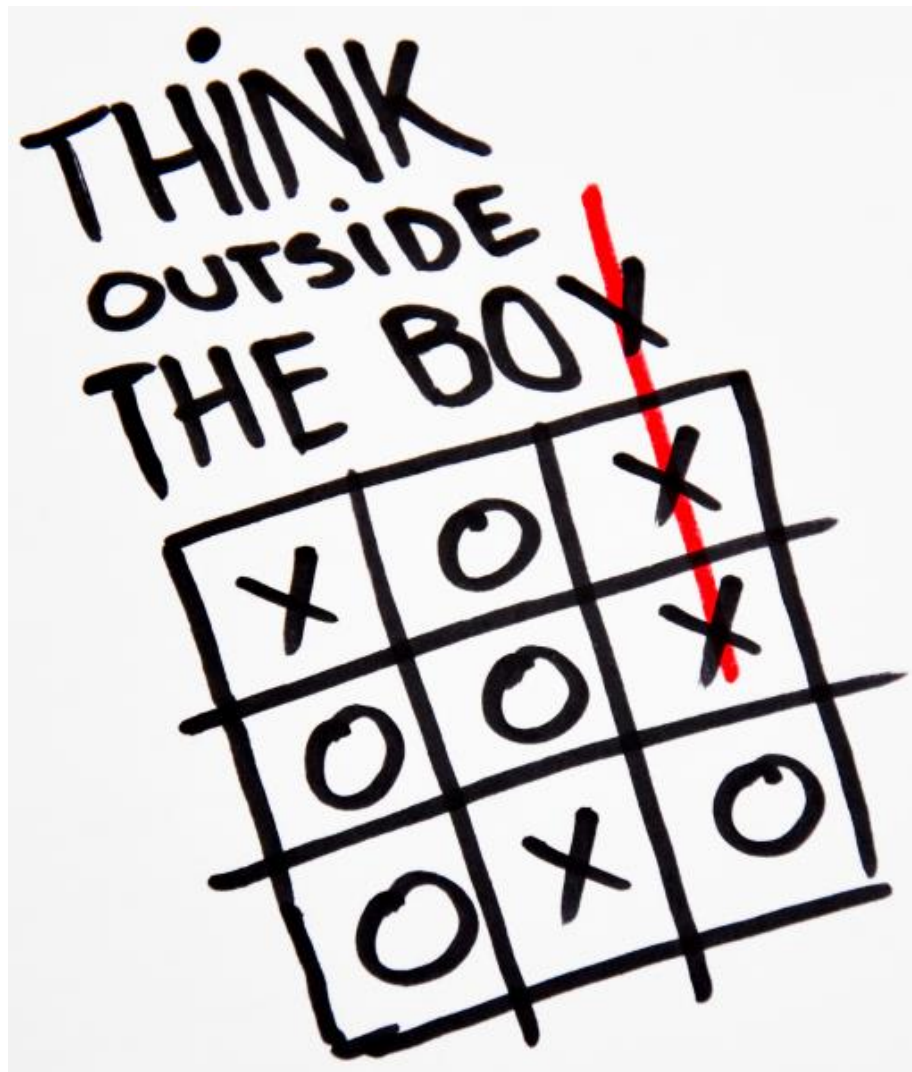
At the end of a thoughtful article on the future of nuclear war, Wiesner and York (1) concluded that: "Both sides in the arms race are . . . confronted by the dilemma of steadily increasing military power and steadily decreasing national security. *It is our considered professional judgment that this dilemma has no technical solution.* If the great powers continue to look for solutions in the area of science and technology only, the result will be to worsen the situation."

technical solution. A technical solution may be defined as one that requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality.

In our day (though not in earlier times) technical solutions are always welcome. Because of previous failures₁₀

the present article. Rather, the concern here is with the important concept of a class of human problems which can be called “no technical solution problems,” and, more specifically, with the identification and discussion of one of these.

It is easy to show that the class is not a null class. Recall the game of tick-tack-toe. Consider the problem, “How can I win the game of tick-tack-toe?” It is well known that I cannot, if I assume (in keeping with the conventions of game theory) that my opponent understands the game perfectly. Put an-



tion” to the problem. I can win only by giving a radical meaning to the word “win.” I can hit my opponent over the head; or I can drug him; or I can falsify the records. Every way in which I “win” involves, in some sense, an abandonment of the game, as we intuitively understand it. (I can also, of course, openly abandon the game—refuse to play it. This is what most adults do.)

The class of “No technical solution problems” has members. My thesis is that the “population problem,” as conventionally conceived, is a member of this class. How it is conventionally con-

ceived needs some comment. It is fair to say that most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy. They think that farming the seas or developing new strains of wheat will solve the problem—technologically. I try to show here that the solution they seek cannot be found. The population problem cannot be solved in a technical way, any

Population, as Malthus said, naturally tends to grow “geometrically,” or, as we would now say, exponentially. In a finite world this means that the per capita share of the world’s goods must steadily decrease. Is ours a finite world?

$$\frac{dN}{dt} = rN$$

Exponential
growth

Per capita growth rate (r)
doesn't change, even if pop.
gets very large.

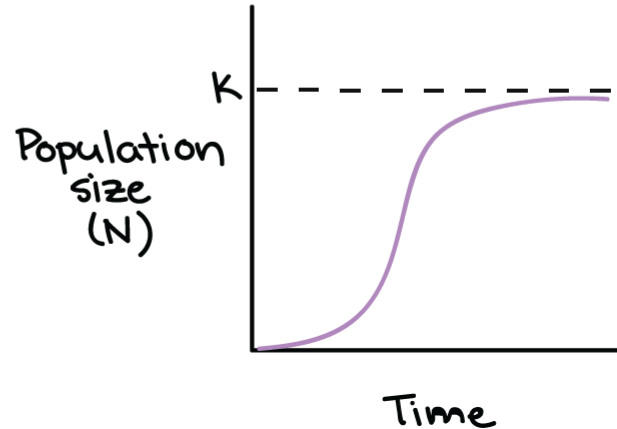
$$\frac{dN}{dt} = r_{\max} N$$



Logistic
growth

Per capita growth rate (r)
gets smaller as pop.
approaches its max. size.

$$\frac{dN}{dt} = r_{\max} \left(\frac{K-N}{K} \right) N$$

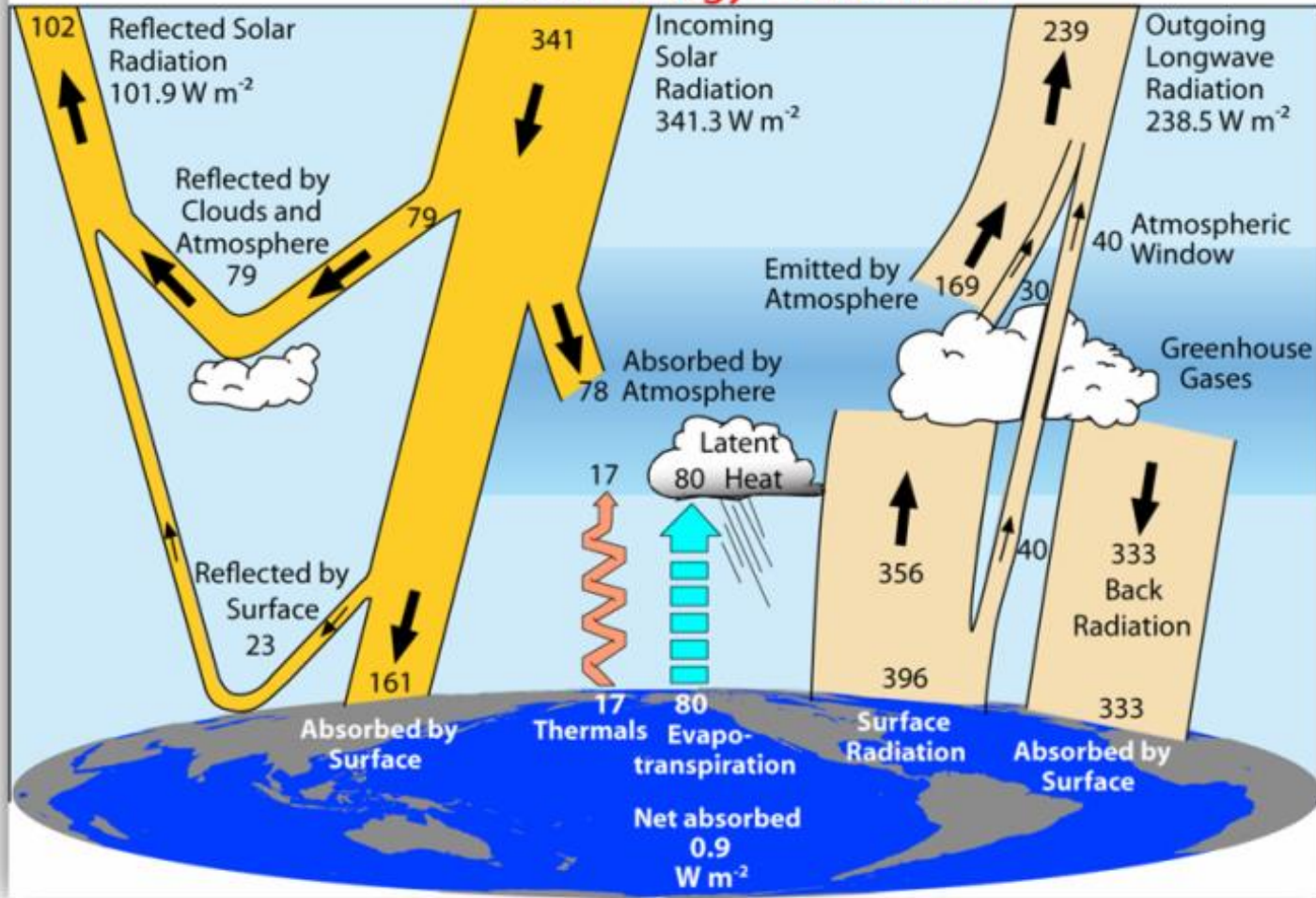


A finite world can support only a finite population; therefore, population growth must eventually equal zero. (The

from biological facts. To live, any organism must have a source of energy (for example, food). This energy is utilized for two purposes: mere maintenance and work. For man, maintenance of life requires about 1600 kilocalories a day ("maintenance calories"). Anything that he does over and above merely staying alive will be defined as work, and is supported by "work calories" which he takes in. Work calories

In reaching this conclusion I have made the usual assumption that it is the acquisition of energy that is the problem. The appearance of atomic energy has led some to question this assumption. However, given an infinite source of energy, population growth still produces an inescapable problem. The problem of the acquisition of energy is replaced by the problem of its dissipation, as J. H. Fremlin has so wit-

Global Energy Flows W m^{-2}



We want the maximum good per person; but what is good? To one person it is wilderness, to another it is ski lodges for thousands. To one it is estuaries to nourish ducks for hunters to shoot; to another it is factory land. Comparing one good with another is, we usually say, impossible because goods are incommensurable. Incommensurables cannot be compared.

Of course, a positive growth rate might be taken as evidence that a population is below its optimum. However, by any reasonable standards, the most rapidly growing populations on earth today are (in general) the most miserable. This association (which need not be invariable) casts doubt on the optimistic assumption that the positive growth rate of a population is evidence that it has yet to reach its optimum.





We can make little progress in working toward optimum poulation size until we explicitly exorcize the spirit of Adam Smith in the field of practical demography. In economic affairs, *The Wealth of Nations* (1776) popularized the “invisible hand,” the idea that an individual who “intends only his own gain,” is, as it were, “led by an invisible hand to promote . . . the public interest”

(5). Adam Smith did not assert that this was invariably true, and perhaps neither did any of his followers. But he contributed to a dominant tendency of thought that has ever since interfered with positive action based on rational analysis, namely, the tendency to assume that decisions reached individually will, in fact, be the best decisions for an entire society. If this assumption is

our present policy of laissez-faire in reproduction. If it is correct we can assume that men will control their individual fecundity so as to produce the optimum population. If the assumption is not correct, we need to reexamine our individual freedoms to see which ones are defensible.

The rebuttal to the invisible hand in population control is to be found in a scenario first sketched in a little-known pamphlet (6) in 1833 by a mathematical amateur named William Forster Lloyd (1794–1852). We may well call it “the tragedy of the commons,” using the



The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

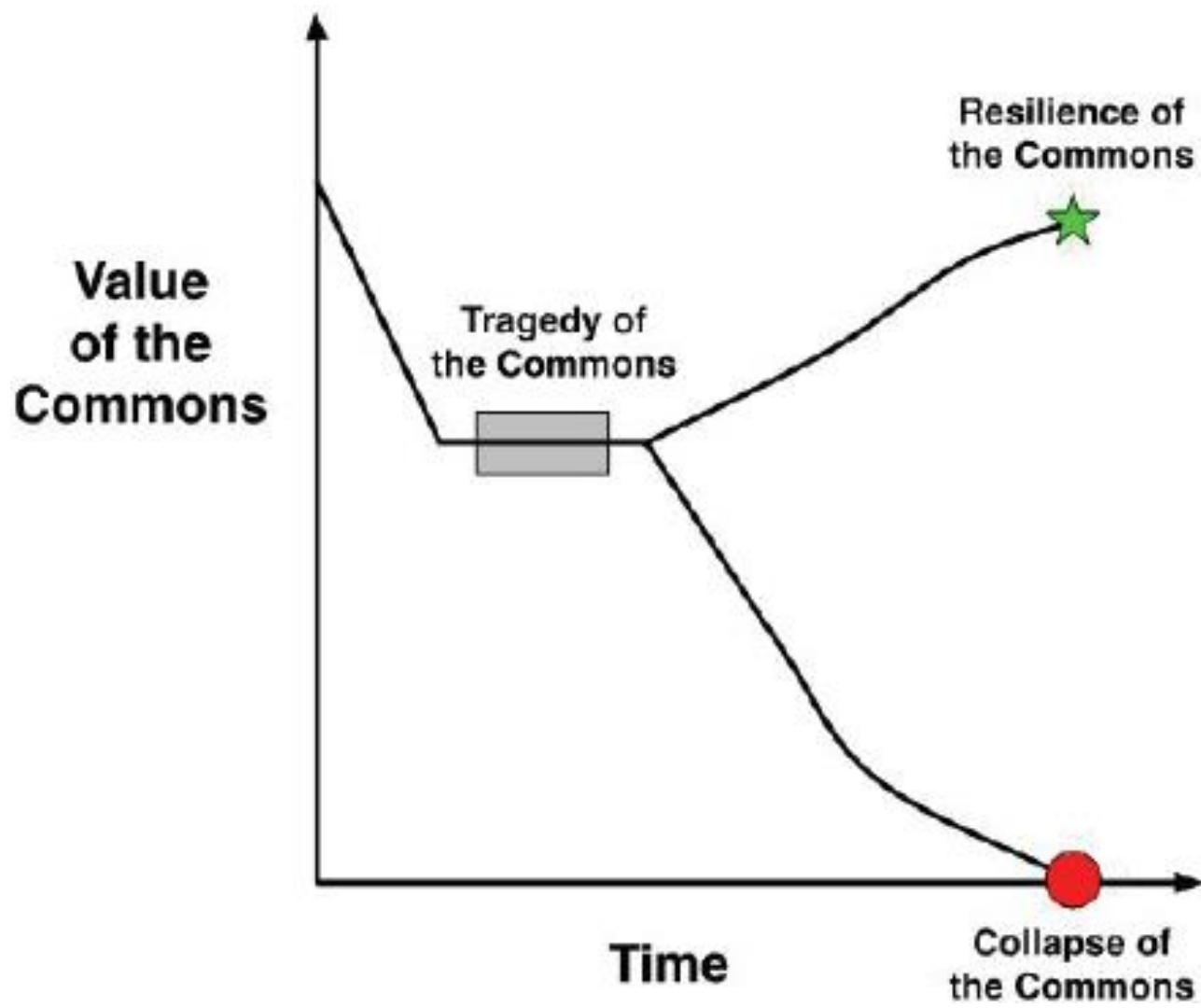


As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, “What is the utility *to me* of adding one more animal to my herd?”

1) The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly $+1$.

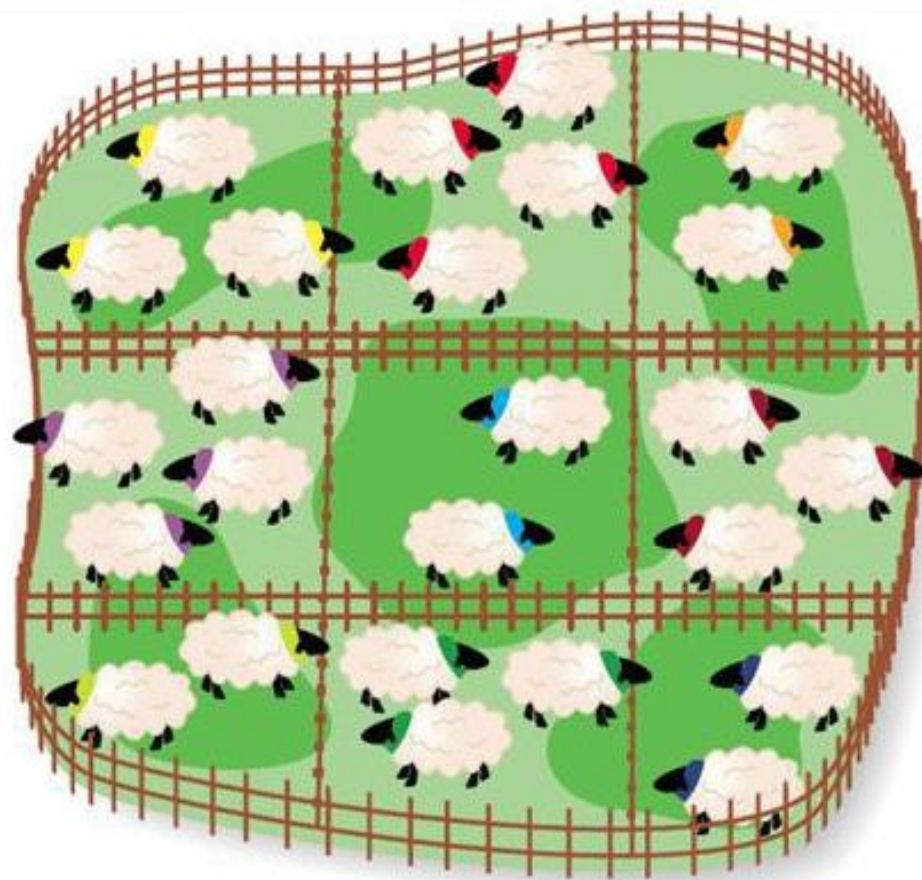
2) The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsman, the negative utility for any particular decision-making herdsman is only a fraction of -1 .

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another. . . . But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination to-



mons. Freedom in a commons brings ruin to all.

Some would say that this is a platitude. Would that it were! In a sense, it was learned thousands of years ago, but natural selection favors the forces of psychological denial (8). The individual benefits as an individual from his ability to deny the truth even though society as a whole, of which he is a part, suffers.



A simple incident that occurred a few years ago in Leominster, Massachusetts, shows how perishable the knowledge is. During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading: "Do not open until after Christmas. Free parking courtesy of the mayor and city council." In other words, facing the prospect of an increased demand for already scarce space, the city fathers reinstituted the system of the commons. (Cynically, we suspect that



ized. Even at this late date, cattlemen leasing national land on the western ranges demonstrate no more than an ambivalent understanding, in constantly pressuring federal authorities to increase the head count to the point where overgrazing produces erosion and weed-dominance. Likewise, the oceans of the world continue to suffer from the survival of the philosophy of the commons.

Maritime nations still respond automatically to the shibboleth of the “freedom of the seas.” Professing to believe in the “inexhaustible resources of the oceans,” they bring species after species of fish and whales closer to extinction (9).



The **National Parks** present another instance of the working out of the tragedy of the commons. At present, they are **open to all, without limit**. The parks themselves are limited in extent—there is only one Yosemite Valley—whereas population seems to grow without limit. The values that visitors seek in the parks are steadily eroded. Plainly, **we must soon cease to treat the parks as commons or they will be of no value to anyone.**

What shall we do? We have several options. We might sell them off as private property. We might keep them as public property, but allocate the right to enter them. The allocation might be on the basis of wealth, by the use of an auction system. It might be on the basis of merit, as defined by some agreed-upon standards. It might be by lottery. Or it might be on a first-come, first-served basis, administered to long queues. These, I think, are all the

In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in—sewage, or chemical, radioactive, and heat wastes into water; noxious and dangerous fumes into the air; and distracting and unpleasant advertising signs into the line of sight. The calculations of

The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of “fouling our own nest,” so long as we behave only as independent, rational, free-enterprisers.

The tragedy of the commons as a food basket is averted by private property, or something formally like it. But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated. We have not progressed as far

have with the first. Indeed, our particular concept of private property, which deters us from exhausting the positive resources of the earth, favors pollution. The owner of a factory on the bank of a stream—whose property extends to the middle of the stream—often has difficulty seeing why it is not his natural right to muddy the waters flowing past his door. The law, always behind the

The pollution problem is a consequence of population. It did not much matter how a lonely American frontiersman disposed of his waste. "Flowing water purifies itself every 10 miles," my grandfather used to say, and the myth people. But as population became denser, the natural chemical and biological recycling processes became overloaded,

Analysis of the pollution problem as a function of population density uncovers a not generally recognized principle of morality, namely: *the morality of an act is a function of the state of the system at the time it is performed* (10). Using the commons as a cesspool does not harm the general public under frontier conditions, because there is no public; the same behavior in a metropolis is unbearable. A hundred and fifty

lis is unbearable. A hundred and fifty years ago a plainsman could kill an American bison, cut out only the tongue for his dinner, and discard the rest of the animal. He was not in any important sense being wasteful. Today, with only a few thousand bison left, we would be appalled at such behavior.



is administrative law, which is rightly feared for an ancient reason—*Quis custodiet ipsos custodes?*—“Who shall watch the watchers themselves?” John Adams said that we must have “a government of laws and not men.” Bureau administrators, trying to evaluate the morality of acts in the total system, are singularly liable to corruption, producing a government by men, not laws.

Prohibition is easy to legislate (though not necessarily to enforce); but how do we legislate temperance? Ex- we cannot avoid. The great challenge facing us now is to invent the corrective feedbacks that are needed to keep custodians honest. We must find ways to

Freedom To Breed Is Intolerable

Mutual Coercion

Mutually Agreed upon

Recognition of Necessity



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POPULATION CONTROL OR
RACE TO OBLIVION?

THE POPULATION BOMB

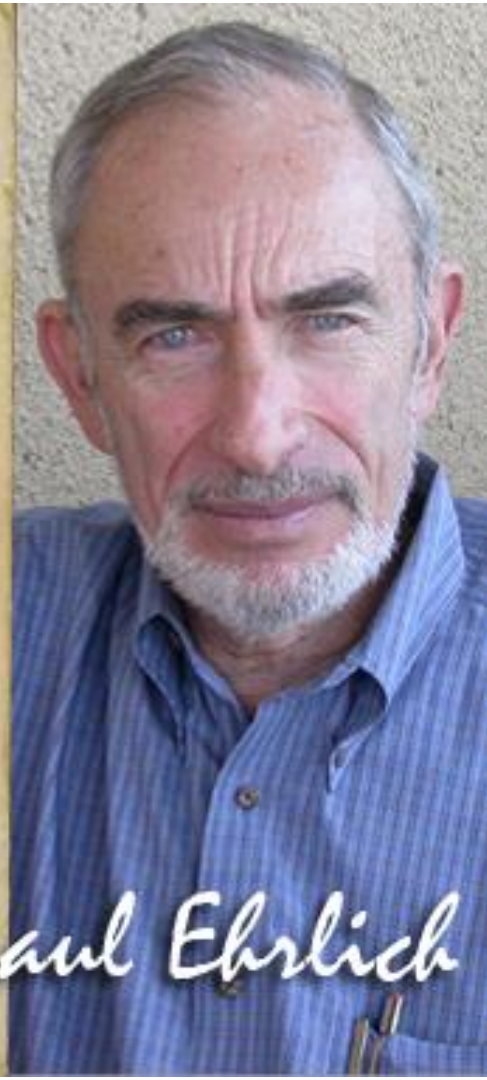
WHILE YOU ARE READING THESE WORDS
FOUR PEOPLE WILL HAVE DIED FROM
STARVATION. MOST OF THEM CHILDREN.

DR. PAUL R. EHRLICH



Foreword by David Brower

Paul Ehrlich

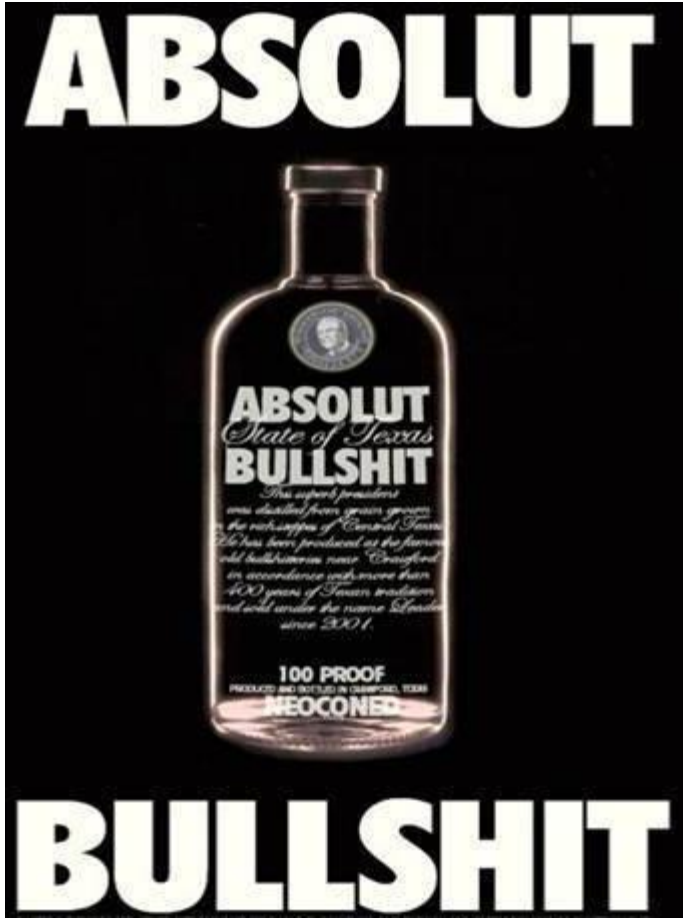


...hundreds of millions of people will die during the 1970s (amended to 1970s and 80s in later editions)

...a substantial increase in the world death rate

I don't see how India could possibly feed two hundred million more people by 1980...

I have yet to meet anyone familiar with the situation who thinks that India will be self-sufficient in food by 1971



The battle to feed humanity is over. In the 1970s and 1980s, hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date, nothing can prevent a substantial increase in the world death rate.

50 Years Since Paul Ehrlich's 'The Population Bomb': And Not All Dead, Yet?

Published on January 19, 2018

Written by James Delingpole



In fact, *The Population Bomb* did the one thing which science books aren't supposed to do: it actually made the people who read it *more* stupid.



DONE