

## Classic Text 18 - Environmental Ethics

According to the *Stanford Encyclopedia of Philosophy*, “**Environmental ethics** is the discipline in philosophy that studies the moral relationship of human beings to, and also the value and moral status of, the environment and its non-human contents”. And while this sounds like an uncontroversial definition of a unobtrusive sub-discipline within ethics, the study and application of environmental philosophy, in general and environmental ethics in particular, has been nothing short of revolutionary, with wide-reaching implications for global and local governance, conservation, economics, feminism and even theology.



*The First Colour Photograph of the Earth Seen from Space 10 Nov.1967- the year of White's Article. (NASA)*

Until the middle of the 20<sup>th</sup> century all of ethics (with the notable exception of Spinoza) was concerned exclusively with Man and his moral relationship to himself and other men. (Women were considered only secondarily until the advent of mainstream modern feminism in the latter part of the 20<sup>th</sup> century.) According to the Greek philosopher Protagoras (c. 490 - c. 420 BC) “Man is the measure of all things,” by which he is thought have meant “that the individual human being, rather than a god or an unchanging moral law, is the ultimate source of value, [and hence ethical judgements]”. (*American Heritage New Dictionary of Cultural Literacy*)

This is the essence of **ethical anthropocentrism** which places humans at the centre of the moral universe: What is good is what is primarily good for humans. Two papers, both published in the prestigious journal *Science*, are often cited as turning points away from the anthropocentric paradigm, towards a more inclusive environmental ethic. They are: Lynn White Jr.'s “The Historical Roots of Our Ecologic Crisis” (March, 1967) and Garrett Hardin's “The Tragedy of the Commons” (December, 1968). Curiously, for a scientific journal, neither paper is Scientific (with a capital 'S'). The first is essentially historico-religious, the second predominantly philosophical. Both papers serve as modern day classic texts for this study unit and can be downloaded for free [here](#) and [here](#) respectively.

We shall briefly discuss the texts in the order that they were published, trying at the same time to build a case for environmental ethics as a discipline and also as a call to action. As both authors stress: we cannot do nothing, nor can we continue with “business as usual” awaiting a technological “fix” for a global ecological crisis of our own making. Something philosophical and/or religious needs to change radically.

### The Historical Roots of Our Ecologic Crisis

White, Jr. begins with the observation that “all forms of life modify their contexts”. The most spectacular examples of which are the humble coral reef building polyps (and sponges) which create an undersea world that supports a community of other species of which they are only a part.

Humans too have been modifying their environment on a large scale, arguably since the earliest use of fire-driven hunting, which may explain the creation of the world's greatest grasslands and disappearance of the Pleistocene megafauna, wherever they came into contact.

The controlled annual flooding of the Nile has been a human artefact for at least the last six millennia, culminating in the construction and completion of the Aswan Dams in the 20<sup>th</sup> century. Other historical artefacts include the use of terraced irrigation and overgrazing as well as the cutting of forests by the Romans for shipbuilding and by the Crusaders for their campaigns.

Other historical examples of widespread human induced environmental change that White refers to include: 1.) the *bocage* region of Western and southern France (and Devonshire, England) that consist of a mix of woodland and cultivated pasture that sets them apart from the open fields of the North and 2.) land reclaimed from the North Sea and more recently the Zuider Zee by the Frisians and the Hollanders. At the time, White believed the question of how their ecological value impacted on the quality of life for the Netherlanders had never been asked, much less answered.

According to White: "People, then, have often been a dynamic element in their own environment ... [but]... as we enter the last third of the 20<sup>th</sup> century, however, concern for the problem of an ecological backlash is mounting". (p. 1203) That concern is even more pressing today. Historically, "Natural Science, conceived of as the effort to understand the nature of things, had flourished in several eras and among several peoples". On the other hand, there had been an age-old accumulation of technological skills; however around 1850 (and before that in the chemical industry) saw "[t]he emergence in widespread practice of the **Baconian creed** that with scientific knowledge comes technological power of over nature..." The acceptance of such a belief as "a normal pattern of action," White considers, "may mark the greatest event in human history since the invention of agriculture, and perhaps in nonhuman terrestrial history as well".

Soon after, in historical terms, the word **ecology**, first coined by the German zoologist Ernst Haeckel, appeared in English in 1873 to mean "that branch of science dealing with the relationship of living things to their environments". Since then, according to White, "...the impact of our race upon the environment has so increased in force that it has changed in essence". Since the early 14<sup>th</sup> century invention of gunpowder fired cannons sent men scrambling into the forests and mountains for saltpetre, sulphur, iron-ore and charcoal, leading to soil erosion and deforestation, the potential for Hydrogen bomb warfare threatens the global environment on an entirely different order of magnitude. And where once London had problem with smog produced by the burning of soft coal as early as 1285, White foresaw in his paper that the "... present combustion of fossil fuels threatens to change the chemistry of the globe's atmosphere as a whole, with consequences which we are only beginning to guess". (p. 1204)

Witnessing the then unchecked population explosion, unplanned urbanisation and the geological scale deposits of sewerage and garbage lead White to declare (justifiably) that, "no creature other than man has ever managed to foul his nest in such short order". What ought we to do about the mess? White acknowledges that "[t]here are many calls to action, but specific proposals, however worthy as individual items, seem too partial, palliative, negative... The simplest solution to any suspect change is, of course, to stop it, or, better yet, to revert to a romanticized state... But neither atavism nor prettification will cope with the ecological crisis of our time". Moreover, "Unless we

think about the fundamentals, [and we do not understand even these fully], our specific measures may produce new backlashes more serious than those they are designed to remedy." (*l.c.*)

Rather than despairing, White recommends that we should "clarify our thinking" by looking back (historically) at the presuppositions that underlie modern technology and science. Traditionally science was "aristocratic, speculative and intellectual in intent; technology was lower-class, empirical and action-orientated". The fusion of the two world views and activities in the second half of the 19<sup>th</sup> century (mentioned above), White maintains, was related to the slightly prior and contemporaneous democratic revolutions which diminished social barriers and which, in more prosaic terms, promoted a functional unity between the intellectual and practical. If true, then our current ecological crisis is, at least partly, a product of democratisation and we cannot survive its implications without rethinking our axioms. Contrast this with our present environmental crisis management thinking: maintain the *de facto* nominally democratic free-market economic fundamentals and seek out *post hoc* technological fixes such as carbon-capture-and-reburial, atmospheric geoengineering, oceanic iron fertilisation, and so on.

### **The Western Traditions of Technology and Science**

Modern technology and science are distinctly Occidental (Western) even though they absorbed elements from all over the world, most notably from China; yet wherever they are practiced today they remain a Western phenomenon. However the science of today is heir to all of those of the past, originating, not in the works classical antiquity, but with Islamic Scholars of the Middle Ages. As we saw in Critical Reasoning 12, we can trace the origins of the experimental method to one individual, the Arabic polymath Alhazen "Ibn al-Haytham" (c. 965 - c. 1040 A.D.) But there were others - White mentions Muhammad ibn Zakariya al-Razi (854 - 925 A.D.) in medicine and Omar Khayyám (1048 - 1131 A.D.) in mathematics; although each of these figures was as much a scientist as a philosopher. Their works became available to the West, in Latin translation, during the later Middle Ages along with those of the classical period, also in Latin, via Arabic.

White also points out that the West's ascendancy in technology and science predated the scientific and industrial revolutions in the 17<sup>th</sup> and 18<sup>th</sup> centuries respectively. By the turn of the first millennium A.D. the West had been applying water power to industrial processes other than simply milling grain. This was supplemented in the late 12<sup>th</sup> century by wind power. "From simple beginnings, but with remarkable consistency of style, the West rapidly expanded its skills in the development of power machinery, labor-saving devices and automation." By the late Middle Ages the Latin West had outstripped its more elaborate, sophisticated and aesthetically magnificent sister cultures, not in craftsmanship but in basic technological capacity. (p. 1204)

By the end of the 15<sup>th</sup> century, White suggests, the technological superiority of Europe was such that even small, mutually hostile nations, such as Portugal (and later The Netherlands) came to dominate the East Indies. What White does not discuss is that the very technological innovations that made such dominance possible also facilitated the slave trade and colonial exploitation in general.

At the time of writing, White believed that the then vernacular understanding of science began in 1543 with the publication of *De humani corporis fabrica* (On the Workings of the Human Body) by the anatomist Andreas Vesalius, and *De Revolutionibus*, by the astronomer Nicolaus Copernicus.

Fortunately, with broad access to the internet and well written and easily understandable articles such as Wikipedia's entry: "History of science" it is no longer credible to claim ignorance of scientific precedents across a wide range of cultures. White however turns next to the medieval view of man and nature because, according to him, "both our technological and our scientific movements got their start, acquired their character, and achieved world dominance in the Middle Ages..." (p. 1024 - 5)

### **Medieval View of Man and Nature**

Before the Industrial Revolution, agriculture had been the chief occupation of every society. White argues that a change in ploughing methods around the latter part of the 7<sup>th</sup> century in Northern Europe led to, or was accompanied by, a change in man's attitude to the soil and Nature in general. Whereas in the semiarid climes of the Near East and the Mediterranean scratch cross ploughing by a pair of oxen was sufficient to work the fairly light soil; the heavier, wetter and hence stickier soils of Northern Europe required a more extreme method first to cut *and* then to turn the sod. The friction created by the newer ploughs used by peasants in this region required a span of eight oxen and produced long parallel strips ploughed land. However no peasant owned eight oxen; therefore those using the new plough pooled their oxen to form ploughing teams and in return received ploughed strips of land in proportion to their contribution. (p. 1205)

Beforehand, where subsistence farming was the norm, land was allocated in units sufficient to support a single family. With the new method of ploughing, the distribution of land was based on the capacity of a power machine to till the earth. Whereas before, the allocation of land was based on family need with man part of Nature, now man's relation to Nature was one of exploitation rather than subservience. (*l.c.*) We pass over discussing White's emotive rhetoric at this point because we believe a stronger case can be made on a purely factual basis.

White observes that this exploitive attitude can be seen slightly before 830 A.D. in the form of illustrated calendars. Previously, the months of the year were depicted as "passive personifications" whereas the newer Frankish calendars showed men manipulating the world around them: "plowing, harvesting, chopping trees, butchering pigs". Such depictions were to "set the style for the Middle Ages" with Man and Nature as separate entities in which Man is the master. (*l.c.*)

Such practical attitudes, White argues, were in harmony with the larger prevailing intellectual attitudes towards man's relation to the world around him or his ecosystem. Indeed, "Human ecology is deeply conditioned by beliefs about our nature and destiny - that is, by religion". And the religion that supplanted paganism in the Medieval West was Christianity. Despite the acceptance that, for better or for worse, we now live in a post-Christian world, White believes that, "We continue today to live, as we have for about 1700 years, very largely in a context of Christian axioms". These include an "implicit faith in perpetual progress"; the belief in linear time with an absolute beginning, as opposed to a cyclical notion of time maintained by intellectuals of the ancient West, and most importantly, an anthropocentric view of creation. (*l.c.*) Nowhere is this belief more blatantly obvious than in *Genesis* 1: 27 - 8 which reads: "God created man in his own image, in the image of God created he him; male and female created he them. And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over fish of the sea, and over fowl of the air, and over every living thing that moveth upon the earth". Thus, not only

was there a duality between man and Nature, it was also God's will that man exploit Nature "for his proper ends".

In Western Antiquity and Paganism in general, by contrast, Nature was animistic - imbued with guardian spirits: "every tree, every stream, every hill had its own *genius loci*...". Man could communicate with these Nature Sprits, who often appeared as human chimeras, such as centaurs, fauns or mermaids. They had to be appeased before a tree could be felled, a stream diverted or a hill mined. Since Christianity's conquest over pagan animism, man had free licence to exploit Nature with no heed to the sensitivity of natural objects. (*l.c.*) In African traditional religions, the Ancestors also have to be consulted on important matters and if necessary appeased, so that man's responsibilities take place in much broader social context, in this world and in the world beyond death.

The creation woman (Eve) in the Judeo-Christian tradition is, as White points out, "an afterthought... to keep Man from being lonely" and to act as a "help meet". Neither is she created equally out of the Earth but from a spare man-part: a rib, as the story goes. (*Genesis 2: 20 - 22*) White does not dwell on the implications of this view as a feminist issue where men have, and continue in many paternalistic cultures, to subjugate women as they do Nature, as a God given right.

When discussing the cult of the Christian saints as a successor to that of animism, White points out that they are functionally quite different. Whereas Nature Spirits inhabited and protected particular natural objects, saints' "citizenship" was in Heaven; although they were mobile and may have had special shrines. Saints, moreover were always human and could be "approached in human terms". Then there were entirely transcendental beings (angels in Heaven and demons from Hell) inherited from Judaism and perhaps at one remove from Zoroastrianism. These too were mobile, however: "The spirits *in* natural objects which formerly had protected nature from man, evaporated. Man's effective monopoly on spirit in in this world was confirmed, and the old inhibitions to the exploitation of nature crumbled". (p. 1025)

White is careful to point out that Christianity is a complex faith and that such generalisations have differing consequences in different contexts. The largest and earliest schism was that between the Greek East, with its marked lack of technological innovation after the invention of Greek Fire in the late 7<sup>th</sup> century, and the Latin West to which much of the preceding discussion pertains. White believes that this contrast is underpinned by a difference in theological outlook between the East and Western Churches:

The Greeks believed that sin was an intellectual blindness, and that salvation was found in illumination, orthodoxy - that is, clear thinking. The Latins, on the other hand, felt that sin was moral evil, and that salvation was to be found in right conduct. Eastern theology has been intellectualist. Western theology has been voluntarist. The Greek saint contemplates; the Western saint acts. The implications of Christianity for the conquest of nature would emerge more easily in the Western atmosphere. (p. 1026)

This is of course a massive generalisation. For every contemplative saint in the East could be found a counterpart in the West. However, on the principle of charitable interpretation, let us assume that White's appraisal is broadly correct. Although the dogma of creation and the belief in divine revelation through Scripture was the same throughout Christendom, the East-West divide provided

different contexts in which the religious study of Nature or natural theology was to be understood: “In the early Church, and always in the Greek East, nature was conceived primarily as a symbolic system through which God speaks to men... This view of nature was essentially artistic rather than scientific”. (*l.c.*)

However by the early 13<sup>th</sup> century, Christian intellectuals of the Latin West were increasingly turning to the understanding of Nature as revealing the mind of God or as Johann Kepler (1571 - 1630) put it: “Thinking God’s thoughts after Him”. So, although the rainbow was no longer simply symbolic of God’s promise to Noah, those scientists who produced treaties on the optics of the rainbow did so “as a venture in religious understanding”. Indeed, every major scientist up till the late 18<sup>th</sup> century, including Newton and Leibniz, professed doing so in a religious spirit. (*l.c.*) Even the statement attributed to Laplace (1749 - 1827) that, “I had no need of that hypothesis” (referring to God) is questionable as to whether he was actually referring to “the *hypothesis* of God’s existence”.

If the consistency of these scientists’ pronouncements on the religious motivation for their work is any reason to believe that they were sincere, as White does, then “modern Western science was cast in a matrix of Christian theology. The dynamism of religious devotion, shaped by the Judeo-Christian dogma of creation, gave it impetus”. (p. 1206)

### **An Alternative Christian View**

To recap, White argued that science is an extrapolation of natural theology and modern technology is to be partly explained as a Western, “voluntarist realisation of the Christian dogma of man’s transcendence, and rightful mastery over, nature”. Since the late 19<sup>th</sup> century these two forces have united to give mankind power over Nature to such an extent that, if the ecological crisis that besets us is anything to go by, its effects are now out of control. “If so, then Christianity bears a huge burden of guilt”.

The Genie is out of the bottle, so to speak, and there is no foreseeable technological fix to our runaway global warming, acidifying oceans, habitat destruction and species’ mass extinctions. So far, more than fifty years after White’s paper, we have heard only talk and no decisive global action. “Despite Darwin we are *not*, in our hearts, part of the natural process. We are superior to nature, contemptuous of it, willing to use it for our slightest whim”. (*l.c.*) Because our religious attitude to Nature is at the root of our present ecological crisis, White believes, only a new religion or a rethink of our old one can extricate us. He is encouraged by the “beatniks” of his day in their affinity for Zen Buddhism, with its conception of the relation between man and Nature, diametrically opposite to that of the Christian view. However, he is sceptical that it might be viable in the West due to its embedded relation within Asian history.

Instead he recommends that we look to “the greatest radical in Christian history since Christ: Saint Francis of Assisi”. According to White’s reading, the key to understanding St. Francis lies in his belief in the virtue of humility for man and mankind as a species among a democracy of species. “With him the ant is no longer simply a homily for the lazy, flames a sign of the thrust of the soul towards union with God; now they are Brother Ant and Sister Fire, praising the Creator in their own ways as Brother Man does in his”. (*l.c.*)

Unlike pantheism (the belief that all is God) which pervades much of mystical thought in both the Eastern and Western traditions, St. Francis is apparently advocating a form of **panpsychism** in which every material thing has an element of individual consciousness that aspires to God. Unfortunately, there is simply no objective way to test this belief that would satisfy the sceptic either way. If every elementary particle in the Universe were minimally conscious there would be no way of telling what difference this iota of consciousness would make compared to one that had no trace of minimal consciousness.

If St. Francis is to be believed, we are but one sentient species in a sea of sentient entities, praising God after their own nature. This implies that all entities are alike in mental essence, differing only by degree, and therefore all sacred. Such radical democracy of value would be an anodyne to man's anthropocentrism but would we really be prepared regard Brother Tape Worm and Sister Forest Fire as "praising the Creator in their own ways"? If everything is sacred then nothing is because the concept fails to pick out special entities from a universe of them. Indeed the origin of the word **sacred** from the Latin *sacerdos* and *sanctum* literally means "set apart (for some special purpose)".

Finally, there is the elephant in the room: Ever fewer people are persuaded by religious beliefs both for personal or philosophical reasons. (See Classic Text 15) Most would certainly not be persuaded that a religious solution is desirable for a problem of its own making. If Western Christian dogma and attitudes towards Nature got us into our present ecological crisis surely *it* needs to be replaced by something holistic, ecologically informed and secular. Unfortunately, it has been more than fifty years of business as usual since White's paper. Can we afford even a decade more of inaction, let alone a global experiment in retrospective Medieval Christian Mysticism?

What is clear is that we can no longer regard man as the fundamental unit of ethical thinking. What is good for some humans (or humankind) in the short term may not be good for the environment or the planet in the medium to long term. If we degrade our environment to such an extent that it might, ultimately, no longer be hospitable to human life there will be no question of what is good for man.

## The Tragedy of the Commons

According to Hardin, "A technical solution [to a problem] 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". (p. 1243) At the time of his address, in 1968 during the height of the Cold War, the problem of the nuclear arms race was one for which there was no technical solution. Both sides had the technical wherewithal to insure mutual destruction but neither had the moral nor political will to realise a solution. Of course we have not solved that problem today, only toned down the rhetoric.<sup>1</sup>

Hardin here is concerned with the class of problems which he calls **no technical solution problems**. The game of tic-tac-toe or noughts and crosses is a member of this class because, if played by two opponents who understand the rules of the game fully, there is no "technical solution" to winning the game, except by stepping outside of the game or cheating. Most intelligent adults realise this and so simply refuse to play. But the class of no technical solution problems has other members and

---

<sup>1</sup> To our knowledge, only one country, South Africa, has voluntarily disarmed itself of nuclear weapons.

Hardin's thesis is that the "population problem," as conventionally conceived, is a member of this class. (*l.c.*) Now, as at the time of his address, most countries and inter-governmental institutions who are concerned with overpopulation are focusing on technological fixes "without relinquishing any of the privileges they now enjoy". These include desalination, fortification of basic foodstuffs, mass vaccinations, marine aquaculture and developing genetically modified crops that are drought resistant or that can grow in ever poorer quality soils. Hardin however believes that the solutions they address cannot solve the population problem "in a technical way, any more than can the problem of winning the game of tick-tac-toe". (*l.c.*)

### What Shall We Maximize

As early as 1798, Thomas Robert Malthus in his *An Essay on the Principle of Population*, predicted that human population growth would increase geometrically (exponentially) but that food production would grow only arithmetically. Unless the birth rate could be controlled, the result would be starvation and famine. At the end of Chapter 7 of the same work Malthus wrote:

That the increase of population is necessarily limited by the means of subsistence,  
 That population does invariably increase when the means of subsistence increase, and,  
 That the superior power of population is repressed, and the actual population kept equal to the means of subsistence, by misery and vice. (Malthus, 1798 p. 61)

Malthus' prediction would still be true in an infinite world. Population growth would always, in time, outstrip food production; however we do not live in an infinite world. Both physical space and resources are constrained. Therefore, as Hardin puts it, "the per capita share of the world's goods must steadily decrease". (p. 1243) If, as some have envisioned, humanity were to succeed in colonising Space and perhaps the Moon and Mars, Malthus' inexorable outcome would only be postponed, not averted.

Given that a finite world can only sustainably support a finite maximum population (its **carrying capacity**) with a net population growth of zero, Hardin asks, "Can Bentham's goal of "the greatest good for the greatest number be realized?" His answer is: "No - for two reasons, each sufficient by itself" - The first theoretic, the second metabolic or energetic. When modelling linked partial differential equations, it is not mathematically possible to simultaneously maximise two (or more) variables. This was clearly shown by John von Neumann and Oskar Morgenstern in their 1944 seminal *Theory of Games and Economic Behavior*. (1947 p. 11) In a mathematical version of Bentham's principle the variables to be maximised are some reliable operationalisation of the "good" and the population number.

Hardin's second reason for believing that "the greatest good for the greatest number" cannot be achieved is as follows: An adult human requires approximately 1600 Kilocalories ( $\approx$  6790 Kilojoules) per day to maintain life. Anything over and above these "maintenance Calories" are known as "work Calories". The latter includes what we would normally call "work" or as Bertrand Russell defined it: "altering the position of matter at or near the Earth's surface relatively to other such matter... [or]... telling other people to do so". (Russell, 1932) Work Calories also include those expended on recreation and enjoyment, from swimming to walks in nature to playing music and writing poetry.

Logically, if we wish to maximise population, then we must minimise work Calories expended per person per day to as close to zero as humanly possible. Clearly, maximising for population does not maximise the “good” as Bentham envisioned.

Hardin admits that he has made the assumption that the acquisition of energy is the problem (to increased population growth). In 1954, in a speech to the National Association of Science Writers, Admiral Lewis L. Strauss, then Chairman of the U.S. Atomic Energy Commission stated: “It is not too much to expect that our children will enjoy electrical energy in their homes too cheap to meter”. Of course, that has not happened. The advent of nuclear power has made very little difference to the global energy generating capacity or to its cost per Megawatt hour. John Heaver Fremlin’s (1964) witty article that Hardin cites, demonstrates, at least theoretically, that the problem of energy acquisition is replaced by its dissipation, if it were ever possible for humanity to reach such an enormous global population, which is doubtful. (Fremlin’s article is available for free download [here](#).) Either way, the optimum population will always be less than the theoretical maximum; hence Bentham’s goal is unattainable.

Still, we want to maximise the good per person but what is good for one person is incommensurable to what is good for another. To one it may be millions of hectares of untrammelled wilderness because it preserves species diversity, to another it may be wide scale opencast mining because it makes him stupendously rich. Incommensurables are, by definition, not able to be judged by the same standards. Nature however has only one standard: survival. According to Hardin, “The compromise achieved depends on a natural weighting of the values of the variables”. (p. 1244)

If humans are to imitate this process, and Hardin recommends that we do, then we require something like a calculus for population optimisation akin to the utilitarian calculus discussed in Classic Text 08. Whether we do so unconsciously is questionable because, from the gene’s eye-view, replication is always the proximal, indeed only, strategy. (See Classical Text 10) At the time of writing, no prosperous nation or cultural group had reached an equilibrium of zero population growth rate. Today a number of socialist nations have, including some with aging populations that have birth rates in decline. Notwithstanding, Hardin is largely correct in recognising that those with the most rapidly growing populations are (in general) the most miserable. This implies that we cannot take it for granted that a population with a positive growth rate “has yet to reach its optimum”. (*l.c.*)

Before introducing the tragedy of the commons, Hardin is at pains to “exorcize the spirit” of the **invisible hand** as it applies to practical demography. The Scottish political philosopher and economist Adam Smith (1723 - 1790) used the phrase as a metaphor to “describe unintended social benefits resulting from individual actions”. The quotation cited by Hardin from Smith’s *The Wealth of Nations* (1776) that an individual who “intends only his own gain” is, as it were, “lead by an invisible hand to promote... the public interest,” in fact occurs in a quite specific context in Book IV, Chapter II, *Of Restraints upon the Importation from Foreign Countries of such Goods as can be Produced at Home*. (Wikipedia: Invisible hand) Never the less, the idea has been seized upon as a justification for *laissez-faire* economic philosophy and if generalised might have justified the then *laissez-faire* policy towards reproduction. But this is speculation when a simpler explanation is credible: Reproduction is simply a biological imperative.

## Tragedy of Freedom in a Commons

Hardin traces the tragedy of the commons to a hypothetical example involving the over-grazing of common land, sketched in an 1833 pamphlet by the mathematician William Foster Lloyd (1794 - 1852), ostensibly as a rebuttal to the “invisible hand” of population control. Hardin uses the term “tragedy” in its dramatic sense of inevitability of destiny rather than simply unhappiness. What makes Oedipus a tragic figure is not his unhappiness but the fact that he is ensnared by his fate and that everything he does to escape it closes the snare more tightly about him. And we the audience know it!

The **tragedy of the commons** is truly a tragedy of this sort and unfolds inexorably as follows: Suppose there is a pasture open to communal grazing, *i.e.* a common. For centuries this arrangement worked well because the burden of disease, warfare and poaching kept the number humans and cattle on the commons in check. However when society achieves a degree of stability and is no longer plagued by regular outbreaks of disease, humans and their cattle rapidly reproduce to the point that the carrying capacity of the commons is equally rapidly approached. At this point the question for each rational herdsman seeking to maximise his utility must be, “What is the utility *to me* of adding one more animal to my heard?”

As Hardin points out, “this unit of utility has a positive and a negative component”.

- 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. However, since the effects of overgrazing are shared by all herdsmen, the negative utility for any particular herdsman is only a fraction of -1. (p. 1244)

The only rational course of action for a herdsman is to add another one of his animals to the heard, and another, and another... So too is it the only rational choice of action for every other herdsman, increasing the heard without limit. Naturally, the commons cannot sustain a grazing heard beyond its finite carrying capacity; therefore a collapse of the ecosystem is inevitable. The tragedy is that as every man goes about his business, freely pursuing his rational self-interest in a society that believes in the freedom of the commons, guarantees its collective ruin. (*l.c.*)

Of course the tragedy of the commons is not just about collectively owned agricultural land but a phenomenon underlying any situation where an unregulated, shared natural resource be it water, air, fish stocks or habitable earth, in which individuals acting independently, according to their own rational self-interest, end up depleting that resource. (Wikipedia: Tragedy of the commons)

Hardin correctly points out that “In a sense [the tragedy of the commons has a lesson] learned thousands of years ago, but natural selection favours the forces of psychological denial. The individual benefits an individual from his ability to deny the truth even though society as a whole, of which he is a part, suffers”. (*l.c.*) This *commons dilemma*, as a specific class of social dilemma, has been studied in a wide range of situations both in the field and the laboratory including game theory, which constructs mathematical models of individuals’ behaviour in strategic situations. Hardin

himself developed a corresponding game known as the Commonize Costs - Privatize Profits Game abbreviated as CC-PP game. (Wikipedia: Tragedy of the commons)

Hardin recognises that education is effective in counteracting people's natural tendency to act in their short-term selfish interests; however because of the succession of generations, such lessons must be "constantly refreshed". In the paragraphs that follow, Hardin mentions a litany of specific examples that "suffer from the survival of the philosophy of the commons" to which we might add the following contemporary examples: Unnecessary burning of fossil fuel reserves at an immediate cost benefit with the medium term consequence of runaway global warming; The misuse of antibiotics and hence antibiotic resistance; Spam email which slows and increases the cost of e-mail and internet use for all because of the actions of a tiny fraction of users.

The question of what to do about National Parks facing the tragedy of the commons is as relevant today as it was at the time of writing, including or especially to those in Africa. Hardin considers the following possibilities but dismisses them out of hand:

- Privatisation
- *De facto* nationalisation but allocating the right to enter them. Such an allocation might be based on:
  - wealth, by means of auction
  - merit, by some agreed standards
  - a lottery system
  - a first-come first-served basis

But we cannot do nothing! Unfortunately, we must choose in the face of poachers and commercial interests that already regard our National Parks as a common resource for exploitation.

## Pollution

Interestingly, Hardin presents the problem of pollution as the tragedy of the commons in reverse. Instead of taking something of value *out of* the commons, pollution is putting something harmful *into the* commons, be it "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", not to mention inescapable noise pollution from private and commercial sources. The utility calculation is much the same as before: Each independent, rational agent realises that the cost of discharging his waste into the commons is less than the cost purifying it before discharging it. And since this is true for everyone we are soon "locked into a system of "fouling our nest," so long as we behave only as independent, rational free-enterprisers". (p. 1245)

Privatisation of property would go some way towards mitigating the tragedy of the commons because no rational agent would want to pollute his own property, however we can't ring-fence the air or ground or surface-water surrounding such property. Therefore the temptation is always to discharge one's effluent into the surrounding environment. Of course, there are always laws or tax disincentives against doing so but these suffer from several defects. Firstly, the law is always several steps behind the latest polluting technologies. Even with the best legislation they may seldom be enforced or even practically enforceable. Secondly, disincentives, so long as they are not too

punitive, can always be factored into a calculation on which the utility of polluting anyway outweighs the cost of the deterrent. Thirdly, if a polluter is the major supplier of jobs or revenue in an area, there is unlikely to be the political will to enforce the policy of “the polluter pays”, especially when there are veiled threats of disinvestment or projected job-losses.

Although fairly obvious, Hardin emphasises the problem that pollution is a consequence or rather a function of population. Whereas once the pollution of a few tribe’s folk or nomads could be absorbed, decomposed and recycled by the environment, population densification overburdens the natural chemical and biological capacity to do so, calling as Hardin does, “for a redefinition of property rights”. (*l.c.*)

### How to Legislate Temperance?

Hardin cites Joseph Fletcher (1966, updated 1997) in highlighting an aspect of morality that, at the time, was not generally recognised, namely that: “the morality of an act is a function of the state of the system at the time it is performed”. Unlike the absolutist Old Testament commands of the form: “Thou shalt not...” and the laws of our society on which they are based, situational ethics takes into account the particular context in which an act occurs. This is especially clear when considering the problem of pollution as a function of population density. According to Hardin, “Using the commons as a cesspool does not harm the public under frontier conditions, because there is no public; the same behaviour in a metropolis is unbearable”. (p. 1245)

Importantly, situational ethics is not relativistic; there are still objectively right and wrong actions in a given situation. In fact, situational ethics is consequentialist in that the consequences of one’s conduct determine the rightness or wrongness of one’s action; however it is not utilitarian either because the question of utility is not the ultimate arbiter of such action. One solution to deal with absolutist laws so that they are situationally relevant is to augment them or supplement them with administrative laws. Since it is not possible to legislate for every conceivable condition covered by such laws, we are thrown back on delegating such details to bureaus. But, as Hardin points out, administrative law is feared for an ancient reason as the Latin poet Juvenal asked: *Quis custodiet ipsos custodes?* - “Who shall watch the watchers themselves?” (p. 1245-6)

It is not clear that this question has an answer. Although, as John Adams (1790) enshrined in the constitution Massachusetts, that we seek to establish “a government of laws and not of men”, bureaucratic administrators are, as Hardin puts it, “singularly liable to corruption, producing a government by men, not laws”. Unfortunately, more than fifty years after Hardin’s paper, the invention of “corrective feedbacks that are needed to keep custodians honest” (p. 1246) enshrined in our constitution as checks and balances and as the separation of powers, have not succeeded in legislating temperance.

### Freedom to Breed Is Intolerable

Humans are, reproductively speaking, **k-strategists**. We invest heavily in a few offspring with a relatively long reproductive period as opposed to **r-strategists**, such as insects, who invest relatively very few resources in a very large number of offspring with a relatively short reproductive period. If freedom to breed were dependent only a human family’s resources, natural selection would have a

negative feedback effect on **fecundity** (the potential for reproduction of a recorded population), thus stabilising population numbers. However most of us who are not capitalists, if we do not actually live in a welfare state, aspire to do so. Because of the believed inalienable right to breed, any group, religion or class within a welfare state is free to augment its representation within society and simultaneously demand equal right to the commons for all of its offspring. Such an approach is to “lock the world into a tragic course of action”. (p. 1246)

Unfortunately, even questioning a person’s right to breed, or to access equal public resources, is likely to be met with howls of contempt, of the sort usually reserved for witches, paedophiles and genocidal maniacs. However we cannot escape the tragedy of the commons on a global scale with both of these universal rights unchecked and, in the case of some religions such as Catholicism, actively promoted.

### Conscience Is Self-Eliminating

Most counties advocate a policy of Planned Parenthood where prospective parents are encouraged to have only so many offspring as they can reasonably care for. The Planned Parenthood Federation worldwide meanwhile provides a variety of reproductive health services as well as sexual education, research into reproductive technology and advocacy work. (Wikipedia: Planned Parenthood) Of course this is a very noble initiative and if every family could be educated, could plan and could pace their reproduction so that every child born had the best possible prospects, we would not be in a global population crisis.

However, Planned Parenthood is not an evolutionarily stable strategy (ESS). Informally, an ESS, recall, is one that does well in a population dominated by the same strategy. (Dawkins, 1982 p. 286) (See also Classic Text 10.) Charles Galton Darwin, the grandson of Charles Darwin provided the following inexorable Darwinian argument: People cannot be relied upon to control breeding by an appeal to conscience. Because people vary, some will respond to a plea to limit their breeding more than others; however those who do not heed this call will have the greatest number of offspring represented in the following generation. This effect will be self-reinforcing down the generations as those who are susceptible to the plea of conscience will continually be outbred by those who are not.

Here Hardin quotes C. G. Darwin directly: “It may well be that it would take hundreds of generations for the progenitive instinct to develop in this way, but if it should do so, nature would have taken her revenge, and the variety *Homo contracipiens* would become extinct and would be replaced by *Homo progenitivus*”. (Darwin, C. G., 1960 p. 469) Naturally, this assumes that the susceptibility to conscience vs. the desire to reproduce is heritable, either via the germ-line or through education (exosomatically). At any rate, humans have been using various methods of birth control from abortifacients to spermicides and coitus interruptus since the time of the Early Mesopotamians and Ancient Egyptians. (Wikipedia: History of birth control) Clearly, we do not have to wait the “hundreds of generations” that C. G. Darwin proposes for the “instinct” to appear either way, because we have already been at it for at least 160 generations and probably a lot longer, since prehistoric times.

As Hardin observes, “The argument here has been stated in the context of the population problem, but it applies equally well to any instance in which society appeals to an individual exploiting a

commons to restrain himself for the general good - by means of his conscience. To make such an appeal is to set up a selective system that works towards the elimination of conscience from the race”.

### Pathogenic Effects of Conscience

Hardin claims that when we exhort someone who is exploiting a commons to desist “in the name of conscience” we are in fact conveying two messages (i.) intended, “If you don’t do as we ask, we will openly condemn you for not acting like a responsible citizen”; and (ii.) unintended, “If you *do* behave as we ask, we will secretly condemn you for a simpleton who can be shamed into standing aside while the rest of us exploit the commons”. (p. 1246) Perceiving two or more contradictory beliefs, ideas, values or actions at the same time is not a “double bind” as Bateson *et al.* (1956) once proposed. Today such a psychological state is known as **cognitive dissonance** and although it may be uncomfortable or anxiety provoking, it is DEFINITELY NOT the cause of Schizophrenia as was once thought. When people are faced with cognitive dissonance they usually employ one of several mechanisms to reduce the anxiety. One of these is rationalisation. In Aesop’s fable of “The Fox and the Grapes,” the fox sees some high hanging grapes which he wants to eat. Unable to think of a way of reaching them, he decides that they must be sour and not worth eating anyway, hence the term “sour grapes”.

Other strategies include: Minimise or discount, justify or avoid, accept, change beliefs or actions and, most difficult of all, integration of beliefs. Yes, “A bad conscience,” as Nietzsche said “is a kind of illness” - but only if one has a fine and sensitive conscience such as Nietzsche did. Apart from psychopaths and those who just don’t care, most people when confronted with cognitive dissonance regarding an environmental issue, say polluting the air with their dirty gas-guzzler, simply react with one of the strategies above *e.g.* “My pollution on a global scale is insignificant” (discounting) or, “I require my vehicle for my commute to work and anyway and I can’t afford a less polluting model” (justification).

Clearly the problem is one of conscientising the issues, not of creating anxiety around them. Hardin quotes Paul Goodman (1968) when he says: “No good has ever come from feeling guilty, neither intelligence, policy, nor compassion. The guilty do not pay attention to the object but only to themselves, and not even to their own interests, which might make sense, but to their anxieties”. (p. 22) Today however, psychologists draw a distinction between **guilt** (a distressing emotion of feeling responsible for having behaved wrongfully) and **shame** (a painful self-conscious emotion caused by consciousness of guilt, shortcoming, or impropriety). Although both are negative emotions, according to Diana Kwon (2016), “Guilt is linked to a specific action or behavior, whereas shame is focused on the self”. While guilt *can* be used as a means to motivate performance or restore a positive self-image, especially if it involves peers, shame tends to have the unintended consequence of individuals becoming angry, aggressive and self-destructive. (p. 67 - 69)

Concerning Hardin’s rhetorical question as to whether, as a matter of policy, we ought to encourage the use of a technique which is psychologically pathogenic, well of course not, if it is pathogenic. However, just because anxiety or guilt are undesirable in some contexts does not mean that they are always pathological. A certain amount of anxiety or guilt, appropriately directed, say as part of an advertising campaign to quit smoking or for absent fathers to take responsibility for the children

they sire, are well intended and used to good effect. Hardin however makes short shrift of the notion of responsibility treating it, without argument, as a synonym for conscience in such contexts. It is certainly not an attempt to get something for nothing. Whether we are trying to get a man to take responsibility for his health or his children, we are trying to wrest responsibility away from the state towards and towards an internal locus of control for him. Responsibility defined by Frankel (1955, p. 203) as “the product of definite social arrangements,” detracts from this essential notion. The definition of **responsibility** as, “the state or fact of being responsible, answerable, or accountable for something within one’s power, control, or management” at dictionary.com is more apt.

### **Mutual Coercion Mutually Agreed Upon**

Where propaganda, social nudges and appeals to responsibility fail, mutually agreed coercion is necessary to ensure that, for example, robbers do not treat a bank as a commons. We do not care that in doing so we might infringe on their freedom. We accept the morality of such outright prohibitions; however the conditions for temperance can also be created by coercion without prohibition. One example is taxation. If a man is a smoker and wants to take out of the commons the same or a higher level of health care benefits as a non-smoker, we can coerce him to smoke less or quit altogether by levying a hefty “sin-tax” on tobacco products. We do not have to prohibit the consumption of tobacco products outright; we can simply make them increasingly expensive to consume. Coercion, then as now, has numerous negative connotations but the only form of coercion that Hardin is advocating is mutual and mutually agreed upon by the majority.

“To say that we mutually agree to such coercion is not to say that we are required to enjoy it, or even pretend we enjoy it”. Although we all grumble about taxes, (most of us) accept them as compulsory because we realise that a policy of voluntary taxation cannot be left to conscience. “We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons”. (p. 1247)

When it comes to property rights our *de facto* alternative to the commons need not be just or equitable to be preferable. The institution of private property coupled with inheritance rights is a case in point. To be perfectly just, inheritance should be based on merit. Ideally, those who are most deserving or in need should receive the lion’s share of any estate. However, we put up with our unjust system of private property and inheritance because, as Hardin claims, “we are not convinced, at the moment, that anyone has invented a better system. The alternative of the commons is too horrifying to contemplate”. (*l.c.*) There are, in fact, other forms of inheritance: under socialism, private property inheritance is heavily taxed so that a significant portion of the proceeds are more equitably distributed by the state. Under communism in the U.S.S.R., inheritance of capitalist property was abolished by decree in 1918 and was only gradually re-introduced as inheritance under a will governed by civil codes. (Great Soviet Encyclopedia: Inheritance, Law of)

### **Recognition of Necessity**

In this final section of his paper Hardin summarises his earlier points as follows:

- The commons are only justifiable under conditions of low population density. As the human population has increased, the commons have had to be abandoned in one aspect or another.
- First we abandoned the commons in food gathering, enclosing farm land and restricting pastures and hunting and fishing areas. These restrictions are still not complete throughout the world.
- Somewhat later we abandoned the commons as a place for waste disposal. Although restrictions on the disposal of domestic sewerage are almost universally accepted, restrictions on emissions and other pollution by motor vehicles, industrial, mining and agricultural sources are in place in most developed countries but are difficult to enforce. The problem of disposing of radiological waste has been postponed indefinitely.
- In most developed nations there are restrictions on sound and electromagnetic pollution as well as the placement of advertising outdoors, although these are regularly flouted with impunity. There are no such restrictions on the placement of advertising on the internet, which remains, in effect, a public commons. Attempts to prevent pollution of this commons by malicious code and spam by appeals to responsible usage have failed. (p. 1248 updated)

According to Hardin, “Every enclosure of the commons involves an infringement of somebody’s personal liberty”. (*l.c.*) Nobody complains about ancient infringements, however newly proposed environmental infringements, such as emission caps or compulsory energy saving schemes are met with protests about “rights” and “freedom”. For people and corporations locked into the commons mind-set, such unfettered freedoms can only bring on universal ruin. On the other hand, when we decide to pass mutually agreed upon laws, say against robbery or vandalism, we become more free, not less so. Only when we see the necessity of such mutual coercion, do we realise that we become free to pursue other goals. Hardin presumably takes the maxim attributed to Hegel (but actually from Engels’ *Anti-Duhring*), that “freedom is the recognition of necessity”, to mean that human freedom cannot be created until the same human beings create the conditions for it. (Jena, 1990)

According to Hardin, “The most important aspect of necessity that we must now recognize, is the necessity of abandoning to commons in breeding”. Recall that the problem of overpopulation is one that admits of no technical solution and that appeals to conscience are ultimately self-eliminating under successive generations of natural selection. “The only way we can preserve and nurture other and more precious freedoms is by relinquishing the freedom to breed, and that very soon”. Unfortunately, Hardin offers only one clause as to how that might be achieved: “and it is the role of education to reveal to all the necessity of abandoning the freedom to breed”. (p. 1248) But if the drive towards education is in any way heritable it seems that this strategy too would come under selective pressure down the generations as the uneducated outbreed the educated, which is already what we see. If so, and there really is *no* technical solution, “Life will find a way” to quote from Michael Crichton’s *Jurassic Park*. And that way will not favour humans.

### Task

1. Both White and Hardin’s papers have been written from the anthropocentric perspective. What is the problem with anthropocentrism for Environmental Ethics?
2. Are there religious solutions or impediments to environmental problems?

3. We all have responsibilities to future generations. How does the tragedy of the commons play out in this scenario?
4. Are there really no technological solutions to the global anthropogenic (man-made) tragedy of the commons?
5. If humans have already or will soon exceed the earth's caring capacity how might "Life... find a way"?

### Feedback

1. Anthropocentrism from the Greek *ἄνθρωπος* (*ánthrōpos*) for "man" and *κέντρον* (*kéntron*), "centre", in the context of ecology or environmental philosophy is the belief that human beings are the most significant species on Earth and that they occupy a higher moral status or value than all other species and/or the belief that the world should be interpreted from the perspective of human values and experiences. (Wikipedia: Anthropocentrism)

Both White and Hardin's papers assume that human welfare is paramount and explore ways of thinking that sustainably promote that ideal. Instead of asking what is good for the planet and the species that inhabit it, they assume, tacitly, that what is good for humans will be good for the planet. The idea that the authors do not entertain is that, from the perspective of every feral species, supposing for argument's sake that there are such perspectives, human beings are the single most pernicious species and that the earth would be better off without them.

2. Your answer to this question will depend very much on your religious persuasion or lack thereof. If, for example, you believe in one of the Abrahamic faiths, you may be convinced that since God created the Earth and saw that it was "good" that all believers have a religious duty to be responsible custodians of the Earth on God's behalf. Adherents of several major Eastern religions believe that humans have a similar duty, but for compassionate and/or pantheistic reasons. Atheists, on the other hand, believe that the sense of entitlement that the Scriptures gives man to "... subdue [the earth]: and have dominion over [it]" is recipe for the global ecological disaster that we witness. The Earth and its inhabitants do not exist for the convenience or pleasure of mankind. Except for domesticated breeds they are simply species that co-evolved with humans, with none enjoying fundamental rights of dominion over the other.
3. We all have a moral duty to leave behind a planet that is pristine and hospitable to subsequent generations. However, the tragedy of the commons plays out in the exercise of this duty. The utility to one man of adding one more beast to the herd or taking out one extra tonne of fish from the ocean in this generation is a quantum of nearly +1, since he enjoys all the proceeds of the sale of such stock. The negative component is a function of the additional overgrazing or overfishing shared by all herdsmen or fishermen in this generation which is only a fraction a quantum of -1. In subsequent generations, whose number of herdsmen and fishermen will be more numerous than this, that fraction of a quantum of -1

approaches zero as their numbers down the generations grow without limit. Therefore unless there is a mechanism for mutual restraint in this and every subsequent generation, the only rational strategy for every player in this generation is to exploit the maximum level of resources for personal gain while they are available.

4. To take one example: Several methods of geoengineering have been proposed to mitigate the effects of climate change. These include the installation of space mirrors, cloud seeding and the release of atmospheric aerosols to deflect sunlight as well as carbon capture and burial techniques, including iron fertilization of the oceans to remove CO<sub>2</sub> from the atmosphere. All of these methods are extremely expensive on a global scale and have not been evaluated for long-term safety. And while climate change is only one of the ecological calamities facing this and subsequent generations, the moral hazard of “pollute now and fix later” does not address the source of the problems which will simply continue unchecked. More than fifty years after Hardin’s paper, we can probably safely assume that there is no technical solution to the global anthropogenic tragedy of the commons.

Recently, Michael Schemer (2016) in discussing “Why Malthus makes for bad science policy” proposes the following “solution” to overpopulation:

The problem with Malthusians, Bailey writes, is that they “cannot let go of the simple but clearly wrong idea that human beings are no different than a herd of deer when it comes to reproduction”. Humans are thinking animals. We find solutions – think Norman Borlaug and the Green Revolution. The result is the opposite of what Malthus predicted: the wealthiest nations with the greatest food security have the lowest fertility rates, whereas the most food insecure countries have the highest fertility rates.

The solution to overpopulation is not to force people to have fewer children. China’s one-child policy showed the futility of that experiment. It is to raise the poorest nations out of poverty through democratic governance, free trade, access to birth control, and the education and economic empowerment of women. (p. 63)

These are clearly noble and desirable goals but would that it were so simple. The reality is that the poor will always be with us. Even if we succeed in raising hundreds of millions out of poverty, the poor will continue to outbreed the educated and prosperous. Moreover, as prosperity increases so does *per capita* consumption of energy and other resources, placing additional strain global supply. As we have seen in developing countries like Brazil and South Africa, the net result is not that everybody becomes more prosperous but that the inequality gap widens: the rich become richer and the poor become even poorer.

5. No habitat can indefinitely sustain numbers beyond its carrying capacity. Estimates of the global carrying capacity of the earth for humans vary from between 4 and 16 billion with a median of about 10 billion. (UN World Population Report 2001, p. 31) More recent estimates that factor in resource depletion and increased consumption however are lower. (Wikipedia: Carrying capacity) At some point, if the current trend continues, a population crash will become inevitable - more and more people will succumb to starvation, malnutrition and

disease. As ever more people clash over diminishing resources, all out warfare will be unavoidable as well as a return to a Hobbesian State of Nature for those that survive.

One final possibility is that *Homo sapiens* may speciate. If a privileged class of human beings uses germ-line genetic engineering to enhance their offspring, their descendants may develop into a reproductively isolated daughter species whose evolution is driven not by natural selection but technology. Such a possibility no longer lies solely in the realm of Science Fiction.

## References

American Heritage New Dictionary of Cultural Literacy 3<sup>rd</sup> edition (2005) Houghton Mifflin Company. Retrieved March 24, 2016 from Dictionary.com website <http://www.dictionary.com/browse/man-is-the-measure-of-all-things>

BATESON, G. *et al.* (1956) Toward a theory of schizophrenia. *Behavioral Science*, **1** p. 251 - 264

DARWIN, C. G. (1960) *In: Evolution after Darwin* Vol. 2. Tax, S. Ed. University of Chicago Press: Chicago

DAWKINS, R. (1982) *The Extended Phenotype*. Oxford University Press: London

FLETCHER, J. (1966) *Situational Ethics*. Westminster: Philadelphia.

FLETCHER, J. (1997) *Situation Ethics: The new morality*. Westminster John Knox Press: Louisville, KY

FRANKEL, C. (1955) *The Case for Modern Man*. Harper: New York

FREMLIN, J.H. (1964) How Many People Can the World Support? *New Scientist* No. 415, 285-287

GOODMAN, P. (1968) *New York Review of Books* **10** (8) p. 22

GREAT SOVIET ENCYCLOPEDIA, The (1970-1979) 3rd edition © 2010 The Gale Group, Inc.

HARDIN, G. (1968) The Tragedy of the Commons. *Science* **162** (3859) p. 1243 - 1248

JENA, K. (1990) *Freedom – Practical need*. International Conference on “Future of Atheism -- Humanism” available at <http://www.positiveatheism.org/india/s1990c40.htm> Vijayawada, December 29-31, 1990

KWON, D. (2016) For Shame. *Scientific American Mind* **27** (3) May/June p. 67 - 69

MALTHUS, T. (1798) *An Essay on the Principle of Population*, *In Oxford World's Classics* (reprint)

RUSSELL, B. (1932) *In Praise of Idleness and Other Essays*. Routledge

SHERMER, M. (2016) Domsday Catch - Why Malthus makes for bad science policy. *Scientific American* 314 (5) p. 63

VON NEUMANN, J. & MORGENSTERN O. (1947) *Theory of Games and Economic Behavior*. Princeton University Press: Princeton, NJ.

WHITE, L., Jr. (1967) The Historical Roots of our Ecologic Crisis. *Science* **155** (3767) p. 1203 - 1207