

POPULATION AND THE ENVIRONMENT

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Introduction

One hopes that human wisdom and ethics will continue to grow, but indefinite growth of population and industry on a finite earth is a logical impossibility.

Today we are pressing against the absolute limits of the earth's carrying capacity. There are many indications that the explosively increasing global population of humans, and the growth of pollution-producing and resource-using industries are threatening our earth with an environmental disaster. Among the serious threats that we face are catastrophic anthropogenic climate change, extinction of species, and a severe global famine, perhaps involving billions of people rather than millions. Such a famine may occur by the middle of the present century when the end of the fossil fuel era, combined with the effects of climate change reduce our ability to support a growing population.

This book will attempt to discuss some of the measures that will help us to stabilize global population to achieve a sustainable global society. Most of the material is new, but I have made use of book chapters and articles that I have previously written on these issues.

Stabilizing global population

Experts agree that the following steps are needed if we are to avoid a catastrophic global famine and a population crash:

1. Higher education and higher status for women throughout the world. Women need higher education to qualify for jobs outside their homes. They need higher status within their families so they will not be forced into the role of baby-producing machines.
2. Primary health care for all. Children should be vaccinated against preventable diseases. Materials and information for family planning should be provided for all women who desire smaller families. Advice should be given on improving sanitation.
3. The provision of clean water supplies near to homes is needed in order to reduce the incidence of water-borne diseases. In some countries today, family members, including children, spend large amounts of time carrying water home from distant sources.

4. State provision of care for the elderly is a population-stabilization measure because in many countries, parents produce many children so that the children will provide for them in their old age.
5. In many countries child labor is common, and in some there is even child slavery. Parents who regard their children as a source of income are motivated to produce large families. Enforceable laws against child labor and slavery contribute to population stabilization.
6. General economic progress has been observed to contribute to population stabilization. However in some countries there is a danger of population growing so rapidly that it prevents the economic progress that would otherwise have stabilized population. This situation is known as the demographic trap.
7. Forced marriage should be forbidden, and very early marriage discouraged.

The battle for birth control

Thomas Robert Malthus' *Essay on The Principle of Population*, the first edition of which was published in 1798, was one of the first systematic studies of the problem of population in relation to resources. Earlier discussions of the problem had been published by Botterro in Italy, Robert Wallace in England, and Benjamin Franklin in America. However Malthus' *Essay* was the first to stress the fact that, in general, powerful checks operate continuously to keep human populations from increasing beyond their available food supply. In a later edition, published in 1803, he buttressed this assertion with carefully collected demographic and sociological data from many societies at various periods of their histories.

Malthus considered birth control to be a form of vice, and as "preventive checks" to excessive population growth he instead recommended celibacy, late marriage and "moral restraint" within marriage. Had he been writing today, Malthus would undoubtedly have agreed that birth control is the most humane method of avoiding the grim "positive checks" that prevent populations from exceeding their supply of food - famine, disease and war.

The battle for birth control was not easily won. Part of the opposition to contraceptive methods came from industrialists who were happy to have an excess supply of workers to whom they could pay starvation wages. Chapter 3 of this book discusses the battle for birth control in various countries.

Women in public life

We mentioned above that one of the most important steps in population stabilization is for women to have higher education, higher status, and jobs outside the home. These reforms, like birth control, have been vigorously opposed by the ruling classes of most countries. Chapter 4 outlines the struggle for women's rights. while Chapters 5 and 6 discuss the history of women's struggle for representation in science, politics, literature and the visual arts.

Achieving a sustainable and peaceful global society

The remaining chapters of the book discuss threats to the environment and the steps that will be needed to achieve a stable and peaceful global society. Here are some of the reforms that will be needed:

1. We must achieve a steady-state economic system.
2. We must restore democracy in our own countries whenever it has been replaced by oligarchy.
3. We must decrease economic inequality both between nations and within nations.
4. We must break the power of corporate greed. Economics must be given both a social conscience and an ecological conscience.
5. We must leave fossil fuels in the ground.
6. We must stabilize and ultimately reduce the global population to a level that can be supported by sustainable agriculture after the end of the fossil fuel era.
7. We must stop using material goods for social competition. This will be necessary in order to reduce per-capita consumption.
8. We must eliminate the institution of war. Thermonuclear weapons have made war prohibitively dangerous.
9. We must build a new global ethical system built on the concept of a universal human family.

Chapter 1

MALTHUS REVISITED

1.1 The education of Malthus

T.R. Malthus' *Essay on The Principle of Population*, the first edition of which was published in 1798, was one of the the first systematic studies of the problem of population in relation to resources. Earlier discussions of the problem had been published by Botero in Italy, Robert Wallace in England, and Benjamin Franklin in America. However Malthus' *Essay* was the first to stress the fact that, in general, powerful checks operate continuously to keep human populations from increasing beyond their available food supply. In a later edition, published in 1803, he buttressed this assertion with carefully collected demographic and sociological data from many societies at various periods of their histories.

The publication of Malthus' *Essay* coincided with a wave of disillusionment which followed the optimism of the Enlightenment. The utopian societies predicted by the philosophers of the Enlightenment were compared with reign of terror in Robespierre's France and with the miseries of industrial workers in England; and the discrepancy required an explanation. The optimism which preceded the French Revolution, and the disappointment which followed a few years later, closely paralleled the optimistic expectations of our own century, in the period after the Second World War, when it was thought that the transfer of technology to the less developed parts of the world would eliminate poverty, and the subsequent disappointment when poverty persisted. Science and technology developed rapidly in the second half of the twentieth century, but the benefits which they conferred were just as rapidly consumed by a global population which today is increasing at the rate of one billion people every decade. Because of the close parallel between the optimism and disappointments of Malthus' time and those of our own, much light can be thrown on our present situation by rereading the debate between Malthus and his contemporaries.

Thomas Robert Malthus (1766-1834) came from an intellectual family: His father, Daniel Malthus, was a moderately well-to-do English country gentleman, an enthusiastic believer in the optimistic ideas of the Enlightenment, and a friend of the philosophers Jean-Jaques Rousseau, David Hume and William Godwin. The famous book on population by the younger Malthus grew out of conversations with his father.



Figure 1.1: **The Rookery near Dorking in Surrey**

Daniel Malthus attended Oxford, but left without obtaining a degree. He later built a country home near Dorking, which he called “The Rookery”. The house had Gothic battlements, and the land belonging to it contained a beech forest, an ice house, a corn mill, a large lake, and serpentine walks leading to “several romantic buildings with appropriate dedications”. Daniel Malthus was an ardent admirer of Rousseau; and when the French philosopher visited England with his mistress, Thérèse le Vasseur, Daniel Malthus entertained him at the Rookery. Rousseau and Thérèse undoubtedly saw Daniel’s baby son (who was always called Robert or Bob) and they must have noticed with pity that he had been born with a hare lip. This was later sutured, and apart from a slight scar which marked the operation, he became very handsome.

Robert Malthus was at first tutored at home; but in 1782, when he was 16 years old, he was sent to study at the famous Dissenting Academy at Warrington in Lancashire. Joseph Priestly had taught at Warrington, and he had completed his famous *History of Electricity* there, as well as his *Essay on Government*, which contains the phrase “the greatest good for the greatest number”.

Robert’s tutor at Warrington Academy was Gilbert Wakefield (who was later imprisoned for his radical ideas). When Robert was 18, Wakefield arranged for him to be admitted to Jesus College, Cambridge University, as a student of mathematics. Robert Malthus graduated from Cambridge in 1788 with a first-class degree in mathematics. He was Ninth Wrangler, which meant that he was the ninth-best mathematician in his graduating class. He also won prizes in declamation, both in English and in Latin, which is surprising in view of the speech defect from which he suffered all his life.

1.2 Debate on the views of Godwin and Condorcet

In 1793, Robert Malthus was elected a fellow of Jesus College, and he also took orders in the Anglican Church. He was assigned as Curate to Okewood Chapel in Surrey. This small chapel stood in a woodland region, and Malthus’ illiterate parishioners were so poor

that the women and children went without shoes. They lived in low thatched huts made of woven branches plastered with mud. The floors of these huts were of dirt, and the only light came from tiny window openings. Malthus' parishioners diet consisted almost entirely of bread. The children of these cottagers developed late, and were stunted in growth. Nevertheless, in spite of the harsh conditions of his parishioners' lives, Malthus noticed that the number of births which he recorded in the parish register greatly exceeded the number of deaths. It was probably this fact which first turned his attention to the problem of population.

By this time, Daniel Malthus had sold the Rookery; and after a period of travel, he had settled with his family at Albury, about nine miles from Okewood Chapel. Robert Malthus lived with his parents at Albury, and it was here that the famous debates between father and son took place. 1793, the year when Robert Malthus took up his position at Okewood, was also the year in which Daniel Malthus friend, William Godwin, published his enormously optimistic book, *Political Justice*. In this book, Godwin predicted a future society where scientific progress would liberate humans from material want. Godwin predicted that in the future, with the institution of war abolished, with a more equal distribution of property, and with the help of scientific improvements in agriculture and industry, much less labour would be needed to support life. Luxuries are at present used to maintain artificial distinctions between the classes of society, Godwin wrote, but in the future values will change; humans will live more simply, and their efforts will be devoted to self-fulfillment and to intellectual and moral improvement, rather than to material possessions. With the help of automated agriculture, the citizens of a future society will need only a few hours a day to earn their bread.

Godwin went on to say, "The spirit of oppression, the spirit of servility and the spirit of fraud - these are the immediate growth of the established administration of property. They are alike hostile to intellectual improvement. The other vices of envy, malice, and revenge are their inseparable companions. In a state of society where men lived in the midst of plenty, and where all shared alike the bounties of nature, these sentiments would inevitably expire. The narrow principle of selfishness would vanish. No man being obliged to guard his little store, or provide with anxiety and pain for his restless wants, each would lose his own individual existence in the thought of the general good. No man would be the enemy of his neighbor, for they would have nothing to contend; and of consequence philanthropy would resume the empire which reason assigns her. Mind would be delivered from her perpetual anxiety about corporal support, and free to expatiate in the field of thought which is congenial to her. Each man would assist the inquiries of all."

Godwin insisted that there is an indissoluble link between politics, ethics and knowledge. *Political Justice* is an enthusiastic vision of what humans could be like at some future period when the trend towards moral and intellectual improvement has lifted men and women above their present state of ignorance and vice. Much of the savage structure of the penal system would then be unnecessary, Godwin believed. (At the time when he was writing, there were more than a hundred capital offenses in England, and this number had soon increased to almost two hundred. The theft of any object of greater value than ten shillings was punishable by hanging.) In its present state, Godwin wrote, society



Figure 1.2: **William Godwin (1756-1836).**



Figure 1.3: **Thomas Robert Malthus (1766-1834).**

decrees that the majority of its citizens “should be kept in abject penury, rendered stupid with ignorance and disgustful with vice, perpetuated in nakedness and hunger, goaded to the commission of crimes, and made victims to the merciless laws which the rich have instituted to oppress them”. But human behavior is produced by environment and education, Godwin pointed out. If the conditions of upbringing were improved, behavior would also improve. In fact, Godwin believed that men and women are subject to natural laws no less than the planets of Newton’s solar system. “In the life of every human”, Godwin wrote, “there is a chain of causes, generated in that eternity which preceded his birth, and going on in regular procession through the whole period of his existence, in consequence of which it was impossible for him to act in any instance otherwise than he has acted.”

The chain of causality in human affairs implies that vice and crime should be regarded with the same attitude with which we regard disease. The causes of poverty, ignorance, vice and crime should be removed. Human failings should be cured rather than punished. With this in mind, Godwin wrote, “our disapprobation of vice will be of the same nature as our disapprobation of an infectious distemper.”

In France the Marquis de Condorcet had written an equally optimistic book, *Esquisse d’un Tableau Historique des Progrès de l’Esprit Humain*. Condorcet’s optimism was unaffected even by the fact that at the time when he was writing he was in hiding, under sentence of death by Robespierre’s government. Besides enthusiastically extolling Godwin’s

ideas to his son, Daniel Malthus also told him of the views of Condorcet.

Condorcet's *Esquisse*, is an enthusiastic endorsement of the idea of infinite human perfectibility which was current among the philosophers of the 18th century, and in this book, Condorcet anticipated many of the evolutionary ideas of Charles Darwin. He compared humans with animals, and found many common traits. Condorcet believed that animals are able to think, and even to think rationally, although their thoughts are extremely simple compared with those of humans. He also asserted that humans historically began their existence on the same level as animals and gradually developed to their present state. Since this evolution took place historically, he reasoned, it is probable, or even inevitable, that a similar evolution in the future will bring mankind to a level of physical, mental and moral development which will be as superior to our own present state as we are now superior to animals. In his *Esquisse*, Condorcet called attention to the unusually long period of dependency which characterizes the growth and education of human offspring. This prolonged childhood is unique among living beings. It is needed for the high level of mental development of the human species; but it requires a stable family structure to protect the young during their long upbringing.

Thus, according to Condorcet, biological evolution brought into existence a moral precept, the sanctity of the family.

Similarly, Condorcet maintained, larger associations of humans would have been impossible without some degree of altruism and sensitivity to the suffering of others incorporated into human behavior, either as instincts or as moral precepts or both; and thus the evolution of organized society entailed the development of sensibility and morality.

Condorcet believed that ignorance and error are responsible for vice; and he listened what he regarded as the main mistakes of civilization: hereditary transmission of power, inequality between men and women, religious bigotry, disease, war, slavery, economic inequality, and the division of humanity into mutually exclusive linguistic groups.

Condorcet believed the hereditary transmission of power to be the source of much of the tyranny under which humans suffer; and he looked forward to an era when republican governments would be established throughout the world. Turning to the inequality between men and women, Condorcet wrote that he could see no moral, physical or intellectual basis for it. He called for complete social, legal, and educational equality between the sexes.

Condorcet predicted that the progress of medical science would free humans from the worst ravages of disease. Furthermore, he maintained that since perfectibility (i.e. evolution) operates throughout the biological world, there is no reason why mankind's physical structure might not gradually improve, with the result that human life in the remote future could be greatly prolonged. Condorcet believed that the intellectual and moral facilities of man are capable of continuous and steady improvement; and he thought that one of the most important results of this improvement will be the abolition of war.

As Daniel Malthus talked warmly about Godwin, Condorcet, and the idea of human progress, the mind of his son, Robert, turned to the unbalance between births and deaths which he had noticed among his parishioners at Okewood Chapel. He pointed out to his father that no matter what benefits science might be able to confer, they would soon be eaten up by population growth. Regardless of technical progress, the condition of the



Figure 1.4: The Marquis de Condorcet (1743-1794).

lowest social class would remain exactly the same: The poor would continue to live, as they always had, on the exact borderline between survival and famine, clinging desperately to the lower edge of existence. For them, change for the worse was impossible since it would loosen their precarious hold on life; their children would die and their numbers would diminish until they balanced the supply of food. But any change for the better was equally impossible, because if more nourishment should become available, more of the children of the poor would survive, and the share of food for each of them would again be reduced to the precise minimum required for life.

Observation of his parishioners at Okewood had convinced Robert Malthus that this sombre picture was a realistic description of the condition of the poor in England at the end of the 18th century. Techniques of agriculture and industry were indeed improving rapidly; but among the very poor, population was increasing equally fast, and the misery of society's lowest class remained unaltered.

Daniel Malthus was so impressed with his son's arguments that he urged him to develop them into a small book. Robert Malthus' first essay on population, written in response to his father's urging, was only 50,000 words in length. It was published anonymously in 1798, and its full title was *An Essay on the Principle of Population, as it affects the future improvement of society, with remarks on the speculations of Mr. Godwin, M. Condorcet, and other writers*. Robert Malthus' Essay explored the consequences of his basic thesis: that "the power of population is indefinitely greater than the power in the earth to produce subsistence for man".

1.3 Publication of the first essay in 1798

"That population cannot increase without the means of subsistence", Robert Malthus wrote, "is a proposition so evident that it needs no illustration. That population does invariably increase, where there are means of subsistence, the history of every people who have ever existed will abundantly prove. And that the superior power cannot be checked without producing misery and vice, the ample portion of these two bitter ingredients in the cup of human life, and the continuance of the physical causes that seem to have produced them, bear too convincing a testimony."

In order to illustrate the power of human populations to grow quickly to enormous numbers if left completely unchecked, Malthus turned to statistics from the United States, where the population had doubled every 25 years for a century and a half. Malthus called this type of growth "geometrical" (today we would call it "exponential"); and, drawing on his mathematical education, he illustrated it by the progression 1,2,4,8,16,32,64,128,256,...etc. In order to show that, in the long run, no improvement in agriculture could possibly keep pace with unchecked population growth, Malthus allowed that, in England, agricultural output might with great effort be doubled during the next quarter century; but during a subsequent 25-year period it could not again be doubled. The growth of agricultural output could at the very most follow an arithmetic (linear) progression, 1,2,3,4,5,6,...etc.

Because of the overpoweringly greater numbers which can potentially be generated by

exponential population growth, as contrasted to the slow linear progression of sustenance, Malthus was convinced that at almost all stages of human history, population has not expanded freely, but has instead pressed painfully against the limits of its food supply. He maintained that human numbers are normally held in check either by “vice or misery”. (Malthus classified both war and birth control as a forms of vice.) Occasionally the food supply increases through some improvement in agriculture, or through the opening of new lands; but population then grows very rapidly, and soon a new equilibrium is established, with misery and vice once more holding the population in check.

Like Godwin’s *Political Justice*, Malthus’ *Essay on the Principle of Population* was published at exactly the right moment to capture the prevailing mood of England. In 1793, the mood had been optimistic; but by 1798, hopes for reform had been replaced by reaction and pessimism. Public opinion had been changed by Robespierre’s Reign of Terror and by the threat of a French invasion. Malthus’ clear and powerfully written essay caught the attention of readers not only because it appeared at the right moment, but also because his two contrasting mathematical laws of growth were so striking.

One of Malthus’ readers was William Godwin, who recognized the essay as the strongest challenge to his utopian ideas that had yet been published. Godwin several times invited Malthus to breakfast at his home to discuss social and economic problems. (After some years, however, the friendship between Godwin and Malthus cooled, the debate between them having become more acrimonious.)

In 1801, Godwin published a reply to his critics, among them his former friends James Mackintosh and Samuel Parr, by whom he recently had been attacked. His *Reply to Parr* also contained a reply to Malthus: Godwin granted that the problem of overpopulation raised by Malthus was an extremely serious one. However, Godwin wrote, all that is needed to solve the problem is a change of the attitudes of society. For example we need to abandon the belief “that it is the first duty of princes to watch for (i.e. encourage) the multiplication of their subjects, and that a man or woman who passes the term of life in a condition of celibacy is to be considered as having failed to discharge the principal obligations owed to the community”. “On the contrary”, Godwin continued, “it now appears to be rather the man who rears a numerous family that has to some degree transgressed the consideration he owes to the public welfare”. Godwin suggested that each marriage should be allowed only two or three children or whatever number might be needed to balance the current rates of mortality and celibacy. This duty to society, Godwin wrote, would surely not be too great a hardship to be endured, once the reasons for it were thoroughly understood.

1.4 The second essay published in 1803

Malthus’ small essay had captured public attention in England, and he was anxious to expand it with empirical data which would show his principle of population to be valid not only in England in his own day, but in all societies and all periods. He therefore traveled widely, collecting data. He also made use of the books of explorers, such as Cook and Vancouver.

Malthus second edition - more than three times the length of his original essay on population - was ready in 1803. Book I and Book II of the 1803 edition of Malthus' *Essay* are devoted to a study of the checks to population growth which have operated throughout history in all the countries of the world for which he possessed facts.

In his first chapter, Malthus stressed the potentially enormous power of population growth contrasted the slow growth of the food supply. He concluded that strong checks to the increase of population must almost always be operating to keep human numbers within the bounds of sustenance. He classified the checks as either preventive or positive, the preventive checks being those which reduce fertility, while the positive checks are those which increase mortality. Among the positive checks, Malthus listed "unwholesome occupations, severe labour and exposure to the seasons, extreme poverty, bad nursing of children, great towns, excesses of all kinds, the whole train of common diseases and epidemics, wars, plague, and famine".

In the following chapters of Books I, Malthus showed in detail the mechanisms by which population is held at the level of sustenance in various cultures. He first discussed primitive hunter-gatherer societies, such as the inhabitants of Tierra del Fuego, Van Diemens Land and New Holland, and those tribes of North American Indians living predominantly by hunting. In hunting societies, he pointed out, the population is inevitably very sparse: "The great extent of territory required for the support of the hunter has been repeatedly stated and acknowledged", Malthus wrote, "...The tribes of hunters, like beasts of prey, whom they resemble in their mode of subsistence, will consequently be thinly scattered over the surface of the earth."

"Like beasts of prey, they must either drive away or fly from every rival, and be engaged in perpetual contests with each other...The neighboring nations live in a perpetual state of hostility with each other. The very act of increasing in one tribe must be an act of aggression against its neighbors, as a larger range of territory will be necessary to support its increased numbers.

"The contest will in this case continue, either till the equilibrium is restored by mutual losses, or till the weaker party is exterminated or driven from its country... Their object in battle is not conquest but destruction. The life of the victor depends on the death of the enemy". Malthus concluded that among the American Indians of his time, war was the predominant check to population growth, although famine, disease and infanticide each played a part.

In the next chapter, Malthus quoted Captain Cook's description of the natives of the region near Queen Charlotte's Sound in New Zealand, whose way of life involved perpetual war. "If I had followed the advice of all our pretended friends", Cook wrote, "I might have extirpated the whole race; for the people of each hamlet or village, by turns, applied to me to destroy the other". According to Cook, the New Zealanders practiced both ceaseless war and cannibalism; and population pressure provided a motive for both practices.

In later chapters on nomadic societies of the Near East and Asia, war again appears, not only as a consequence of the growth of human numbers, but also as one of the major mechanisms by which these numbers are reduced to the level of their food supply. The studies quoted by Malthus make it seem likely that the nomadic Tartar tribes of central



Figure 1.5: Captain James Cook, FRS (1728-1779). According to Cook, the native New Zealanders practiced both ceaseless war and cannibalism; and population pressure provided a motive for both practices. Malthus based his description of hunter-gatherer societies on the writings of explorers such as Cook and Vancouver.

Asia made no use of the preventive checks to population growth. In fact the Tartar tribes may have regarded growth of their own populations as useful in their wars with neighboring tribes.

Malthus also described the Germanic tribes of Northern Europe, whose population growth led them to the attacks which destroyed the Roman Empire.

He quoted the following passage from Machiavelli's *History of Florence*: "The people who inhabit the northern parts that lie between the Rhine and the Danube, living in a healthful and prolific climate, often increase to such a degree that vast numbers of them are forced to leave their native country and go in search of new habitations. When any of those provinces begins to grow too populous and wants to disburden itself, the following method is observed. In the first place, it is divided into three parts, in each of which there is an equal portion of the nobility and commonality, the rich and the poor. After this they cast lots; and that division on which the lot falls quits the country and goes to seek its fortune, leaving the other two more room and liberty to enjoy their possessions at home. These emigrations proved the destruction of the Roman Empire". Regarding the Scandinavians in the early middle ages, Malthus wrote: "Mallet relates, what is probably true, that it was their common custom to hold an assembly every spring for the purpose of considering in what quarter they should make war".

In many of the societies which Malthus described, a causal link can be seen, not only between population pressure and poverty, but also between population pressure and war. As one reads his *Essay*, it becomes clear why both these terrible sources of human anguish saturate so much of history, and why efforts to eradicate them have so often met with failure: The only possible way to eliminate poverty and war is to reduce the pressure of population by preventive checks, since the increased food supply produced by occasional cultural advances can give only very temporary relief.

In Book II, Malthus turned to the nations of Europe, as they appeared at the end of the 18th century, and here he presents us with a different picture. Although in these societies poverty, unsanitary housing, child labour, malnutrition and disease all took a heavy toll, war produced far less mortality than in hunting and pastoral societies, and the preventive checks, which lower fertility, played a much larger roll.

Malthus had visited Scandinavia during the summer of 1799, and he had made particularly detailed notes on Norway. He was thus able to present a description of Norwegian economics and demography based on his own studies. Norway was remarkable for having the lowest reliably-recorded death rate of any nation at that time: Only 1 person in 48 died each year in Norway. (By comparison, 1 person in 20 died each year in London.) The rate of marriage was also remarkably low, with only 1 marriage each year for every 130 inhabitants; and thus in spite of the low death rate, Norway's population had increased only slightly from the 723,141 inhabitants recorded in 1769.

There were two reasons for late marriage in Norway: Firstly, every man born of a farmer or a labourer was compelled by law to be a soldier in the reserve army for a period of ten years; and during his military service, he could not marry without the permission of both his commanding officer and the parish priest. These permissions were granted only to those who were clearly in an economic position to support a family. Men could be inducted

into the army at any age between 20 and 30, and since commanding officers preferred older recruits, Norwegian men were often in their 40's before they were free to marry. At the time when Malthus was writing, these rules had just been made less restrictive; but priests still refused to unite couples whose economic foundations they judged to be insufficient.

The second reason for late marriages was the structure of the farming community. In general, Norwegian farms were large; and the owner's household employed many young unmarried men and women as servants. These young people had no chance to marry unless a smaller house on the property became vacant, with its attached small parcel of land for the use of the "houseman"; but because of the low death rate, such vacancies were infrequent.

Thus Norway's remarkably low death rate was balanced by a low birth rate. Other chapters in Book II are devoted to the checks to population growth in Sweden, Russia, Central Europe, Switzerland, France, England, Scotland and Ireland.

Malthus painted a very dark panorama of population pressure and its consequences in human societies throughout the world and throughout history: At the lowest stage of cultural development are the hunter-gatherer societies, where the density of population is extremely low. Nevertheless, the area required to support the hunters is so enormous that even their sparse and thinly scattered numbers press hard against the limits of sustenance. The resulting competition for territory produces merciless intertribal wars.

The domestication of animals makes higher population densities possible; and wherever this new mode of food production is adopted, human numbers rapidly increase; but very soon a new equilibrium is established, with the population of pastoral societies once more pressing painfully against the limits of the food supply, growing a little in good years, and being cut back in bad years by famine, disease and war.

Finally, agricultural societies can maintain extremely high densities of population; but the time required to achieve a new equilibrium is very short. After a brief period of unrestricted growth, human numbers are once more crushed against the barrier of limited resources; and if excess lives are produced by overbreeding, they are soon extinguished by deaths among the children of the poor.

Malthus was conscious that he had drawn an extremely dark picture of the human condition. He excused himself by saying that he has not done it gratuitously, but because he was convinced that the dark shades really are there, and that they form an important part of the picture. He did allow one ray of light, however: By 1803, his own studies of Norway, together with personal conversations with Godwin and the arguments in Godwin's *Reply to Parr*, had convinced Malthus that "moral restraint" should be included among the possible checks to population growth. Thus he concluded Book II of his 1803 edition by saying that the checks which keep population down to the level of the means of subsistence can all be classified under the headings of "moral restraint, vice and misery". (In his first edition he had maintained that vice and misery are the only possibilities).

1.5 Systems of equality

In the 1803 edition of Malthus' *Essay*, Books III and IV form a second volume.

The ideas which he put forward in this second volume are much more open to dispute than are the solidly empirical demographic studies of Books I and II. Malthus excused himself at the beginning of the second volume, saying that he realized that the ideas which he was about to put forward were less solidly based than those in his first volume. However, he said that he wished to explore all the consequences of his principle of population: "...Even the errors into which I may have fallen", he wrote, "by according a handle to argument, and an additional excitement to examination, may be subservient to the important end of bringing a subject so nearly connected with the happiness of society into more general notice".

Malthus began Book III by discussing the systems of equality proposed by Condorcet and Godwin; and he tried to show that such utopian societies would prove impossible in practice, because they would rapidly drown in a flood of excess population. Condorcet himself had recognized this difficulty. He realized that improved living conditions for the poor would lead to a rapid growth of population. "Must not a period then arrive", Condorcet had written, "... when the increase of the number of men surpassing their means of subsistence, the necessary result must be either a continual diminution of happiness and population... or at least a kind of oscillation between good and evil?"

Condorcet believed the serious consequences of population pressure to be far in the future, but Malthus disagreed with him on exactly that point: "M. Condorcet's picture of what may be expected to happen when the number of men shall surpass subsistence is justly drawn... The only point in which I differ from M. Condorcet in this description is with regard to the period when it may be applied to the human race... This constantly subsisting cause of periodical misery has existed in most countries ever since we have had any histories of mankind, and continues to exist at the present moment."

"M. Condorcet, however, goes on to say", Malthus continued, "that should the period, which he conceives to be so distant, ever arrive, the human race, and the advocates of the perfectibility of man, need not be alarmed at it. He then proceeds to remove the difficulty in a manner which I profess not to understand. Having observed that the ridiculous prejudices of superstition would by that time have ceased to throw over morals a corrupt and degrading austerity, he alludes either to a promiscuous concubinage, which would prevent breeding, or to something else as unnatural. To remove the difficulty in this way will surely, in the opinion of most men, be to destroy that virtue and purity of manners which the advocates of equality and of the perfectibility of man profess to be the end and object of their views."

When Malthus referred to "something else as unnatural", he of course meant birth control, some forms of which existed at the time when he was writing; and in this passage we see that he was opposed to the practice. He preferred late marriage or "moral restraint" as a means of limiting excessive population growth.

After his arguments against Condorcet, Malthus discussed William Godwin's egalitarian utopia, which, he said, would be extremely attractive if only it could be achieved: "The

system of equality which Mr. Godwin proposes”, Malthus wrote, “is, on the first view of it, the most beautiful and engaging which has yet appeared. A melioration of society to be produced merely by reason and conviction gives more promise of permanence than any change effected and maintained by force. The unlimited exercise of private judgement is a doctrine grand and captivating, and has a vast superiority over those systems where every individual is in a manner the slave of the public.”

“The substitution of benevolence, as a master-spring and moving principle of society, instead of self-love, appears at first sight to be a consummation devoutly to be wished. In short, it is impossible to contemplate the whole of this fair picture without emotions of delight and admiration, accompanied with an ardent longing for the period of its accomplishment.”

“But alas!” Malthus continued, “That moment can never arrive.... The great error under which Mr. Godwin labours throughout his whole work is the attributing of almost all the vices and misery that prevail in civil society to human institutions. Political regulations and the established administration of property are, with him, the fruitful sources of all evil, the hotbeds of all the crimes that degrade mankind. Were this really a true state of the case, it would not seem a completely hopeless task to remove evil completely from the world; and reason seems to be the proper and adequate instrument for effecting so great a purpose. But the truth is, that though human institutions appear to be, and indeed often are, the obvious and obtrusive causes of much misery in society, they are, in reality, light and superficial in comparison with those deeper-seated causes of evil which result from the laws of nature and the passions of mankind.”

The passions of mankind drive humans to reproduce, while the laws of nature set limits to the carrying capacity of the environment. Godwin’s utopia, if established, would be very favorable to the growth of population; and very soon the shortage of food would lead to its downfall: Because of the overpowering force of population growth, “Man cannot live in the midst of plenty. All cannot share alike the bounties of nature. Were there no established administration of property, every man would be obliged to guard with his force his little store. Selfishness would be triumphant. The subjects of contention would be perpetual. Every individual would be under constant anxiety about corporal support, and not a single intellect would be left free to expatiate in the field of thought.”

Malthus believed that all systems of equality are doomed to failure, not only because of the powerful pressure of population growth, but also because differences between the upper, middle, and lower classes serve the useful purpose of providing humans with an incentive for hard work. He thought that fear of falling to a lower social status, and hope of rising to a higher one, provide a strong incentive for constructive activity. However, he believed that happiness is most often found in the middle ranks of society, and that therefore the highest and lowest classes ought not to be large. Malthus advocated universal education and security of property as means by which the lowest classes of society could be induced to adopt more virtuous and prudent patterns of behavior.

1.6 The Poor Laws

Among the most controversial chapters of Malthus' second volume are those dealing with the Poor Laws. During the reign of Queen Elisabeth I, a law had been enacted according to which justices were authorized to collect taxes in order to set to work "...the children of all such, whose parents shall not by the said persons be thought able to keep and maintain their children; and also such persons, married or unmarried, as, having no means to maintain them, use no ordinary or daily trade to get their living by..". Malthus commented:

"What is this but saying that the funds for the maintenance of labour in this country may be increased without limit by a fiat of government...? Strictly speaking, this clause is as arrogant and absurd as if it had enacted that two ears of wheat should in the future grow where one had grown before. Canute, when he commanded the waves not to wet his princely foot, did not assume a greater power over the laws of nature." Malthus pointed out that if we believe that every person has a right to have as many children as he or she wishes, and if we enact a law, according to which every person born has a right to sustenance, then we implicitly assume that the supply of food can be increased without limit, which of course is impossible.

During the first few years of the nineteenth century there was a severe shortage of food in England, partly because of war with France, and partly because of harvest failures. As a result, the price of wheat tripled, causing great distress among the poor. By 1803, 3,000,000 pounds sterling were being distributed to make up the difference between the wages of poor workers and the amount which they needed to pay for food. Malthus regarded the supply of grain as constant, i.e. independent of the price; and he therefore believed that distribution of money under the Poor Laws merely raised the price of grain still further in relation to wages, forcing a larger number of independent workers to seek help. He thought that the distributed money helped to relieve suffering in some cases, but that it spread the suffering over a wider area.

In some parishes, the amount of money distributed under the Poor Laws was proportional to the number of children in a family, and Malthus believed that this encouraged the growth of population, further aggravating the shortage of food. "A poor man may marry with little or no prospect of being able to support a family in independence", he wrote, "...and the Poor Laws may be said therefore in some measure to create the poor which they maintain; and as the provisions of the country must, in consequence of the increased population, be distributed to every man in smaller proportions, it is evident that the labour of those who are not supported by parish assistance, will purchase a smaller quantity of provisions than before, and consequently more of them must be driven to ask for support." Malthus advocated a very gradual abolition of the Poor Laws, and he believed that while this change was being brought about, the laws ought to be administered in such a way that the position of least well-off independent workers should not be worse than the position of those supported by parish assistance.

1.7 Replies to Malthus

The second edition of Malthus' *Essay* was published in 1803. It provoked a storm of controversy, and a flood of rebuttals. In 1803 England's political situation was sensitive. Revolutions had recently occurred both in America and in France; and in England there was much agitation for radical change, against which Malthus provided counter-arguments. Pitt and his government had taken Malthus' first edition seriously, and had abandoned their plans for extending the Poor Laws. Also, as a consequence of Malthus' ideas, England's first census was taken in 1801. This census, and subsequent ones, taken in 1811, 1821 and 1831, showed that England's population was indeed increasing rapidly, just as Malthus had feared. (The population of England and Wales more than doubled in 80 years, from an estimated 6.6 million in 1750 to almost 14 million in 1831.) In 1803, the issues of poverty and population were at the center of the political arena, and articles refuting Malthus began to stream from the pens of England's authors.

William Coleridge planned to write an article against Malthus, and he made extensive notes in the margins of his copy of the *Essay*. In one place he wrote: "Are Lust and Hunger both alike Passions of physical Necessity, and the one equally with the other independent of the Reason and the Will? Shame upon our race that there lives an individual who dares to ask the Question." In another place Coleridge wrote: "Vice and Virtue subsist in the agreement of the habits of a man with his Reason and Conscience, and these can have but one moral guide, Utility, or the virtue and Happiness of Rational Beings". Although Coleridge never wrote his planned article, his close friend Robert Southey did so, using Coleridge's notes almost verbatim. Some years later Coleridge remarked: "Is it not lamentable - is it not even marvelous - that the monstrous practical sophism of Malthus should now have gained complete possession of the leading men of the kingdom! Such an essential lie in morals - such a practical lie in fact it is too! I solemnly declare that I do not believe that all the heresies and sects and factions which ignorance and the weakness and wickedness of man have ever given birth to, were altogether so disgraceful to man as a Christian, a philosopher, a statesman or citizen, as this abominable tenet."

In 1812, Percy Bysshe Shelley, who was later to become William Godwin's son-in-law, wrote: "Many well-meaning persons... would tell me not to make people happy for fear of over-stocking the world... War, vice and misery are undoubtedly bad; they embrace all that we can conceive of temporal and eternal evil. Are we to be told that these are remedyless, because the earth would in case of their remedy, be overstocked?" A year later, Shelley called Malthus a "priest, eunuch, and tyrant", and accused him, in a pamphlet, of proposing that "... after the poor have been stript naked by the taxgatherer and reduced to bread and tea and fourteen hours of hard labour by their masters.. the last tie by which Nature holds them to benignant earth (whose plenty is garnered up in the strongholds of their tyrants) is to be divided... They are required to abstain from marrying under penalty of starvation... whilst the rich are permitted to add as many mouths to consume the products of the poor as they please".

Godwin himself wrote a long book (which was published in 1820) entitled *Of Population, An Enquiry Concerning the Power and Increase in the Number of Mankind, being an*



Figure 1.6: Coleridge's notes on Malthus: "I do not believe that all the heresies and sects and factions which ignorance and the weakness and wickedness of man have ever given birth to, were altogether so disgraceful to man as a Christian, a philosopher, a statesman or citizen, as this abominable tenet."



Figure 1.7: Shelley: “.. after the poor have been stript naked by the taxgatherer and reduced to bread and tea and fourteen hours of hard labour by their masters.. the last tie by which Nature holds them to benignant earth (whose plenty is garnered up in the strongholds of their tyrants) is to be divided...They are required to abstain from marrying under penalty of starvation...”



Figure 1.8: Tiny Tim, from Charles Dickens' *A Christmas Carol*. When he is informed that Tiny Tim will die unless he receives medical treatment, Scrooge remarks, "Then he had better die and reduce the surplus population!". Many of the events in Dickens' books can be viewed as protests against the ideas of Malthus.



Figure 1.9: Charles Dickens' *Oliver Twist* asks for a second portion of gruel, provoking a storm of outrage. As a boy, Dickens himself spent some time in a workhouse.



Figure 1.10: A portrait of the British political economist, author and social theorist Harriet Martineau (1802-1876). She was a very close friend of Charles Darwin's older brother, Erasmus. Commenting on the ideas of Malthus, she wrote: "Prudence as to time of marriage and making due provision for it was, one would think, a harmless recommendation enough, under the circumstances." Martineau's books were highly successful, sometimes outselling those of Charles Dickens.

answer to Mr. Malthus. One can also view many of the books of Charles Dickens as protests against Malthus' point of view. For example, *Oliver Twist* gives us a picture of a workhouse "administered in such a way that the position of least well-off independent workers should not be worse than the position of those supported by parish assistance."

Among the authors defending Malthus was Harriet Martineau, who wrote: "The desire of his heart and the aim of his work were that domestic virtue and happiness should be placed within the reach of all... He found that a portion of the people were underfed, and that one consequence of this was a fearful mortality among infants; and another consequence the growth of a recklessness among the destitute which caused infanticide, corruption of morals, and at best, marriage between pauper boys and girls; while multitudes of respectable men and women, who paid rates instead of consuming them, were unmarried at forty or never married at all. Prudence as to time of marriage and for making due provision for it was, one would think, a harmless recommendation enough, under the circumstances."

1.8 Ricardo's Iron Law of Wages; the Corn Laws

Malthus continued a life of quiet scholarship, unperturbed by the heated public debate which he had caused. At the age of 38, he married a second cousin. The marriage produced only three children, which at that time was considered to be a very small number. Thus he practiced the pattern of late marriage which he advocated. Although he was appointed rector of a church in Lincolnshire, he never preached there, hiring a curate to do this in his place. Instead of preaching, Malthus accepted an appointment as Professor of History and Political Economy at the East India Company's College at Haileybury. This appointment made him the first professor of economics in England, and probably also the first in the world. Among the important books which he wrote while he held this post was *Principles of Political Economy, Considered with a View to their Practical Application*. Malthus also published numerous revised and expanded editions of his *Essay on the Principle of Population*. The third edition was published in 1806, the fourth in 1807, the fifth in 1817, and the sixth in 1826.

Malthus became a close friend of the wealthy financier and economic theorist, David Ricardo (1772-1823). He and Ricardo met frequently to discuss economic problems, and when circumstances prevented them from meeting, they exchanged endless letters. Ricardo and Malthus differed on the subject of the Corn Laws, but they never allowed this difference of opinion to affect their friendship.

Although shortages of food had produced drastic increases in the price of grain, the import of cheap foreign grain was effectively prevented by the Corn Laws. These laws had been introduced by the large landowners, who controlled Parliament, but they were opposed by the manufacturers, who wished to make less expensive food available to their workers. On this issue, Malthus sided with the landowners, arguing that if England became dependent on imports of foreign grain, the country would be insecure: What if England's ability to export manufactured goods in exchange for the grain should later be undermined



Figure 1.11: The economist David Ricardo (1772-1823), a close friend of Malthus. The joint pessimism of Ricardo and Malthus caused Carlyle to call economics “the dismal science”.

by foreign competition? Malthus pointed out that the country would then face starvation. Ricardo, on the other hand, sided with the rising class of manufacturers. In 1832 the Reform Bill gave the manufacturers control of Parliament, the Corn Laws were repealed, and England's rapidly-growing population became dependent on imports of foreign grain.

Ricardo accepted Malthus' principle of population, and from it he deduced what came to be called his "Iron Law of Wages". According to Ricardo, labor is a commodity, and wages are determined by the law of supply and demand: When wages fall below the starvation level, the workers' children die. Labor then becomes a scarce commodity, and wages rise. On the other hand, when wages rise above the starvation level, the working population multiplies rapidly, labor becomes a plentiful commodity, and wages fall again.

Thus, according to Ricardo, there is an Iron Law which holds wages at the minimum level at which life can be supported. The combined pessimism of Malthus and Ricardo caused Carlyle to call economics "the dismal science".

1.9 The Irish Potato Famine of 1845

Meanwhile, in Ireland, a dramatic series of events had occurred, confirming the ideas of Malthus. Anti-Catholic laws prevented the Irish cottagers from improving their social position; and instead they produced large families, fed almost exclusively on a diet of milk and potatoes. The potato and milk diet allowed a higher density of population to be supported in Ireland than would have been the case if the Irish diet had consisted primarily of wheat. As a result, the population of Ireland grew rapidly: In 1695 it had been approximately one million, but by 1821 it had reached 6,801,827. By 1845, the population of Ireland was more than eight million; and in that year the potato harvest failed because of blight. All who were able to do so fled from the country, many emigrating to the United States; but two million people died of starvation. As the result of this shock, Irish marriage habits changed, and late marriage became the norm, just as Malthus would have wished. After the Potato Famine of 1845, Ireland maintained a stable population of roughly four million.



Figure 1.12: The Irish Potato Famine.



Figure 1.13: The Irish Potato Famine.

1.10 The impact of Malthus on biology

The impact of Malthus' *Essay* was great, not only in demography and political economics, but also in biology. In 1836, Charles Darwin returned from his voyage on the Beagle with a mass of facts and ideas on species out of which he was struggling to construct a coherent picture; and Malthus gave him the clue he needed. "In October, 1838", Darwin wrote later in his Autobiography, "that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement 'Malthus on Population', and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favorable variations would tend to be preserved, and unfavorable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work..."

Darwin wrote a sketch of his theory of evolution through natural selection; but he did not publish it, probably because he had a premonition of the furious opposition which his heretical ideas would provoke. In 1854 he returned to his work on species, but he was writing on a scale which would have developed into an enormous multi-volume work, whose completion might have taken the remainder of his life. Meanwhile, a young English biologist named Alfred Russell Wallace, working in the jungles of Malaysia, arrived at exactly the same theory as Darwin's, and in exactly the same way - by reading Malthus! Wallace wrote a short paper describing his theory and sent it to Darwin, asking the older scientist's opinion. Darwin was at first inclined to burn all his own work on the subject out of fairness to Wallace, but his friends persuaded him to instead write a short paper describing his views, which could be presented together with Wallace's article. The two papers were read together to a meeting of the Linnean Society, which listened in stunned silence. Posterity has given both Darwin and Wallace credit for their joint discovery of the theory of evolution through natural selection.

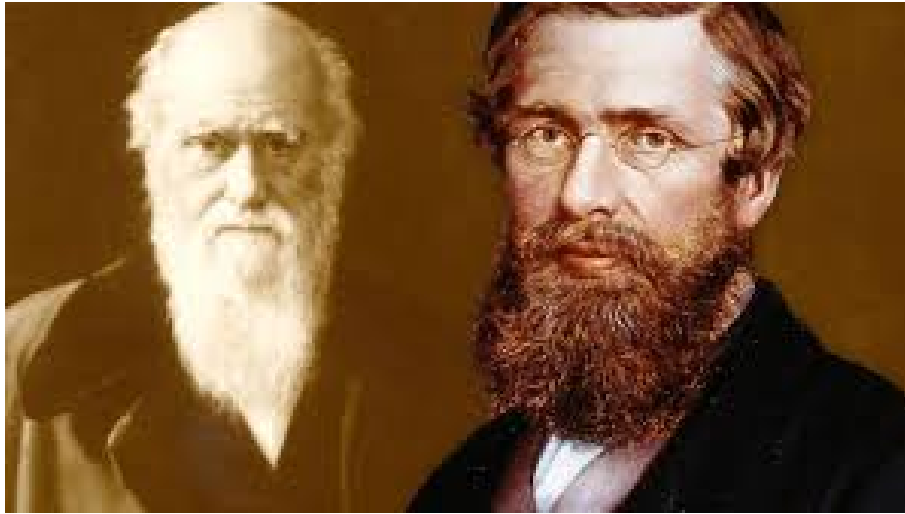


Figure 1.14: Both Charles Darwin and Alfred Russel Wallace arrived at their theories of natural selection in evolution as a result of reading Malthus.

1.11 Malthus importance of Malthus today

Malthus died in Bath in 1834, but debate on his ideas continued to rage, both in his own century and our own. Each year he is refuted, and each year revived. Despite the impressive scientific progress, of our century, the frightful Malthusian forces - poverty, famine, disease, and war - cast as dark a shadow in our own times as they did in the nineteenth century. Indeed, the enormous power of modern weapons has greatly intensified the dangers posed by war; and the rapid growth of global population has given new dimensions to the problems of poverty and famine.

Looking at the world today, we can see regions where Malthus seems to be a truer prophet than Condorcet and Godwin. In most developing countries, poverty and disease are still major problems. In other parts of the world, the optimistic prophecies of Condorcet and Godwin have been at least partially fulfilled. In the industrialized nations, Godwin's prophecy of automatized agriculture has certainly come true. In the nations of the North, only a small percentage of the population is engaged in agriculture, while most of the citizens are free to pursue other goals than food production. Scandinavia is an example of an area where poverty and war have both been eliminated locally, and where death from infectious disease is a rarity.

These achievements would have been impossible without the low birth rates which also characterize the region. In Scandinavia, and in other similar regions, low birth rates and death rates, a stable population, high educational levels, control of infectious disease, equal status for women, democratic governments, and elimination of poverty and war are linked together in a mutually re-enforcing circle of cause and effect. By contrast, in many large third-world cities, overcrowding, contaminated water, polluted air, dense population without adequate sanitation, low status of women, high birth rates, rapidly increasing

population, high unemployment levels, poverty, crime, ethnic conflicts, and resurgence of infectious disease are also linked in a self-perpetuating causal loop - in this case a vicious circle.

Does the contrast between the regions of our contemporary world mean that Malthus has been “proved wrong” in some regions and “proved right” in others? To answer this question, let us re-examine the basic assertion which Malthus puts forward in Books I and II of the 1803 version of his *Essay*.

His basic thesis is that the maximum natural fertility of human populations is greatly in excess of replacement fertility. This being so, Malthus points out, human populations would always increase exponentially if they were not prevented from doing so by powerful and obvious checks. In general, Malthus tells us, populations cannot increase exponentially because the food supply increases slowly, or is constant. Therefore, he concludes, in most societies and almost all periods of history, checks to population growth are operating. These checks may be positive, or they may be preventive, the positive checks being those which raise the death rate, while the preventive checks lower the birth rate. There are, however, Malthus says, exceptional periods of history when the populations of certain societies do actually increase exponentially because of the opening of new lands or because of the introduction of new methods of food production. As an example, he cites the growth of the population of the United States, which doubled every 25 years over a period of 150 years.

We can see, from this review of Malthus’ basic thesis, that his demographic model is flexible enough to describe all of the regions of our contemporary world: If Malthus were living today, he would say that in countries with low birth and death rates and stable populations, the checks to population growth are primarily preventive, while in countries with high death rates, the positive checks are important. Finally, Malthus would describe our rapidly-growing global population as the natural result of the introduction of improved methods of food production in the developing countries. We should notice, however, that the flexibility of Malthus’ demographic model first appears in the 1803 version of his *Essay*: In the 1798 version, he maintained “..that population does invariably increase, where there are means of subsistence..” and “that the superior power (of population) cannot be checked without producing misery and vice..” This narrower model of population did not agree with Malthus’ own observations in Norway in 1799, and therefore in his 1803 *Essay* he allowed more scope for preventive checks, which included late marriage and moral restraint as well as birth control (which he classified under the heading of “vice”).

Hyperbolic trajectory Today we are able to estimate the population of the world at various periods in history, and we can also make estimates of global population in prehistoric times. Looking at the data, we can see that the global population of humans has not followed an exponential curve as a function of time, but has instead followed a hyperbolic trajectory. At the time of Christ, the population of the world is believed to have been approximately 220 million.

By 1500, the earth contained 450 million people, and by 1750, the global population exceeded 700 million. As the industrial and scientific revolution has accelerated, global population has responded by increasing at a breakneck speed: In 1930, the population of

the world reached two billion; in 1958 three billion; in 1974 four billion; in 1988 five billion, and in 1999, six billion.

Today, roughly a billion people are being added to the world's population every decade.

The simple mathematical curve which most nearly approximates the global population of humans as a function of time is an hyperbola of the form $P=C/(2025-t)$. Here P is the population, t is the year, and $C=190,000,000,000$ is a constant. How are we to explain the fact that the population curve is not an exponential? We can turn to Malthus for an answer: According to his model, population does not increase exponentially, except under special circumstances, when the food supply is so ample that the increase of population is entirely unchecked. Malthus gives us instead a model of culturally-driven population growth. He tells us that population increase tends to press against the limits of the food supply, and since these limits are culturally determined, population density is also culturally-determined. Hunter-gatherer societies need large tracts of land for their support; and in such societies, the population density is necessarily low. Pastoral methods of food production can support populations of a higher density. Finally, extremely high densities of population can be supported by modern agriculture. Thus, the hyperbolic curve, $P=C/(2025-t)$, should be seen as describing the rapidly-accelerating growth of human culture, this being understood to include methods of food production.

If we look at the curve, $P=C/(2025-t)$, it is obvious that human culture has reached a period of crisis. The curve predicts that the world's population will rise to infinity in the year 2025, which of course is impossible. Somehow the actual trajectory of global population as a function of time must deviate from the hyperbolic curve, and in fact, the trajectory has already begun to fall away slightly from the hyperbola. Because of the great amount of human suffering which may be involved, and the potentially catastrophic damage to the earth's environment, the question of how the actual trajectory of human population will come to deviate from the hyperbola is a matter of enormous importance. Will population overshoot the sustainable limit, and crash? Or will it gradually approach a maximum? In the case of the second alternative, will the checks which slow population growth be later marriage and family planning? Or will the grim Malthusian forces - famine, disease and war - act to hold the number of humans within their food supply?

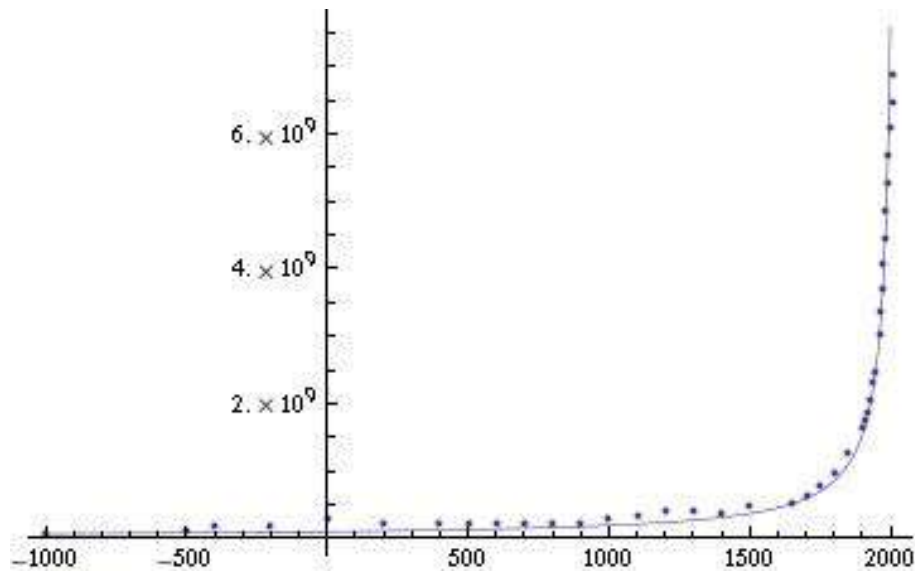


Figure 1.15: The simple mathematical curve that fits best to human population data over the last 3,000 years is not an exponential increase, but rather a hyperbola of the form $P=C/(2025-t)$. Here P represents population, $C=190,000,000,000$ and t is the year. The curve goes to infinity at $t=2025$ (only a few years away), which is of course impossible. Global population has already started to fall away from the hyperbolic trajectory. Will it level off, or will it crash disastrously? Because of the enormous amount of human suffering that would be involved in a population crash, the question has great importance.

1.12 Limits to environmental carrying capacity

There are many indications that both the global population and the size of the global human economy are rapidly approaching absolute limits set by the carrying capacity of the earth's environment. For example, a recent study by Vitousek, Ehrlich, Ehrlich and Matsen showed that 40 percent of the net primary product of land-based photosynthesis is appropriated, directly or indirectly, for human use. (The net primary product of photosynthesis is defined as the amount of solar energy converted to chemical energy by plants minus the energy used by the plants for their own metabolism). Thus, we are only a single doubling time away from 80 percent appropriation, which would certainly imply a disastrous degradation of the natural environment.

Another indication of our rapid approach to the absolute limit of environmental carrying capacity can be found in the present rate of loss of biodiversity. The total number of species of living organisms on the earth is thought to be between 5 million and 30 million, of which only 1.4 million have been described. Between 50 percent and 90 percent of these species live in tropical forests, a habitat which is rapidly being destroyed because of pressures from exploding human populations. 55 percent of the earth's tropical forests have already been cleared and burned; and an additional area four times the size of Switzerland is lost every year. Because of this loss of habitat, tropical species are now becoming extinct at a rate which is many thousands of times the normal background rate. If losses continue at the present rate, 20 percent of all tropical species will vanish irrevocably within the next 50 years. One hardly dares to think of what will happen after that.

Further evidence that the total size of the human economy has reached or exceeded the limits of sustainability comes from global warming, from the destruction of the ozone layer, from the rate of degradation and desertification of land, from statistics on rapidly vanishing non-renewable resources, and from recent famines.

In 1983, the Secretary-General of the United Nations established a World Commission on Environment and Development, led by Gro Harlem Brundtland, who was then Prime Minister of Norway. The Commission's report, *Our Common Future*, examines the question of whether the earth can support a population of 10 billion people without the collapse of the ecological systems on which all life depends. With respect to food, the report has this to say:

"...Researchers have assessed the 'theoretical' potential for global food production. One study assumes that the area under food production can be around 1.5 billion hectares (3.7 billion acres - close to the present level), and that the average yields could go up to 5 tons of grain equivalent per hectare (as against the present average of 2 tons of grain equivalent). Allowing for production from rangelands and marine sources, the total 'potential' is placed at 8 billion tons of grain equivalent."

"How many people can this sustain? The present global average consumption of plant energy for food, seed, and animal feed amounts to about 6,000 calories daily, with a range among countries of 3,000-15,000 calories, depending on the level of meat consumption. On this basis, the potential production could sustain a little more than 11 billion people. But if the average consumption rises substantially - say, to 9,000 calories - the population

carrying capacity of the Earth comes down under 7.5 billion.”

“These figures could be substantially higher if the area under food production and the productivity of 3 billion hectares of permanent pasturage can be increased on a sustainable basis. Nevertheless, the data do suggest that meeting the food requirements of an ultimate world population of around 10 billion would require some changes in food habits, as well as greatly improving the efficiency of traditional agriculture.”

Thus, the next doubling will bring the global population of humans near to or beyond the maximum number that the earth can support, even assuming greatly improved agricultural yields. The study quoted in the Brundtland Report assumes that the world average for agricultural yields per hectare can be doubled; but this assumption raises many problems.

Extremely high-yield varieties of rice and wheat have indeed been produced by “Green Revolution” plant geneticists, such as Norman Borlaug. However, monocultures are vulnerable to plant diseases. Will the exclusive cultivation of high-yield plant varieties expose us to the risk of a repetition of the Irish Potato Famine on a much larger scale? High-yield crop varieties also require heavy use of chemical fertilizers and pesticides, as well as large amounts of water. Will the enormous quantities of fertilizer and water required be available globally?

According to an MIT study (*Man's Impact on the Global Environment*, MIT Press, 1970), the world's food production rose by 34 percent between 1951 and 1966; but this required a 146 percent increase in the use of nitrate fertilizers, and a 300 percent increase in the use of pesticides. Between 1964 and 1987, the fertilizer consumption of Asia increased by a factor of 10, from 4 million metric tons to 40 million metric tons. Much greater increases will be needed if global agriculture is to double its productivity per hectare during the next half century. Assuming the availability of the needed amounts of fertilizer, we can anticipate that the runoff from fields, heavily saturated with nitrates and phosphates and pesticides, will contaminate the ground-water, lakes and oceans, thus reducing fish populations.

One can already observe a catastrophic depletion of oxygen in the bottom layers of such bodies of water as the Baltic Sea (which is surrounded by countries presently making heavy use of fertilizers in agriculture). This oxygen depletion is due to the growth of algae in layers near to the surface, stimulated by the presence of nitrates and phosphates. Bacterial decay of the algae at the bottom exhausts the oxygen; and in many parts of the Baltic, all bottom-living species have disappeared.

Pesticides and fertilizer in drinking water can cause a variety of human health problems, including cancer and methemoglobinemia. (Methemoglobinemia is sometimes called “blue baby syndrome”, and it results from drinking water containing too large a concentration of nitrates.)

If a global population of 10 billion is to be supported, another alternative is open: More land can be exploited for agriculture. However, we may encounter as many problems in doubling the area of the world's agricultural land as in doubling its productivity per hectare.

The cost of roads, irrigation, clearance and fertilizer for new agricultural land averages

more than a thousand U.S. dollars per hectare. During the next half century, hunger will strike the poorest parts of the world's population. Capital for opening new agricultural land cannot come from those who are threatened by famine. It must be found in some other way.

A Report by the United Nations Food and Agricultural Organization makes the following statement concerning new agricultural lands: "In Southern Asia,...in some countries in Eastern Asia, in the Near East, and North Africa...there is almost no scope for expanding the agricultural area... In the dryer regions, it will even be necessary to return to permanent pasture the land which is marginal or sub-marginal for cultivation. In most of Latin America and Africa south of the Sahara, there are still considerable possibilities for expanding cultivated areas; but the costs of development are high, and it will often be more economical to intensify the utilization of the areas already settled."

In the 1950's, both the USSR and Turkey attempted to convert arid grasslands into wheat farms. In both cases, the attempts were defeated by drought and wind erosion, just as the wheat farms of Oklahoma were overcome by drought and dust in the 1930's.

If irrigation of arid lands is not performed with care, salt may be deposited, so that the land is ruined for agriculture. This type of desertification can be seen, for example, in some parts of Pakistan. Another type of desertification can be seen in the Sahel region of Africa, south of the Sahara.

Rapid population growth in the Sahel has led to overgrazing, destruction of trees, and wind erosion, so that the land has become unable to support even its original population. In the Sahel, and in many other regions of the world, scarcity of fresh water may become critical as populations increase, a fact which is indicated by quickly-falling water tables in many regions.

Added to the agricultural and environmental problems, are problems of finance and distribution. Famines can occur even when grain is available somewhere in the world, because those who are threatened with starvation may not be able to pay for the grain, or for its transportation. The economic laws of supply and demand are not able to solve this type of problem. One says that there is no "demand" for the food (meaning demand in the economic sense), even though people are in fact starving.

We can anticipate that as the earth's human population approaches 10 billion, severe famines will occur in many developing countries. The beginnings of this tragedy can already be seen. It is estimated that roughly 30,000 children now die every day from starvation, or from a combination of disease and malnutrition.

An analysis of the global ratio of population to cropland shows that we may already have exceeded the sustainable limit of population through our dependence on petroleum: Between 1950 and 1982, the use of cheap synthetic fertilizers increased by a factor of 8. Much of our present agricultural output depends on their use, but their production is expensive in terms of energy. Furthermore, petroleum-derived synthetic fibers have reduced the amount of cropland needed for growing natural fibers, and petroleum-driven tractors have replaced draft animals which required cropland for pasturage. Also, petroleum fuels have replaced fuelwood and other fuels derived from biomass.

The reverse transition, from fossil fuels back to renewable energy sources, will require



Figure 1.16: **Climate change, overgrazing and lack of water have turned many formerly-fertile areas of the world into deserts.**

a considerable diversion of land from food production to energy production. For example, 1.1 hectares are needed to grow the sugarcane required for each alcohol-driven Brazilian automobile. This figure may be compared with the steadily falling average area of cropland available to each person in the world: .24 hectares in 1950, .16 hectares in 1982.

As population increases, the cropland per person will continue to fall, and we will be forced to make still heavier use of fertilizers to increase output per hectare. Also marginal land will be used in agriculture, with the probable result that much land will be degraded through erosion and salination. Reserves of oil are likely to be exhausted by the end of 21st century. Thus there is a danger that just as global population reaches the unprecedented level of 10 billion or more, the agricultural base for supporting it may suddenly collapse.

The resulting ecological catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history - a catastrophe of unimaginable proportions, involving billions rather than millions of people.

The resources of the earth and the techniques of modern science can support a global population of moderate size in comfort and security; but the optimum size is probably much smaller than the world's present population.

Given a sufficiently small global population, renewable sources of energy can be found to replace disappearing fossil fuels. Technology may also be able to find renewable substitutes for many disappearing mineral resources for a global population of a moderate size. What technology cannot do, however, is to give a global population of 10 billion people the standard of living which the industrialized countries enjoy today.

1.13 What would Malthus say today?

What would Malthus tell us if he were alive today? Undoubtedly he would say that we have reached a period of human history where it is vital to stabilize the world's population if catastrophic environmental degradation and famine are to be avoided. He would applaud efforts to reduce suffering by eliminating poverty, widespread disease, and war; but he would point out that, since it is necessary to stop the rapid increase of human numbers, it follows that whenever the positive checks to population growth are removed, it is absolutely necessary to replace them by preventive checks. Malthus' point of view became more broad in the successive editions of his *Essay*; and if he were alive today, he might even agree that family planning is the most humane of the preventive checks.

In Malthus' *Essay on the Principle of Population*, population pressure appears as one of the main causes of war; and Malthus also discusses many societies in which war is one of the the principle means by which population is reduced to the level of the food supply. Thus, his *Essay* contains another important message for our own times: If he were alive today, Malthus would also say that there is a close link between the two most urgent tasks which history has given to the 21st century - stabilization of the global population, and abolition of the institution of war.

Suggestions for further reading

1. A. Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, Rodale Books, New York, (2006).
2. A. Gore, *Earth in the Balance: Forging a New Common Purpose*, Earthscan, (1992).
3. A.H. Ehrlich and P.R. Ehrlich, *Earth*, Thames and Methuen, (1987).pro Simon and Schuster, (1990).
4. P.R. Ehrlich and A.H. Ehrlich, *Healing the Planet: Strategies for Resolving the Environmental Crisis*, Addison-Wesley, (1991).
5. P.R. Ehrlich and A.H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens our Future*, Island Press, (1998).
6. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
7. A.H. Ehrlich and U. Lele, *Humankind at the Crossroads: Building a Sustainable Food System*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
8. P.R. Ehrlich, *The Population Bomb*, Sierra/Ballentine, New York, (1972).
9. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Human Ecology*, W.H. Freeman, San Francisco, (1972).
10. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Ecoscience: Population, Resources, Environment*, W.H. Freeman, San Francisco, (1977)
11. P.R. Ehrlich and A.H. Ehrlich, *Extinction*, Victor Gollancz, London, (1982).

12. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
13. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).
14. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
15. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
16. A. Peccei, *The Human Quality*, Pergamon Press, Oxford, (1977).
17. A. Peccei, *One Hundred Pages for the Future*, Pergamon Press, New York, (1977).
18. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
19. R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
20. IPCC, Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis*, (2001).
21. N. Stern et al., *The Stern Review*, www.sternreview.org.uk, (2006).
22. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).
23. P.M. Vitousek, H.A. Mooney, J. Lubchenco and J.M. Melillo, *Human Domination of Earth's Ecosystems*, *Science*, **277**, 494-499, (1997).
24. P.M. Vitousek, P.R. Ehrlich, A.H. Ehrlich and P.A. Matson, *Human Appropriation of the Products of Photosynthesis*, *Bioscience*, **34**, 368-373, (1986).
25. D. King, *Climate Change Science: Adapt, Mitigate or Ignore*, *Science*, **303** (5655), pp. 176-177, (2004).
26. S. Connor, *Global Warming Past Point of No Return*, *The Independent*, (116 September, 2005).
27. D. Rind, *Drying Out the Tropics*, *New Scientist* (6 May, 1995).
28. J. Patz et al., *Impact of Regional Climate Change on Human Health*, *Nature*, (17 November, 2005).
29. M. McCarthy, *China Crisis: Threat to the Global Environment*, *The Independent*, (19 October, 2005).
30. L.R. Brown, *The Twenty-Ninth Day*, W.W. Norton, New York, (1978).
31. N. Myers, *The Sinking Ark*, Pergamon, New York, (1972).
32. N. Myers, *Conservation of Tropical Moist Forests*, National Academy of Sciences, Washington D.C., (1980).
33. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
34. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
35. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
36. E. Eckholm, *The Picture of Health: Environmental Sources of Disease*, New York, (1976).

37. Economic Commission for Europe, *Air Pollution Across Boundaries*, United Nations, New York, (1985).
38. G. Hagman and others, *Prevention is Better Than Cure*, Report on Human Environmental Disasters in the Third World, Swedish Red Cross, Stockholm, Stockholm, (1986).
39. G. Hardin, "The Tragedy of the Commons", *Science*, December 13, (1968).
40. K. Newland, *Infant Mortality and the Health of Societies*, Worldwatch Paper 47, Worldwatch Institute, Washington D.C., (1981).
41. D.W. Orr, *Ecological Literacy*, State University of New York Press, Albany, (1992).
42. E. Pestel, *Beyond the Limits to Growth*, Universe Books, New York, (1989).
43. D.C. Pirages and P.R. Ehrlich, *Ark II: Social Responses to Environmental Imperatives*, W.H. Freeman, San Francisco, (1974).
44. Population Reference Bureau, *World Population Data Sheet*, PRM, 777 Fourteenth Street NW, Washington D.C. 20007, (published annually).
45. R. Pressat, *Population*, Penguin Books Ltd., (1970).
46. M. Rechcigl (ed.), *Man/Food Equation*, Academic Press, New York, (1975).
47. J.C. Ryan, *Life Support: Conserving Biological Diversity*, Worldwatch Paper 108, Worldwatch Institute, Washington D.C., (1992).
48. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
49. B. Stokes, *Local Responses to Global Problems: A Key to Meeting Basic Human Needs*, Worldwatch Paper 17, Worldwatch Institute, Washington D.C., (1978).
50. L. Timberlake, *Only One Earth: Living for the Future*, BBC/ Earthscan, London, (1987).
51. UNEP, *Environmental Data Report*, Blackwell, Oxford, (published annually).
52. UNESCO, *International Coordinating Council of Man and the Biosphere*, MAB Report Series No. 58, Paris, (1985).
53. United Nations Fund for Population Activities, *A Bibliography of United Nations Publications on Population*, United Nations, New York, (1977).
54. United Nations Fund for Population Activities, *The State of World Population*, UNPF, 220 East 42nd Street, New York, 10017, (published annually).
55. United Nations Secretariat, *World Population Prospects Beyond the Year 2000*, U.N., New York, (1973).
56. J. van Klinken, *Het Dierde Punte*, Uitgiversmaatschappij J.H. Kok-Kampen, Netherlands (1989).
57. B. Ward and R. Dubos, *Only One Earth*, Penguin Books Ltd., (1973).
58. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
59. E.O. Wilson, *Sociobiology*, Harvard University Press, (1975).
60. E.O. Wilson (ed.), *Biodiversity*, National Academy Press, Washington D.C., (1988).
61. E.O. Wilson, *The Diversity of Life*, Allen Lane, The Penguin Press, London, (1992).
62. G. Woodwell (ed.), *The Earth in Transition: Patterns and Processes of Biotic Impoverishment*, Cambridge University Press, (1990).

63. World Resources Institute (WRI), *Global Biodiversity Strategy*, The World Conservation Union (IUCN), United Nations Environment Programme (UNEP), (1992).
64. World Resources Institute, *World Resources 200-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
65. D.W. Pearce and R.K. Turner, *Economics of Natural Resources and the Environment*, Johns Hopkins University Press, Baltimore, (1990).
66. P. Bartelmus, *Environment, Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, New York, (1994).
67. H.E. Daly and K.N. Townsend, (editors), *Valuing the Earth. Economics, Ecology, Ethics*, MIT Press, Cambridge, Massachusetts, (1993)
68. C. Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Paper 91, Worldwatch Institute, Washington D.C., (1989).
69. S.H. Schneider, *The Genesis Strategy: Climate and Global Survival*, Plenum Press, (1976).
70. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
71. World Commission on Environment and Development, *Our Common Future*, Oxford University Press, (1987).
72. W. Jackson, *Man and the Environment*, Wm. C. Brown, Dubuque, Iowa, (1971).
73. T. Berry, *The Dream of the Earth*, Sierra Club Books, San Francisco, (1988).
74. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).
75. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
76. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
77. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).
78. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
79. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
80. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
81. British Petroleum, *BP Statistical Review of World Energy*, (published yearly).
82. R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
83. J. Darmstadter, *A Global Energy Perspective*, Sustainable Development Issue Backgrounder, Resources for the Future, (2002).
84. D.C. Hall and J.V. Hall, *Concepts and Measures of Natural Resource Scarcity*, *Journal of Environmental Economics and Management*, **11**, 363-379, (1984).

85. M.K. Hubbert, *Energy Resources*, in *Resources and Man: A Study and Recommendations*, Committee on Resources and Man, National Academy of Sciences, National Research Council, W.H. Freeman, San Francisco, (1969).
86. J.A. Krautkraemer, *Nonrenewable Resource Scarcity*, *Journal of Economic Literature*, bf 36, 2065-2107, (1998).
87. C.J. Cleveland, *Physical and Economic Aspects of Natural Resource Scarcity: The Cost of Oil Supply in the Lower 48 United States 1936-1987*, *Resources and Energy* **13**, 163-188, (1991).
88. C.J. Cleveland, *Yield Per Effort for Additions to Crude Oil Reserves in the Lower 48 States, 1946-1989*, *American Association of Petroleum Geologists Bulletin*, **76**, 948-958, (1992).
89. M.K. Hubbert, *Technique of Prediction as Applied to the Production of Oil and Gas*, in *NBS Special Publication 631*, US Department of Commerce, National Bureau of Standards, (1982).
90. L.F. Ivanhoe, *Oil Discovery Indices and Projected Discoveries*, *Oil and Gas Journal*, **11**, 19, (1984).
91. L.F. Ivanhoe, *Future Crude Oil Supplies and Prices*, *Oil and Gas Journal*, July 25, 111-112, (1988).
92. L.F. Ivanhoe, *Updated Hubbert Curves Analyze World Oil Supply*, *World Oil*, November, 91-94, (1996).
93. L.F. Ivanhoe, *Get Ready for Another Oil Shock!*, *The Futurist*, January-February, 20-23, (1997).
94. Energy Information Administration, *International Energy Outlook, 2001*, US Department of Energy, (2001).
95. Energy Information Administration, *Caspian Sea Region*, US Department of Energy, (2001).
96. National Energy Policy Development Group, *National Energy Policy*, The White House, (2004). (<http://www.whitehouse.gov/energy/>)
97. IEA, *CO2 from Fuel Combustion Fact-Sheet*, International Energy Agency, (2005).
98. H. Youguo, *China's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity*, International Energy Agency, (2003).
99. R.H. Williams, *Advanced Energy Supply Technologies*, in *World Energy Assessment: Energy and the Challenge of Sustainability*, UNDP, (2000).
100. H. Lehmann, *Energy Rich Japan*, Institute for Sustainable Solutions and Innovations, Aachen, (2003).
101. W.V. Chandler, *Materials Recycling: The Virtue of Necessity*, Worldwatch Paper 56, Worldwatch Institute, Washington D.C, (1983).
102. W.C. Clark and others, *Managing Planet Earth*, Special Issue, *Scientific American*, September, (1989).
103. B. Commoner, *The Closing Circle: Nature, Man and Technology*, Bantam Books, New York, (1972).
104. J.R. Frisch, *Energy 2000-2020: World Prospects and Regional Stresses*, World Energy Conference, Graham and Trotman, (1983).

105. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
106. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
107. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
108. C. Pollock, *Mining Urban Wastes: The Potential for Recycling*, Worldwatch Paper 76, Worldwatch Institute, Washington D.C., (1987).
109. World Resources Institute, *World Resources*, Oxford University Press, New York, (published annually).
110. World Resources Institute, *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
111. J.E. Young, John E., *Mining the Earth*, Worldwatch Paper 109, Worldwatch Institute, Washington D.C., (1992).
112. J.R. Craig, D.J. Vaughan and B.J. Skinner, *Resources of the Earth: Origin, Use and Environmental Impact, Third Edition*, Prentice Hall, (2001).
113. W. Youngquist, *Geodestinies: The Inevitable Control of Earth Resources Over Nations and Individuals*, National Book Company, Portland Oregon, (1997).
114. M. Tanzer, *The Race for Resources. Continuing Struggles Over Minerals and Fuels*, Monthly Review Press, New York, (1980).
115. C.B. Reed, *Fuels, Minerals and Human Survival*, Ann Arbor Science Publishers Inc., Ann Arbor Michigan, (1975).
116. M.K. Hubbert, *Energy Resources*, in *Resources and Man: A Study and Recommendations*, Committee on Resources and Man, National Academy of Sciences, National Research Council, W.H. Freeman, San Francisco, (1969).
117. J.A. Krautkraemer, *Nonrenewable Resource Scarcity*, *Journal of Economic Literature*, bf 36, 2065-2107, (1998).
118. C.J. Cleveland, *Physical and Economic Aspects of Natural Resource Scarcity: The Cost of Oil Supply in the Lower 48 United States 1936-1987*, *Resources and Energy* **13**, 163-188, (1991).
119. C.J. Cleveland, *Yield Per Effort for Additions to Crude Oil Reserves in the Lower 48 States, 1946-1989*, *American Association of Petroleum Geologists Bulletin*, **76**, 948-958, (1992).
120. M.K. Hubbert, *Technique of Prediction as Applied to the Production of Oil and Gas*, in *NBS Special Publication 631*, US Department of Commerce, National Bureau of Standards, (1982).
121. Energy Information Administration, *International Energy Outlook, 2001*, US Department of Energy, (2001).
122. Energy Information Administration, *Caspian Sea Region*, US Department of Energy, (2001).
123. National Energy Policy Development Group, *National Energy Policy*, The White House, (2004). (<http://www.whitehouse.gov/energy/>)
124. M. Klare, *Bush-Cheney Energy Strategy: Procuring the Rest of the World's Oil*, *Foreign Policy in Focus*, (Interhemispheric Resource Center/Institute for Policy Studies/SEEN), Washington DC and Silver City NM, January, (2004).

125. IEA, *CO₂ from Fuel Combustion Fact-Sheet*, International Energy Agency, (2005).
126. H. Youguo, *China's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity*, International Energy Agency, (2003).
127. R.H. Williams, *Advanced Energy Supply Technologies*, in *World Energy Assessment: Energy and the Challenge of Sustainability*, UNDP, (2000).
128. H. Lehmann, *Energy Rich Japan*, Institute for Sustainable Solutions and Innovations, Aachen, (2003).
129. W.V. Chandler, *Materials Recycling: The Virtue of Necessity*, Worldwatch Paper 56, Worldwatch Institute, Washington D.C, (1983).
130. J.R. Frisch, *Energy 2000-2020: World Prospects and Regional Stresses*, World Energy Conference, Graham and Trotman, (1983).
131. J. Gever, R. Kaufmann, D. Skole and C. Vorosmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge MA, (1986).
132. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
133. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
134. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
135. P.B. Smith, J.D. Schilling and A.P. Haines, *Introduction and Summary*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
136. World Resources Institute, *World Resources*, Oxford University Press, New York, (published annually).
137. J.R. Craig, D.J. Vaughan and B.J. Skinner, *Resources of the Earth: Origin, Use and Environmental Impact, Third Edition*, Prentice Hall, (2001).
138. W. Youngquist, *Ge destinies: The Inevitable Control of Earth Resources Over Nations and Individuals*, National Book Company, Portland Oregon, (1997).
139. M. Tanzer, *The Race for Resources. Continuing Struggles Over Minerals and Fuels*, Monthly Review Press, New York, (1980).
140. C.B. Reed, *Fuels, Minerals and Human Survival*, Ann Arbor Science Publishers Inc., Ann Arbor Michigan, (1975).
141. A.A. Bartlett, *Forgotten Fundamentals of the Energy Crisis*, American Journal of Physics, **46**, 876-888, (1978).
142. N. Gall, *We are Living Off Our Capital*, Forbes, September, (1986).

Chapter 2

STEPS NEEDED FOR POPULATION STABILIZATION

2.1 All the needed reforms are desirable in themselves

Experts agree that the following steps are needed if we are to avoid a catastrophic global famine and population crash:

1. Higher education and higher status for women throughout the world. Women need higher education to qualify for jobs outside their homes, and higher status within their families so they will not be forced into the role of baby-producing machines.
2. Primary health care for all. Children should be vaccinated against preventable diseases. Materials and information for family planning should be provided for all women who desire smaller families. Advice should be given on improving sanitation.
3. The provision of clean water supplies near to homes is needed in order to reduce the incidence of water-borne diseases. In some countries today, family members, including children, spend large amounts of time carrying water home from distant sources.
4. State provision of care for the elderly is a population-stabilization measure because in many countries, parents produce many children so that the children will provide for them in their old age.
5. In many countries child labor is common, and in some there is even child slavery. Parents who regard their children as a source of income are motivated to produce large families. Enforceable laws against child labor and slavery contribute to population stabilization.
6. General economic progress has been observed to contribute to population stabilization. However in some countries there is a danger of population growing so rapidly that it prevents the economic progress that would otherwise have stabilized population. This situation is known as the demographic trap.



Figure 2.1: **Professor Sir Partha Dasgupta of Cambridge University has pointed out that all of the steps are needed for population stabilization are desirable in themselves.**

2.2 Higher status and higher education for women

It is only recently that women have had the right to vote. In most of the industrialized countries, this right was only granted during the early part of the 20th century. In some countries, this reform was even slower. For example, in Switzerland, it was only in 1971 that women gained the right to vote in federal elections. In Lichtenstein, women's right to vote was delayed until 1981. It was only in December, 2015 that Saudi Arabia granted the right to vote to women. Currently, the only country in the world where this right is denied is the Vatican City.

It is important that women should have equal political representation because female representation not only advances gender equality in legal matters, such as the inheritance of property, but also promotes the rights of children.

Prior to the 20th century, women were very largely barred from higher education. In later chapters we will look at some particular cases. For example, the famous pioneer of modern educational methods, Dr. Maria Montessori, had to overcome many barriers to obtain her medical degree.

With higher education, comes the motivation and the opportunity for women to have jobs outside their homes. With lower rates of infant mortality, and the aid of machines, being a housewife and mother has become less and less a lifelong full-time occupation. Experts agree that higher education for women, and jobs for women outside their homes are vitally important measures for population stabilization; but these reforms are also very desirable for their own sake, for the sake of justice, and for the sake of the uniquely life-oriented vision that women can bring to public life.



Figure 2.2: Higher education and higher political representation for women are vitally needed reforms.

2.3 Primary health care for all

An International Conference on Primary Health Care took place at Alma-Ata, USSR, 6-12 September, 1978. Point **VII** of the Alma-Ata Declaration defines primary health care as follows:

Primary health care

1. *reflects and evolves from the economic conditions and sociocultural and political characteristics of the country and its communities and is based on the application of the relevant results of social, biomedical and health services research and public health experience;*
2. *addresses the main health problems in the community, providing promotive, preventive, curative and rehabilitative services accordingly;*
3. *includes at least: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs;*
4. *involves, in addition to the health sector, all related sectors and aspects of national and community development, in particular agriculture, animal husbandry, food, industry, education, housing, public works, communications and other sectors; and demands the coordinated efforts of all those sectors;*
5. *requires and promotes maximum community and individual self-reliance and participation in the planning, organization, operation and control of primary health care,*



Figure 2.3: The provision of primary health care to all countries throughout the world should include not only measures, such as vaccination, for the prevention of diseases, but also making advice and materials for family planning available to all women who desire them.



Figure 2.4: Bill and Melinda Gates.

making fullest use of local, national and other available resources; and to this end develops through appropriate education the ability of communities to participate;

- 6. should be sustained by integrated, functional and mutually supportive referral systems, leading to the progressive improvement of comprehensive health care for all, and giving priority to those most in need;*
- 7. relies, at local and referral levels, on health workers, including physicians, nurses, midwives, auxiliaries and community workers as applicable, as well as traditional practitioners as needed, suitably trained socially and technically to work as a health team and to respond to the expressed health needs of the community.*

Provision of primary health care is high on the list of priorities of the World Health Organization. The Bill and Melinda Gates Foundation has also made great financial contributions to this goal.



Figure 2.5: **Carrying water from distant sources to homes is a time-consuming burden. Often this task is performed by children.**

2.4 Clean water supplies near homes

According to the World Health Organization, 842,000 deaths per year are attributable to a lack of safe drinking water supply, sanitation and hygiene. Wikipedia states that “Waterborne diseases can have a significant impact on the economy, locally as well as internationally. People who are infected by a waterborne disease are usually confronted with related costs and not seldom with a huge financial burden. This is especially the case in less developed countries. The financial losses are mostly caused by e.g. costs for medical treatment and medication, costs for transport, special food, and by the loss of manpower. Many families must even sell their land to pay for treatment in a proper hospital. On average, a family spends about 10% of the monthly households income per person infected.”

2.5 State provision of care for the elderly

In many countries, elderly parents have traditionally been cared for by their children. This is one of the motives for large family size. Parents with many children feel that they will have a secure old age. For example, in India, parents are typically cared for by their children into old age, most commonly by their sons. Thus, many parents in India continue to have children until they produce a son, and this often leads to large family sizes. State supported care for the elderly throughout the world is an important step that is needed for population stabilization.



Figure 2.6: **Government-provided care for the elderly will help to stabilize the currently-exploding global population of humans.**

2.6 Abolition of child labor and slavery

Today the hard-won achievements of reformers in the industrialized countries are being undermined and lost because of uncritical and unregulated globalization. A factory owner or CEO, anxious to avoid high labor costs, and anxious to violate environmental regulations merely moves his factory to a country where laws against child labor and rape of the environment do not exist or are poorly enforced. In fact, he must do so or be fired, since the only thing that matters to the stockholders is the bottom line. One might say (as someone has done), that Adam Smith's invisible hand is at the throat of the world's peoples and at the throat of the global environment.

The movement of a factory from Europe or North America to a country with poorly enforced laws against environmental destruction, child labor and slavery puts workers into unfair competition. Unless they are willing to accept revival of the unspeakable conditions of the early Industrial Revolution, they are unable to compete.

Today, child labor accounts for 22% of the workforce in Asia, 32% in Africa, and 17% in Latin America. Large-scale slavery also exists today, although there are formal laws against it in every country. There are more slaves now than ever before - their number is estimated to be between 12 million and 27 million. Besides outright slaves, who are bought and sold for as little as 100 dollars, there many millions of workers whose lack of options and dreadful working conditions must be described as slave-like.

We need to reform our economic system to give it both a social conscience and an ecological conscience. Perhaps some of the things that the world produces and consumes today are not really necessary.



Figure 2.7: Laws prohibiting child labor are non-existent in many countries, or poorly enforced.



Figure 2.8: More slaves exist today than ever before.

2.7 General economic progress

It has been observed that general economic progress leads to population stabilization. However, it often happens that population growth in a country is so rapid that it prevents economic progress. This phenomenon is known as the *demographic trap*. For example, if we look at the population-age structure of Egypt in 2005, shown in Figure 2.9, we see that there are very many young people approaching reproductive age, and very few old people. Thus the birth rate will not be balanced by the death rate, and the population of any country with a similar population-age structure can be expected to grow rapidly, preventing the economic development that might have slowed population growth. In such a situation, strong state-supported birth control programs are clearly needed.

Very early marriage and forced marriage must also be discouraged. We can recall that Malthus mentions late marriage as one of the preventive checks to population growth. Forced and child marriages entrap women and young girls in relationships that deprive them of their basic human rights. Forced marriage constitutes a human rights violation in and of itself.

According to the website Stop Violence Against Women, “In 2003, the International Centre for Research on Women estimated that more than 51 million girls under 18 years were married and they expected the figure to rise to over 100 million within the next ten years. Similarly, in 2006, experts estimated that thirty-eight percent of young women aged 20 to 24 in the fifty least developed countries were married before the age of 18.

“In *Early Marriage: A Harmful Traditional Practice*, UNICEF estimates that among women aged 15 to 24, 48 percent were married before the age of 18 in South Asia. In Bangladesh, 27.3 percent of women aged 15 to 19 years old were married by the age of 15, and 65.3 percent of women aged 20 to 24 were married before the age of 18.

“UNICEF estimates that in Africa 42 percent of women aged 15 to 24 were married before the age of 18. In Niger, 27.3 percent of women ages 15 to 19 were married before the age of 15, and 76.6 percent of women ages 20 to 24 were married before the age of 18. According to surveys conducted by the National Committee on Traditional Practices of Ethiopia (NCTPE), the prevalence of marriage by abduction is as high as 92 per cent in Southern Nations Nationalities and Peoples Region (SNNPR), with a national average of 69 percent.”

Today’s world is one in which the wealth of the richest 1% of the global population increased by 82% in 2017, while for the poorest half of humanity there was no increase at all. It is a world where an estimated 11 million children die every year from starvation or from diseases related to poverty. It is a world where obesity is a serious public health problem in rich nations, while at the same time, children in poorer countries scavenge among toxic wastes in garbage dumps. It is a world where almost a billion people are undernourished.

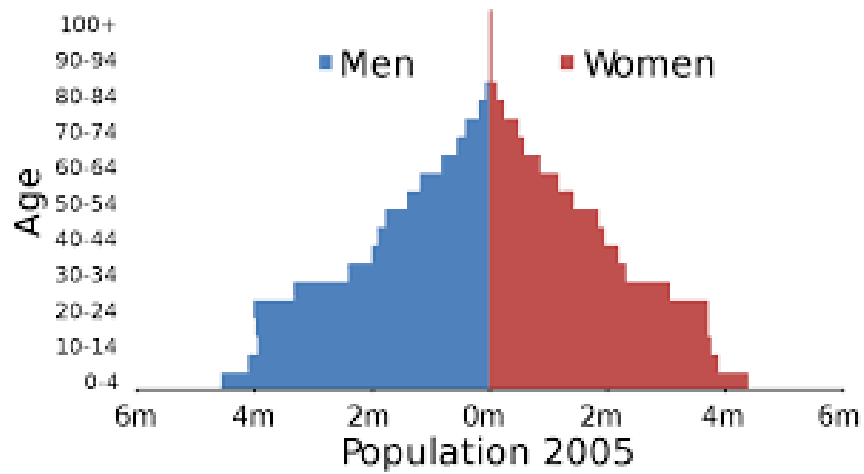


Figure 2.9: The population pyramid of Egypt in 2005.



Figure 2.10: A slum in India



Figure 2.11: Children scavenging at a garbage dump.

Suggestions for further reading

1. King, M., and Elliott, C. (1993). *Legitimate Double-Think*. Lancet 341:669-672.
2. Sen, A. (1989). *On Ethics and Economics*. Oxford, UK: Blackwell.
3. Worldwatch Institute (1987). *State of the World 1987*. Washington, DC: Worldwatch Institute.
4. United Nations, Department of Economic and Social Affairs, Population Division (2013) *World Population Prospects: The 2012 Revision*. (United Nations, New York).
5. Campbell, M., Cleland, J., Ezech, A. and Prata, N. (2007) *Return of the Population Growth Factor*. Science 315: 1501-1502
6. Coale, A.J. and Hoover, E.M. 1958. *Population growth and economic development in low-income countries*. Princeton University Press, New Jersey USA.
7. Friedman, T.L. (2013) *Tell me how this ends*. New York Times, 21 May 2013.
8. George, S. (2010) *Whose crisis, whose future?*, Polity Press, Cambridge.
9. Kirk, D. (1996) *Demographic Transition Theory*. Population Studies 50(3): 361-387.
10. Lagi, M., Bertrand, K.Z., Bar-Yam, Y. (2011) *The food crises and political instability in North Africa and the Middle East*. New England Complex Systems Institute
11. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
12. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
13. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).

14. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
15. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
16. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
17. British Petroleum, *BP Statistical Review of World Energy*, (published yearly).
18. R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
19. J. Darmstadter, *A Global Energy Perspective*, Sustainable Development Issue Backgrounder, Resources for the Future, (2002).
20. D.C. Hall and J.V. Hall, *Concepts and Measures of Natural Resource Scarcity*, *Journal of Environmental Economics and Management*, **11**, 363-379, (1984).
21. M.K. Hubbert, *Energy Resources*, in *Resources and Man: A Study and Recommendations*, Committee on Resources and Man, National Academy of Sciences, National Research Council, W.H. Freeman, San Francisco, (1969).
22. J.A. Krautkraemer, *Nonrenewable Resource Scarcity*, *Journal of Economic Literature*, bf 36, 2065-2107, (1998).
23. C.J. Cleveland, *Physical and Economic Aspects of Natural Resource Scarcity: The Cost of Oil Supply in the Lower 48 United States 1936-1987*, *Resources and Energy* **13**, 163-188, (1991).
24. C.J. Cleveland, *Yield Per Effort for Additions to Crude Oil Reserves in the Lower 48 States, 1946-1989*, *American Association of Petroleum Geologists Bulletin*, **76**, 948-958, (1992).
25. M.K. Hubbert, *Technique of Prediction as Applied to the Production of Oil and Gas*, in *NBS Special Publication 631*, US Department of Commerce, National Bureau of Standards, (1982).
26. L.F. Ivanhoe, *Oil Discovery Indices and Projected Discoveries*, *Oil and Gas Journal*, **11**, 19, (1984).
27. L.F. Ivanhoe, *Future Crude Oil Supplies and Prices*, *Oil and Gas Journal*, July 25, 111-112, (1988).
28. L.F. Ivanhoe, *Updated Hubbert Curves Analyze World Oil Supply*, *World Oil*, November, 91-94, (1996).
29. L.F. Ivanhoe, *Get Ready for Another Oil Shock!*, *The Futurist*, January-February, 20-23, (1997).
30. Energy Information Administration, *International Energy Outlook, 2001*, US Department of Energy, (2001).
31. Energy Information Administration, *Caspian Sea Region*, US Department of Energy, (2001).
32. National Energy Policy Development Group, *National Energy Policy*, The White House, (2004). (<http://www.whitehouse.gov/energy/>)
33. IEA, *CO₂ from Fuel Combustion Fact-Sheet*, International Energy Agency, (2005).
34. H. Youguo, *China's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity*, International Energy Agency, (2003).

35. R.H. Williams, *Advanced Energy Supply Technologies*, in *World Energy Assessment: Energy and the Challenge of Sustainability*, UNDP, (2000).
36. H. Lehmann, *Energy Rich Japan*, Institute for Sustainable Solutions and Innovations, Aachen, (2003).
37. W.V. Chandler, *Materials Recycling: The Virtue of Necessity*, Worldwatch Paper 56, Worldwatch Institute, Washington D.C., (1983).
38. W.C. Clark and others, *Managing Planet Earth*, Special Issue, *Scientific American*, September, (1989).
39. B. Commoner, *The Closing Circle: Nature, Man and Technology*, Bantam Books, New York, (1972).
40. J.R. Frisch, *Energy 2000-2020: World Prospects and Regional Stresses*, World Energy Conference, Graham and Trotman, (1983).
41. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
42. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
43. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
44. C. Pollock, *Mining Urban Wastes: The Potential for Recycling*, Worldwatch Paper 76, Worldwatch Institute, Washington D.C., (1987).
45. World Resources Institute, *World Resources*, Oxford University Press, New York, (published annually).
46. World Resources Institute, *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
47. J.E. Young, John E., *Mining the Earth*, Worldwatch Paper 109, Worldwatch Institute, Washington D.C., (1992).
48. J.R. Craig, D.J. Vaughan and B.J. Skinner, *Resources of the Earth: Origin, Use and Environmental Impact, Third Edition*, Prentice Hall, (2001).
49. W. Youngquist, *Geodestinies: The Inevitable Control of Earth Resources Over Nations and Individuals*, National Book Company, Portland Oregon, (1997).
50. M. Tanzer, *The Race for Resources. Continuing Struggles Over Minerals and Fuels*, Monthly Review Press, New York, (1980).
51. C.B. Reed, *Fuels, Minerals and Human Survival*, Ann Arbor Science Publishers Inc., Ann Arbor Michigan, (1975).
52. M.K. Hubbert, *Energy Resources*, in *Resources and Man: A Study and Recommendations*, Committee on Resources and Man, National Academy of Sciences, National Research Council, W.H. Freeman, San Francisco, (1969).
53. J.A. Krautkraemer, *Nonrenewable Resource Scarcity*, *Journal of Economic Literature*, bf 36, 2065-2107, (1998).
54. C.J. Cleveland, *Physical and Economic Aspects of Natural Resource Scarcity: The Cost of Oil Supply in the Lower 48 United States 1936-1987*, *Resources and Energy* **13**, 163-188, (1991).
55. C.J. Cleveland, *Yield Per Effort for Additions to Crude Oil Reserves in the Lower 48 States, 1946-1989*, *American Association of Petroleum Geologists Bulletin*, **76**, 948-958, (1992).

56. M.K. Hubbert, *Technique of Prediction as Applied to the Production of Oil and Gas*, in *NBS Special Publication 631*, US Department of Commerce, National Bureau of Standards, (1982).
57. Energy Information Administration, *International Energy Outlook, 2001*, US Department of Energy, (2001).
58. Energy Information Administration, *Caspian Sea Region*, US Department of Energy, (2001).
59. National Energy Policy Development Group, *National Energy Policy*, The White House, (2004). (<http://www.whitehouse.gov/energy/>)
60. M. Klare, *Bush-Cheney Energy Strategy: Procuring the Rest of the World's Oil*, Foreign Policy in Focus, (Interhemispheric Resource Center/Institute for Policy Studies/SEEN), Washington DC and Silver City NM, January, (2004).
61. IEA, *CO₂ from Fuel Combustion Fact-Sheet*, International Energy Agency, (2005).
62. H. Youguo, *China's Coal Demand Outlook for 2020 and Analysis of Coal Supply Capacity*, International Energy Agency, (2003).
63. R.H. Williams, *Advanced Energy Supply Technologies*, in *World Energy Assessment: Energy and the Challenge of Sustainability*, UNDP, (2000).
64. H. Lehmann, *Energy Rich Japan*, Institute for Sustainable Solutions and Innovations, Aachen, (2003).
65. W.V. Chandler, *Materials Recycling: The Virtue of Necessity*, Worldwatch Paper 56, Worldwatch Institute, Washington D.C, (1983).
66. J.R. Frisch, *Energy 2000-2020: World Prospects and Regional Stresses*, World Energy Conference, Graham and Trotman, (1983).
67. J. Gever, R. Kaufmann, D. Skole and C. Vorosmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge MA, (1986).
68. J. Holdren and P. Herrera, *Energy*, Sierra Club Books, New York, (1971).
69. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
70. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
71. P.B. Smith, J.D. Schilling and A.P. Haines, *Introduction and Summary*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
72. World Resources Institute, *World Resources*, Oxford University Press, New York, (published annually).
73. J.R. Craig, D.J. Vaughan and B.J. Skinner, *Resources of the Earth: Origin, Use and Environmental Impact, Third Edition*, Prentice Hall, (2001).
74. W. Youngquist, *Ge destinies: The Inevitable Control of Earth Resources Over Nations and Individuals*, National Book Company, Portland Oregon, (1997).
75. M. Tanzer, *The Race for Resources. Continuing Struggles Over Minerals and Fuels*, Monthly Review Press, New York, (1980).
76. C.B. Reed, *Fuels, Minerals and Human Survival*, Ann Arbor Science Publishers Inc., Ann Arbor Michigan, (1975).
77. A.A. Bartlett, *Forgotten Fundamentals of the Energy Crisis*, American Journal of Physics, **46**, 876-888, (1978).

Chapter 3

THE BATTLE FOR BIRTH CONTROL

3.1 Economics without ethics

Adam Smith

The history of the epoch that immediately preceded the modern era can cast much light on the challenges facing us today, so we will begin by reviewing it. Until the start of the Industrial Revolution in the 18th and 19th centuries, human society maintained a more or less sustainable relationship with nature. However, with the beginning of the industrial era, traditional ways of life, containing both ethical and environmental elements, were replaced by the money-centered, growth-oriented life of today, from which these vital elements are missing.

According to the great classical economist Adam Smith (1723-1790), self-interest (even greed) is a sufficient guide to human economic actions. The passage of time has shown that Smith was right in many respects. The free market, which he advocated, has turned out to be the optimum prescription for economic growth. However, history has also shown that there is something horribly wrong or incomplete about the idea that individual self-interest alone, uninfluenced by ethical and ecological considerations, and totally free from governmental intervention, can be the main motivating force of a happy and just society. There has also proved to be something terribly wrong with the concept of unlimited economic growth. Here is what actually happened:

Highland Clearances and Enclosure Acts

In pre-industrial Europe, peasant farmers held a low but nevertheless secure position, protected by a web of traditional rights and duties. Their low dirt-floored and thatched cottages were humble but safe refuges. If a peasant owned a cow, it could be pastured on common land.



Figure 3.2: London during the industrial revolution



Figure 3.3: A girl pulling a coaltub through the narrow space left by removal of coal from a seam.

like coal or grain, and wages were paid according to the laws of supply and demand, without regard for the needs of the workers. Wages fell to starvation levels, hours of work increased, and working conditions deteriorated.

John Fielden's book, "The Curse of the Factory System" was written in 1836, and it describes the condition of young children working in the cotton mills. "The small nimble fingers of children being by far the most in request, the custom instantly sprang up of procuring 'apprentices' from the different parish workhouses of London, Birmingham and elsewhere... Overseers were appointed to see to the works, whose interest it was to work the children to the utmost, because their pay was in proportion to the quantity of pay that they could exact."

"Cruelty was, of course, the consequence; and there is abundant evidence on record to show that in many of the manufacturing districts, the most heart-rending cruelties were practiced on the unoffending and friendless creatures... that they were flogged, fettered and tortured in the most exquisite refinements of cruelty, that they were in many cases starved to the bone while flogged to their work, and that they were even in some instances driven to commit suicide... The profits of manufacture were enormous, but this only whetted the appetite that it should have satisfied."

Dr. Peter Gaskell, writing in 1833, described the condition of the English mill workers as follows:

"The vast deterioration in personal form which has been brought about in the manufacturing population during the last thirty years... is singularly impressive, and fills the mind with contemplations of a very painful character... Their complexion is sallow and pallid, with a peculiar flatness of feature caused by the want of a proper quantity of adipose substance to cushion out the cheeks. Their stature is low - the average height of men being five feet, six inches... Great numbers of the girls and women walk lamely or awkwardly... Many of the men have but little beard, and that in patches of a few hairs... (They have) a spiritless and dejected air, a sprawling and wide action of the legs..."

"Rising at or before daybreak, between four and five o'clock the year round, they swallow a hasty meal or hurry to the mill without taking any food whatever... At twelve o'clock the engine stops, and an hour is given for dinner... Again they are closely immured from one o'clock till eight or nine, with the exception of twenty minutes, this being allowed for tea. During the whole of this long period, they are actively and unremittingly engaged in a crowded room at an elevated temperature."

Dr. Gaskell described the housing of the workers as follows:

"One of the circumstances in which they are especially defective is that of drainage and water-closets. Whole ranges of these houses are either totally undrained, or very partially... The whole of the washings and filth from these consequently are thrown into the front or back street, which, often being unpaved and cut into deep ruts, allows them to collect into stinking and stagnant pools; while fifty, or even more than that number, having only a single convenience common to them all, it is in a very short time choked with excrementous matter. No alternative is left to the inhabitants but adding this to the already defiled street."

"It frequently happens that one tenement is held by several families... The demoralizing

effects of this utter absence of domestic privacy must be seen before they can be thoroughly appreciated. By laying bare all the wants and actions of the sexes, it strips them of outward regard for decency - modesty is annihilated - the father and the mother, the brother and the sister, the male and female lodger, do not scruple to commit acts in front of each other which even the savage keeps hid from his fellows."

The invisible hand

As everyone knows, Adam Smith invented the theory that individual self-interest is, and ought to be, the main motivating force of human economic activity, and that this, in effect, serves the wider social interest. He put forward a detailed description of this concept in an immense book, "The Wealth of Nations" (1776).

Adam Smith (1723-1790) had been Professor of Logic at the University of Glasgow, but in 1764 he withdrew from his position at the university to become the tutor of the young Duke of Buccleuch. In those days a Grand Tour of Europe was considered to be an important part of the education of a young nobleman, and Smith accompanied Buccleuch to the Continent. To while away the occasional dull intervals of the tour, Adam Smith began to write an enormous book on economics which he finally completed twelve years later. He began his "Inquiry into the Nature and Causes of the Wealth of Nations" by praising division of labor. As an example of its benefits, he cited a pin factory, where ten men, each a specialist in his own set of operations, could produce 48,000 pins in a day. In the most complex civilizations, Smith stated, division of labor has the greatest utility.

The second factor in prosperity, Adam Smith maintained, is a competitive market, free from monopolies and entirely free from governmental interference. In such a system, he tells us, the natural forces of competition are able to organize even the most complex economic operations, and are able also to maximize productivity. He expressed this idea in the following words:

"As every individual, therefore, endeavors as much as he can, both to employ his capital in support of domestic industry, and so to direct that industry that its produce may be of greatest value, each individual necessarily labours to render the annual revenue of the Society as great as he can."

"He generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing that industry in such a manner as its produce may be of greatest value, he intends only his own gain; and he is in this, as in many other cases, led by an invisible hand to promote an end that was no part of his intention. Nor is it always the worse for Society that it was no part of it. By pursuing his own interest, he frequently promotes that of Society more effectively than when he really intends to promote it."

For example, a baker does not bake bread out of an unselfish desire to help his fellow humans; he does so in order to earn money; but if he were not performing a useful service, he would not be paid. Thus the "invisible hand" guides him to do something useful. Free competition also regulates prices: If the baker charges too much, he will be undersold.



Figure 3.4: **Adam Smith (1723-1790)**

Finally, if there are too many bakers, the trade will become so unprofitable that some bakers will be forced into other trades. Thus highly complex operations are automatically regulated by the mechanisms of the free market. “Observe the accommodation of the most common artificer or day labourer in a civilized and thriving country”, Smith continues, “and you will perceive that the number of people of whose industry a part, though but a small part, has been employed in securing him this accommodation, exceeds all computation. The woolen coat, which covers the day-labourer, as coarse and rough as it may seem, is the joint labour of a great multitude of workmen. The shepherd, the sorter of wool, the wool-comber, the carder, the dyer, the scribbler, the spinner, the weaver, the fuller, the dresser, with many others, must all join their different arts to complete even the most homely production. How many merchants and carriers, besides, must have been employed... how much commerce and navigation... how many ship-builders, sailors, sail-makers, rope-makers...”

Adam Smith’s remarks on population

Adam Smith was a Malthusian in the sense that he believed that the large excess of births among the poor is continuously cut back by the terrible rate of infant mortality in the lowest class of society. Here are some of his words on the subject: “Poverty... seems even to be favourable to generation. A half-starved Highland woman frequently bears more than twenty children... Luxury in the fair sex, while it enflames perhaps the passion for enjoyment, seems always to weaken and frequently to destroy altogether, the powers of generation. But poverty... is extremely unfavourable to the rearing of children... It is not uncommon... in the Highlands... for a mother who has borne twenty children not to have two alive... In civilized society it is only among the inferior ranks of people that the

scantiness of subsistence can set limits to the further multiplication of the human species... by destroying a great part of the children which their fruitful marriages produce.”

Smith thought that the laws of supply and demand apply to the number of people in the working class. If more workers are needed, wages rise and more of the children of the poor survive. It is, of course, in the interest of factory owners to have very cheap labor, and the bitter opposition of the establishment to both birth control and trade unions can be understood by the desire to force wages down to the absolute minimum needed to support life.

Reinvestment and growth

An important feature of Adam Smith’s economic model is that it is by no means static. The virtuous manufacturer does not purchase pearl necklaces for his wife; he reinvests his profits, buying more machinery or building new factories. An industrialist who ignores the commandment to reinvest is “...like him who perverts the revenues of some pious foundation to profane purposes; he pays the wages of idleness with those funds which the fragility of his forefathers had, as it were, consecrated to the maintenance of industry.”

The expansion of the system will not be slowed, Smith maintained, by shortages of labor, because “...the demand for men, like that for any other commodity, necessarily regulates the production of men.” Smith did not mean that more births would occur if the demand for workers became greater. He meant that if wages began to rise above the lowest level needed to maintain life, more children of the workers would survive. In those days, the rates of infant and child mortality were horrendous, particularly among the half-starved poor. “It is not uncommon”, Smith wrote, “in the Highlands of Scotland, for a mother who has borne twenty children not to have two alive.”

Adam Smith’s ideas were enthusiastically adopted by the rising class of manufacturers and by their representatives in government. The reverence shown to him can be illustrated by an event that occurred when he visited England’s Prime Minister, William Pitt, and his Cabinet. The whole gathering stood up when Smith entered. “Pray be seated, gentlemen”, Smith said. “Not until you first are seated Sir”, Pitt replied, “for we are all your scholars.”

History has shown that Adam Smith was right in many respects. The free market is indeed a dynamo that produces economic growth, and it is capable of organizing even the most complex economic endeavors. Through Adam Smith’s “invisible hand”, self interest is capable of guiding the economy so that it will maximize the production of wealth. However, history has also shown the shortcomings of a market that is totally free of governmental regulation.

The landowners of Scotland were unquestionably following self-interest as they burned the cottages of their crofters; and self-interest motivated overseers as they whipped half-starved child workers in England’s mills. Adam Smith’s “invisible hand” no doubt guided their actions in such a way as to maximize production. But whether a happy and just society was created in this way is questionable. Certainly it was a society with large areas of unhappiness and injustice. Self-interest alone was not enough. A society following purely economic laws - a society where selfishness is exalted as the mainspring for action - lacks

both the ethical and ecological dimensions needed for social justice, widespread happiness, and sustainability¹.

3.2 The reform movement

Trade unions; Robert Owen

During the early phases of the Industrial Revolution in England, the workers suffered greatly. Enormous fortunes were made by mill and mine owners, while workers, including young children, were paid starvation wages for cruelly long working days. However, trade unions, child labor laws, and the gradual acceptance of birth control finally produced a more even distribution of the benefits of industrialization.

One of the most interesting pioneers of these social reforms was Robert Owen (1771-1858), who is generally considered to have been the father of the Cooperative Movement. Although in his later years not all of his projects developed as he wished, his life started as an amazing success story. Owen's life is not only fascinating in itself; it also illustrates some of the reforms that occurred between 1815 and 1850.

Robert Owen was born in Wales, the youngest son of a family of iron-mongers and saddle-makers. He was a very intelligent boy, and did well at school, but at the age of 9, he was apprenticed to a draper, at first in Wales. Later, at the age of 11, he was moved to London, where he was obliged to work eighteen hours a day, six days a week, with only short pauses for meals. Understandably, Robert Owen found this intolerable, and he moved again, this time to Manchester, where he again worked for a draper.

While in Manchester, Robert Owen became interested in the machines that were beginning to be used for spinning and weaving. He borrowed a hundred pounds from his brother, and entered (as a partner) a small business that made these machines. After two years of moderate success as a small-scale industrialist, Owen saw the newspaper advertisement of a position for manager of a large spinning mill, owned by a Mr. Drinkwater.

"I put on my hat", Owen wrote later, "and proceeded straight to Mr. Drinkwater's counting house. 'How old are you?' 'Twenty this May', was my reply. 'How often do you get drunk in the week?'... 'I was never', I said, 'drunk in my life.' blushing scarlet at this unexpected question. 'What salary do you ask?' 'Three hundred a year', was my reply. 'What?', Mr. Drinkwater said with some surprise, repeating the words, 'Three hundred pounds! I have had this morning I know not how many seeking the situation and I do not think that all of their askings would amount to what you require.' 'I cannot be governed by what others seek', said I, 'and I cannot take less.'

Apparently impressed by Robert Owen's success as a small-scale industrialist, and

¹In fact, Adam Smith himself would have accepted this criticism of his enthronement of self-interest as the central principle of society. He believed that his "invisible hand" would not work for the betterment of society except within the context of a certain amount of governmental regulation. His modern Neoliberal admirers, however, forget this aspect of Smith's philosophy, and maintain that market forces alone can achieve a desirable result.



Figure 3.5: New Lanark World Heritage village in Scotland. A view of the school.

perhaps also impressed by his courage, Mr. Drinkwater hired him. Thus, at the age of 19, Owen became the manager of a large factory. Mr. Drinkwater had no cause to regret his decision, since his new manager quickly became the boy wonder of Manchester's textile community. Within six months, Drinkwater offered Owen a quarter interest in his business.

After several highly successful years in his new job, Robert Owen heard of several mills that were for sale in the village of New Lanark, near to Glasgow. The owner, Mr. Dale, happened to be the father of the girl with whom Robert Owen had fallen in love. Instead of directly asking Dale for permission to marry his daughter, Owen (together with some business partners) first purchased the mills, after which he won the hand of the daughter.

Ownership of the New Lanark mills gave Robert Owen the chance to put into practice the ideas of social reform that he had been developing throughout his life. Instead of driving his workers by threats of punishment, and instead of subjecting them to cruelly long working hours (such as he himself had experienced as a draper's apprentice in London), Owen made the life of his workers at New Lanark as pleasant as he possibly could. He established a creche for the infants of working mothers, free medical care, concerts, dancing, music-making, and comprehensive education, including evening classes. Instead of the usual squalid one-room houses for workers, neat two-room houses were built. Garbage was collected regularly instead of being thrown into the street. New Lanark also featured pleasant landscaped areas.

Instead of leading to bankruptcy, as many of his friends predicted, Robert Owen's reforms led to economic success. Owen's belief that a better environment would lead to better work was vindicated. The village, with its model houses, schools and mills, became

internationally famous as a demonstration that industrialism need not involve oppression of the workers. Crowds of visitors made the journey over narrow roads from Glasgow to learn from New Lanark and its visionary proprietor. Among the twenty thousand visitors who signed the guest-book between 1815 and 1825 were the Grand Duke Nicholas of Russia (who later became Czar Nicholas I), and Princes John and Maximilian of Austria.

Robert Owen's ideas of social reform can be seen in the following extract from an "Address to the Inhabitants of New Lanark", which he presented on New Year's Day, 1816: "What ideas individuals may attach to the term 'Millennium' I know not; but I know that society may be formed so as to exist without crime, without poverty, with health greatly improved, with little, if any, misery. and with intelligence and happiness increased a hundredfold; and no obstacle whatsoever intervenes at this moment except ignorance to prevent such a state of society from becoming universal."

Robert Owen believed that these principles could be applied not only in New Lanark but also in the wider world. He was soon given a chance to express this belief. During the years from 1816 to 1820, apart from a single year, business conditions in England were very bad, perhaps as a result of the Napoleonic Wars, which had just ended. Pauperism and social unrest were widespread, and threatened to erupt into violence. A committee to deal with the crisis was formed under the leadership of the Dukes of Kent and York.

Because of Owen's reputation, he was asked for his opinion, but the committee was hardly expecting the answer that they received from him. Robert Owen handed the two Dukes and the other committee members a detailed plan for getting rid of pauperism by making paupers productive. They were to be settled in self-governing Villages of Cooperation, each with between 800 and 1,200 inhabitants. Each family was to have a private apartment, but there were to be common sitting rooms, reading rooms and kitchens. Near to the houses, there were to be gardens tended by the children, and farther out, fields to be cultivated by the adults. Still farther from the houses, there was to be a small factory.

Owen's idea for governmentally-planned paupers' collectives was at first rejected out of hand. The early 19th century was, after all, a period of unbridled *laissez-faire* economics. Owen then bombarded the Parliament with pamphlets advocating his scheme. Finally a committee was formed to try to raise the money to establish one Village of Cooperation as an experiment; but the money was never raised.

Unwilling to accept defeat, Robert Owen sold his interest in New Lanark and sailed for America, where he believed that his social experiment would have a better chance of success. He bought the town of Harmonie and 30,000 acres of land on the banks of the Wabash River in Indiana. There he established a Village of Cooperation which he named "New Harmony". He dedicated it on the 4th of July, 1826. It remained a collective for only two years, after which individualism reasserted itself. Owen's four sons and one of his daughters made their homes in New Harmony, and it also became the home of numerous scientists, writers and artists.

Owen's son, Robert Dale Owen, became a member of the U.S. House of Representatives, where he introduced the bill establishing the Smithsonian Institution. In 1862 he wrote an eloquent letter to Abraham Lincoln urging emancipation of the slaves. Three days later, probably influenced by Owen's letter, Lincoln read the Emancipation Proclamation to his

cabinet. Another son, Richard Owen, served as President of the University of Indiana, and was later elected as the first President of Purdue University.

When Robert Owen returned to England shortly after dedicating New Harmony, he found that he had become a hero of the working classes. They had read his writings avidly, and had begun to establish cooperatives, following his principles. There were both producer's cooperatives and consumer's cooperatives. In England, the producer's cooperatives failed, but in Denmark they succeeded².

One of the early consumer's cooperatives in England was called the Rochdale Society of Equitable Pioneers. It was founded by 28 weavers and other artisans, who were being forced into poverty by mechanization. They opened a small cooperative store selling butter, sugar, flour, oatmeal and candles. After a few months, they also included tobacco and tea. From this small beginning, the Cooperative Movement grew, finally becoming one of the main pillars of the British Labour Party.

Robert Owen's attention now turned from cooperatives to the embryonic trade union movement, which was struggling to establish itself in the face of fierce governmental opposition. He assembled the leaders of the working class movement and proposed the formation of the "Grand National Moral Union of Productive and Useful Classes". The name was soon shortened to "The Grand National Consolidated Trades Union" or simply the "Grand National".

Owen's Grand National was launched in 1833, and its membership quickly grew to half a million. It was the forerunner of modern nationwide trade unions, but it lasted only two years. Factory-owners saw the Grand National as a threat, and they persuaded the government to prosecute it under anti-union laws. Meanwhile, internal conflicts helped to destroy the Grand National. Owen was accused of atheism by the working class leaders, and he accused them of fermenting class hatred.

Robert Owen's influence helped to give raw *laissez faire* capitalism a more human face, and helped to spread the benefits of industrialization more widely. Through the work of other reformers like Owen, local trade unions succeeded, both in England and elsewhere; and in the end, successful national unions were finally established. The worst features of the early Industrial Revolution were moderated by the growth of the trade union movement, by child labor laws, by birth control and by minimum wage laws.

Rusting of the Iron Law

David Ricardo's Iron Law of Wages maintained that workers must necessarily live at the starvation level: Their wages are determined by the law of supply and demand, Ricardo said. If the wages should increase above the starvation level, more workers' children would survive, the supply of workers would increase, and the wages would fall again. This gloomy pronouncement was enthusiastically endorsed by members of the early 19th century Establishment, since it absolved them from responsibility for the miseries of the poor. However,

²The success of Danish agricultural producer's cooperatives was helped by the People's High School movement, founded by N.F.S. Grundvig (1783-1872).



Figure 3.6: **Robert Owen, (1771-1858), founder of the Cooperative Movement.**

the passage of time demonstrated that the Iron Law of Wages held only under the assumption of an economy totally free from governmental intervention.

Both the growth of the political power of industrial workers, and the gradual acceptance of birth control were important in eroding Ricardo's Iron Law. Birth control is especially important in countering the argument used to justify child labor under harsh conditions. The argument (still used in many parts of the world) is that child labor is necessary in order to save the children from starvation, while the harsh conditions are needed because if a business provided working conditions better than its competitors, it would go out of business. However, with a stable population and appropriate social legislation prohibiting both child labor and harsh working conditions, the Iron Law argument fails.

The Fabian Society

With the gradual acceptance of birth control in England, the growth of trade unions, the passage of laws against child labor and finally minimum wage laws, conditions of workers gradually improved, and the benefits of industrialization began to spread to the whole of society.

One of the important influences for reform was the Fabian Society, founded in London in 1884. The group advocated gradual rather than revolutionary reform (and took its name from Quintus Fabius Maximus, the Roman general who defeated Hannibal's Carthaginian army by using harassment and attrition rather than head-on battles). The Fabian Society came to include a number of famous people, including Sydney and Beatrice Webb, George Bernard Shaw, H.G. Wells, Annie Besant, Leonard Woolf, Emmeline Pankhurst, Bertrand Russell, John Maynard Keynes, Harold Laski, Ramsay MacDonald, Clement Attlee, Tony Benn and Harold Wilson. Jawaharlal Nehru, India's first Prime Minister, was greatly influenced by Fabian economic ideas.

The group was instrumental in founding the British Labour Party (1900), the London School of Economics and the New Statesman. In 1906, Fabians lobbied for a minimum wage law, and in 1911 they lobbied for the establishment of a National Health Service.

The reform movement's efforts, especially those of the Fabians, overcame the worst horrors of early 19th century industrialism, but today their hard-won achievements are being undermined and lost because of uncritical and unregulated globalization. Today, a factory owner or CEO, anxious to avoid high labor costs, and anxious to violate environmental regulations merely moves his factory to a country where laws against child labor and rape of the environment do not exist or are poorly enforced. In fact, he must do so or be fired, since the only thing that matters to the stockholders is the bottom line.

The movement of a factory from Europe or North America to a country with poorly enforced laws against environmental destruction, child labor, and slavery, puts workers into unfair competition. Unless they are willing to accept revival of the unspeakable conditions of the early Industrial Revolution, they are unable to compete.

Today, child labor accounts for 22% of the workforce in Asia, 32% in Africa, and 17% in Latin America. Large-scale slavery also exists today, although there are formal laws against it in every country. There are more slaves now than ever before. Their number is



Figure 3.7: The sociologist, economist, socialist, labour historian and social reformer, Beatrice Webb (1858-1943), played an important role in the founding of the Fabian Society and the British Labour Party.

estimated to be between 12 million and 27 million. Besides outright slaves, who are bought and sold for as little as 100 dollars, there many millions of workers whose lack of options and dreadful working conditions must be described as slavlike.³

3.3 Birth Control in England: The Utilitarians

James Mill and John Stuart Mill

John Stuart Mill (1806-1873) showed his genius at an early age, and his father, the Utilitarian philosopher and political economist James Mill, immediately began to groom him to replace Jeremy Bentham as the leader of the Utilitarian movement. From the age of 3 onwards, Mill was deliberately kept away from children of his own age and made to spend all his waking hours in study. Play was not allowed, since it would break the habit of continual diligence.

At the age of three, Mill was taught Greek. By the time he reached eight, he had read Aesop's Fables, Xenophon's Anabasis, and all the works of Herodotus. He was also acquainted with Lucian, Diogenes Laërtius, Isocrates and six dialogues of Plato, in their original language. Furthermore, he had also read a great deal of history in English and had been taught arithmetic, physics and astronomy.

When he was twelve, Mill began a thorough study of the scholastic logic, at the same time reading Aristotle's logical treatises in the original language. At thirteen, he was introduced to political economy and studied the classical economists Adam Smith and David Ricardo. In fact Ricardo, who was a close friend of his father, used to invite the young Mill to his house for a walk in order to talk about political economy.

At the age of fourteen, Mill spent a year in France, where he attended the winter courses on chemistry, zoology, logic of the Faculté des Sciences, as well as taking a course of the higher mathematics. He also met the economist Jean-Baptiste Say, a friend of his father, and the political philosopher Henri Saint-Simon.

³<http://www.commondreams.org/news/2015/08/04/state-dept-accused-watering-down-human-rights-ratings-advance-obama-trade-agenda>
<http://www.foodispower.org/slavery-chocolate/>
<https://www.wsws.org/en/articles/2014/10/01/modi-o01.html>
<http://www.theguardian.com/world/2007/oct/28/ethicalbusiness.retail>
<http://www.techtimes.com/articles/22530/20141221/apple-turning-blind-eye-to-miserable-working-conditions-of-workers-in-china-and-indonesia-secret-video.htm>
<http://www.waronwant.org/sweatshops-china>
<https://www.dosomething.org/facts/11-facts-about-sweatshops>
<https://sites.google.com/site/rgssenglishmsgswheatshops/conditions-of-sweatshops-in-indonesia>
<http://www.greenpeace.org/eastasia/campaigns/air-pollution/problems/>
<http://www.wired.com/2015/04/benedikt-partenheimer-particulate-matter/>



Figure 3.8: The Utilitarian philosopher and political economist James Mill (1773-1836) was an early advocate of birth control. In his *Elements of Political Economy*, he wrote: “The result to be aimed at is to secure to the great body of the people all the happiness which is capable of being derived from the matrimonial union, (while) preventing the evils which the too rapid increase of their numbers would entail. The progress of legislation, the improvement of the education of the people, and the decay of superstition will, in time, it may be hoped, accomplish the difficult task of reconciling these important objects.”

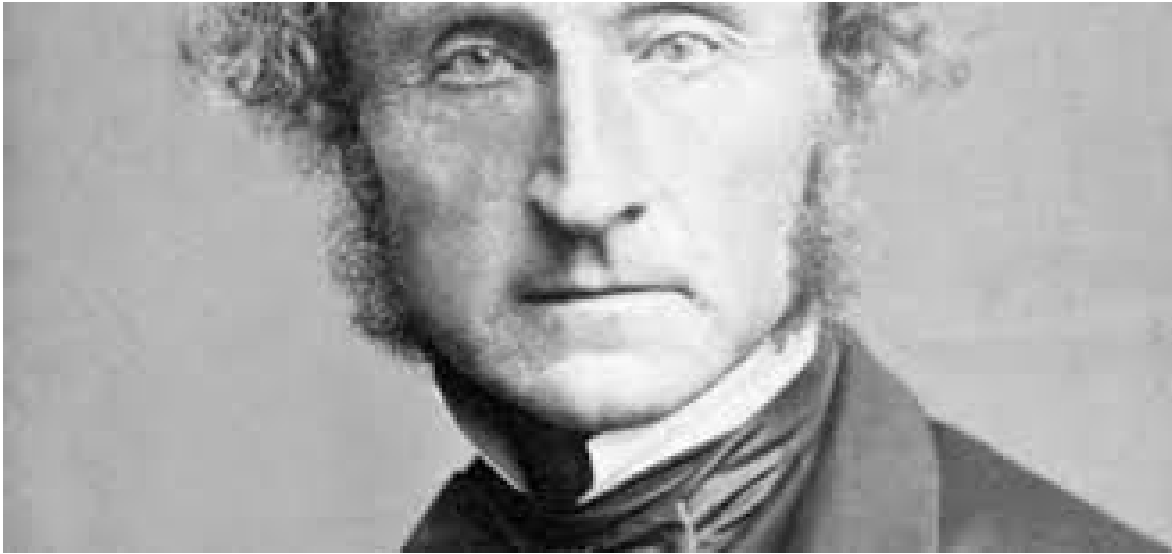


Figure 3.9: As a Member of Parliament, John Stuart Mill (1806-1873) introduced a law, the first of its kind, to give votes to women. Unfortunately it was defeted, but it set a precedent. He also foresaw that economic growth would have to end.

Limits to growth

John Stuart Mill pioneered the concept of a steady.state economy. He realized that on a finite earth, neither the population of humans nor the economy can continue to grow forever. In 1848 (when there were just over one billion people in the world), he described the optimal global population in the following words:

“The density of population necessary to enable mankind to obtain, in the greatest degree, all the advantages of cooperation and social intercourse, has, in the most populous countries, been attained. A population may be too crowded, although all be amply supplied with food and raiment.”

“... Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture plowed up, all quadrupeds or birds which are not domesticated for man’s use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not better or happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it.”

Contributions to Utilitarian theory

Jeremy Bentham (1748-1832) had written that “it is the greatest happiness of the greatest number that is the measure of right and wrong”. Mill refined this basic principle of Utilitarianism by pointing out the difference between higher pleasures, for example moral or intellectual pleasures, and lower ones, such as pleasures of the flesh. Mill remarked that “It is better to be a human being dissatisfied than a pig satisfied; better to be Socrates dissatisfied than a fool satisfied. And if the fool, or the pig, are of a different opinion, it is because they only know their own side of the question.”

Ideas on economics and on individual liberty

According to David Ricardo’s “Iron Law of Wages”, laborers must always live on the exact borderline between starvation and survival. Wages, Ricardo argued, are determined by the laws of supply and demand. If wages increase above the starvation level, more children of workers survive, the supply of workers increases, and the wages fall once more.

Mill rebelled against Ricardo’s dismal “Iron Law” by pointing out that although the means of production might be regulated by the necessities of economics, social conscience can determine the way in which the goods are distributed. (Later Mahatma Gandhi extended this idea by showing that social conscience can also play a role in the way that goods are produced).

John Stuart Mill also contributed importantly to the idea of individual liberty as opposed to unlimited control by the state or by social opinion. He is the author of the following influential principle: “The only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others.”

Opposition to slavery

Regarding slavery, Mill wrote: “This absolutely extreme case of the law of force, condemned by those who can tolerate almost every other form of arbitrary power, and which, of all others, presents features the most revolting to the feeling of all who look at it from an impartial position, was the law of civilized and Christian England within the memory of persons now living: and in one half of Angle-Saxon America three or four years ago, not only did slavery exist, but the slave trade, and the breeding of slaves expressly for it, was a general practice between slave states. Yet not only was there a greater strength of sentiment against it, but, in England at least, a less amount either of feeling or of interest in favour of it, than of any other of the customary abuses of force: for its motive was the love of gain, unmixed and undisguised: and those who profited by it were a very small numerical fraction of the country, while the natural feeling of all who were not personally interested in it, was unmitigated abhorrence.”

Member of Parliament and advocate of for votes for women

During the years between 1865 and 1868, John Stuart Mill served simultaneously as a Member of Parliament and as Lord Rector of the University of St. Andrews. In Parliament, Mill was the first person to call for votes for women. His motion was defeated, but it set an important precedent. Mill may have been influenced by his wife, Harriet Taylor Mill, who was a brilliant person in her own right.

Together with his wife and stepdaughter, Mill composed a book entitled *The Subjugation of Women*, which was completed in 1861. It contains a passage arguing that “the legal subordination of one sex to another - is wrong in itself, and now one of the chief hindrances to human improvement; and that it ought to be replaced by a system of perfect equality, admitting no power and privilege on the one side, nor disability on the other.

Ricardo’s model accurately described the condition of industrial workers at the time when he was living. However, this model did not take into account the possibility of trade unions and social legislation fixing the minimum wage; nor did Ricardo’s model take into account the possibility that workers would use birth control to limit their population growth.

We have seen that Malthus himself was opposed to birth control, advocating late marriage and “moral restraint” instead as the proper means for avoiding excessive population growth. However others in England, notably the Utilitarians, while accepting Malthus’ ideas concerning population pressure, advocated birth control as a means of relieving it. In 1821, the Utilitarian philosopher James Mill (the father of John Stuart Mill) wrote in his *Elements of Political Economy*: “The result to be aimed at is to secure to the great body of the people all the happiness which is capable of being derived from the matrimonial union, (while) preventing the evils which the too rapid increase of their numbers would entail. The progress of legislation, the improvement of the education of the people, and the decay of superstition will, in time, it may be hoped, accomplish the difficult task of reconciling these important objects.”

This somewhat vague advocacy of birth control was made much more explicit by the trade union leader Francis Place (1771-1854). In 1822 Place published, at considerable risk to himself, a pamphlet entitled *To the Married of Both Sexes of the Working People*. Place’s pamphlet contains the following passages:

“It is a great truth, often told and never denied, that when there are too many working people in any trade or manufacture, they are worse paid than they ought to be paid, and are compelled to work more hours than they ought to work. When the number of working people in any trade or manufacture has for some years been too great, wages are reduced very low, and the working people become little better than slaves.” “When wages have thus been reduced to a very small sum, working people can no longer maintain their children as all good and respectable people wish to maintain their children, but are compelled to neglect them; - to send them to different employments; - to Mills and Manufactories, at a very early age.”

“The miseries of these poor children cannot be described, and need not be described to you, who witness them and deplore them every day of your lives.”

"The sickness of yourselves and your children, the privation and pain and premature death of those you love but cannot cherish as you wish, need only be alluded to. You know all these evils too well." "And what, you will ask, is the remedy? How are we to avoid these miseries? The answer is short and plain: the means are easy. Do as other people do, to avoid having more children than they wish to have, and can easily maintain."

Place's pamphlet then goes on to describe very explicitly the sponge method of contraception. "What is to be done is this. A piece of soft sponge is tied by a bobbin or penny ribbon, and inserted just before intercourse takes place. Many tie a sponge to each end of a ribbon, and they take care not to use the same sponge again until it has been washed. If the sponge be large enough, that is, as large as a green walnut, or a small apple, it will prevent conception.... without diminishing the pleasures of married life..."

In 1832, Dr. Charles Knowlton, a Boston physician, published a book entitled *The Fruits of Philosophy, or the Private Companion of Young Married People*. It reviewed the various methods of birth control then available, and it pointed out that in order to be reliable, the sponge method required the use of a saline douching solution. This small book was reprinted in England and sold for a number of years without opposition. However, in 1876, the book was classified as obscene under a new law, and a bookseller was sentenced to two years in prison for selling it. The feminist leader, Annie Besant, and the liberal politician, Charles Bradlaugh, then provoked a new trial by selling the book themselves. They sent a polite letter to the magistrates announcing when and where they intended to sell Knowlton's book, and asking to be arrested. The result was a famous trial, at which the arguments of Malthus were quoted both by the judge and by the defense. The result of trial was inconclusive, however: Annie Besant and Charles Bradlaugh were acquitted, but Knowlton's book was held to be obscene.

As the nineteenth century progressed, birth control gradually came to be accepted in England, and the average number of children per marriage fell from 6.16 in 1860 to 4.13 in 1890. By 1915 this figure had fallen to 2.43. Because of lowered population pressure, combined with the growth of trade unions and better social legislation, the condition of England's industrial workers improved; and under the new conditions, Ricardo's Iron Law of Wages fortunately no longer seemed to hold.

Trade unions and child labor laws

The battle to establish trade unions was not won easily. At the start of the 19th century, many countries had laws prohibiting organizing unions, and these invoked penalties up to and including death. In England, the Reform Act of 1832 made unions legal, but nevertheless in 1834, six men from Dorset who had formed the "Friendly Society of Agricultural Workers" were arrested and sentenced to a seven years' transportation to Australia. An obscure law from 1797 was invoked, which prohibited swearing secret oaths. This they had in fact done, but their main crime seems to have been refusing to work for less than 10 shillings a week. Despite bitter opposition, trade unions gradually developed both in England and in other industrial countries.

One of the important influences for reform was the Fabian Society, founded in London



Figure 3.10: **Francis Place (1771-1854)**, was a trade union leader and reformer who was anxious to improve the lives of workers. His political activities brought him into contact with William Godwin, James Mill, John Stuart Mill, Robert Owen and Jeremy Bentham. He courageously advocated birth control at a time when it was dangerous to do so.



Figure 3.11: Annie Besant (1847-1933). She and the Liberal politician Charles Bradlaugh sent a polite letter to the magistrates announcing when and where they intended to sell Knowlton's book on birth control methods, and asking to be arrested. The result was a famous trial, at which the arguments of Malthus were quoted both by the judge and by the defense. The result of trial was inconclusive, however: Annie Besant and Charles Bradlaugh were acquitted, but Knowlton's book was held to be obscene.



Figure 3.12: Marie Stopes (1880-1958). She founded the first birth control clinic in Britain, and authored the controversial sex manual *Married Love*. Stopes disapproved of abortion and believed that birth control methods should be used to make abortion unnecessary. She edited the newsletter *Birth Control News*, which gave explicit practical advice.

in 1884. The group advocated gradual rather than revolutionary reform (and took its name from Quintus Fabius Maximus, the Roman general who defeated Hannibal's Carthaginian army by using harassment and attrition rather than head-on battles). The Fabian Society came to include a number of famous people, including Sydney and Beatrice Webb, George Bernard Shaw, H.G. Wells, Annie Besant, Leonard Woolf, Emmeline Pankhurst, Bertrand Russell, John Maynard Keynes, Harold Laski, Ramsay MacDonald, Clement Attlee, Tony Benn and Harold Wilson. Jawaharlal Nehru, India's first Prime Minister, was greatly influenced by Fabian economic ideas.

The group was instrumental in founding the British Labour Party (1900), the London School of Economics and the New Statesman. In 1906, Fabians lobbied for a minimum wage law, and in 1911 they lobbied for the establishment of a National Health Service.

Adam Smith had praised division of labor as one of the main elements in industrial efficiency, but precisely this aspect of industrialism was criticized by Thomas Carlyle (1795-1891), John Ruskin (1819-1900) and William Morris (1834-1896). They considered the numbingly repetitive work of factory laborers to be degrading, and they rightly pointed out that important traditions of design were being lost and replaced by ugly mass produced artifacts. The Arts and Crafts movement founded by Ruskin and Morris advocated cooperative workshops, where creative freedom and warm human relationships would make work rewarding and pleasant. In several Scandinavian countries, whose industrialization came later than England's, efforts were made to preserve traditions of design. Hence the present artistic excellence of Scandinavian furniture and household articles.

Through the influence of reformers, the more brutal aspects of Adam Smith's economic model began to be moderated. Society was learning that free market mechanisms alone do not lead to a happy and just society. In addition, ethical and ecological considerations and some degree of governmental regulation are also needed.

The Reform Movement aimed at social goals, but left ecological problems untreated. Thus our economic system still does not reflect the true price to society of environmentally damaging activities. For example, the price of coal does not reflect the cost of the environmental damage done by burning it. This being so, our growth-worshipping economic system of today thunders ahead towards an environmental mega-catastrophe, as we will see in the next chapter.

3.4 Birth control in the United States

The Comstock Laws

Anthony Comstock (1844-1915) was a United States Postal Inspector, which is to say that he was the head of a department of the US Postal Service that had the responsibility of preventing the mail from being used for illegal or immoral purposes. Unfortunately, in his view, this included any information or materials related to birth control.

According to the Wikipedia article about him, "In 1873, Comstock created the New York Society for the Suppression of Vice, an institution dedicated to supervising the morality of the public. Later that year, Comstock successfully influenced the United States Congress to pass the Comstock Law, which made illegal the delivery by U.S. mail, or by other modes of transportation, of 'obscene, lewd, or lascivious' material, as well as prohibiting any methods of production or publication of information pertaining to the procurement of abortion, the prevention of conception and the prevention of venereal disease.

"During his career, Comstock clashed with Emma Goldman and Margaret Sanger. In her autobiography, Goldman referred to Comstock as the leader of America's 'moral eunuchs'. Comstock had numerous enemies, and in later years his health was affected by a severe blow to the head from an anonymous attacker. He lectured to college audiences and wrote newspaper articles to sustain his causes. Before his death, Comstock attracted the interest of a young law student, J. Edgar Hoover, who was interested in his causes and methods.

"Comstock is also known for his opposition to suffragists Victoria Woodhull and Tennessee Celeste Claflin, and those associated with them. The men's journal *The Days' Doings* had popularized images of the sisters for three years and was instructed by its editor (while Comstock was present) to stop producing lewd images. Comstock also took legal action against the paper for advertising contraceptives. When the sisters published an expose of an adulterous affair between Reverend Henry Ward Beecher and Elizabeth Tilton, he had the sisters arrested under laws forbidding the use of the postal service to distribute 'obscene material'

"Comstock's ideas of what might be 'obscene, lewd, or lascivious' were quite broad.

During his time of greatest power, even some anatomy textbooks were prohibited from being sent to medical students by the United States Postal Service.

“Through his various campaigns, he destroyed 15 tons of books, 284,000 pounds of plates for printing ‘objectionable’ books, and nearly 4,000,000 pictures. Comstock boasted that he was responsible for 4,000 arrests and claimed he drove fifteen persons to suicide.”

“In 1915, architect William Sanger was charged under the New York law against disseminating contraceptive information.[24] His wife Margaret Sanger was similarly charged in 1915 for her work *The Woman Rebel*. Sanger circulated this work through the U.S. postal service, effectively violating the Comstock Law. On appeal, her conviction was reversed on the grounds that contraceptive devices could legally be promoted for the cure and prevention of disease.

“The prohibition of devices advertised for the explicit purpose of birth control was not overturned for another eighteen years. During World War I, U.S. servicemen were the only members of the Allied forces sent overseas without condoms.

“In 1932, Sanger arranged for a shipment of diaphragms to be mailed from Japan to a sympathetic doctor in New York City. When U.S. customs confiscated the package as illegal contraceptive devices, Sanger helped file a lawsuit. In 1936, a federal appeals court ruled in *United States v. One Package of Japanese Pessaries* that the federal government could not interfere with doctors providing contraception to their patients.

“*Griswold v. Connecticut* (1965) struck down one of the remaining contraception Comstock laws in Connecticut and Massachusetts. However, *Griswold* only applied to marital relationships. *Eisenstadt v. Baird* (1972) extended its holding to unmarried persons as well.”

Margaret Sanger is widely regarded as the founder of the modern birth control movement. She was born in 1879 in New York State, to Irish-American parents. Margaret Sanger’s mother, Anne Higgins, went through 18 pregnancies, resulting in 11 live births, before dying, exhausted, at the age of 49. Of the 11 surviving children, Margaret was the sixth, and she spent much of her youth caring for her younger siblings. Nevertheless, with the help of her two older sisters, she attended Claverack College and the Hudson River Institute. She became a nurse, and in 1902 she married William Sanger, who was both a socialist and a successful architect.

In the years 1911-1912, Margaret Sanger wrote a series of articles for the magazine *The New York Call* entitled *What Every Mother Should Know* and in 1912-1913 *What Every Girl Should Know*. Both of these series appeared as books in 1916. Many New York readers were outraged by the frankness of the articles, but many others praised them for their honesty. One reader stated that the articles contained “a purer morality than whole libraries full of hypocritical cant about modesty”.

Margaret Sanger’s work as a nurse among poor immigrant women convinced her that birth control information was urgently needed to avoid excessive family size and deaths from the consequences of back-street abortions. Throughout her career, Sanger disapproved of abortion, and believed that preventative birth control is the only practical way to avoid it.

One of her patients, Sadie Sachs, died after a self-induced abortion. Remembering this



Figure 3.13: Anthony Comstock (1844-1915). He boasted that he was responsible for 4,000 arrests and claimed he drove fifteen persons to suicide. Through his various campaigns, he destroyed 15 tons of books, 284,000 pounds of plates for printing 'objectionable' books, and nearly 4,000,000 pictures.



Figure 3.14: Emma Goldman (1869-1940). She was arrested several times for illegally distributing information on birth control. Wikipedia states that “Her writing and lectures spanned a wide variety of issues, including prisons, atheism, freedom of speech, militarism, capitalism, marriage, free love, and homosexuality.”



Figure 3.15: Margaret Sanger (1879-1966) is considered to be the founder of the modern birth control movement. Defying threats of arrest, she founded the first birth control clinic in America as well as an organization that developed into the Planned Parenthood Federation of America. In 1925 Sanger organized the Sixth International Neo-Malthusian Birth Control Conference. From 1952 to 1959, she served as President of the International Planned Parenthood Federation.

event, Margaret Sanger said later: “I threw my nursing bag in the corner and announced ... that I would never take another case until I had made it possible for working women in America to have the knowledge to control birth”.

3.5 China and India

Table 2.1 shows the population of China at the start of various dynasties. In 125 AD, at the start of the Eastern Han Dynasty, the population was 48,690,789. The precision of this figure is surprising, and it is perhaps the result of the strength of the central government of China even at that early date. As seen in Table 2.1 the population seems to have fallen again, probably to famine and war. Fear of these terrible Malthusian forces explains the Chinese preference for a strong central government. At the start of the Qing dynasty in the 17th century, the population of China began to increase rapidly, probably because of improved flood control and irrigation methods. By 1901, the population of China had reached 426,447,325.

Figure 2.19 shows the growth of Chinese population between 1960 and the present. China’s population continues to increase, dispute the government’s one-child policy, and today the country has approximately 1.4 billion people. China’s rate of population growth is currently only 0.59%.

The post-1949 Chinese government leaders at first viewed population growth as an asset. However, worries about falling water tables and the future availability of fresh water for agriculture, as well as the realization that rapid population growth would block economic development soon produced a policy switch; and the Chinese government began to strongly support both birth control and late marriage.

Since 1979, the Chinese government has advocated a one-child policy for both rural and urban areas. However, this policy admits many exceptions and has been most effective in cities, where the government is able to exert its power by giving apartments only to families with a single child. In 2016, the one-child policy began to be phased out.



Figure 3.16: The one-child policy: A Chinese mother and her only child at a market in Jiayuguan.

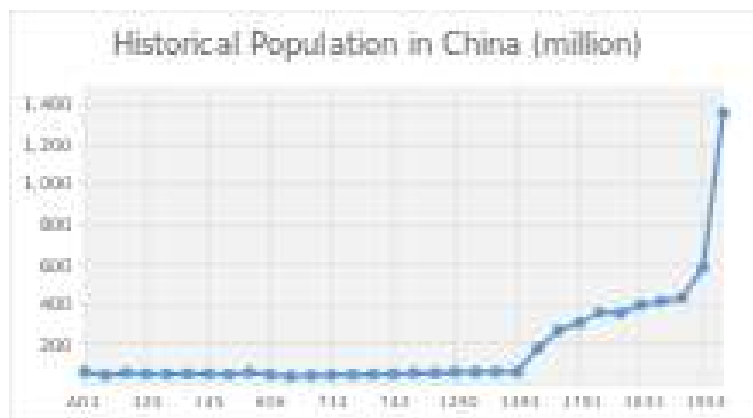


Figure 3.17: Historical estimates of China's population, in millions, from AD 2 until the present. After Ming and earlier period of Qing dynasty founded population moved around 100 million to 150 million until 1700s. In the period between 1749 and 1851, the population doubled in a century. During 1960-2015, the population doubled to nearly 1.4 billion .

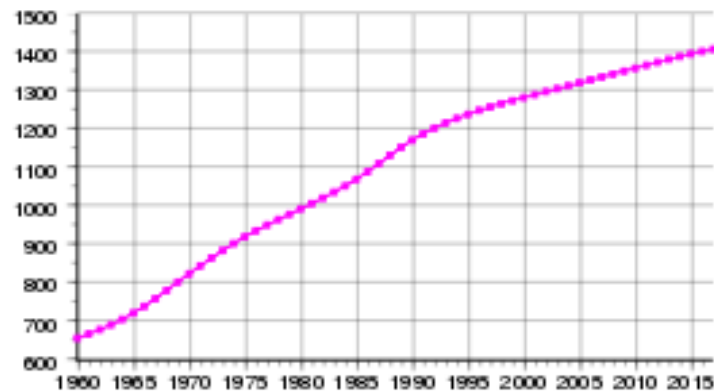


Figure 3.18: This graph shows the population growth of China, in billions, since 1900. Despite China's one-child policy, the country's population continues to grow because of exceptions to the policy and because so many young people are now reaching reproductive age.

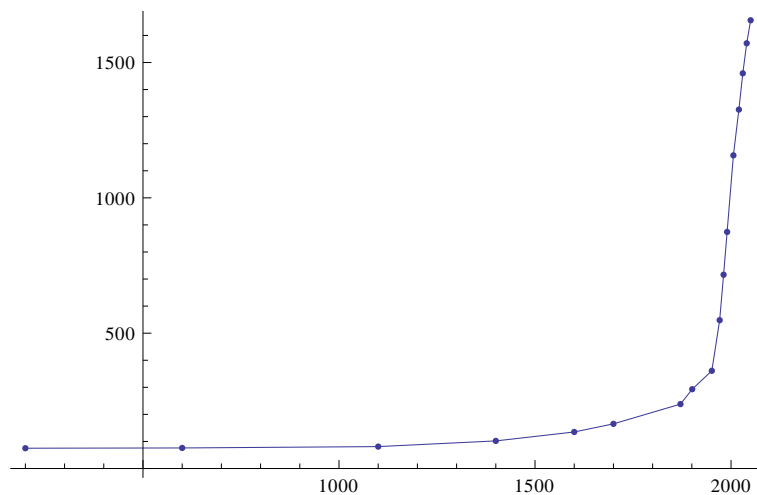


Figure 3.19: The historical and projected population of India as a function of time, from 200 AD to 2050, based on data from the Wikipedia article on *Demographics of India*. If the projections hold, there will be 1.4 billion people in India by 2050, making it the most populous country in the world. However, there is a danger that death rates may rise sharply because of famine and because of deaths due to rising temperatures.

Table 3.1: **China's Dynastic Census Data**

Dynasty	Date (AD)	Households	Population
Eastern Han	125	9,647,838	48,690,789
Western Jin	280	2,458,480	16,163,863
Tang	639	3,120,151	13,252,894
Song	1003	6,864,160	14,278,040
Ming	1398	10,699,399	58,323,933
Qing	1661	not recorded	58,323,933
Qing	1722	not recorded	103,053,992
Qing	1812	not recorded	333,700,560
Qing	1901	not recorded	426,447,325

Table 3.2: **World Population in 2050 (in billions)**

Region	2000	2050	growth
Asia	3.73	5.26	41%
Africa	0.82	2.53	209%
Europe	0.73	0.72	-2%
Latin America	0.53	0.78	48%
North America	0.31	0.43	39%
Oceania	0.03	0.06	84%
World	6.14	9.77	60%



Figure 3.20: This figure shows China’s economic growth rate in recent years. The doubling time for a quantity growing at the rate of 6.8% per year is only 11 years. This high rate of economic growth, compounded by China’s still-growing population, cannot continue without producing an ecological catastrophe, the beginnings of which can already be seen in China.

3.6 Population projections in Africa

Wikipedia’s article on *Projections of Population Growth* states that “By 2070, the bulk of the world’s population growth will take place in Africa: of the additional 2.4 billion people projected between 2015 and 2050, 1.3 billion will be added in Africa, 0.9 billion in Asia and only 0.2 billion in the rest of the world. Africa’s share of global population is projected to grow from 16% in 2015 to 25% in 2050 and 39% by 2100, while the share of Asia will fall from 60% in 2015 to 54% in 2050 and 44% in 2100. The strong growth of the African population will happen regardless of the rate of decrease of fertility, because of the exceptional proportion of young people already living today. For example, the UN projects that the population of Nigeria will surpass that of the United States by 2050.”

“During 2005-2050, twelve countries are expected to account for half of the world’s projected population increase: India, China, United States, Indonesia, Nigeria, Pakistan, Brazil, Democratic Republic of the Congo, Ethiopia, Philippines, Mexico and Egypt, listed according to the size of their contribution to population growth.”

The predictions shown in Table 2.2, especially the prediction that the population of Africa will be 2.53 billion people, raise some worrying questions. It seems likely that because of climate change, failure of the West African monsoon, desertification, and sale of African agricultural land to rich countries such as China and Saudi Arabia, the food available to the people of Africa will diminish rather than increase. Can the population of Africa really increase by 209% by 2050? Or will this be prevented by the terrible Malthusian forces of famine, disease and war? In some parts of Africa famine is already present.

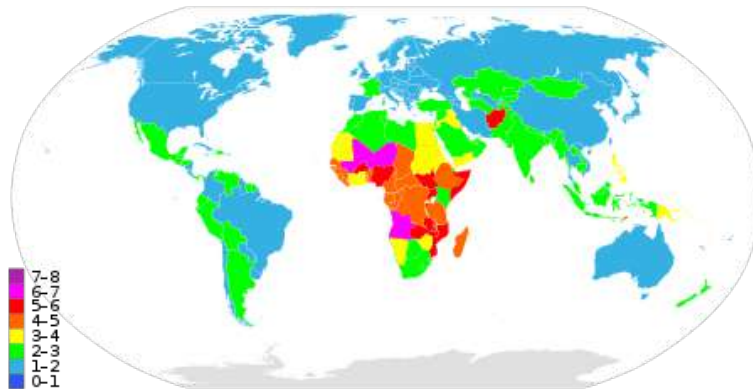


Figure 3.21: A map from the Wikipedia article showing global fertility rates in 2015. The highest fertility rates (purple, 7-8 children per woman-life) occur in Africa.

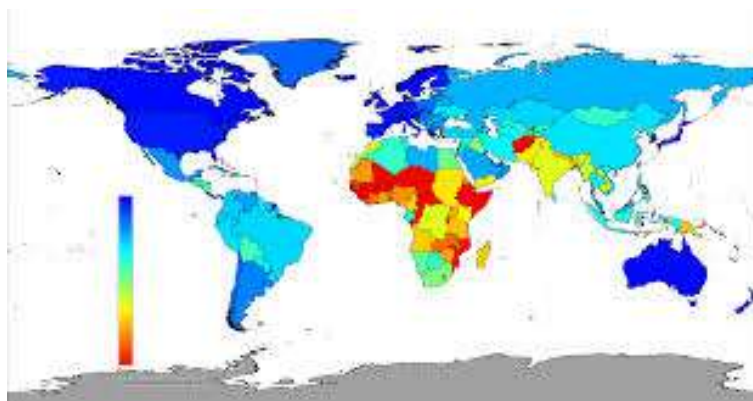


Figure 3.22: A map showing the human development index (HDI) in various parts of the world. The index is based on educational levels, life expectancy, and GDP per capita. It can be seen that regions of high fertility generally have low HDI values.

3.7 What is the future of megacities?

A transformation in cities is going on. Over 80% of the people on the planet today are living in cities. Over 100 new cities will be created within 25 years in China alone. Over 20 new Megacities will redefine the consumer marketplace and society. Most of these cities of over 8 million people each will be in the developing world. With the huge migration to cities of the global population, what challenges will these cities face? What are the opportunities and risks? How should global organizations prepare for the future of cities?

Transition Towns

The Transition Town Movement of today is a response to the end of the fossil fuel era and the threat of economic collapse. It can be thought of as a modern branch of the Cooperative Movement. In 2006, the Transition Town of Totnes in Devon, England was the first to use this name, which implied a transition from globalism, consumerism and growth to a sustainable, local and self-sufficient economy. The ideal was to produce locally all the necessary food for the town, and as much of other necessities as possible. In this way, the energy expenditures involved in transportation could be avoided.

Today there are more than a thousand Transition Towns and they are located in 43 countries. Many of them have local currencies which are legal tender within the town. If the pioneers of this movement are right in saying that this is the only sustainable model for the future, we may wonder whether mega-cities will be able to survive in the long-term future.⁴

Gandhi's vision of India's future

Gandhi tried to reconstruct the crafts and self-reliance of village life that he felt had been destroyed by the colonial system. "I would say that if the village perishes, India will perish too", he wrote, "India will be no more India. Her own mission in the world will get lost. The revival of the village is only possible when it is no more exploited. Industrialization on a mass scale will necessarily lead to passive or active exploitation of the villagers as problems of competition and marketing come in. Therefore we have to concentrate on the village being self-contained, manufacturing mainly for use. Provided this character of the village industry is maintained, there would be no objection to villagers using even the modern machines that they can make and can afford to use. Only they should not be used as a means of exploitation by others."

"You cannot build nonviolence on a factory civilization, but it can be built on self-contained villages... Rural economy as I have conceived it, eschews exploitation altogether, and exploitation is the essence of violence... We have to make a choice between India of

⁴<https://en.wikipedia.org/wiki/Degrowth>
<http://commondreams.org/views/2015/07/31/we-are-all-greece>
<http://www.localfutures.org/>
<http://www.powells.com/biblio/7-9780871566430-2>

Table 3.3: The World's Largest Cities in 2016

Rank	Name	Country	Population
1	Tokyo	Japan	38,140,000
2	Shanghai	China	34,000,000
3	Jakarta	Indonesia	31,500,000
4	Delhi	India	27,200,000
5	Seoul	Korea	25,600,000
6	Guangzhou	China	25,000,000
7	Beijing	China	24,900,000
8	Manila	Philippines	24,100,000
9	Mumbai	India	23,900,000
10	New York City	United States	23,876,155
11	Shenzhen	China	23,300,000
12	Sao Paulo	Brazil	21,242,939



Figure 3.23: Totnes, Devon, England: a transition town.

the villages that are as ancient as herself and India of the cities which are a creation of foreign domination...”

Suggestions for further reading

1. John Fielden, *The Curse of the Factory System*, (1836).
2. A. Smith, *The Theory of Moral Sentiments...* (1759), ed. D.D. Raphael and A.L. MacPhie, Clarendon, Oxford, (1976).
3. A. Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776), Everyman edn., 2 vols., Dent, London, (1910).
4. Charles Knowlton *The Fruits of Philosophy, or The Private Companion of Young Married People*, (1832).
5. John A. Hobson, *John Ruskin, Social Reformer*, (1898).
6. E. Pease, *A History of the Fabian Society*, Dutton, New York, (1916).
7. G. Claeys, ed., *New View of Society, and other writings by Robert Owen*, Penguin Classics, (1991).
8. W. Bowden, *Industrial Society in England Towards the End of the Eighteenth Century*, MacMillan, New York, (1925).
9. G.D. Cole, *A Short History of the British Working Class Movement*, MacMillan, New York, (1927).
10. P. Deane, *The First Industrial Revolution*, Cambridge University Press, (1969).
11. Marie Boaz, *Robert Boyle and Seventeenth Century Chemistry*, Cambridge University Press (1958).
12. J.G. Crowther, *Scientists of the Industrial Revolution*, The Cresset Press, London (1962).
13. R.E. Schofield, *The Lunar Society of Birmingham*, Oxford University Press (1963).
14. L.T.C. Rolt, *Isambard Kingdom Brunel*, Arrow Books, London (1961).

15. J.D. Bernal, *Science in History*, Penguin Books Ltd. (1969).
16. Bertrand Russell, *The Impact of Science on Society*, Unwin Books, London (1952).
17. Wilbert E. Moore, *The Impact of Industry*, Prentice Hall (1965).
18. Charles Morazé, *The Nineteenth Century*, George Allen and Unwin Ltd., London (1976).
19. Carlo M. Cipolla (editor), *The Fontana Economic History of Europe*, Fontana/Collins, Glasgow (1977).
20. Martin Gerhard Geisbrecht, *The Evolution of Economic Society*, W.H. Freeman and Co. (1972).
21. P.N. Stearns, *The Industrial Revolution in World History*, Westview Press, (1998).
22. E.P. Thompson, *The Making of the English Working Class*, Penguin Books, London, (1980).
23. N.J. Smelser, *Social Change and the Industrial Revolution: An Application of Theory to the British Cotton Industry*, University of Chicago Press, (1959).
24. D.S. Landes, *The Unbound Prometheus: Technical Change and Industrial Development in Western Europe from 1750 to the Present*, 2nd ed., Cambridge University Press, (2003).
25. S. Pollard, *Peaceful Conquest: The Industrialization of Europe, 1760-1970*, Oxford University Press, (1981).
26. M. Kranzberg and C.W. Pursell, Jr., eds., *Technology in Western Civilization*, Oxford University Press, (1981).
27. M.J. Daunton, *Progress and Poverty: An Economic and Social History of Britain, 1700-1850*, Oxford University Press, (1990).
28. L.R. Berlanstein, *The Industrial Revolution and Work in 19th Century Europe*, Routledge, (1992).
29. J.D. Bernal, *Science and Industry in the 19th Century*, Indiana University Press, Bloomington, (1970).
30. P.A. Brown, *The French Revolution in English History*, 2nd edn., Allen and Unwin, London, (1923).
31. E. Burke, *Reflections on the Revolution in France and on the Proceedings of Certain Societies in London Relative to that Event...*, Dent, London, (1910).
32. J.B. Bury, *The Idea of Progress*, MacMillan, New York, (1932).
33. I.R. Christie, *Stress and Stability in Late Eighteenth Century Britain; Reflections on the British Avoidance of Revolution* (Ford Lectures, 1983-4), Clarendon, Oxford, (1984).
34. H.T. Dickenson, *Liberty and Property, Political Ideology in Eighteenth Century Britain*, Holmes and Meier, New York, (1977).
35. W. Eltis, *The Classical Theory of Economic Growth*, St. Martin's, New York, (1984).
36. E. Halévy, *A History of the English People in the Nineteenth Century*, (transl. E.I. Watkin), 2nd edn., Benn, London, (1949).
37. E. Halévy, *The Growth of Philosophic Radicalism*, (transl. M. Morris), new edn., reprinted with corrections, Faber, London, (1952).

38. W. Hazlitt, *The Complete Works of William Hazlitt*, ed. P.P. Howe, after the edition of A.R. Walker and A. Glover, 21 vols., J.M. Dent, London, (1932).
39. W. Hazlitt, *A Reply to the Essay on Population by the Rev. T.R. Malthus...*, Longman, Hurst, Rees and Orme, London, (1807).
40. R. Heilbroner, *The Worldly Philosophers: The Lives, Times and Ideas of the Great Economic Thinkers*, 5th edn., Simon and Schuster, New York, (1980).
41. R.K. Kanth, *Political Economy and Laissez-Faire: Economics and Ideology in the Ricardian Era*, Rowman and Littlefield, Totowa N.J., (1986).
42. J.M. Keynes, *Essays in Biography*, in *The Collected Writings of John Maynard Keynes*, MacMillan, London, (1971-82).
43. F. Knight, *University Rebel: The Life of William Frend, 1757-1841*, Gollancz, London (1971).
44. M. Lamb, and C. Lamb, *The Works of Charles and Mary Lamb*, ed. E.V. Lucas, 7 vols., Methuen, London, (1903).
45. A. Lincoln, *Some Political and Social Ideas of English Dissent, 1763-1800*, Cambridge University Press, (1938).
46. D. Locke, *A Fantasy of Reason: The Life and Thought of William Godwin*, Routledge, London, (1980).
47. J. Locke, *Two Treatises on Government. A Critical Edition with an Introduction and Apparatus Criticus*, ed. P. Laslett, Cambridge University Press, (1967).
48. J. Macintosh, *Vindicae Gallicae. Defense of the French Revolution and its English Admirers against the Accusations of the Right Hon. Edmund Burke...*, Robinson, London, (1791).
49. J. Macintosh, *A Discourse on the Study of the Law of Nature and of Nations*, Caldell, London, (1799).
50. T. Paine, *The Rights of Man: being an Answer to Mr. Burke's Attack on The French Revolution*, Jordan, London, part I (1791), part II (1792).
51. H.G. Wells, *Anticipations of the Reaction of Mechanical and Scientific Progress on Human Life and Thought*, Chapman and Hall, London, (1902).
52. B. Wiley, *The Eighteenth Century Background: Studies of the Idea of Nature in the Thought of the Period*, Chatto and Windus, London, (1940).
53. G.R. Morrow, *The Ethical and Economic Theories of Adam Smith: A Study in the Social Philosophy of the 18th Century*, Cornell Studies in Philosophy, **13**, 91-107, (1923).
54. H.W. Schneider, ed., *Adam Smith's Moral and Political Philosophy*, Harper Torchbook edition, New York, (1948).
55. F. Rosen, *Classical Utilitarianism from Hume to Mill*, Routledge, (2003).
56. J.Z. Muller, *The Mind and the Market: Capitalism in Western Thought*, Anchor Books, (2002).
57. J.Z. Muller, *Adam Smith in His Time and Ours: Designing the Decent Society*, Princeton University Press, (1995).
58. S. Hollander, *The Economics of Adam Smith*, University of Toronto Press, (19773).

59. K. Haakonssen, *The Cambridge Companion to Adam Smith*, Cambridge University Press, (2006).
60. K. Haakonssen, *The Science of a Legeslator: The Natural Jurisprudence of David Hume and Adam Smith*, Cambridge University Press, (1981).
61. I. Hont and M. Ignatieff, *Wealth and Virtue: The Shaping of Political Economy in the Scottish Enlightenment*, Cambridge University Press, (1983).
62. I.S. Ross, *The Life of Adam Smith*, Clarendon Press, Oxford, (1976).
63. D. Winch, *Adam Smith's Politics: An Essay in Historiographic Revision*, Cambridge University Press, (1979).

Chapter 4

WOMEN'S RIGHTS

4.1 Woman's rights and population stabilization

Experts agree that higher status for women, higher education for women, and jobs outside the home are key steps that are needed to stabilize global population. Moreover, these reforms are highly desirable for their own sake, for the sake of justice and equality, and for the sake of the uniquely life-oriented vision that women can give us.

In this chapter, we review some of the historical steps in this direction, starting with Mary Wollstonecraft's book *Vindication of the Rights of Woman*, published in 1792.

Mary Wollstonecraft

The first of a new genus

Mary Wollstonecraft was born in London in 1759. Although her family had a comfortable income during her childhood, Mary's father later lost his fortune through speculation, and the family entered a period of severe financial difficulties. He also subjected his wife to physical violence, and Mary often slept in front of her mother's door in order to protect her.

Because of the family's financial problems, Mary was forced to take a number of jobs which she found very distasteful, for example as companion to an unpleasant old lady. However, while working, she tried her hand as a writer, producing a children's book, *Original Stories From Real Life* (1788), and two pioneering feminist books, *Thoughts on the Education of Daughters* and *Mary: A Fiction* (1788).

Mary Wollstonecraft then bravely decided to try to support herself through writing. As she wrote to her sister, had decided to become the first of a new genus: a professional female writer. Having learned French and German, she translated Necker's *Of the Importance of Religious Opinions* and Saltzman's *Elements of Morality for the Use of Children*. Mary was helped in her new career by the liberal publisher, Joseph Johnson, who was also the publisher of Thomas Paine and William Godwin. Mary met these already famous authors at Johnson's dinner parties, and conversations with them helped to expand her knowledge



Figure 4.1: Mary Wollstonecraft in a painting by John Opie (public domain).

and ambitions. Joseph Johnson was a very brave man. By publishing the works of radical authors, he was risking arrest by England's repressive government. In her letters, Mary described Johnson as "a father and brother".

Scandalous love affairs

Mary Wollstonecraft had two scandalous love affairs. At that time, according to the strict rules for female behavior, these placed her completely outside the bounds of society.

The first of these unconventional love affairs was with the already married artist Henry Fuseli. Mary proposed to Fuseli's wife that all three of them should live together, but (not surprisingly) Fuseli's wife rejected this plan in horror and forced her husband to break off the relationship with Mary.

Mary then decided to travel to France, where the French Revolution had just taken place. She arrived there in 1792, about a month before the execution of Louis XVI. There she fell passionately in love with an American adventurer, Gilbert Imlay, with whom she had a daughter named Fanny. When Britain declared war on France in 1794, Imlay registered Mary as his wife in order to protect her from the French authorities, even though they were not married.

Vindication of the Rights of Woman

While in France, Mary Wollstonecraft had written *An Historical and Moral View of the French Revolution*, which was published in London in 1794. She also wrote *Vindication of the Rights of Woman* (1792) and *Vindication of the Rights of Man* (1792). Both of these were replies to Edmund Burke's argument for conservatism, *Reflection on the Revolution in France*. In her book on the rights of women, Mary wrote:

"My main argument is built on this simple principle, that if [woman] be not prepared by education to become the companion of man, she will stop the progress of knowledge and virtue; for truth must be common to all",

Wollstonecraft contends that society will degenerate without educated women, particularly because mothers are the primary educators of young children. She attributes the problem of uneducated women to men and

"...a false system of education, gathered from the books written on this subject by men who [consider] females rather as women than human creatures"

"Taught from their infancy that beauty is woman's sceptre, the mind shapes itself to the body, and, roaming round its gilt cage, only seeks to adorn its prison"

"I then would fain convince reasonable men of the importance of some of my remarks; and prevail on them to weigh dispassionately the whole tenor of my observations. I appeal to their understandings; and, as a fellow-creature, claim, in the name of my sex, some interest in their hearts. I entreat them to assist to emancipate their companion, to make her a help meet for them! Would men but generously snap our chains, and be content with rational fellowship instead of slavish obedience, they would find us more observant

daughters, more affectionate sisters, more faithful wives, more reasonable mothers: in a word, better citizens. ”

Return to England and marriage to William Godwin

When France became too dangerous, Imlay had traveled to London, and Mary joined him there in 1794, hoping to continue their relationship. When he rejected her, she attempted suicide. In another attempt to win Imlay’s affections. Mary traveled to Norway to take care of Imlay’s business dealings there. But when she returned to London, Imlay once again rejected her, and she once again attempted suicide. Once again was saved, this time by someone who saw her leap from a bridge into the Thames.

Gradually recognizing that her pursuit of Imlay was hopeless, Mary resumed her writing career, encouraged, as before by the brave publisher Joseph Johnson. At Johnson’s parties she once again met the famous novelist and philosopher William Godwin. This time, they both formed a higher opinion of each other than at their first meeting. A passionate love affair developed between them, and when Mary became pregnant, they were married. Tragically, Mary Wollstonecraft died in childbirth. Her daughter with William Godwin would later become the wife of Godwin’s admirer, the poet Percy Bysshe Shelley. Mary Shelley continued the family tradition by becoming a famous author: She created the masterpiece *Frankenstein*.

4.2 Votes for women

Emmeline Pankhurst (1858-1928)

The daughter of politically active parents, Emmeline was introduced to the campaign for women’s suffrage at the age of 14. In 1879 she married Richard Pankhurst. He was a barrister, sympathetic to the cause of votes for women, and 24 years older than she. Of the five children born to the marriage Emmeline and Richard’s daughters Christobel and Sylvia became active in the fight for the political rights of women.

In 1903, a year after the death of her husband, Emmeline Pankhurst founded what was to become the most radical and controversial branch of the campaign for women’s rights: the Women’s Social and Political Union (WSPU). This organization, consisting entirely of women, believed that little progress would be made through polite requests for reform. Therefore WSPU members chained themselves to railings, broke the windows of prominent buildings, set fire to postboxes, attacked policemen, and, when arrested, went on hunger strikes. The hunger striking women were force-fed, their jaws being held open by steel clamps and tubes forced down their throats. Of course newspapers reported all of this, and debate about the issues reached a high pitch.

After World War I, the Representation of the People Act of 1918 extended the right to vote to men over 21, and to women property owners over 30.



Figure 4.2: Emmeline Pankhurst (1858-1928). In 1999, Time Magazine named Emmeline Pankhurst as one of the 100 most important people of the 20th century, noting that “she shaped an idea of women for our time; she shook society into a new pattern from which there could be no going back”.



Figure 4.3: A WSPU poster by Hilda Davis, 1909.



Figure 4.4: Annie Kenney and Emmeline Pankhurst's daughter, Christobel. When World War I broke out, both Emmeline and Christobel Pankhurst halted their protests and supported conscription and the war effort. By contrast, Sylvia opposed the war. When the war was over, the Representation of the People Act of 1918 extended the right to vote to men over 21, and to women property owners over 30. The discrepancy between men and women was intended to ensure that women did not become a majority.



Figure 4.5: Sylvia Pankhurst in 1910. She wanted the suffragette movement to be explicitly on the side of the Labour Party, and broke with her family on this issue. She was also opposed to war. In 1915, Sylvia Pankhurst gave her enthusiastic support to the International Woman's Peace Congress, which was held in the Hague.



Figure 4.6: A suffragette who has chained herself to a railing.



Figure 4.7: The arrest of a suffragette.

4.3 Women's political rights in other countries

According to the Wikipedia article on *Woman's Suffrage*, "The first European country to introduce women's suffrage was the Grand Duchy of Finland, then part of the Russian Empire, which elected the world's first women Members of Parliament in the 1907 parliamentary elections. Norway followed, granting full women's suffrage in 1913. Denmark followed in 1915, and the Soviet Union followed in 1917.

"Most independent countries enacted women's suffrage in the inter-war era, including Canada in 1917, Britain (over 30 in 1918, over 21 in 1928), Germany, Poland in 1918, Austria and the Netherlands in 1919, and the United States in 1920 (Voting Rights Act of 1965 secured voting rights for racial minorities)...

"Late adopters in Europe were Spain in 1933, France in 1944, Italy in 1946, Greece in 1952,[12] San Marino in 1959, Monaco in 1962, Andorra in 1970, Switzerland in 1971 at federal level, and at local canton level between 1959 in the cantons of Vaud and Neuchâtel and 1991 in the canton of Appenzell Innerrhoden,[16] and Liechtenstein in 1984. In addition, although women in Portugal obtained suffrage in 1931, this was with stronger restrictions than those of men; full gender equality in voting was only granted in 1976...

"The last Latin American country to give women the right to vote was Paraguay in 1961. In December 2015, women were first allowed to vote in Saudi Arabia (municipal elections).

"Extended political campaigns by women and their supporters have generally been necessary to gain legislation or constitutional amendments for women's suffrage. In many countries, limited suffrage for women was granted before universal suffrage for men; for instance, literate women or property owners were granted suffrage before all men received it. The United Nations encouraged women's suffrage in the years following World War II, and the Convention on the Elimination of All Forms of Discrimination Against Women (1979) identifies it as a basic right with 189 countries currently being parties to this Convention."

4.4 Educational equality for women

Maria Montessori and modern educational methods

Dr. Maria Montessori (1870-1952) was an Italian physician and educator who pioneered modern non-authoritarian methods of education. Her father was an official in the Italian Ministry of Finance, while her mother belonged to a family that greatly valued education. Encouraged by her mother, the young Maria first studied to become an engineer, at that time an unusual profession for a woman, and then changed to the even more unusual study of medicine.

After passing examinations in botany, zoology, experimental physics, histology, anatomy, and general and organic chemistry at the University of Rome, she was finally accepted as a medical student. Because she was a woman, Montessori encountered discrimination and opposition from both the students and staff of Rome's medical school. She was forced



Figure 4.8: **Dr. Maria Montessori (1870-1952).**

to perform anatomy dissections alone at night, because it was considered improper for a woman to view naked bodies in the company of men. Nevertheless, Maria Montessori graduated with distinction, having specialized in pediatrics and psychology during her last two years.

Dr. Montessori then became interested in the problem of educating retarded children. The experimental methods which she introduced were built on the natural tendencies of all children to explore their environments and to learn new skills. She gave her students the materials that they needed to be creative, and let them use these materials in their own spontaneous way. Her results were astonishingly successful, and most of her students, despite having been classified as retarded, were able to pass normal examinations. Encouraged by this success, Montessori tried the same methods on normal students. Again the results were remarkable. The normal children became super-good students. Her astonishingly good results made Maria Montessori internationally famous. She later studied

anthropology and added this discipline to medicine, pediatrics and psychology as a background for her educational work.

Some quotations from Dr. Maria Montessori's many books

"And so we discovered that education is not something which the teacher does, but that it is a natural process which develops spontaneously in the human being. It is not acquired by listening to words, but in virtue of experiences in which the child acts on his environment. The teacher's task is not to talk, but to prepare and arrange a series of motives for cultural activity in a special environment made for the child" (from *The Absorbent Mind*).

"..the task of the educator lies in seeing that the child does not confound good with immobility, and evil with activity, as often happens in old-time discipline... A room in which all the children move about usefully, intelligently, and voluntarily, without committing any rough or rude act, would seem to me a classroom very well disciplined indeed." (from *The Montessori Method*)

"The instructions of the teacher consist then merely in a hint, a touch - enough to give a start to the child. The rest develops of itself." (from *Dr. Montessori's Own Handbook*)

"Today, however, those things which occupy us in the field of education are the interests of humanity at large and of civilization, and before such great forces we can recognize only one country - the entire world." (from *The Montessori Method*)

"How can we speak of Democracy or Freedom when from the very beginning of life we mould the child to undergo tyranny, to obey a dictator? How can we expect democracy when we have reared slaves? Real freedom begins at the beginning of life, not at the adult stage. These people who have been diminished in their powers, made short-sighted, devitalized by mental fatigue, whose bodies have become distorted, whose wills have been broken by elders who say: 'your will must disappear and mine prevail!' - how can we expect them, when school-life is finished, to accept and use the rights of freedom?" (from *Education for a New World*)

"Nowadays nobody's life is safe. An absurd war may be declared in which all men - young and old, women and children - are in mortal danger. Civilians are bombed and people have to take refuge in underground shelters just as primitive men took refuge in caves to defend themselves against wild beasts. The supply of food may be cut off and millions may die of famine and plague. Do we not see men in rags or even naked, freezing to death, families separated and torn apart, children abandoned and roaming about in wild hordes?

"This we see, not only among those vanquished in war, but everywhere. Humanity itself is vanquished and enslaved - but why enslaved? Because all men are slaves, the victors as well as the vanquished, insecure, frightened, suspicious and hostile, compelled to defend themselves by means of spying and brigandage, using and fostering immorality as a means

of defense...”

“It may seem that we have drifted rather far from our original subject - Education. This digression, however, must open up the new road along which we now have to go. In the same way in which we help the patients in a hospital to recover their health and continue to live so we must now help humanity to save itself. We must be nurses in a hospital, as vast as the world itself.” (from *The Formation of Man*).

Malala Yousafzai

Malala Yousafzai was born in 1997 in the beautiful Swat Valley of Pakistan. Her father, Ziauddin Yousafzai is a poet, educational activist, and school owner. In 2008, he was contacted by a representative of the BBC’s Urdu service and asked to recommend a girl from one of his schools to write a continuing blog about what life was like under the Taliban. When all of the girls whom Ziauddin asked were too frightened, he finally recommended his own daughter, Malala. Her blog was aired anonymously by the BBC Urdu service.

After the BBC diary ended, Malala Yousafzai and her father were approached by a New York Times reporter about filming a documentary. Wikipedia states that “Following the documentary, Yousafzai was interviewed on the national Pashto-language station AVT Khyber, the Urdu-language Daily Aaj, and Canada’s Toronto Star.[34] She made a second appearance on Capital Talk on 19 August 2009. Her BBC blogging identity was being revealed in articles by December 2009. She also began appearing on television to publicly advocate for female education. From 2009 to 2010 she was the chair of the District Child Assembly of the Khpal Kor Foundation through 2009 and 2010.”

“In October 2011, Archbishop Desmond Tutu, a South African activist, nominated Yousafzai for the International Children’s Peace Prize of the Dutch international children’s advocacy group KidsRights Foundation. She was the first Pakistani girl to be nominated for the award. The announcement said, ‘Malala dared to stand up for herself and other girls and used national and international media to let the world know girls should also have the right to go to school.’ The award was won by Michaela Mycroft of South Africa.

“Her public profile rose even further when she was awarded Pakistan’s first National Youth Peace Prize two months later in December. On 19 December 2011, Prime Minister Yousaf Raza Gillani awarded her the National Peace Award for Youth. At the proceedings in her honor, Yousafzai stated that she was not a member of any political party, but hoped to found a national party of her own to promote education. The prime minister directed the authorities to set up an IT campus in the Swat Degree College for Women at Yousafzai’s request, and a secondary school was renamed in her honor. By 2012, Yousafzai was planning to organize the Malala Education Foundation, which would help poor girls go to school

“As Yousafzai became more recognized, the dangers facing her increased. Death threats against her were published in newspapers and slipped under her door. On Facebook, where she was an active user, she began to receive threats and fake profiles were created under her name. Eventually, a Taliban spokesman said they were ‘forced’ to act. In a meeting held in the summer of 2012, Taliban leaders unanimously agreed to kill her.

“On 9 October 2012, a Taliban gunman shot Yousafzai as she rode home on a bus after taking an exam in Pakistan’s Swat Valley. Yousafzai was 15 years old at the time. According to reports, a masked gunman shouted ”Which one of you is Malala? Speak up, otherwise I will shoot you all”, and, on upon her being identified, shot her. She was hit with one bullet, which went through her head, neck, and ended in her shoulder. Two other girls were also wounded in the shooting.”

Malala did not die, however. The shooting resulted in an enormous international wave of sympathy for her, and outrage at Taliban’s murder attempt. She became the world’s most famous teenager. She met Queen Elizabeth II and Barack Obama, and spoke at the Oxford Union. Harvard University and the Canadian Parliament. In 2014, she shared the Nobel Peace Prize with Kailash Satyarthi, a children’s rights activist from India. Here are some excerpts from her Nobel Address:

“We had a thirst for education, we had a thirst for education because our future was right there in that classroom. We would sit and learn and read together. We loved to wear neat and tidy school uniforms and we would sit there with big dreams in our eyes. We wanted to make our parents proud and prove that we could also excel in our studies and achieve those goals, which some people think only boys can.

“But things did not remain the same. When I was in Swat, which was a place of tourism and beauty, suddenly it changed into a place of terrorism. I was just ten when more than 400 schools were destroyed. Women were flogged. People were killed. And our beautiful dreams turned into nightmares.

“Education went from being a right to being a crime. Girls were stopped from going to school. When my world suddenly changed, my priorities changed too. I had two options. One was to remain silent and wait to be killed. And the second was to speak up and then be killed. I chose the second one. I decided to speak up.

“We could not just stand by and see those injustices of the terrorists denying our rights, ruthlessly killing people and misusing the name of Islam. We decided to raise our voice and tell them: Have you not learnt, have you not learnt that in the Holy Quran Allah says: if you kill one person it is as if you kill the whole humanity?

“...I tell my story, not because it is unique, but because it is not. It is the story of many girls. Today, I tell their stories too. I have brought with me some of my sisters from Pakistan, from Nigeria and from Syria, who share this story. My brave sisters Shazia and Kainat who were also shot that day on our school bus. But they have not stopped learning. And my brave sister Kainat Soomro who went through severe abuse and extreme violence, even her brother was killed, but she did not succumb.

“Also my sisters here, whom I have met during my Malala Fund campaign. My 16-year-old courageous sister, Mezon from Syria, who now lives in Jordan as refugee and goes from tent to tent encouraging girls and boys to learn. And my sister Amina, from the North of Nigeria, where Boko Haram threatens, and stops girls and even kidnaps girls, just for wanting to go to school.

“I am Malala. But I am also Shazia. I am Kainat. I am Kainat Soomro. I am Mezon. I am Amina. I am those 66 million girls who are deprived of education. And today I am

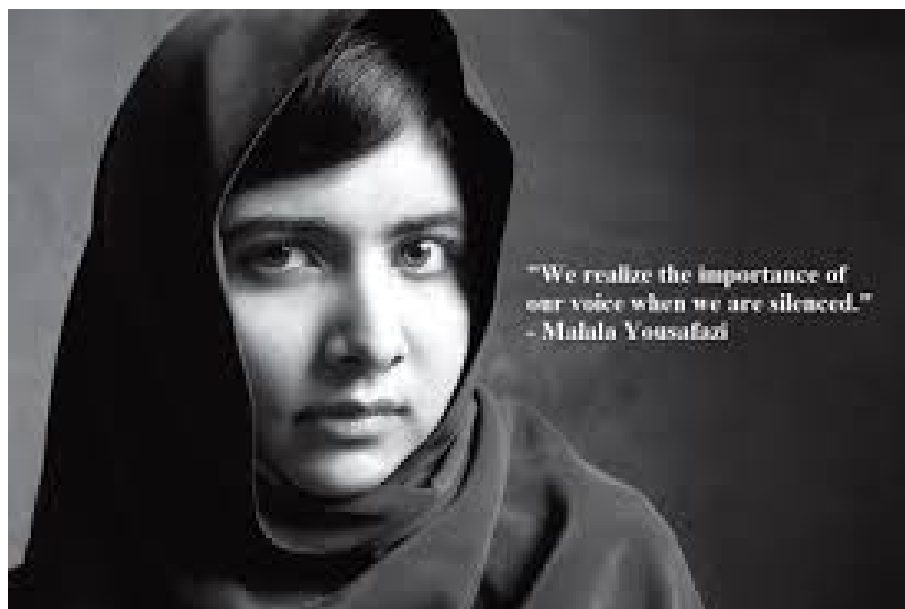


Figure 4.9: Malala Yousafzai: “We realize the importance of our voice when we are silenced”.

not raising my voice, it is the voice of those 66 million girls.

“...Dear sisters and brothers, today, in half of the world, we see rapid progress and development. However, there are many countries where millions still suffer from the very old problems of war, poverty, and injustice.

“We still see conflicts in which innocent people lose their lives and children become orphans. We see many people becoming refugees in Syria, Gaza and Iraq. In Afghanistan, we see families being killed in suicide attacks and bomb blasts.

“Many children in Africa do not have access to education because of poverty. And as I said, we still see, we still see girls who have no freedom to go to school in the north of Nigeria.

“Many children in countries like Pakistan and India, as Kailash Satyarthi mentioned, many children, especially in India and Pakistan are deprived of their right to education because of social taboos, or they have been forced into child marriage or into child labor.

“...Dear sisters and brothers, dear fellow children, we must work - not wait. Not just the politicians and the world leaders, we all need to contribute. Me. You. We. It is our duty.

“Let us become the first generation to decide to be the last, let us become the first generation that decides to be the last that sees empty classrooms, lost childhoods, and wasted potentials. Let this be the last time that a girl or a boy spends their childhood in a factory. Let this be the last time that a girl is forced into early child marriage. Let this be the last time that a child loses life in war. Let this be the last time that we see a child out of school. Let this end with us. Let’s begin this ending ... together ... today ... right here, right now. Let’s begin this ending now.”



Figure 4.10: **Women are the intellectual equals of men.**



Figure 4.11: When he was Sweden's Prime Minister, Olof Palme declared that his administration's goal was that "neither in education, nor in opportunities for employment, nor in law, nor in social custom, should there be any difference whatever between men and women".



Figure 4.12: Experts agree that educational and legal equality for women are vitally important steps towards stabilizing, and ultimately reducing, global population. These reforms are also extremely important for their own sake, and for the sake of the uniquely life-oriented insights that women can give to the world.

4.5 A few Scandinavian women

The countries of Scandinavia, Denmark, Norway, Sweden, Finland and Iceland, have a seafaring tradition. Especially during the Viking era (793-1066), the men were frequently away on voyages. The women, left behind to manage families and farms by themselves, established a tradition of independence which has lasted until modern times. In Scandinavia, the high educational level and social status of women is linked with low birth rates, which are in turn the cause of the prosperity of the region. There are many famous Scandinavian women. Here are some short biographical sketched of a few of them.

Aud the Deep-Minded (9th century)

In the 9th century AD, a local king named Harold (c.850-c.932) resolved to become king of all of Norway. He swore that he would not cut or comb his hair until he had achieved this goal. Finally after much struggle, he became the first king of the entire country. He then cut and combed his hair, after which he was known as Harold Finehair.

Many local leaders in Norway left the country rather than submit to the rule of Harold Finehair. One of these chieftains was Ketill Flatnose, who sailed to Ireland with his daughter Aud. Aud married Olaf the White, the son of King Ingjald, who had named himself King of Dublin after conquering the city. Aud and Olaf had a son, named Thorstein the Red, who later conquered northern Scotland. Thorstein was married in the Hebrides, and had six daughters. However, he was betrayed and killed in battle.

When the news of Thorstein's death reached Aud, she realized that she and her followers were no longer safe in Scotland. Therefore she ordered the secret building of a ship, on which she and her people escaped and sailed to Iceland. Aud the Deep-Minded is remembered as a great matriarch and one of the founders of the Icelandic nation.



Figure 4.13: **Aud the Deep-Minded (9th century)** was the daughter of Ketill Flatnose. She is remembered as a great matriarch, and one of the founders of the Icelandic nation.

Queen Margrethe I (1353-1412)

Today, Denmark's queen is Margrethe II, who is artistically gifted, highly intelligent and immensely popular. Just as England's Queen Elizabeth II is named after a famous earlier queen, so Margrethe II also takes her name from a famous figure in the history of Scandinavia, Queen Margrethe I, the architect of the Kalmar Union which united Norway, Sweden and Denmark for more than a century.

Margrethe, the daughter of King Valdemar IV of Denmark. At the age of 6, she was engaged to the 18-year-old King Haakon VI of Norway. They were married in 1363, and through the marriage, Margrethe became the Queen Consort of Norway. Margrethe and Haakon had a son, named Olaf. When Margrethe's father died in 1375, Margrethe succeeded in having her infant son Olaf installed as King of Denmark. Of course, it was she who actually ruled Denmark.

When Haakon died in 1380, Olaf succeeded him as King of Norway. However, Olaf died suddenly in 1387, aged 17, and Margaret, who had ruled both kingdoms in his name, was chosen Regent of Norway and Denmark in 1388. Meanwhile, in Sweden, the noblemen were rebelling against their unpopular king, Albert. Several of the powerful nobles wrote to Margaret that if she would help rid Sweden of Albert, she would become their regent. She quickly gathered an army and invaded Sweden.

At a conference at Dalaborg Castle in 1388, the Swedes elected Margrethe as "Sovereign Lady and Ruler" of Sweden. However, the deposed King Albert returned with an army, aiming to overthrow Margrethe. A decisive battle was fought, in which Margrethe's army was victorious. She thus became the undisputed ruler of three countries, Norway, Denmark and Sweden. Through her great diplomatic skills, Margrethe I stabilized this union of the three Scandinavian countries.



Figure 4.14: An effigy of Margrethe I in Roskilde Cathedral. She created the Kalmar Union, which united Denmark, Sweden and Norway.



Figure 4.15: The pioneering Danish feminist author Mathilde Fabiger (1830-1872), Her novel *Clara Raphael* created a storm of controversy and debate when it was published in 1851. At one point in the book, Clara, the heroine, writes to a friend, “For the first time in my life, I felt sorrow over the fact that I am not a man... Is it really true that half of humanity is excluded from intellectual occupations?”



Figure 4.16: Thit Jensen as a young author (left) and as an older birth control campaigner (right).

Thit Jensen (1876-1957)

Thit Jensen was a Danish author and activist for planned parenthood. She was the sister of Johannes V. Jensen, who won the Nobel Prize for Literature in 1944. The brother and sister authors were part of a flock of 12 children born to a veterinarian and his wife in a small town in Jutland. Thit Jensen's mother suffered greatly during the birth of her many children. During one birth, both her eardrums burst, after which she was almost completely deaf. During another birth, the mother's back was so damaged that afterwards she had to wear a painful iron corset. The spectacle of her mother's suffering made Thit Jensen resolve to work for women's freedom to choose whether or not they wished to have babies.

Thit Jensen loved and admired her older brother Johannes, but when she moved to Copenhagen in 1900 with the intention of becoming a writer, Johannes, who was already an established author, refused to help her. He regarded Thit as unsophisticated and an embarrassment. Lacking the support which her brother could easily have given to her, Thit was forced to move into loft where, in return for serving morning coffee and running errands, she was allowed to have a piece of rye-bread and a glass of milk - her only food for several years.

Finally, her books began to be published, starting with *Two Sisters* in 1903. Many of her first books were about women's rights. Later she wrote about forgotten women in history. To her satisfaction, some of Thit's books outsold those of those of her brother Johannes.

Thit Jensen became a famous lecturer and advocate of voluntary motherhood. Her lectures were both scandalous and popular, since, at the time, contraceptive methods and abortion could not be discussed in public. She was the founder of two societies: Voluntary Motherhood and The Copenhagen Housewives' Association.



Figure 4.17: **Astrid Lindgren**

Astrid Lindgren (1907-2002)

Astrid Lindgren was and is one of the world's most beloved authors of children's books. As of 2012, her books had been translated into 95 different languages and dialects. More than 3000 editions of her books have been issued, and globally, 150 million copies have been sold. She was so well loved in Sweden that when she died, her funeral was attended by King Carl XVI Gustav, Queen Sylvia, other members of the royal family, and Prime Minister Göran Persson.

Astrid Lindgren had a difficult life because of a relationship with the chief editor of a newspaper where she was working. When she became pregnant, he proposed marriage, but she refused because he was already married and a father. She took her illegitimate son, Lars, to Copenhagen, where he was cared for by a foster family. She visited him whenever she could, although it meant long train journeys. Later she was able to take Lars back to Sweden to live with her family in Småland.

She was active in advocating children's and animals' rights, and in opposing corporal punishment. In 1994 Astrid Lindgren received the Right Livelihood Award (sometimes known as the Alternative Nobel Prize) for "For her commitment to justice, non-violence and understanding of minorities as well as her love and caring for nature".



Figure 4.18: **Pippi Longstocking.**



Figure 4.19: **Emil from Lönneberg.**



Figure 4.20: **Ronya Robber's-Daughter**



Figure 4.21: Gro Harlem Brundtland (born in 1939).

Gro Harlem Brundtland (born 1939)

Gro Harlem Brundtland is the daughter of Gudmund Harlem, a physician who was also Norway's Minister of Social Affairs. Like her father she became a physician and a high-ranking politician associated with Norway's Labor Party. From 1974 to 1979 she was Norway's Minister for Environmental Affairs. In 1981, she became the first female Prime Minister of Norway. Although her first term in this position only lasted a year, she was later Prime Minister for longer periods, from 1986 to 1989 and from 1990 to 1996.

In 1983, Gro Harlem Brundtland was invited by United Nations Secretary-General Javier Pérez de Cuéllar to set up and chair a World Commission on Environment and Development. This later became known as the Brundtland Commission. The Commission's report, entitled *Our Common Future* was published in 1987, and it provided a basis for the 1992 Earth Summit, which was held in Rio de Janeiro.

In order to obtain broad political support, Brundtland was forced to introduce the concept of "sustainable development", which is dangerously close to the self-contradictory concept of "sustainable growth". Nevertheless, the Brundtland report, *Our Common Future*, and the Rio Earth Summit, were enormously valuable in spreading awareness of the problems involved in achieving sustainability. An important achievement of the Rio Earth Summit was the *Climate Change Convention*, which later led to the *Kyoto Protocol*, and more recently to the *Paris Agreement*.

In 1998, Brundtland (whose third term as Prime Minister of Norway had come to an end) was elected Director-General of the World Health Organization. One of her notable achievements was a campaign to reduce cigarette smoking worldwide through education, persuasion, and increased taxation.

Gro Harlem Brundtland is currently engaged in many organizations working to find solutions to the serious problems facing us today. For example she works with The Elders, and with the Council of Women World Leaders.



Figure 4.22: Elizabeth Møller Jensen (born 1946),.

Elizabeth Møller Jensen (born 1946)

Elizabeth Møller Jensen was the first of her family to receive a university education. Both of her parents would have liked to have a higher education, but their economic circumstances did not permit it. In her best-selling autobiography *Dengang i Lemvig - en familiehistorie* (*Back Then in Lemvig - a family history*), Elizabeth Møller Jensen describes her gifted but troubled mother, who died at the age of 53 from alcohol and medicine misuse. She also describes the family's close ties with the Social Democrat Party, which were such that the famous longest-sitting Danish Prime Minister Thorvald Stauning visited her grandfather's home when he was in Jutland.

In her autobiography, Elizabeth credits Stauning's reforms with the fact that she was able to receive a university education. She made very good use of it, becoming the editor of an enormous 5-volume series of books, *Nordic Women's Literary History*. Today you can access this huge study online at the following link:

<https://nordicwomensliterature.net/writers/> One clicks on the image of each author to obtain a biography.

For 24 years, from 1990 to 2014, Elizabeth served as the director of Kvindfo, the Danish Center for Information on Women and Gender. Her decisiveness and gifts as an administrator are remarkable, and under her leadership, the organization increased greatly in size and importance. Elizabeth is also a literary critic and frequently lectures on gender and politics.

One of Elizabeth Møller Jensen's early books, *Roser och Laurbær* (*Roses and Laurels*) is a study of the life of Thit Jensen. The title comes from the fact that Thit Jensen realized that she had to choose between marriage (roses) and a writing career (laurels). Thit chose laurels.

Elizabeth Møller Jensen's first husband was my wife's brother, Flemming Christiansen. My family and I have experienced Elizabeth's hospitality and kindness for very many years, and we are proud to be part of her extended family. ,

Birgitta Jonsdottir (born 1967)

The Icelandic parliamentarian, Birgitta Jonsdottir, has taken an important step towards solving one of the central problems that the world is facing today. The problem is this: How can we regain democratic government when the mainstream media are completely controlled the corporate oligarchy?

If anyone doubts that democratic government has been lost and needs to be regained, let them think of the recent US election, in which a large percentage of the voters stayed home because they were disillusioned with the political process. They knew that whomever they elected, their voices would not be heard.

The voters did not like to be told that they had power, which in fact they did not have. Both major political parties follow the dictates of the corporate oligarchs, rather than the will of the people. No doubt the Democrats in the US Congress are slightly better than the Republicans, but both parties have essentially been bought by big money from lobbies representing the military-industrial complex, the fossil fuel companies, and Israel.

Contrary to the wishes of the people, social services continue to be cut in favor of obscenely bloated military budgets, perpetual foreign wars, and environment-destroying subsidization of the fossil fuel industry. Despite the will of the people, the US government exposes our beautiful earth to the deadly risks of all-destroying thermonuclear war and out-of-control global warming.

The United States is by no means the only country with an oligarchic non-democratic government. Globally, countries with truly democratic and sane governments are the exception rather than the rule. Therefore the problem is a global one, and let us repeat it: How can we regain democratic government when the mainstream media are completely controlled the corporate oligarchy?

Let us return to Birgitta Jonsdottir. Who is she? Birgitta is a popular and successful young Icelandic poet, writer, artist, publisher and anti-war activist, who had no inkling until quite recently that she was destined to become a politician. Then in 2008, Iceland underwent a financial crisis. It became clear that the crisis was due to corrupt links of politicians with Iceland's financial sector. In 2009, Birgitta ran for the Icelandic Parliament (Althingi, the oldest parliament in the world) as part of the reform movement.

Believing that lack of free information was the main cause of the corruption behind Iceland's 2008 crisis, Birgitta Jonsdottir persuaded her colleagues in the Althingi to pass unanimously a law calling for complete freedom of information in Iceland. She also worked closely with Julian Assange to produce the video "Collateral Murder".¹

Under Birgitta Jonsdottir's leadership, Icelandic parliamentarians plan to pass laws which will make make Iceland a safe haven for journalistic freedom. In so doing, they will help to re-establish democratic government throughout the world, a vital step if nuclear and climatic disasters are to be averted.

¹<https://en.immi.is/media/documentaries-on-immi/>
<http://birgitta.is>
<http://en.immi.is>



Figure 4.23: The Icelandic poet, writer, artist, publisher, anti-war activist, and parliamentarian Birgitta Jonsdottir.

4.6 The Danish system today

In 2017, Denmark ranked 2nd in the world (after Norway) in the World Happiness Report. In a number of other years, Denmark has ranked 1st. In compiling the report, researchers ask people in a given country whether they are happy, and record how many say “yes”. Interestingly, in Denmark, women are the most happy of all. It is therefore relevant to look at the Danish social and political system of today, and to examine the reasons why women are so satisfied with it.

Denmark has very high taxes, but in return for these, its citizens receive many social services, such as free health care. If they qualify for university education, the tuition is free, and students are given an allowance for their living expenses. Mothers or alternatively fathers, can take paid leave of up to 52 weeks after the birth of a child. After that, a *vuggestue* (cresch) is always available, so that mothers can return to their jobs. When the child become too old for the cresch, day care centers are always available. For children of school age, after-school clubs are available where children can practice arts and crafts or other activities under supervision until their parents come home from work.

It is illegal in Denmark to fire a woman because she has become pregnant, or to deny her work because the employer fears that she may become pregnant. Thus, Danish women grow up expecting to find jobs outside the home. Danish women are happy to have careers, but it is also a necessity, because with taxes so high that a single income is not enough to give a family the desired standard of living. Husbands are grateful to their wives for



Figure 4.24: A Danish day-care center.

helping to support the family. In the case of single mothers, support is given by the state.

The number of births per woman-life reached a low of 1.38 in 1983, but since that time the number has gradually risen gradually and in 2017 the fertility rate was 1.77, still less than the replacement level. The other Scandinavian countries have very similar systems, and they all have high human development indices, as well as a high degree of economic equality. When US Senator Bernie Sanders declared that he is a socialist, he made the statement more precise by saying that he is in favor of the Scandinavian social and political system.

4.7 The social impact of science and technology

Before the development of modern medicine, infant mortality was so high that in any family, large numbers of children were needed in order to ensure that a few of them survived. This was true in Europe only a few hundred years ago. Today, with vaccines and antibiotics, infant mortality has been reduced to such an extent that parents with only two children can be almost entirely sure that both of them will live to adulthood. While low infant mortality now is the norm in the industrialized parts of the world, many less developed countries still have high birth rates and high infant mortality. In other words, these countries have not yet passed through the demographic transition, and they need to do so as quickly as possible.

Today, science and technology are moving with lightning-like speed, but social customs are slow to change. Thus, in many parts of the world, death rates have been drastically reduced, but nevertheless, birth rates remain high, and as a result, population surges upward, outrunning infrastructure and employment opportunities.

In industrialized countries today, small families have become the norm, and this has changed the role of women. Being a housewife is no longer a full-time life-long occupation. The role of women has also been changed by modern machines. Doing the family's laundry is no longer an enormous project. Formerly, physical strength was required for many kinds

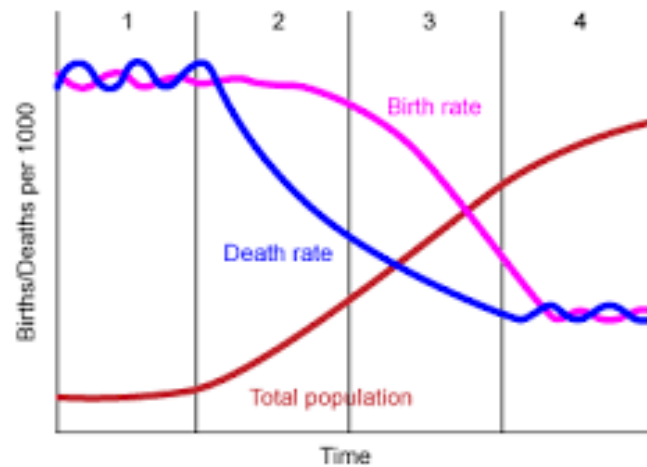


Figure 4.25: The demographic transition.



Figure 4.26: Machines have helped to change the role of women.

of work, but today, a woman sitting at the controls of an enormous crane can lift just as many tons as a man.

Suggestions for further reading

1. Lise Busck Jensen, *The First Manifesto of the Woman's Movement*, <https://nordicwomensliterature.net/first-manifesto-of-the-womens-movement/>
2. E. Sylvia Pankhurst, *The Sufferegette Movement: An Intimate Account of Persons and Ideals*, (1931)
3. Christobel Pankhurst, *Ubshakeled: The Story of How We Won The Vote*, (1959)
4. Antonia Raeburn, *The Militant Suffragettes*, (1974).
5. Elizabeth Robins, *Votes for Women*, (1907).
6. Tracy Chevalier, *Falling Angesls*, (2001).
7. Joyce Marlow (editor), *Votes for Women: The Virago Book of Suffragettes*, (2001).
8. Ian McDonald, *Vindication! A Postcard History of the Woman's Movement*, (1989)
9. Kate Charlsworth and Brian Talbot, *Sally Heathcote, Suffragette*, (2014).
10. Diane Atkinson *The Suffragetts in Pictures*, (2010).

Chapter 5

WOMEN IN SCIENCE AND POLITICS

5.1 Women in science

Letting a few names stand for many

It seems natural to me that women should be scientists, since my own mother, Margaret Scales Avery (1901-2003) was a bacteriologist. At the time when she was studying, this was a very unusual career choice for a woman, but the situation is gradually improving. For example, it has become quite common for women to study medicine. According to the American Association of Medical Colleges (AAMC) 48.3% of medical degrees awarded in the US in 2009-10 were earned by women, an increase from 26.8% in 1982-3. Women have not yet achieved parity as medical practitioners, but in certain specialties, they outnumber men. In the United States, female physicians outnumber male physicians in pediatrics and female residents outnumber male residents in family medicine, obstetrics and gynecology, pathology, and psychiatry.

In other fields of science, the situation is also gradually improving. Central Asia (47.2%), Latin American and the Caribbean (44.7%), Central and Eastern Europe (39.6%), and the Arab States (39.9%) are regions in which women currently represent over a third of the Research and Development workforce.

It would be impossible to list all of the women who have contributed importantly to scientific and political developments in human cultural evolution. A few pioneers are chosen here to represent the multitude of women who have overcome prejudice and male tyranny to make important contributions.



Figure 5.1: Hypatia (c.360-415 AD) was an important mathematician, astronomer and philosopher who lived in Egypt during the Hellenistic era. She is the first female mathematician whose life is reasonably well known. She taught in Alexandria's neoplatonist school, and was famous as a great teacher and a wise counsellor. Among Hypatia's works is a commentary on Diophantus' 13-volume *Arithmetica*. She is also thought to have edited Ptolemy's great astronomical book, the *Almagest*. Hypatia was an advisor to Orestes, the Roman Prefect of Alexandria, and she was murdered in 415 AD by the followers of Cyril, the Christian Bishop of Alexandria, because of a feud between Orestes and Cyril, thus becoming a "martyr to philosophy". The historian Socrates of Constantinople, a contemporary of Hypatia, describes her in the following words: "There was a woman at Alexandria named Hypatia, daughter of the philosopher Theon, who made such attainments in literature and science, as to far surpass all the philosophers of her own time."



Figure 5.2: Maria Merian (1647-1717) depicted on a 500 DM banknote. She was a German-born naturalist and scientific illustrator. She was one of the first naturalists to observe the metamorphosis of insects. At the age of 13, she started collecting silk worms and observing them. In 1679, she published the first volume of a 2-volume series on caterpillars, and the second volume was published in 1683. Each volume contained 50 of her etchings, and the books documented evidence for the metamorphosis and plant hosts for 187 species. In 1699 she traveled to Dutch Surinam to study the tropical insects, and her observations and illustrations were published in 1705. She was the leading entomologist of her time, and she is considered by David Attenborough to be one of the most significant contributors to the field of entomology.



Figure 5.3: Émilie du Chatalet (1706-1749) was a French mathematician, philosopher and physicist. Her translation of Newton's *Principia Mathematica* remains the standard French translation today. She added profoundly to Newton's ideas by proposing the general law of conservation of energy in physics. Her highly influential philosophical masterpiece, *Institutions de Physique* (or in English, *Foundations of Physics*) was published in 1740. The book generated heated debate, and it was quickly republished in several other languages. Together with her husband, the Marquis Florent-Claude du Chastellet-Lomont, and their close friend, Voltaire, she performed many experiments on the nature of fire and heat. After her death, Émilie du Chatalet's ideas were heavily represented in the Enlightenment's most important book, the *Encyclopédie* of Denis Diderot and Jean le Rond D'Alembert.



Figure 5.4: The physicist Laura Bassi (1711-1778), Professor of Physics at the University of Bologna. She was the first woman scientist ever to be appointed to a university professorship. Bassi's experimental work was mainly in the fields of hydrolics and electricity, but she was also important in bringing Newtonian physics to Italy. She corresponded widely with Europe's leading scientists and philosophers. Voltaire once wrote to her, "There is no Bassi in London, and I would be much happier to be added to your Academy of Bologna than that of the English, even though it has produced a Newton".



Figure 5.5: Lord Byron's daughter, Augusta Ada, Countess of Lovelace (1815-1852), is seen here in a painting by Margaret Carpenter. She was an excellent mathematician, and a frequent visitor to the workshops of Charles Babbage, inventor of the first universal computing machine. It is through Augusta Ada's lucid writings that we know how Babbage's never-completed universal calculating engine was to have worked. Augusta Ada was the first person to recognize that Babbage's calculating machine could be used for other purposes than than arithmetical manipulations, and she was both first person to realize the full potential of computers. She was also the first computer programmer. The programming language ADA is named after her



Figure 5.6: Marie Curie (1867-1934) won Nobel prizes both in physics and in chemistry. Her daughter Irène also won a Nobel Prize in Physics. Born in Poland, Marie married Pierre Curie, a French scientist who had invented a sensitive electrometer. Following Henri Becquerel's serendipitous discovery of the radioactivity of uranium in 1896, Marie Curie began using her husband's electrometer to examine various uranium-containing ores. She soon realized that the ores must contain radioactive elements other than uranium. Excited by this discovery, Pierre Curie dropped his own research and joined her. Together they finally succeeded in isolating two new radioactive elements, polonium (named after Marie's native Poland) and radium. Together with Becquerel, they shared the 1903 Nobel Prize in Physics. Marie Curie won an additional Nobel Prize in Chemistry in 1911. She became a world-famous symbol of what women can achieve.



Figure 5.7: **Henrietta Swan Levitt (1868-1921).** Her studies of the periods and luminosities of variable stars allowed Edwin Hubble to discover the enormous size of the universe, and the fact that the universe is expanding. Hubble often said that Levitt deserved the Nobel Prize for her work. Gösta Mittag-Leffler of the Swedish Academy of Sciences tried to nominate her for that prize in 1924, only to learn that she had died of cancer three years earlier

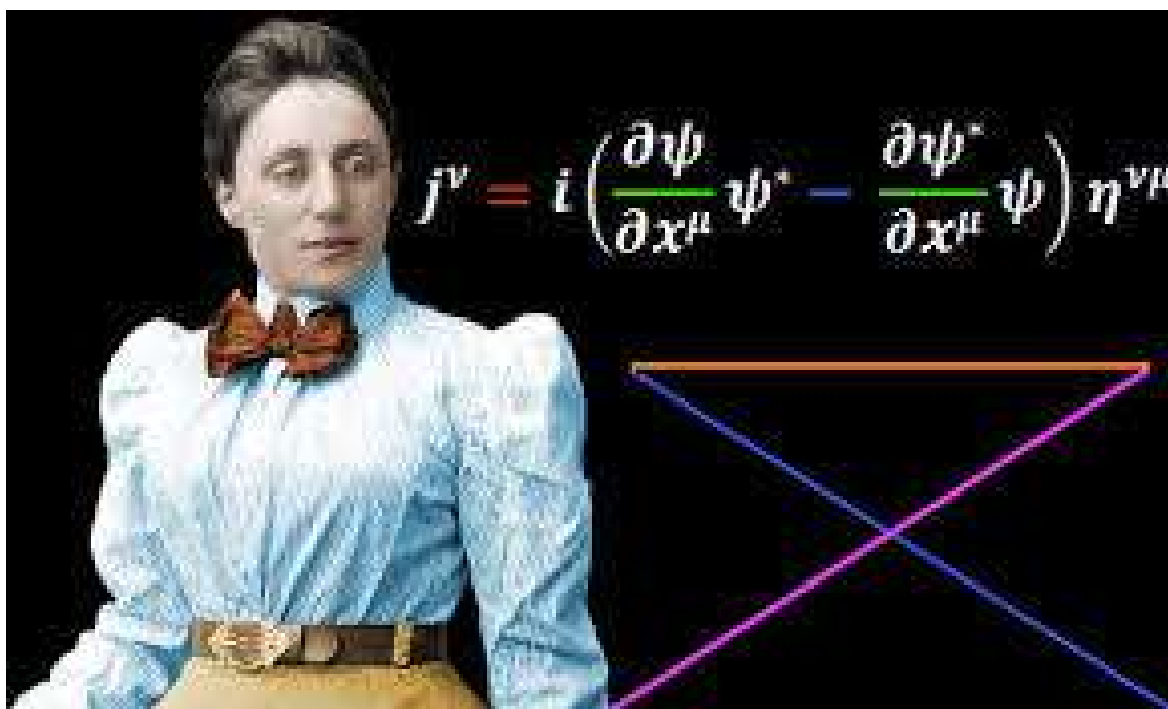


Figure 5.8: Emmy Noether (1882-1935), the “mother of modern algebra”, was described by Albert Einstein, Hermann Weyl and Norbert Wiener as the most important woman in the history of mathematics. She developed the theories of rings, fields, and algebras. In physics, Noether’s theorem explains the connection between symmetry and conservation laws. Following in her father’s footsteps, Noether began her career in mathematics at the University of Erlangen. In 1915, although at the time women were largely excluded from academic positions, she was invited by Felix Klein and David Hilbert to join the world-famous mathematics department of the University of Göttingen. Her students, sometimes called “Noether’s boys”, spread her ideas, and ultimately her influence was enormous. Forced to leave Germany because of the Nazis, she died of ovarian cancer in the United States.



Figure 5.9: Maria Goeppert Mayer (1906-1972) received the 1963 Nobel Prize in Physics for her shell model of nuclei. She was my teacher at the University of Chicago. Maria Goeppert began her education at the University of Göttingen, where her father was a professor of pediatrics. Her thesis was on the theory of two-photon absorption by atoms. The unit of absorption cross section for this process is now named after her. After marrying the American physicist, Joseph Mayer, she moved to the United States, where she and her husband eventually joined Enrico Fermi at the University of Chicago. In 1950, she published her shell model of nuclei, for which she shared the 1963 Nobel Prize in Physics.



Figure 5.10: Inge Lehman, FRS, (1888-1993) was a Danish geophysicist and seismologist who discovered the inner structure of the earth, especially its silicate mantle, fluid outer core and solid inner core. After completing her highschool education at a progressive school run by Niels Bohr's aunt, Hannah Adler, Lehman studied mathematics at the University of Copenhagen and Cambridge University. In a 1936 paper, she analyzed seismic waves from earthquakes, and proposed her model of the earth's interior, which has come to be accepted by all geophysicists. Inge Lehman received numerous honorary degrees and medals for her work. The asteroid 5632 Ingelehmanna was named after her. In 1997, the American Geophysical Union established the annual Inge Lehman Medal to honor "outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth's mantle and core." In 2015 (which was the 100th anniversary of women's suffrage in Denmark) Lehman's great struggle against the male-dominated research community that existed in Denmark in the mid-20th century was recognized when a new beetle species named after her: *Globicornis (Hadrotoma) ingelehmannae*. She died in 1993 at the age of 104, the longest-lived woman scientist in history.



Figure 5.11: Dorothy Crowfoot Hodgkin (1910-1994) received a Nobel Prize in Chemistry in 1964 for her pioneering research in determining the structure of biologically important macromolecules by means of X-ray crystallography. She is especially famous for discovering the structures of steroids, penicillin, vitamin B₁₂ and insulin. Professor Hodgkin was also a long-serving President of Pugwash Conferences on Science and World Affairs, an organization which won the Nobel Peace Prize in 1995 for its efforts to achieve the abolition of nuclear weapons. On the 350th anniversary of the founding of the British Royal Society, of which she was a Fellow, a stamp was issued in her honor.



Figure 5.12: The famous primatologist and environmental activist Jane Goodall (born 1934) with one of her friends. She is known for her 55-year-long studies of the behavior of wild chimpanzees. Having been given a toy chimpanzee by her father as a child, Jane Goodall was always passionately interested in animals and in Africa. In 1957, she visited the farm of a friend in Kenya. On the advice of her friend, she contacted the paleoanthropologist Louis Leakey, who happened to be looking for someone to study chimpanzees. He thought that their behavior could cast light on the behavior of early human ancestors. This was the beginning of Jane Goodall's research, in the course of which she discovered many striking similarities between humans and our closest animal relatives: toolmaking, personalities, rational thought, and affectionate long-term personal relationships. She also discovered darker traits, such as war-making. Goodall observed that alpha female chimps sometimes assert their dominance by killing and eating the babies of other females. Dr. Goodall is the founder of *Roots and Shoots*, an international organization devoted to preserving the environment. She has received very numerous honors. For example she is a Dame Commander of the British Empire, and a United Nations Messenger of Peace. She is also the subject of an award-winning film, *Jane*, which makes use of beautiful footage shot by her former husband, the distinguished wildlife photographer Baron Hugo van Lawick.

5.2 Women in politics

Wikipedia states that “As of January 2017, the global participation rate of women in national-level parliaments is 23.3%. A number of countries are exploring measures that may increase women’s participation in government at all levels, from the local to the national...”

“Gender inequality within families, inequitable division of labor within households, and cultural attitudes about gender roles further subjugate women and serve to limit their representation in public life. Societies that are highly patriarchal often have local power structures that make it difficult for women to combat. Thus, their interests are often not represented or under-represented.”

Despite the fact that they are currently under-represented in politics, women throughout history have demonstrated that they are just as capable political leaders as men. Indeed, women bring to politics some very desirable qualities that are usually lacking in men. For example greater representation of women in governments would favor legislation ensuring the rights of children. Also, it might be true that women in high governmental positions favor kinder policies in general. For example, we can think of Angela Merkel’s kind refugee policies, which she pursued regardless of the political cost.

The Universal Declaration of Human Rights, which Eleanor Roosevelt played a large role in drafting, guarantees equal political rights for women.

The map in Figure 4.12 shows the status of the 1979 United Nations Convention on the Elimination of All Forms of Discrimination Against Women in various countries throughout the world. Red indicates non-signatory countries, while yellow means signed but not ratified. Interestingly, the Convention has not been ratified in the United States.

In the remainder of this chapter, we give a few examples of outstanding women who have contributed greatly to human welfare in positions of political leadership, letting these few examples stand for many others, much too numerous to be listed.



Figure 5.13: Yellow means “signed but not ratified”; red means “not signed”.



Figure 5.14: Queen Elizabeth I of England (1533-1603). The daughter of Henry VIII and Anne Boleyn, Elizabeth lived in a time of bitter conflict between Catholics and Protestants. After the death of Henry VIII, Elizabeth's half-brother Edward VI (a Protestant) ruled until his early death in 1553. Edward was succeeded by Elizabeth's half-sister Mary ("Bloody Mary"), a fanatical Catholic who ordered the killing of large numbers of Protestants. Mary also imprisoned Elizabeth. When Mary died in 1558, Elizabeth finally became queen. She was a wise and skillful ruler, and reigned over one of England's greatest epochs, the "Elizabethan Era". She was urged to marry and produce a Tudor heir to the throne, but she realized that if she married, her husband would claim power. Elizabeth wisely softened the bitter religious conflicts that had preceded her reign. England remained Protestant, but Catholics were tolerated, and free to worship as they wished.



Figure 5.15: Queen Christina of Sweden (1526-1689). She was the only surviving legitimate heir of King Gustav II Adolf, and she became queen at the age of six, when her father was killed at the Battle of Lützen. Christina was one of the most highly educated women of the 17th century, and she was determined to bring culture to Sweden, to make it “the Athens of the North”. At one point she sent a warship to Holland in order to bring René Descartes to Sweden. Unable to resist this flattering attention from a royal patron, Descartes set sail for the frozen north. He found that he had to give philosophy lessons to Christina at 5 AM each day in a chilly library room, and before the winter was over, poor Descartes had died of pneumonia. Because she was more interested in culture than in ruling, Christina abdicated in favor of her cousin, converted to Catholicism, and moved to Rome, where she became a patron of the arts and a heroine of the Counter-Reformation. Her life has inspired numerous books, plays and films, for example the 1933 film in which she was portrayed by Greta Garbo.



Figure 5.16: Bertha von Suttner (1843-1914) became the second woman, after Marie Curie, to win a Nobel Prize. In this case, it was the Nobel Peace Prize, which she won in 1905. In fact, without Bertha von Suttner, the Nobel Peace Prize would not exist. Born in Prague as Countess Kinsky, she later married the Austrian Baron Arthur von Suttner. In 1889, she became a leading figure in the peace movement through the publication of her pacifist novel, *Die Waffen Nieder!* or *Lay Down Your Arms!*, which was published in 37 editions and translated into 12 languages. She became the founder and chairwoman of the German Peace Movement. After working briefly with Alfred Nobel, she continued to correspond with him, and because of her influence, he used part of his fortune to establish the Nobel Peace Prize.



Figure 5.17: A portrait of Helen Keller (1880-1968). She was the first blind and deaf person to obtain a BA degree. On the way to this triumph, Helen had taught herself to speak normally, and she could understand what other people were saying by placing her hand on their lips. Helen Keller quickly developed into a popular lecturer and author. She spoke and wrote to advocate many social reforms, including woman's suffrage, labor rights, socialism and anti-militarism. Among her many writings against war are the words: "Strike against war, for without you no battles can be fought! Strike against manufacturing shrapnel and gas bombs and all other tools of murder! Strike against preparedness that means death and misery to millions of human beings! Be not dumb, obedient slaves in an army of destruction! Be heroes in an army of construction."

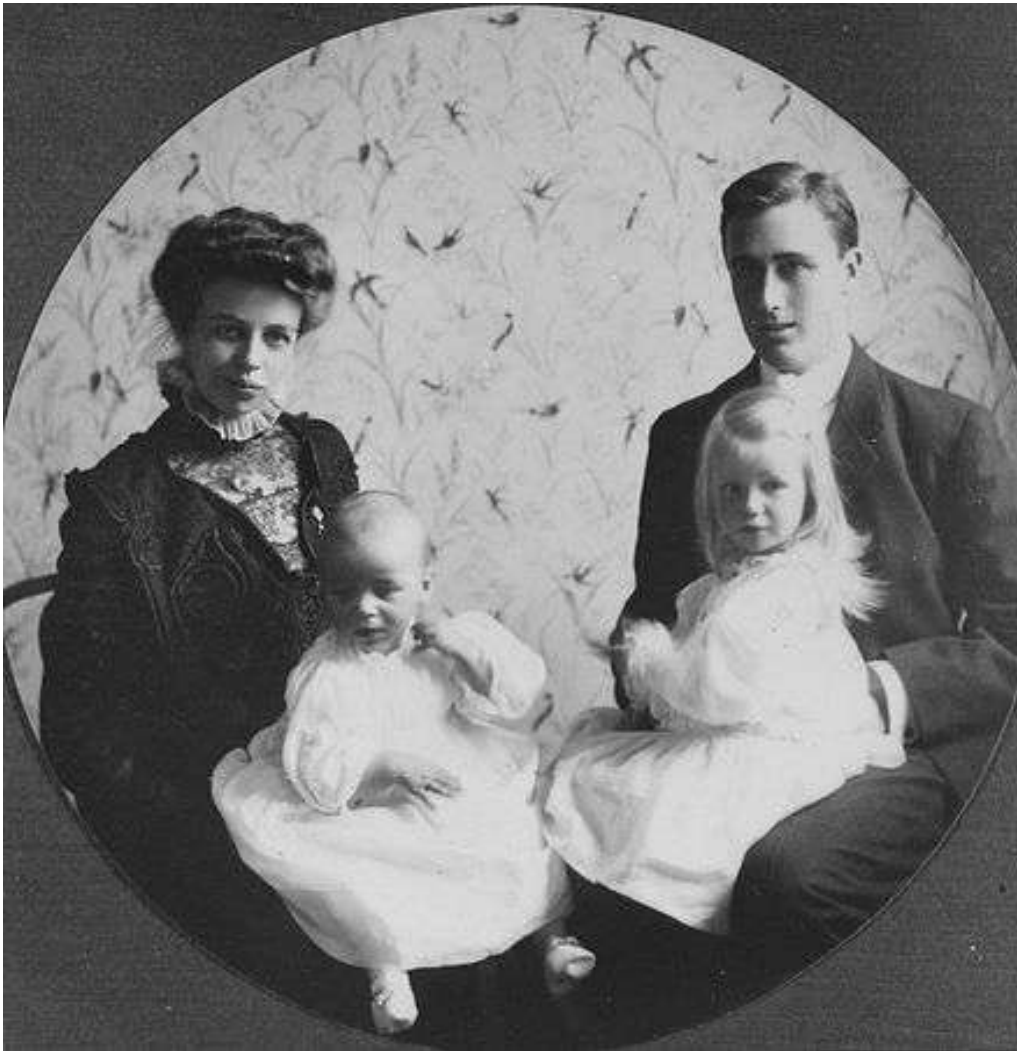


Figure 5.18: Eleanor and Franklin Roosevelt with their first two children. Eleanor Roosevelt (1884-1962) was the niece of US President Theodore Roosevelt. After marrying her fifth cousin, Franklin Delano Roosevelt, she served as First Lady during his four terms as US President. She also served as US Delegate to the United Nations General Assembly from 1945 to 1953. Harry Truman called her “First Lady of the World” in recognition of her achievements in the field of human rights. She served as the first chair of the UN Commission on Human Rights and oversaw the drafting of the Universal Declaration of Human Rights. She later chaired John F. Kennedy’s Presidential Commission on the Status of Women. Eleanor Roosevelt is also remembered as an outstanding advocate of racial equality, economic and social justice, and journalistic freedom.



Figure 5.19: Eleanor Roosevelt on a commemorative stamp.



Figure 5.20: Indira Gandhi (1917-1984) as a child, together with Mahatma Gandhi. Despite the fact that they had the same surname, they were not related.



Figure 5.21: Indira Gandhi was the daughter of India's first Prime Minister, Jawaharlal Nehru. During his tenure in office, Indira served as her father's assistant and hostess. This experience was valuable to her when she herself later became India's first and only woman Prime Minister.



Figure 5.22: Rajiv Gandhi, Indira's son, also served as India's Prime Minister.



Figure 5.23: Wangari Maathai (1940-2011). In 1977, she founded the Green Belt Movement in Kenya, an organization devoted to planting trees, environmental conservation and women's rights. Since that time, the organization has planted over 51 million trees. In 2004 she was awarded the Nobel Peace Prize for "her contribution to sustainable development, democracy and peace."



Figure 5.24: Maidread McGuire (born 1944). She and Betty Williams shared the 1976 Nobel Peace Prize for founding and leading Peace People, an organization working for peace in Northern Ireland. Today McGuire's concerns are global. She opposed the Iraq Wars of 1990 and 2003, and the sanctions that caused hundreds of thousands of deaths among the civilians of Iraq. She is critical of US militarism and wars, nuclear weapons wherever they are found, and Israel's occupation of Gaza. At the Russell Tribunal in 2012, she "asked the question that seems to be taboo in the U.S.: Why does President Barack Obama allow Israel to threaten Iran with war when Iran has signed the NPT and Israel has at least 200 nuclear weapons? Why does the president not demand that Israel sign the NPT?" Regarding nuclear weapons, she said "I have for years been speaking out against nuclear weapons. I am actively opposed to nuclear weapons in Britain, in the United States, in Israel, in any country, because nuclear weapons are the ultimate destruction of humankind." Together with Desmond Tutu and Adolfo Pérez Esquivel, Maidread McGuire has also published a letter in support of Chelsea Manning.



Figure 5.25: Dr. María Fernanda Espinosa (born 1964), the recently-elected President of the United Nations General Assembly. Dr. Espinosa is also an environmentalist. She was awarded a Ph.D. in environmental geography by Rutgers University, and was a postdoctoral fellow there in 1996-1997. From 2008 to 2009 she was a Permanent Representative of Ecuador to the UN in New York. She was Regional Director of the South American Office of the World Conservation Union's (IUCN) in 2005 and 2006, served as the Social Equity and Conservation Officer and as an Adviser on Indigenous Peoples and Biodiversity Policy to IUCN from August 2000 to October 2005. Having started her career in 1989 as a Planning and Management Technical Officer for the Amazon Protected Areas Project, Fundacion Natura in Quito, Espinosa has served as an Adviser for several projects over the years, including the Government Environmental Plan (1992) and the "Environmental Care and Children's Participation" project (Central Bank of Ecuador and UNICEF, 1993-1994). Dr. Espinosa is a member of the World Future Council, and also a poet and an essayist.

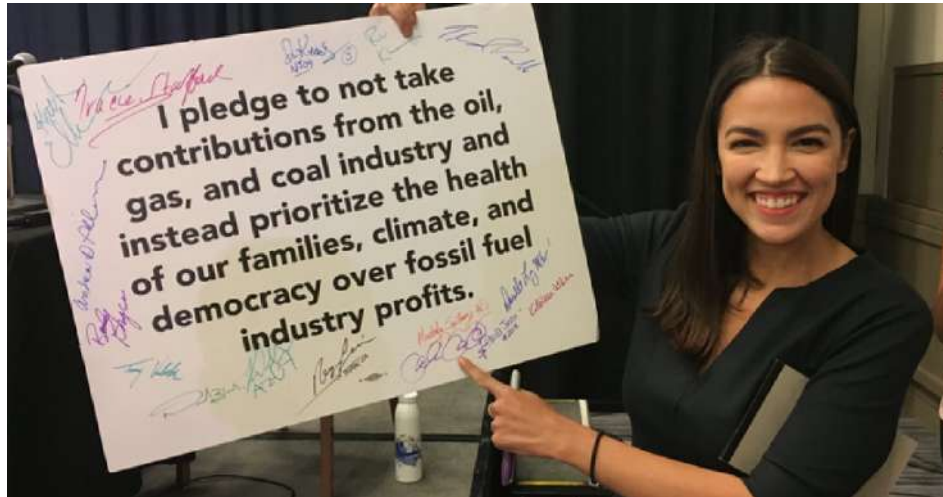


Figure 5.26: 28-year-old Alexandra Ocasio-Cortez (born in 1989) won a stunning victory in the Democratic Party primary election of June 26, 2018. Although outspent by a factor of 18 to 1 by her opponent (Democratic Caucus Chair, Joseph Crowley), she won the primary by 57% to 42%. Her campaign contributions came from small individual donors, while his came in large blocks, from corporations. Ocasio-Cortez calls for the United States to transition by 2035 to an electrical grid running on 100% renewable-energy production and end the use of fossil fuels. She calls healthcare “a human right”, and says: “Almost every other developed nation in the world has universal healthcare. It’s time the United States catch up to the rest of the world in ensuring all people have real healthcare coverage that doesn’t break the bank”. The Guardian called her victory “one of the biggest upsets in recent American political history”, and Senator Bernie Sanders commented “She took on the entire local Democratic establishment in her district and won a very strong victory. She demonstrated once again what progressive grassroots politics can do”. The lesson that the US Democratic Party must learn from this is that in order to overthrow Donald Trump’s openly racist Republican Party in the 2018 midterm elections, they must free themselves from the domination of corporate oligarchs, and instead stand for honest government and progressive values.



Figure 5.27: In England, women succeeded in reclaiming Greenham Commons from use as a base for nuclear weapons.

Suggestions for further reading

1. Reddy, E.S. and Holger Terp, eds., *Friends of Gandhi*, <http://www.fredsakademiet.dk/library/nordic/friends.pdf>
2. Opfell, Olga S., *Lady Laureates : Women Who Have Won the Nobel Prize*. Metuchen, N.J & London: Scarecrow Press, (1978).
3. Dodson, Guy; Glusker, Jenny P.; Sayre, David (eds.), *Structural Studies on Molecules of Biological Interest: A Volume in Honour of Professor Dorothy Hodgkin*. Oxford: Clarendon Press, (1981).
4. Ferry, Georgina, *Dorothy Hodgkin A Life*. London: Granta Books, (1998).
5. Arianrhod, Robyn, *Seduced by logic : Émilie du Chatelet, Mary Somerville, and the Newtonian revolution* (US ed.). New York: Oxford University Press, (2012).
6. Bodanis, David, *Passionate Minds: The Great Love Affair of the Enlightenment*. New York: Crown. (2006).
7. Hagengruber, Ruth, editor, *Émilie Du Chatelet between Leibniz and Newton*. Springer, (2011).
8. Jayakar, Pupul, *Indira Gandhi: An Intimate Biography*. New York: Pantheon, (1992).
9. Genovese, Michael A., ed. *Women As National Leaders*. Newbury Park, CA: Sage Publications, (1993).
10. Jannuzi, F. Tomasson, *India in transition : issues of political economy in a plural society*. Boulder: Westview Press, (1989).
11. Buscher, Sarah and Ling, Bettina, *Mairead Corrigan and Betty Williams: Making Peace in Northern Ireland*. New York: The Feminist Press, (1999).

Chapter 6

WOMEN IN THE ARTS

6.1 Women in literature

Only twelve women have won the Nobel Prize in Literature. There ought to be more, since women are better novelists than men. Here is the list:

1. Selma Lagerlof, (Sweden) 1909.
2. Grazia Deledda (Italy), 1926
3. Sigrid Undset (Norway), 1928.
4. Pearl Buck (United States), 1938.
5. Gabriela Mistral (Chili), 1945.
6. Nelly Sachs (Germany and Sweden), 1966.
7. Nadine Gordimer (South Africa), 1991.
8. Toni Morrison (United States), 1993.
9. Wislawa Szymborska (Poland), 1996.
10. Elfriede Jelinek, (Austria), 2004.
11. Doris Lessing, (England), 2007.
12. Herta Muller (Germany), 2009.

It makes sense that women are better novelists than men. After all, the novel is a slow-moving genre, in which social sensitivity and the spirit of the times are important. Women are more observant and sensitive to interpersonal relationships than men are. These qualities are exactly those needed for a good novelist.

Although popularity and literary merit are not the same, it is worth noting that most widely-read novelist of all time is a woman: Agatha Christie. Her novels have sold roughly 2 billion copies, and, after Shakespeare and the Bible, they are the most widely-read books ever printed. For American readers, the second most popular book, after the Bible, is Margaret Mitchell's *Gone With the Wind* (1936).



Figure 6.1: Jane Austen (1775-1817). Her novels, *Sense and Sensibility*, *Pride and Prejudice*, *Mansfield Park*, *Emma*, *Northanger Abby*, *Persuasion* and *Lady Susan*, were published anonymously, and during her own lifetime they brought her little money or recognition. However, today, the film and television versions of Jane Austen's writings have become enormously popular. The books themselves have been translated into many languages and are read throughout the world. Jane Austen explored the condition of women of her own time, when marriage was the only way that they could achieve financial security and social position.



Figure 6.2: Mary Shelley (1797-1851) was the daughter of Mary Wollstonecraft and William Godwin, and the wife of Percy Bysshe Shelley. In 1816, she and Shelley, together with Lord Byron were staying in a villa near to Lake Geneva. Byron and Shelley had been discussing the myth of Prometheus, and its symbolic possibilities. The weather worsened, and they were forced to stay indoors. Byron proposed that each of them should write a ghost story, but Mary was slow in finding her theme. She went to bed, but was unable to sleep. Images from the discussions of Prometheus passed before her eyes. Later she wrote: “I saw, with shut eyes, but acute mental vision, I saw the pale student of unhallowed arts kneeling beside the thing he had put together. I saw the hideous phantasm of a man stretched out, and then, on the working of some powerful engine, show signs of life, and stir with an uneasy, half vital motion. Frightful must it be; for supremely frightful would be the effect of any human endeavor to mock the stupendous mechanism of the Creator of the world.” Mary had found her theme. The next morning, with Shelley’s encouragement, she began to write her masterpiece, *Frankenstein or The Modern Prometheus*.



Figure 6.3: Elizabeth Gaskell (1810-1865). Gaskell's circle of friends included the writers Harriet Martineau, Charlotte Brontë, Charles Dickens, John Ruskin and Harriet Becher Stowe. Her first novel, *Mary Barton* gives us a realistic picture of the suffering of the industrial workers of Manchester during the early part of the 19th century. Her second novel, *Cranford*, is also an accurate piece of sociology. In recent years, *Cranford* has three times been adapted for television. In general, Elizabeth Gaskell's books emphasize the role of women, and she is recognized as a pioneer of the feminist movement.



Figure 6.4: The Brontë sisters, Anne (1820-1849), Emily (1818-1848) and Charlotte (1816-1855), in a painting by their brother, Branwell. Their father had graduated from Cambridge University, but his earnings as a Curate of a small church were meager and money was very scarce in the family. The sisters originally published their poetry and novels under male pseudonyms. Charlotte's *Jane Eyre*, Emily's *Wuthering Heights*, and Anne's *The Tenant of Wildfell Hall* all achieved great success but attracted much criticism when they were published because of their extreme originality and violent themes. Today, the three novels are accepted as literary masterpieces.



Figure 6.5: Virginia Woolf (1882-1941) was born into a well-established family of intellectuals and reformers. Her grandfather, Sir James Steven, was the British Under-Secretary of State for the Colonies and an outspoken opponent of slavery. Her father, Sir Leslie Steven was a distinguished writer and historian, while her mother Julia, famous for her beauty, was the subject of many Pre-Raphaelite paintings. Virginia Woolf's pioneering stream-of-consciousness novels *Mrs. Dalloway* (1925), *To the Lighthouse* (1927) and *Orlando* (1928), became the model and inspiration for all subsequent modernist authors. She and her husband, Leonard Woolf, were central figures in the famous Bloomsbury group of writers and artists. Virginia Woolf suffered from bipolar disorder, and the illness led to her suicide in 1941.



Figure 6.6: The beautiful red-haired American poet, Edna St. Vincent Millay (1892-1950). The daughter of a divorced, poor, but very literate, mother, Millay grew up in Maine. At 14, Millay won the St. Nicolas Gold Badge for poetry, and by 15, she had published her poetry in the high-profile anthology, *Current Literature*. She was able attend Vassar College, because her fees were paid by an admirer who was impressed by her talent. Millay often wrote sonnets, combining classic form with modern imagery, and many consider her sonnets to be the best written in the 20th century. My own favorite is the anti-war sequence of eighteen sonnets, *Epitaph for the Race of Man*. Her short couplets in *A Few Figs From Thistles* are also memorable, for example: “My candle burns at both its ends, it will not last the night; but oh my foes and oh my friends, it gives a lovely light!” or “Safe upon the solid rock, the ugly houses stand; Come and see my shining palace, built upon the sand!” She won the Pulitzer Prize for Poetry, and the English novelist, Thomas Hardy, said of her, “America has two attractions: skyscrapers and Edna St. Vincent Millay.” The large house and 500 acre property, Steepletop, where Millay and her lawyer husband spent their last years, was declared to be a National Historic Landmark in 1971, and it is now a museum.



Figure 6.7: The existentialist philosopher Simone de Beauvoir (1908-1986) is famous for her feminist book, *The Second Sex*, published in 1949. Wikipedia writes of its reception: “The first French publication of *The Second Sex* sold around 22,000 copies in a week. It has since been translated into 40 languages. The Vatican placed the book on its List of Prohibited Books. The sex researcher Alfred Kinsey was critical of *The Second Sex*, holding that while it was an interesting literary production, it contained no original data of interest or importance to science. In 1960, Beauvoir wrote that *The Second Sex* was an attempt to explain ‘why a woman’s situation, still, even today, prevents her from exploring the world’s basic problems.’ The attack on psychoanalysis in *The Second Sex* helped to inspire subsequent feminist arguments against psychoanalysis, including those of Betty Friedan’s *The Feminine Mystique* (1963), Kate Millett’s *Sexual Politics* (1969), and Germaine Greer’s *The Female Eunuch* (1970). Millett commented in 1989 that she did not realize the extent to which she was indebted to Beauvoir when she wrote *Sexual Politics*. The philosopher Judith Butler writes that Beauvoir’s formulation asserts that ‘One is not born, but rather becomes, a woman’.” In other words, de Beauvoir distinguishes between women’s biology and the the influence of society which forces women into a particular role.



Figure 6.8: Doris Lessing (1919-2013) was awarded the 2007 Nobel Prize in Literature. She was the 11th woman and the oldest person to receive the prize. The citation described her as “that epicist of the female experience, who with scepticism, fire and visionary power has subjected a divided civilization to scrutiny”. In making the award, a representative of the Swedish Academy stated that “She has revealed the totalitarian temptations and shown us the strength of undogmatic humanism. She has displayed an almost limitless empathy with odd lives and a freedom from prejudice regarding every form of human behavior. She was early in flagging global environmental threats and poverty and corruption in the Third World. She has given voice to the silent and to the refugees and homeless of our century - from Afghanistan to Zimbabwe. And as few others have done, she personified the woman’s role in the 20th century.”



Figure 6.9: Arundhati Roy (born 1961) achieved both fame and financial independence through the publication of her best-selling novel, *The God of Small Things* (1997). The book criticizes India's caste system and the country's conventions prohibiting marriage across ethnic boundaries. Roy has become a political activist in many fields, advocating independence for Kashmir, criticizing India's nuclear weapons and opposing US militarism. Shocked by the bombing of Afghanistan, she wrote: "When he announced the air strikes, President George Bush said: 'We're a peaceful nation.' America's favorite ambassador, Tony Blair, (who also holds the portfolio of prime minister of the UK), echoed him: 'We're a peaceful people.' So now we know. Pigs are horses. Girls are boys. War is peace." She also wrote: "Once weapons were manufactured to fight wars, now wars are manufactured to sell weapons". Her concerns include many environmental and human rights issues.

6.2 Women in music

Why so few woman composers?

Women have always excelled in performing music, but in Europe, they have traditionally been barred from the study of musical composition theory. The Wikipedia article entitled *List of Female Composers by Birth Dates* gives the following explanation:

“Women composers’ names are still largely absent from music textbooks and concert programs that constitute the Western canon, even though a large number of women have composed music. The reasons for women’s exclusion are various.

“The musicologist Marcia Citron speculated that women composers were deemed less important than men because women typically wrote smaller works, such as art songs, rather than large works, such as symphonies, for public performance in large halls. Female composers were long barred from the profession, owing in part to the essentialist notion that women could not, in Citron’s words, ‘control emotion with logic and reason, masculine attributes requisite for composition.’ Women were systematically denied access to compositional training and musical performances, and were castigated by critics for writing music that was either too feebly feminine or too unbecomingly masculine. Because the discrimination against women composers is related to general societal attitudes about gender or perceived roles of men and women, many musicologists and critics have come to incorporate gender studies in assessing the history and practice of the art.”

By contrast, women have been encouraged to perform music. In Europe, young ladies from good families were expected to be able to entertain the assembled guests at a party by playing an instrument or singing. During the Renaissance, madrigal singing was a common form of after-dinner entertainment, and both women and men participated.

When operas became popular, charismatic soprano and contralto soloists often outshone the tenors and basses. This continues in recent times, with such celebrated divas as Maria Callas, Renata Tebaldi, Kiri Te Kanawa, Joan Sutherland, Nellie Melba, Elizabeth Schwarzkopf, Kirsten Flagstad and Eileen Farrell. Today, in popular music and folk music the stars are just as likely to be women as men.





Figure 6.10: Hildegard von Bingen (1098-1179) and her nuns. She was a German scientist, philosopher, theologian, and composer. Her works include three large volumes of visionary theology, over 70 chants and hymns that continue to be performed today, 400 letters to popes, emperors, abbots and abbesses throughout Europe, two volumes devoted to medicine and cures, the first known invented language, and pioneering works on natural history. One of her musical compositions, *Ordo Vertutum*, is a liturgical drama believed to be the oldest example of a morality play. She has for centuries been recognized as a saint by branches of the Roman Catholic Church, and in 2012, Pope Benedict XVI named her a Doctor of the Church. She is also known as Saint Hildegard and Sibyl of the Rhine.



Figure 6.11: Princess Anna Amalia of Prussia (1723-1787) was the daughter of King Frederick William I of Prussia. Although she was musically gifted, she was not allowed to study music by her tyrannical father. After his death she studied musical theory under Johann Philipp Kirnberger, a student of Johann Sebastian Bach, and she composed many works in the Baroque style. Although a marriage between Anna Amalia and the Crown Prince of Sweden was proposed, in the end it was her sister, Louisa Ulrika, whom the Swedes chose. Princess Anna Amalia instead became Abbess of Quedlinburg, a position in which she was more free to devote herself to music.



Figure 6.12: Clara Schuman (1819-1896). Educated in music by her father, Clara Weiss (later Schuman) was a child prodigy. When she was eight years old, her piano performance so much impressed the seventeen-year-old Robert Schuman, that he asked his mother for permission to drop his legal studies and instead take lessons in music from Clara's father. He moved into the Weiss home, and (not surprisingly) later married Clara. Meanwhile, at the age of eleven, Clara made a hugely successful tour of European cities as a concert pianist. She played from memory, which at the time was unique. Through her influence, performance by memory has now become a common practice for concert pianists. In 1838, Clara was named "Royal and Imperial Virtuoso", Austria's highest musical honor. Clara and her husband met the violinist Joseph Joachim in 1844. His playing so impressed her that Clara later gave over 238 concerts with Joachim, in Germany and Britain. Joachim introduced Clara and Robert Schuman to Johannes Brahms, who was then 20 years old. Deeply impressed by Brahms' talents, Clara wrote in her diary that he "seemed to have been sent straight from God". The Schumans helped greatly to encourage Brahms and to promote his career. Clara Schuman was also an excellent composer, but unfortunately her other duties left her little time for this pursuit. Undoubtedly, if time had allowed her to do so, she would have composed many great musical works, instead of the few that she has left to us. Clara Schuman's life has been celebrated in numerous films, for example *Song of Love* (1947), starring Katherine Hepburn as Clara.



Figure 6.13: Jacqueline du Pré, OBE, (1945-1987). In the background we see her husband, the pianist and conductor Daniel Barenboim. Although her career was tragically cut short by multiple sclerosis, du Pré is regarded as one of the greatest cellists of all time. Her mother, Iris, was a talented concert pianist. At the age of four, Jacqueline heard the sound of a cello on the radio, and asked her mother for “one of those”. Iris taught her small daughter to play the cello, composing little pieces for her. In 1959, at the age of 14, Jacqueline played the Lalo Cello Concerto on BBC Television, and in 1960, she won the Queen’s Prize for outstanding young musicians. Yehudi Menuhin, the chairman of the committee that unanimously awarded her the prize, then invited du Pré to play trios with himself and his sister. Jacqueline’s glittering concert career was cut short in 1971, when multiple sclerosis made it difficult for her to play, or even to open her cello case. She died of the disease in 1987 at the age of 42.



Figure 6.14: Joan Baez (born 1941) on the 1962 cover of Time Magazine. She is an American folk-singer and activist who has been highly influential since her breakthrough 60 years ago. Her father was a Mexican-American physicist who is credited with inventing the X-ray microscope. While her father was working at MIT, Joan Baez gave her first concert in 1958 at Club 47 in Cambridge. In 1959, Bob Gibson invited Baez to perform at the Newport Folk Festival, where her astonishingly clear and expressive voice produced a sensation. Joan Baez promoted the career of Bob Dylan, at a time when she was a star while he was unknown, by inviting him to join her on the stage for duets. Wholeheartedly engaged in many anti-war, human rights and environmental causes, including opposition to the Viet Nam and Iraq wars, she regards her activism as more important than her singing. In 2011, Amnesty International introduced the yearly Joan Baez Award for outstanding service to human rights, giving the first award to Baez herself.

6.3 Women in the visual arts

The Wikipedia article on *Women Artists* states that “Though women artists have been involved in the making of art throughout history, their work, when compared to that of their male counterparts, is often both overlooked and undervalued. Prevailing stereotypes about the sexes have caused certain media, such as textile or fiber arts, to be primarily associated with women, despite having once been categories both men and women participated in. Additionally, art forms that have gained this distinction are, as in the case of both textile and fabric arts, demoted to categories like ‘arts and crafts’, rather than fine art.

“Women in art have been faced with challenges due to gender biases in the mainstream fine art world. They have often encountered difficulties in training, travelling and trading their work, as well as gaining recognition. Beginning in the late 1960s and 1970s, feminist artists and art historians created a Feminist art movement that overtly addresses the role of women in the art world and explores the role of women in art history and in society.

“ Among the earliest European historical records concerning individual artists is that of Pliny the Elder, who wrote about a number of Greek women who were painters, including Helena of Egypt, daughter of Timon of Egypt,

“Artists from the Medieval period include Claricia, Diemudus, Ende, Guda, Herrade of Landsberg and Hildegard of Bingen. In the early Medieval period, women often worked alongside men. Manuscript illuminations, embroideries, and carved capitals from the period clearly demonstrate examples of women at work in these arts.

“Artists from the Renaissance era include Sofonisba Anguissola, Lucia Anguissola, Lavinia Fontana, Fede Galizia, Diana Scultori Ghisi, Caterina van Hemessen, Esther Inglis, Barbara Longhi, Maria Ormani, Marietta Robusti (daughter of Tintoretto), Properzia de’ Rossi,[Plautilla Nelli, Levina Teerlinc, Mayken Verhulst, and St. Catherine of Bologna (Caterina dei Vigri).

“Artists from this period¹ include Lucy Bacon, Marie Bashkirtseff, Anna Boch, Rosa Bonheur, Olga Boznanska, Marie Bracquemond, Mary Cassatt, Camille Claudel, Marie Ellenrieder, Kate Greenaway, Kitty Lange Kielland, Edmonia Lewis, Constance Mayer, Victorine Meurent, Berthe Morisot, Suzanne Valadon, Enid Yandell, and Wilhelmina Weber Furlong among others. Marie Ellenrieder and Marie-Denise Villers worked in the field of portraiture in the beginning of the century, and Rosa Bonheur in realist painting and sculpture. Elizabeth Jane Gardner was an American academic painter who was the first American woman to exhibit at the Paris Salon. In 1872 she became the first woman to ever win a gold medal at the Salon. Olga Boznanska is considered the best-known of all Polish women artists, and was stylistically associated with French Impressionism. Barbara Bodichon, Eleanor Fortescue-Brickdale, Kate Bunce, Evelyn De Morgan, Emma Sandys, Elizabeth Siddal, Marie Spartali Stillman, and Maria Zambaco were women artists of the Pre-Raphaelite movement.

A few paintings by women are shown below, letting a few stand for many.

¹The late 19th century



Figure 6.15: A painting by Berthe Morisot (1841-1895). She contributed importantly to the Impressionist movement.



Figure 6.16: *The Child's Bath* (1893) by the American-born Impressionist artist Mary Cassatt (1844-1926).



Figure 6.17: Anne Ancher (1839-1935) often painted interior scenes. She belonged to a group of artists who worked together in Skagen, a peninsula in Northern Jutland, Denmark. They worked at roughly the same time as the Impressionists in France.



Figure 6.18: Another interior scene by Anne Ancher. She was married to Michael Ancher, who was also an excellent painter. Anne Ancher modestly kept in the shadow of her husband, but today, most critics consider her paintings to be even better than his, because of her skilful observation of light and colors.



Figure 6.19: “Hip Hip Hurrah”, a painting by P.S. Kroyer, shows the group of Skagen artists, with Anne Ancher and her daughter in white dresses in the right-hand foreground.



Figure 6.20: One of a series of prints which the German artist Käthe Kollwitz (1867-1945) made as a protest against the atrocities of World War I.



Figure 6.21: Another anti-war print by Käthe Kollwitz.



Figure 6.22: *Interior With a Table* (1921), a painting by Virginia Woolf's sister, Vanessa Bell (1879-1961).



Figure 6.23: A self-portrait by Frida Kahlo (1907-1954). Frieda was born in Mexico to a German father and a part-indigenous mother. She suffered polio as a child and a serious traffic accident at the age of 18. The accident left her crippled and in pain for the rest of her life. Nevertheless, she married the famous Mexican muralist Diego Rivera, and even had an affair with Leon Trotsky.



Figure 6.24: Another of Frida's self-portraits.



Figure 6.25: Georgia O'Keeffe's *Bud* (1939), oil on canvas. Georgia O'Keeffe (1887-1985) was married to the photographer Joseph Stieglitz. Her work was honored with the National Medal of Arts, the Presidential Medal of Freedom, and the Edward McDowell Medal. She holds the record (44.4 million dollars in 2014) for the highest price paid for a single painting by a woman.

Suggestions for further reading

1. Seeger, Peggy (2002) *The Peggy Seeger Songbook: Forty Years of Songmaking*, Oak Publications
2. Freedman, Jean R., (2017) *Peggy Seeger: A Life of Music, Love and Politics* University of Illinois Press.
3. Seeger, Peggy, (2017), *First Time Ever: A Memoir*, Faber & Faber
4. Smith, Charles H. and Nancy Schimmel, *Maline Reynolds' Biography*,
<http://people.wku.edu/charles.smith/MALVINA/homep.htm>
5. Irvine, Robert *Jane Austen*. London: Routledge, (2005).
6. Jenkyns, Richard. *A Fine Brush on Ivory: An Appreciation of Jane Austen*. Oxford: Oxford University Press, (2004).
7. Johnson, Claudia. *Austen cults and cultures: The Cambridge Companion to Jane Austen*. Eds. Edward Copeland and Juliet McMaster. Cambridge: Cambridge University Press, (2014).
8. Shelley, Mary. *Collected Tales and Stories*. Ed. Charles E. Robinson. Baltimore: Johns Hopkins University Press, (1976).
9. Shelley, Mary. *Frankenstein; or, The Modern Prometheus*. Ed. Susan J. Wolfson. New York: Pearson Longman, (2007).
10. Shelley, Mary. *The Journals of Mary Shelley, 1814-44*. Ed. Paula R. Feldman and Diana Scott-Kilvert. Baltimore: Johns Hopkins University Press, (1995).
11. Gaskell, Elizabeth. *The Life of Charlotte Brontë*. (1857)
12. Smith Kenyon, Karen, *The Brontë Family: Passionate Literary Geniuses*. Lerner Publications. (2002).
13. Barker, Juliet R. V., *The Brontës*. London: Phoenix House, (1995).
14. Ridout, Alice, *Contemporary Women Writers Look Back: From Irony to Nostalgia*. London: Continuum International Publishing, (2010).

Chapter 7

MADMEN AND ECONOMISTS

“Anyone who believes in indefinite growth in anything physical, on a physically finite planet, is either mad or an economist.”

Kenneth E. Boulding (1910-1993)

7.1 Population stabilization today

The phrase “developing countries” is more than a euphemism; it expresses the hope that with the help of a transfer of technology from the industrialized nations, all parts of the world can achieve prosperity. Some of the forces that block this hope have just been mentioned. Another factor that prevents the achievement of worldwide prosperity is population growth.

In the words of Dr. Halfdan Mahler, former Director General of the World Health Organization, “Country after country has seen painfully achieved increases in total output, food production, health and educational facilities and employment opportunities reduced or nullified by excessive population growth.”

The growth of population is linked to excessive urbanization, infrastructure failures and unemployment. In rural districts in the developing countries, family farms are often divided among a growing number of heirs until they can no longer be subdivided. Those family members who are no longer needed on the land have no alternative except migration to overcrowded cities, where the infrastructure is unable to cope so many new arrivals. Often the new migrants are forced to live in excrement-filled makeshift slums, where dysentery, hepatitis and typhoid are endemic, and where the conditions for human life sink to the lowest imaginable level. In Brazil, such shanty towns are called “favelas”.

If modern farming methods are introduced in rural areas while population growth continues, the exodus to cities is aggravated, since modern techniques are less labor-intensive and favor large farms. In cities, the development of adequate infrastructure requires time, and it becomes a hopeless task if populations are growing rapidly. Thus, population stabilization is a necessary first step for development.

It can be observed that birth rates fall as countries develop. However, development

is sometimes blocked by the same high birth rates that economic progress might have prevented. In this situation (known as the “demographic trap”), economic gains disappear immediately because of the demands of an exploding population.

For countries caught in the demographic trap, government birth control programs are especially important, because one cannot rely on improved social conditions to slow birth rates. Since health and lowered birth rates should be linked, it is appropriate that family-planning should be an important part of programs for public health and economic development.

A recent study conducted by Robert F. Lapham of Demographic Health Surveys and W. Parker Maudlin of the Rockefeller Foundation has shown that the use of birth control is correlated both with socio-economic setting and with the existence of strong family-planning programs. The implication of this study is that even in the absence of increased living standards, family-planning programs can be successful, provided they have strong government support.

China, the world's most populous nation, has adopted the somewhat draconian policy of allowing only one child for families living in towns and cities (35.9% of the population). Chinese leaders obtained popular support for their one-child policy by means of an educational program which emphasized future projections of diminishing water resources and diminishing cropland per person if population increased unchecked. Like other developing countries, China has a very young population, which will continue to grow even when fertility has fallen below the replacement level because so many of its members are contributing to the birth rate rather than to the death rate. China's present population is 1.4 billion. Its projected population for the year 2025 is 1.6 billion. China's one-child policy is supported by 75% of the country's people, but the methods of enforcement are sometimes criticized, and it has led to a M/F sex ratio of 1.17/1.00. The natural baseline for the sex ratio ranges between 1.03/1.00 and 1.07/1.00.

Education of women and higher status for women are vitally important measures, not only for their own sake, but also because in many countries these social reforms have proved to be the key to lower birth rates. Religious leaders who oppose programs for the education of women and for family planning on “ethical” grounds should think carefully about the scope and consequences of the catastrophic global famine which will undoubtedly occur within the next 50 years if population is allowed to increase unchecked. Do these leaders really wish to be responsible for the suffering and death from starvation of hundreds of millions of people?

At the United Nations Conference on Population and Development, held in Cairo in September, 1994, a theme which emerged very clearly was that one of the most important keys to controlling the global population explosion is giving women better education and equal rights. These goals are desirable for the sake of increased human happiness, and for the sake of the uniquely life-oriented point of view which women can give us; but in addition, education and improved status for women have shown themselves to be closely connected with lowered birth rates. When women lack education and independent careers outside the home, they can be forced into the role of baby-producing machines by men who do not share in the drudgery of cooking, washing and cleaning; but when women have

educational, legal, economic, social and political equality with men, experience has shown that they choose to limit their families to a moderate size.

Sir Partha Dasgupta of Cambridge University has pointed out that the changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor and general economic development.

7.2 Why are economists addicted to growth?

Economists (with a few notable exceptions) have long behaved as though growth were synonymous with economic health. If the gross national product of a country increases steadily by 4 percent per year, most economists express approval and say that the economy is healthy. If the economy could be made to grow still faster (they maintain), it would be still more healthy. If the growth rate should fall, economic illness would be diagnosed. However, it is obvious that on a finite Earth, neither population growth nor economic growth can continue indefinitely.

Today, as economic growth falters, the defects and injustices of our banking system have come sharply into focus, and light has also been thrown onto the much-too-cozy relationship between banking and government. The collapse of banks during the subprime mortgage crisis of 2008 and their subsequent bailout by means of the taxpayer's money can give us an insight into both phenomena - the faults of our banking system and its infiltration into the halls of government. The same can be said of the present national debt crisis in the Euro zone and elsewhere.

One feature of banking that cries out for reform is "fractional reserve banking", i.e. the practice whereby private banks keep only a tiny fraction of the money entrusted to them by their depositors, and lend out all the remaining amount. By doing so, the banks are in effect coining their own money and putting it into circulation, a prerogative that ought to be reserved for governments. Under the system of fractional reserve banking, profits from any expansion of the money supply go to private banks rather than being used by the government to provide social services. This is basically fraudulent and unjust; the banks are in effect issuing their own counterfeit money.

When the economy contracts instead of expanding, the effect of fractional reserve banking is still worse. In that case the depositors ask the banks for their money, which it is their right to do. But the banks do not have the money - they have lent it out, and thus they fail. However, the bankers have insured themselves against this eventuality by buying the votes of government officials. Thus the banks are bailed out and the taxpayers are left with the bill, as in the recent example in which the US Federal Reserve secretly gave 7.7 trillion of the taxpayers' dollars to bail out various banks.

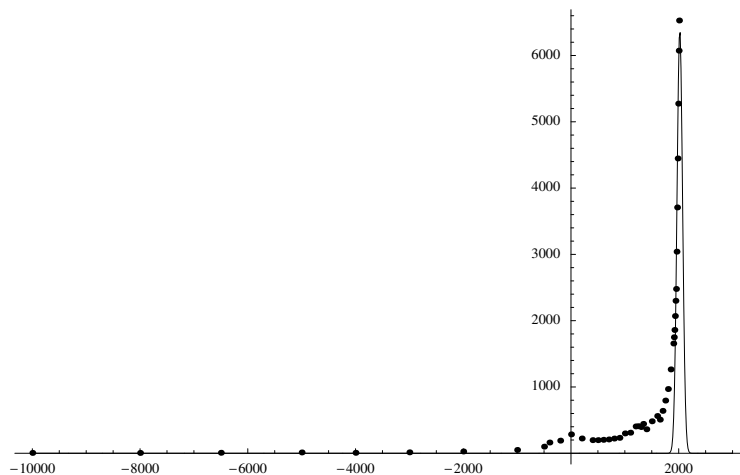


Figure 7.1: **Population growth and fossil fuel use, seen on a time-scale of several thousand years.** The dots are population estimates in millions from the US Census Bureau. Fossil fuel use appears as a spike-like curve, rising from almost nothing to a high value, and then falling again to almost nothing in the space of a few centuries. When the two curves are plotted together, the explosive rise of global population is seen to be simultaneous with, and perhaps partially driven by, the rise of fossil fuel use. This raises the question of whether the world's population is headed for a crash when the fossil fuel era has ended. (Author's own graph)

7.3 Information-driven population growth

Today we are able to estimate the population of the world at various periods in history, and we can also make estimates of global population in prehistoric times. Looking at the data, we can see that the global population of humans has not followed an exponential curve as a function of time, but has instead followed a hyperbolic trajectory. At the time of Christ, the population of the world is believed to have been approximately 220 million. By 1500, the earth contained 450 million people, and by 1750, the global population exceeded 700 million. As the industrial and scientific revolution has accelerated, global population has responded by increasing at a break-neck speed: In 1930, the population of the world reached two billion; in 1958 three billion; in 1974 four billion; in 1988 five billion, and in 1999, six billion. Today, roughly a billion people are being added to the world's population every fourteen years.

As the physicist Murry Gell-Mann has pointed out, a simple mathematical curve which closely approximates the global population of humans over a period of several thousand years is a hyperbola of the form

$$P = \frac{190,000,000,000}{2025 - t}$$

Here P is the population and t is the year. How are we to explain the fact that the popu-

lation curve is not an exponential? We can turn to Malthus for an answer: According to his model, population does not increase exponentially, except under special circumstances, when the food supply is so ample that the increase of population is entirely unchecked. Malthus gives us a model of culturally-driven population growth. He tells us that population increase tends to press against the limits of the food supply, and since these limits are culturally determined, population density is also culturally-determined. Hunter-gatherer societies need large tracts of land for their support; and in such societies, the population density is necessarily low. Pastoral methods of food production can support populations of a higher density. Finally, extremely high densities of population can be supported by modern agriculture. Thus, the hyperbolic curve, $P=C/(2025-t)$, where C is a constant, should be seen as describing the rapidly-accelerating growth of human culture, this being understood to include methods of food production.

If we look at the curve, $P=C/(2025-t)$, it is obvious that human culture has reached a period of crisis. The curve predicts that the world's population will rise to infinity in the year 2025, which of course is impossible. Somehow the actual trajectory of global population as a function of time must deviate from the hyperbolic curve, and in fact, the trajectory has already begun to fall away from the hyperbola. Because of the great amount of human suffering which may be involved, and the potentially catastrophic damage to the earth's environment, the question of how the actual trajectory of human population will come to deviate from the hyperbola is a matter of enormous importance. Will population overshoot the sustainable limit, and crash? Or will it gradually approach a maximum? In the case of the second alternative, will the checks which slow population growth be later marriage and family planning? Or will the grim Malthusian forces - famine, disease and war - act to hold the number of humans within the carrying capacity of their environment?

We can anticipate that as the earth's human population approaches 10 billion, severe famines will occur in many developing countries. The beginnings of this tragedy can already be seen. It is estimated that roughly 30,000 children now die every day from starvation, or from a combination of disease and malnutrition.

An analysis of the global ratio of population to cropland shows that we have probably already exceeded the sustainable limit of population through our dependence on petroleum: Between 1950 and 1982, the use of cheap synthetic fertilizers increased by a factor of 8. Much of our present agricultural output depends on their use, but their production is expensive in terms of energy. Furthermore, petroleum-derived synthetic fibers have reduced the amount of cropland needed for growing natural fibers, and petroleum-driven tractors have replaced draft animals which required cropland for pasturage.

Also, petroleum fuels have replaced fuelwood and other fuels derived for biomass. The reverse transition, from fossil fuels back to renewable energy sources, will require a considerable diversion of land from food production to energy production. For example, 1.1 hectares are needed to grow the sugarcane required for each alcohol-driven Brazilian automobile. This figure may be compared with the steadily falling average area of cropland available to each person in the world: .24 hectares in 1950, .16 hectares in 1982.

As population increases, the cropland per person will continue to fall, and we will be forced to make still heavier use of fertilizers to increase output per hectare. Also marginal



Figure 7.2: The number of hectares of cropland available per person as a function of time.

land will be used in agriculture, with the probable result that much land will be degraded through erosion and salination. Climate change will reduce agricultural output. The Hubbert peaks for oil and natural gas will occur within one or two decades, and the fossil fuel era will be over by the end of 21st century. Thus there is a danger that just as global population reaches the unprecedented level of 10 billion or more, the agricultural base for supporting it may suddenly collapse. Ecological catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history - a disaster of unimaginable proportions, involving billions rather than millions of people.

The resources of the earth and the techniques of modern science can support a global population of moderate size in comfort and security; but the optimum size is undoubtedly smaller than the world's present population (see Chapter 4). Given a sufficiently small global population, renewable sources of energy can be found to replace disappearing fossil fuels. Technology may also be able to find renewable substitutes for many disappearing mineral resources for a global population of a moderate size. What technology cannot do, however, is to give a global population of 10 billion people the standard of living which the industrialized countries enjoy today.

What would Malthus tell us if he were alive today? Certainly he would say that we have reached a period of human history where it is vital to stabilize the world's population if catastrophic environmental degradation and famine are to be avoided. He would applaud efforts to reduce suffering by eliminating poverty, widespread disease, and war; but he would point out that, since it is necessary to stop the rapid increase of human numbers, it follows that whenever the positive checks to population growth are removed, it is absolutely necessary to replace them by preventive checks. Malthus' point of view became more broad in the successive editions of his *Essay*; and if he were alive today, he would probably agree that family planning is the most humane of the preventive checks.

In Malthus' *Essay on the Principle of Population*, population pressure appears as one of the main causes of war; and Malthus also discusses many societies in which war is one of the the principle means by which population is reduced to the level of the food supply. Thus, his *Essay* contains another important message for our own times: If he were alive today, Malthus would also say that there is a close link between the two most urgent tasks which history has given to the 21st century - stabilization of the global population, and abolition of the institution of war.

In most of the societies which Malthus described, a clear causal link can be seen, not only between population pressure and poverty, but also between population pressure and war. As one reads his *Essay*, it becomes clear why both these terrible sources of human anguish saturate so much of history, and why efforts to eradicate them have so often met with failure: The only possible way to eliminate poverty and war is to reduce the pressure of population by preventive checks, since the increased food supply produced by occasional cultural advances can give only very temporary relief. Today, the links between population pressure, poverty, and war are even more pronounced than they were in the past, because the growth of human population has brought us to the absolute limits imposed by ecological constraints.

7.4 Biology and economics

Classical economists like Smith and Ricardo pictured the world as largely empty of human activities. According to the “empty-world” picture of economics, the limiting factors in the production of food and goods are shortages of capital and labor. The land, forests, fossil fuels, minerals, oceans filled with fish, and other natural resources upon which human labor and capital operate, are assumed to be present in such large quantities that they are not limiting factors. In this picture, there is no naturally-determined upper limit to the total size of the human economy. It can continue to grow as long as new capital is accumulated, as long as new labor is provided by population growth, and as long as new technology replaces labor by automation.

Biology, on the other hand, presents us with a very different picture. Biologists remind us that if any species, including our own, makes demands on its environment which exceed the environment's carrying capacity, the result is a catastrophic collapse both of the environment and of the population which it supports. Only demands which are within the carrying capacity are sustainable. For example, there is a limit to regenerative powers of a forest. It is possible to continue to cut trees in excess of this limit, but only at the cost of a loss of forest size, and ultimately the collapse and degradation of the forest. Similarly, cattle populations may for some time exceed the carrying capacity of grasslands, but the ultimate penalty for overgrazing will be degradation or desertification of the land. Thus, in biology, the concept of the carrying capacity of an environment is extremely important; but in economic theory this concept has not yet been given the weight that it deserves.

The terminology of economics can be applied to natural resources: For example, a forest can be thought of as natural capital, and the sustainable yield from the forest as

interest. Exceeding the biological carrying capacity then corresponds, in economic terms, to spending one's capital.

If it is to be prevented from producing unacceptable contrasts of affluence and misery within a society, the free market advocated by Adam Smith needs the additional restraints of ethical principles, as well as a certain amount of governmental regulation. Furthermore, in the absence of these restraints, it will destroy the natural environment of our planet.

There is much evidence to indicate that the total size of the human economy is rapidly approaching the absolute limits imposed by the carrying capacity of the global environment. For example, a recent study by Vitousek et. al. showed that 40 percent of the net primary product of landbased photosynthesis is appropriated, directly or indirectly, for human use. (The net primary product of photosynthesis is defined as the total quantity of solar energy converted into chemical energy by plants, minus the energy used by the plants themselves). Thus we are only a single doubling time away from 80 percent appropriation, which would imply a disastrous environmental degradation.

Another indication of our rapid approach to the absolute limits of environmental carrying capacity can be found in the present rate of loss of biodiversity. Biologists estimate that between 10,000 and 50,000 species are being driven into extinction each year as the earth's rainforests are destroyed.

The burning of fossil fuels and the burning of tropical rain forests have released so much carbon dioxide that the atmospheric concentration of this greenhouse gas has increased from a preindustrial value of 260 ppm to its present value: 380 ppm. Most scientists agree that unless steps are taken to halt the burning of rain forests and to reduce the use of fossil fuels, the earth's temperature will steadily rise during the coming centuries. This gradual long-term climate change will threaten future agricultural output by changing patterns of rainfall. Furthermore, the total melting of the Arctic and Antarctic icecaps, combined with the thermal expansion of the oceans, threatens to produce a sea level rise of up to 12 meters. Although these are slow, long-term effects, we owe it to future generations to take steps now to halt global warming.

The switch from fossil fuels to renewable energy sources is vital not only because of the need to reduce global warming, but also because the earth's supply of fossil fuels is limited. A peak in the production and consumption of conventional petroleum is predicted within one or two decades. Such a peak in the use of any non-renewable natural resource is called a "Hubbert peak" after the oil expert Dr. M. King Hubbert. It occurs when reserves of the resource are approximately half exhausted. After that point, the resource does not disappear entirely, but its price increases steadily because supply fails to meet demand, and because of rising extraction costs. It is predicted that the Hubbert peak for both oil and natural gas will also occur within a few decades. The peak for oil may occur within the present decade. Thus, halfway through the 21st Century, oil and natural gas will become very expensive - perhaps so expensive that they will not be burned but will instead be reserved as starting points for chemical synthesis.

The reserves of coal are much larger, and at the present rate of use they would last for slightly more than two centuries. However, it seems likely that as petroleum is exhausted, coal will be converted into liquid fuels, as was done in Germany during World War II,

and in South Africa during the oil embargo. Thus, in predicting a date for the end of the fossil fuel era, we ought to lump oil, natural gas and coal together. If we do so, we find the total supply has an energy content of 1260 terawatt-years. (1 terawatt is equal to 1,000,000,000,000 Watts). One finds in this way that if they are used at the present rate of 13 terawatts, fossil fuels will last about 100 years.

Resolute government intervention is needed to promote energy conservation measures and to bring about the switch from fossil fuels to renewable energy sources, such as biomass, photovoltaics, solar thermal power, wind and wave power, and hydropower. Both subsidies for renewable energy technologies, to help them get started, and taxes on fossil fuels will be needed. Changes in tax structure could also encourage smaller families, encourage resource conservation, or diminish pollution. In general, taxation should be used, not merely to raise money, but, more importantly, to guide the evolution of society towards humane and sustainable goals.

7.5 Fossil fuel use and climate change

“Some of the potential risks could be irreversible and could accelerate the process of global warming. Melting of permafrost in the Arctic could lead to the release of huge quantities of methane. Dieback of the Amazon forest could mean that the region starts to emit rather than to absorb greenhouse gases. These feedbacks could lead to warming that is at least twice as fast as current high-emission projections, leading to temperatures higher than seen in the last 50 million years. There are still uncertainties about how much warming would be needed to trigger these abrupt changes. Nevertheless, the consequences would be catastrophic if they do occur.”

Stern Report Discussion Paper, January 31, 2006.

Melting of the polar ice caps

At present the amount of carbon in the atmosphere is increasing by about 6 gigatons per year because of human activities; and projections estimate that the CO_2 concentration will reach about 600 ppm by 2050 (more than double the preindustrial concentration). In addition to CO_2 , methane, CH_4 , and nitrous oxide, NO_2 , are also released into the atmosphere by human activities. Anthropogenic methane comes from the production and transportation of coal, natural gas and oil, decomposition of organic wastes in municipal landfills, cultivation of rice paddies, and the raising of livestock.

The greenhouse gasses (which include water vapor, carbon dioxide, methane, ozone, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons and many other gasses) absorb a part of the infrared radiation from the earth's surface, which otherwise would have been sent directly into outer space. Part of this energy is re-radiated into space, but a part is sent downward to the earth, where it is absorbed. The result is that the earth's surface is much warmer than it otherwise would be. The mechanism is much the same as that of a greenhouse, where the glass absorbs and re-radiates infrared radiation. A moderate greenhouse effect on earth is helpful to life, but climatologists believe that anthropogenic CO_2 and CH_4 emissions may produce a dangerous amount of global warming during the next few centuries.

According to the Intergovernmental Panel on Climate Change the percentages of greenhouse gas emissions contributed by various human activities are as follows:

Energy use	{	Transportation	13.5%
		Electricity and heat	24.6%
		Other fuel combustion	9.0%
		Industry	10.4%
		Fugitive emissions	3.9%
Other sources	{	Industrial processes	3.4%
		Land use change (deforestation)	18.2%
		Agriculture	13.5%
		Waste	3.6%

In thinking about global warming, it is important to remember that it is a very slow and long-term phenomenon. Stephen H. Schneider and Janica Lane of Stanford University,

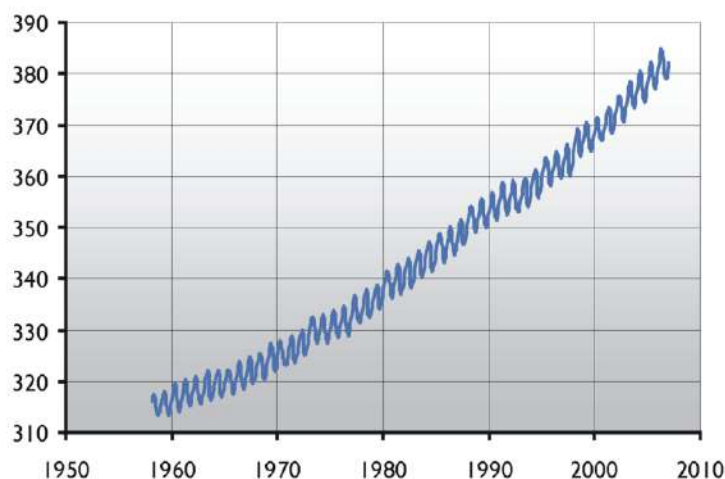


Figure 7.3: Atmospheric CO_2 concentrations measured at Mount Loa, Hawaii

in an article entitled *An Overview of ‘Dangerous’ Climate Change* include a figure that emphasizes the long-term nature of global warming. The figure presupposes that CO_2 emissions will peak within 50 years and will thereafter be reduced. According to the figure, it will still take more than a century for the level of CO_2 in the atmosphere to stabilize. The establishment of temperature equilibrium will require several centuries. Sea level rises due to thermal expansion of ocean water will not be complete before the end of the millennium, while sea level rises due to melting of the polar icecaps might not be complete for several millennia!

It is worrying to think that total melting of the Greenland ice cap, which some authors think might begin in earnest during the 22nd century, would result in a sea level rise of up to 7 meters. Of course, society would have some time to adjust to this event. But a glance at maps and elevations makes one realize the extent of such a catastrophe and the importance of preventing it.

The IPCC and Stern reports

Models put forward by the Intergovernmental Panel on Climate Change (IPCC, 2007 Report) suggest that if no steps are taken to reduce carbon emissions, a temperature increase of 1.4-5.6 degrees C will occur by 2100¹. Global warming may have some desirable effects, such as increased possibilities for agriculture in Canada, Sweden and Siberia. However, most of the expected effects of global warming will be damaging. These unwanted effects include ocean level rises, extreme weather conditions (such as heat waves, hurricanes and tropical cyclones), changes in the patterns of ocean currents, melting of polar ice and glaciers, abnormal spread of diseases, extinctions of plant and animal species, together

¹relative to 1990 temperatures.

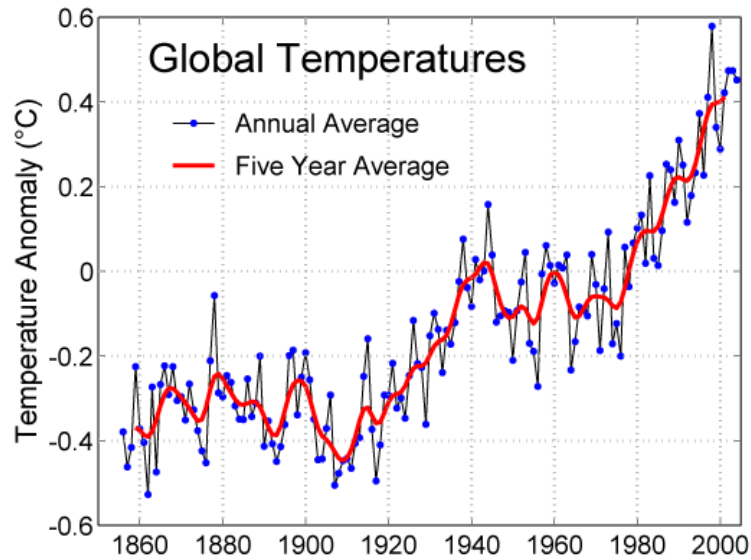


Figure 7.4: Global temperatures during the last two centuries

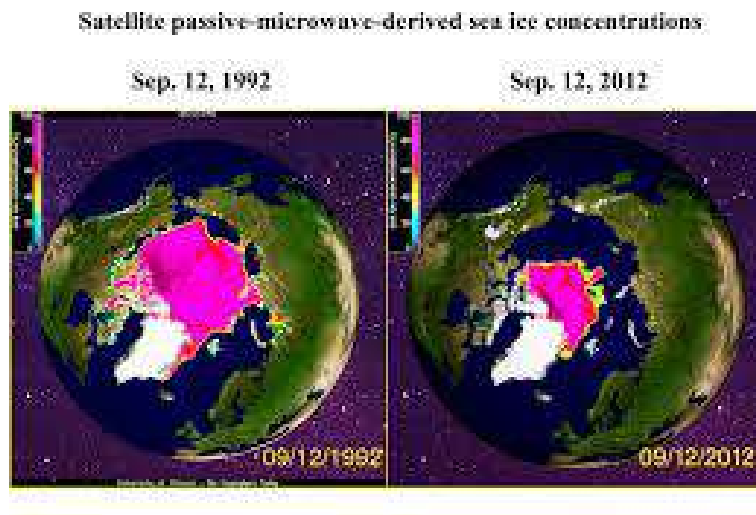


Figure 7.5: Recent loss of Arctic ice, as measured by NASA's Aqua satellite



Figure 7.6: The collapsing Larsen-B iceshelf in the Antarctic is similar in size to the US state of Rhode Island

with aridity and crop failures in some areas of the world which are now able to produce and export large quantities of grain.

According to a report presented to the Oxford Institute of Economic Policy by Sir Nicholas Stern on 31 January, 2006, areas likely to lose up to 30% of their rainfall by the 2050's because of climate change include much of the United States, Brazil, the Mediterranean region, Eastern Russia and Belarus, the Middle East, Southern Africa and Southern Australia. Meanwhile rainfall is predicted to increase up to 30% in Central Africa, Pakistan, India, Bangladesh, Siberia, and much of China.

Stern and his team point out that "We can... expect to see changes in the Indian monsoon, which could have a huge impact on the lives of hundreds of millions of people in India, Pakistan and Bangladesh. Most climate models suggest that the monsoon will change, although there is still uncertainty about exactly how. Nevertheless, small changes in the monsoon could have a huge impact. Today, a fluctuation of just 10% in either direction from average monsoon rainfall is known to cause either severe flooding or drought. A weak summer monsoon, for example, can lead to poor harvests and food shortages among the rural population - two-thirds of India's almost 1.1 billion people. Heavier-than-usual monsoon downpours can also have devastating consequences..."

In some regions, melting of glaciers can be serious from the standpoint of dry-season water supplies. For example, melts from glaciers in the Hindu Kush and the Himalayas now supply much of Asia, including China and India, with a dry-season water supply. Complete melting of these glacial systems would cause an exaggerated runoff for a few decades, after which there would be a drying out of some of the most densely populated regions of the world.

The threat of feed-back loops

The Discussion Paper presented by Stern on January 31, 2006, also notes that "Some of the potential risks could be irreversible and accelerate the process of global warming. Melting of permafrost in the Arctic could lead to the release of huge quantities of methane. Dieback of the Amazon forest could mean that the region starts to emit rather than absorb greenhouse gases. These feedbacks could lead to warming that is at least twice as fast as current high-emissions projections, leading to temperatures higher than seen in the past 50 million years. There are still uncertainties about how much warming would be needed to trigger these abrupt changes. Nevertheless, the consequences would be catastrophic if they do occur."

The much larger (700 page) Stern Report was made public on October 30, 2006. It explores not only the scientific basis for predictions of global warming but also the possible economic consequences. Unless we act promptly to prevent it, the Stern Report states, global warming could render swaths of the planet uninhabitable, and do economic damage equal to that inflicted by the two world wars.

A large United Nations Climate Conference (COP15) took place in Copenhagen from December 7 to December 18, 2009. In order to make the latest results of researchers available to the 15,000 expected participants, a preliminary meeting of scientists was held

at the University of Copenhagen in March, 2009. 2,500 delegates from 80 countries attended the meeting. Among the conclusions of this international congress of scientists were the following:

- **Climatic trends:** “Recent observations confirm that, given the high rates of observed emissions, the worst-case IPCC scenario trajectories (or even worse) are being realized. For many key parameters, the climate system is already moving beyond the patterns of natural variability within which our society and economy developed and thrived. These parameters include global mean surface temperature, sea-level rise, ocean and ice sheet dynamics, ocean acidification and extreme climate events. There is a significant risk that many of the trends will accelerate, leading to an increasing risk of abrupt or irreversible climatic shifts.”
- **Social disruption:** “Recent observations show that societies are highly vulnerable to even modest levels of climate change, with poor nations and communities particularly at risk. Temperature rises above 2° C will be very difficult for contemporary societies to cope with, and will increase the level of climate disruption through the rest of the century.”

To avoid temperature increases of more than 2° C, the scientists said that it will be necessary for the world to reduce its CO₂ emissions by 90% by 2050. In other words if dangerous climate change is to be avoided, the fossil fuel era must essentially end by that date.

Despite these clear and unanimous warnings from the scientific community, the United Nations climate conference in Copenhagen failed to reach an agreement sufficiently strong to avoid dangerous climate change. The problem encountered by the conference was a deep disagreement between developed and developing countries. The developing countries correctly maintained that historically, they have not been to blame for emission of greenhouse gases. Meanwhile, the industrialized countries pointed to the future, saying (also correctly) that unless the developing countries accepted their future responsibilities, there would be no hope of avoiding disaster.

At the last moment, the United States, China, India, Brazil and South Africa hammered out a weak agreement, the *Copenhagen Accord*, which the other nations at the conference agreed to “take note of”. The Copenhagen Accord recognizes the aim of limiting global warming to 2° C. However, it does not provide mechanisms sufficiently strong to reach that goal. Another UN climate conference will be held in Mexico in November, 2010, and it is to be hoped that during the intervening months, negotiators will be able to build on the very modest results of COP15 and put together an adequate and legally binding treaty.

Table 7.1: This table shows the 2006 CO₂ emissions from burning of fossil fuels, by country as percentages of the global total and in terms of metric tons per capita. The eight countries with greatest emissions are shown. China is still classified as a developing country, and its per capita emissions are still relatively low (although rapidly increasing). However, because of its large population, China now puts more CO₂ into the atmosphere per year than any other country. Similarly, despite India's low per capita emissions, it is now in 4th place.

Country	Percentage of global total	Per capita in metric tons
China	21.5%	4.57
United States	20.2%	18.67
Russia	5.5%	11.03
India	5.3%	1.29
Japan	4.6%	10.14
Germany	2.8%	9.82
United Kingdom	2.0%	9.26
Canada	1.9%	16.08

7.6 Loss of biodiversity

Agricultural monocultures

In modern agriculture it has become common to plant large regions with a single crop variety. For example, it is common to plant large regions with a single high-yield wheat variety. Monocultures of this kind offer farmers advantages of efficiency in the timing of planting and harvesting. With regard to pest and disease control, there may be short-term advantages, but these have to be weighed against the threat of long-term disasters. In the great Irish Potato Famine of 1845-1849, the potato monoculture which had sustained Ireland's growing population was suddenly devastated by *Phytophthora infestans*, commonly called "potato blight". The result was a catastrophic famine that resulted in the death or emigration of much of Ireland's population.

In general, monocultures are vulnerable to plant disease. Thus the replacement of traditional varieties with the high-yield crops developed by the "Green Revolution" carries serious risks. Adjustment to climate change also requires genetic diversity. In general, a genetically diverse population is far better to adjust to environmental changes than a genetically homogeneous population. This being so, it is vital to preserve civilization's heritage of genetically diverse crops.

Deforestation and loss of biodiversity

The earth's tropical rain forests are rapidly being destroyed for the sake of new agricultural land. Tropical rain forests are thought to be the habitat of more than half of the world's species of plants, animals and insects; and their destruction is accompanied by an alarming rate of extinction of species. The Harvard biologist, E.O. Wilson, estimates that the rate of extinction resulting from deforestation in the tropics may now exceed 4,000 species per year - 10,000 times the natural background rate (*Scientific American*, September, 1989).

The enormous biological diversity of tropical rain forests has resulted from their stability. Unlike northern forests, which have been affected by glacial epochs, tropical forests have existed undisturbed for millions of years. As a result, complex and fragile ecological systems have had a chance to develop. Professor Wilson expresses this in the following words:

"Fragile superstructures of species build up when the environment remains stable enough to support their evolution during long periods of time. Biologists now know that biotas, like houses of cards, can be brought tumbling down by relatively small perturbations in the physical environment. They are not robust at all."

The number of species which we have until now domesticated or used in medicine is very small compared with the number of potentially useful species still waiting in the world's tropical rain forests. When we destroy them, we damage our future. But we ought to regard the annual loss of thousands of species as a tragedy, not only because biological diversity is potential wealth for human society, but also because every form of life deserves our respect and protection.

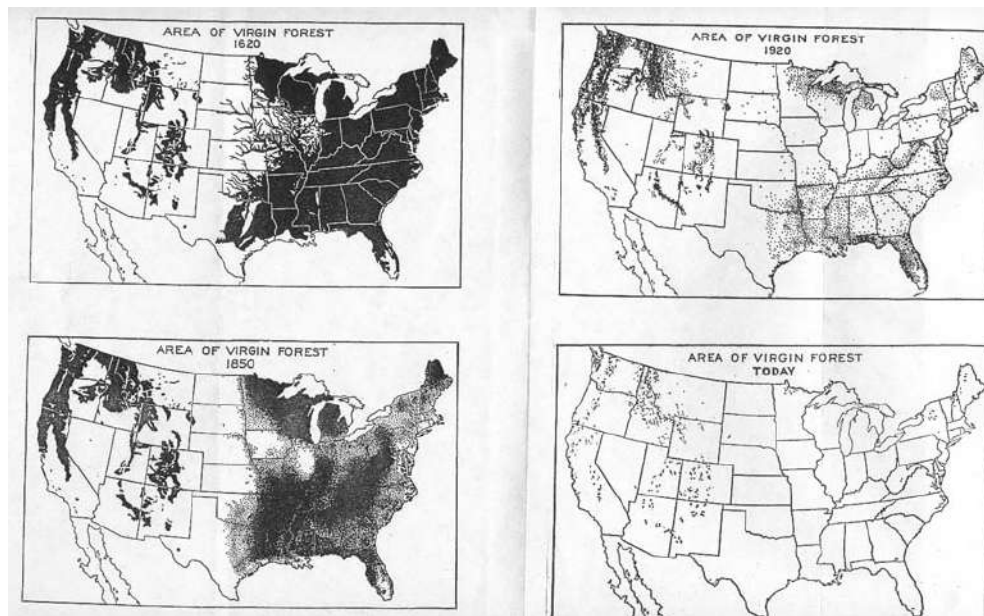


Figure 7.7: Deforestation in the United States between 1620 and the present.



Figure 7.8: Jungle burned for agriculture in southern Mexico.

7.7 Economics without growth

According to Adam Smith, the free market is the dynamo of economic growth. The true entrepreneur does not indulge in luxuries for himself and his family, but reinvests his profits, with the result that his business or factory grows larger, producing still more profits, which he again reinvests, and so on. This is indeed the formula for exponential economic growth.

Economists (with a few notable exceptions such as Aurelio Pecci and Herman Daly) have long behaved as though growth were synonymous with economic health. If the gross national product of a country increases steadily by 4% per year, most economists express approval and say that the economy is healthy. If the economy could be made to grow still faster (they maintain), it would be still more healthy. If the growth rate should fall, economic illness would be diagnosed. However, the basic idea of Malthus is applicable to exponential increase of any kind. It is obvious that on a finite Earth, neither population growth nor resource-using and pollution-generating economic growth can continue indefinitely.

A “healthy” economic growth rate of 4% per year corresponds to an increase by a factor of 50 in a century. (The reader is invited to calculate the factor of increase in five centuries. The answer is $50^5 = 312,500,000$.) No one can maintain that this type of growth is sustainable except by refusing to look more than a short distance into the future. Sooner or later (perhaps surprisingly soon) an entirely new form of economics will be needed - not the empty-world economics of Adam Smith, but what might be called “full-world economics”, or “steady-state economics”.

Economic activity is usually divided into two categories, 1) production of goods and 2) provision of services. It is the rate of production of goods that will be limited by the carrying capacity of the global environment. Services that have no environmental impact will not be constrained in this way. Thus a smooth transition to a sustainable economy will involve a shift of a large fraction the work force from the production of goods to the provision of services.

In his recent popular book *The Rise of the Creative Class*, the economist Richard Florida points out that in a number of prosperous cities - for example Stockholm - a large fraction of the population is already engaged in what might be called creative work - a type of work that uses few resources, and produces few waste products - work which develops knowledge and culture rather than producing material goods. For example, producing computer software requires few resources and results in few waste products. Thus it is an activity with a very small ecological footprint. Similarly, education, research, music, literature and art are all activities that do not weigh heavily on the carrying capacity of the global environment. Furthermore, cultural activities lead in a natural way to global cooperation and internationalism. Florida sees this as a pattern for the future, and maintains that everyone is capable of creativity. He visualizes the transition to a sustainable future economy as one in which a large fraction of the work force moves from industrial jobs to information-related work. Meanwhile, as Florida acknowledges, industrial workers feel uneasy and threatened by such trends.

The present use of resources by the industrialized countries is extremely wasteful. A

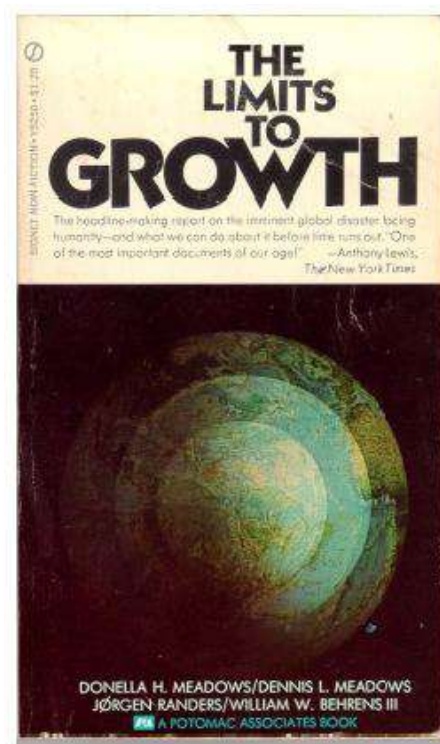


Figure 7.9: In 1968 Aurelio Pecci, Thorkil Kristensen and others founded the Club of Rome, an organization of economists and scientists devoted to studying the predicament of human society. One of the first acts of the organization was to commission an MIT study of future trends using computer models. The result was a book entitled “Limits to Growth”, published in 1972. From the outset the book was controversial, but it became a best-seller. It was translated into many languages and sold 30 million copies. The book made use of an exponential index for resources, i.e. the number of years that a resource would last if used at an exponentially increasing rate. Today the more accurate Hubbert Peak model is used instead to predict rate of use of a scarce resource as a function of time. Although the specific predictions of resource availability in “Limits to Growth” lacked accuracy, its basic thesis - that unlimited economic growth on a finite planet is impossible - was indisputably correct. Nevertheless the book was greeted with anger and disbelief by the community of economists, and these emotions still surface when it is mentioned. Perhaps part of this collective blindness was and is due to the polarization of opinion produced by the Cold War. In any case, the myth of unlimited growth has remained the central dogma of western economics.

growing national economy must, at some point, exceed the real needs of the citizens. It has been the habit of the developed countries to create artificial needs by means of advertising, in order to allow economies to grow beyond the point where all real needs have been met; but this extra growth is wasteful, and in the future it will be important not to waste the earth's diminishing supply of non-renewable resources.

Thus, the times in which we live present a challenge: We need a revolution in economic thought. We must develop a new form of economics, taking into account the realities of the world's present situation - an economics based on real needs and on a sustainable equilibrium with the environment, not on the thoughtless assumption that growth can continue forever.

Adam Smith was perfectly correct in saying that the free market is the dynamo of economic growth; but rapid growth of human population and economic activity have brought us, in a surprisingly short time, from the empty-world situation in which he lived to a full-world situation. In today's world, we are pressing against the absolute limits of the earth's carrying capacity, and further growth carries with it the danger of future collapse. Full-world economics, the economics of the future, will no longer be able to rely on growth to give profits to stockbrokers or to solve problems of unemployment or to alleviate poverty. In the long run, growth of any kind is not sustainable (except perhaps growth of culture and knowledge); and we are now nearing the environmentally-imposed limits.

Transition to a sustainable economy

Like a speeding bus headed for a brick wall, the earth's rapidly-growing population of humans and its rapidly-growing resource-using and pollution-generating economic activity are headed for a collision with a very solid barrier - the carrying capacity of the global environment. As in the case of the bus and the wall, the correct response to the situation is to apply the brakes in time - but fear prevents us from doing this. What will happen if we slow down very suddenly? Will not many of the passengers be injured? Undoubtedly. But what will happen if we hit the wall at full speed? Perhaps it would be wise, after all, to apply the brakes!

The memory of the great depression of 1929 makes us fear the consequences of an economic slowdown, especially since unemployment is already a serious problem in many parts of the world. Although the history of the 1929 depression is frightening, it may nevertheless be useful to look at the measures which were used then to bring the global economy back to its feet. A similar level of governmental responsibility may help us to avoid some of the more painful consequences of the necessary transition from the economics of growth to steady-state economics.

In the United States, President Franklin D. Roosevelt was faced with the difficult problems of the depression during his first few years in office. Roosevelt introduced a number of special governmental programs, such as the WPA, the Civilian Construction Corps and the Tennessee Valley Authority, which were designed to create new jobs on projects directed towards socially useful goals - building highways, airfields, auditoriums, harbors, housing projects, schools and dams. The English economist John Maynard Keynes, (1883-1946),

provided an analysis of the factors that had caused the 1929 depression, and a theoretical justification of Roosevelt's policies.

The transition to a sustainable global society will require a similar level of governmental responsibility, although the measures needed are not the same as those which Roosevelt used to end the great depression. Despite the burst of faith in the free market which has followed the end of the Cold War, it seems unlikely that market mechanisms alone will be sufficient to solve problems of unemployment in the long-range future, or to achieve conservation of land, natural resources and environment.

The Worldwatch Institute, Washington D.C., lists the following steps as necessary for the transition to sustainability²:

1. Stabilizing population
2. Shifting to renewable energy
3. Increasing energy efficiency
4. Recycling resources
5. Reforestation
6. Soil Conservation

All of these steps are labor-intensive; and thus, wholehearted governmental commitment to the transition to sustainability can help to solve the problem of unemployment.

In much the same spirit that Roosevelt (with Keynes' approval) used governmental powers to end the great depression, we must now urge our governments to use their powers to promote sustainability and to reduce the trauma of the transition to a steady-state economy. For example, an increase in the taxes on fossil fuels could make a number of renewable energy technologies economically competitive; and higher taxes on motor fuels would be especially useful in promoting the necessary transition from private automobiles to bicycles and public transportation. Tax changes could also be helpful in motivating smaller families.

The present economic recession offers us an opportunity to take steps towards the creation of a sustainable steady-state economic system. Government measures to avoid unemployment could at the same time shift the work force to jobs that promote sustainability, i.e., jobs in the areas listed by the Worldwatch Institute.

Governments already recognize their responsibility for education. In the future, they must also recognize their responsibility for helping young people to make a smooth transition from education to secure jobs. If jobs are scarce, work must be shared, in a spirit of solidarity, among those seeking employment; hours of work (and if necessary, living standards) must be reduced to insure a fair distribution of jobs. Market forces alone cannot achieve this. The powers of government are needed.

Population and goods per capita

In the distant future, the finite carrying capacity of the global environment will impose limits on the amount of resource-using and waste-generating economic activity that it will

²L.R. Brown and P. Shaw, 1982.



Figure 7.10: Lester R. Brown, founder of the Worldwatch Institute, and for many years its President. He is now the leader of the Earth Policy Institute. His recent book, “Plan B”, gives important information about the ecological crisis now facing the world. It may be downloaded free of charge from the website of the Earth Policy Institute.

be possible for the world to sustain. The consumption of goods per capita will be equal to this limited total economic activity divided by the number of people alive at that time. Thus, our descendants will have to choose whether they want to be very numerous and very poor, or less numerous and more comfortable, or very few and very rich. Perhaps the middle way will prove to be the best.

Given the fact that environmental carrying capacity will limit the sustainable level of resource-using economic activity to a fixed amount, average wealth in the distant future will be approximately inversely proportional to population over a certain range of population values. Obviously, if the number of people is reduced to such an extent that it approaches zero, the average wealth will not approach infinity, since a certain level of population is needed to maintain a modern economy. However, if the global population becomes extremely large, the average wealth will indeed approach zero.

In the 1970's the equation $I = P \times A \times T$ was introduced in the course of a debate between Barry Commoner, Paul R. Ehrlich and John P. Holdren. Here I represents environmental impact, P is population, while A represents goods per capita, and T is an adjustable factor that depends on the technology used to produce the goods. The assertion of the previous paragraph can be expressed by solving for A and setting I equal to a constant: $A = I/(P \times T)$. In the distant future, the environmental impact I will not be allowed to increase, and therefore for a given value of T , A will be inversely proportional to P .

If the environmental impact I is broken up into several components, a few of them have historically fallen with increasing values of $A \times P$ because of diminishing T (thus exhibiting the *environmental Kuznets curve*). However, most components of I , such as energy, land and resource use, have historically increased with increasing $A \times P$.

Suggestions for further reading

1. A. Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, Rodale Books, New York, (2006).
2. A. Gore, *Earth in the Balance: Forging a New Common Purpose*, Earthscan, (1992).
3. A.H. Ehrlich and P.R. Ehrlich, *Earth*, Thames and Methuen, (1987).pro Simon and Schuster, (1990).
4. P.R. Ehrlich and A.H. Ehrlich, *Healing the Planet: Strategies for Resolving the Environmental Crisis*, Addison-Wesley, (1991).
5. P.R. Ehrlich and A.H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens our Future*, Island Press, (1998).
6. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
7. A.H. Ehrlich and U. Lele, *Humankind at the Crossroads: Building a Sustainable Food System*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
8. P.R. Ehrlich, *The Population Bomb*, Sierra/Ballentine, New York, (1972).

9. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Human Ecology*, W.H. Freeman, San Francisco, (1972).
10. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Ecoscience: Population, Resources, Environment*, W.H. Freeman, San Francisco, (1977)
11. P.R. Ehrlich and A.H. Ehrlich, *Extinction*, Victor Gollancz, London, (1982).
12. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
13. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).
14. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
15. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
16. A. Peccei, *The Human Quality*, Pergamon Press, Oxford, (1977).
17. A. Peccei, *One Hundred Pages for the Future*, Pergamon Press, New York, (1977).
18. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
19. R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
20. IPCC, Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis*, (2001).
21. N. Stern et al., *The Stern Review*, www.sternreview.org.uk, (2006).
22. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).
23. P.M. Vitousek, H.A. Mooney, J. Lubchenco and J.M. Melillo, *Human Domination of Earth's Ecosystems*, *Science*, **277**, 494-499, (1997).
24. P.M. Vitousek, P.R. Ehrlich, A.H. Ehrlich and P.A. Matson, *Human Appropriation of the Products of Photosynthesis*, *Bioscience*, **34**, 368-373, (1986).
25. D. King, *Climate Change Science: Adapt, Mitigate or Ignore*, *Science*, **303** (5655), pp. 176-177, (2004).
26. S. Connor, *Global Warming Past Point of No Return*, *The Independent*, (116 September, 2005).
27. D. Rind, *Drying Out the Tropics*, *New Scientist* (6 May, 1995).
28. J. Patz et al., *Impact of Regional Climate Change on Human Health*, *Nature*, (17 November, 2005).
29. M. McCarthy, *China Crisis: Threat to the Global Environment*, *The Independent*, (19 October, 2005).
30. L.R. Brown, *The Twenty-Ninth Day*, W.W. Norton, New York, (1978).
31. N. Myers, *The Sinking Ark*, Pergamon, New York, (1972).
32. N. Myers, *Conservation of Tropical Moist Forests*, National Academy of Sciences, Washington D.C., (1980).
33. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).

34. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
35. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
36. E. Eckholm, *The Picture of Health: Environmental Sources of Disease*, New York, (1976).
37. Economic Commission for Europe, *Air Pollution Across Boundaries*, United Nations, New York, (1985).
38. G. Hagman and others, *Prevention is Better Than Cure*, Report on Human Environmental Disasters in the Third World, Swedish Red Cross, Stockholm, Stockholm, (1986).
39. G. Hardin, "The Tragedy of the Commons", *Science*, December 13, (1968).
40. K. Newland, *Infant Mortality and the Health of Societies*, Worldwatch Paper 47, Worldwatch Institute, Washington D.C., (1981).
41. D.W. Orr, *Ecological Literacy*, State University of New York Press, Albany, (1992).
42. E. Pestel, *Beyond the Limits to Growth*, Universe Books, New York, (1989).
43. D.C. Pirages and P.R. Ehrlich, *Ark II: Social Responses to Environmental Imperatives*, W.H. Freeman, San Francisco, (1974).
44. Population Reference Bureau, *World Population Data Sheet*, PRM, 777 Fourteenth Street NW, Washington D.C. 20007, (published annually).
45. R. Pressat, *Population*, Penguin Books Ltd., (1970).
46. M. Rechcigl (ed.), *Man/Food Equation*, Academic Press, New York, (1975).
47. J.C. Ryan, *Life Support: Conserving Biological Diversity*, Worldwatch Paper 108, Worldwatch Institute, Washington D.C., (1992).
48. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
49. B. Stokes, *Local Responses to Global Problems: A Key to Meeting Basic Human Needs*, Worldwatch Paper 17, Worldwatch Institute, Washington D.C., (1978).
50. L. Timberlake, *Only One Earth: Living for the Future*, BBC/ Earthscan, London, (1987).
51. UNEP, *Environmental Data Report*, Blackwell, Oxford, (published annually).
52. UNESCO, *International Coordinating Council of Man and the Biosphere*, MAB Report Series No. 58, Paris, (1985).
53. United Nations Fund for Population Activities, *A Bibliography of United Nations Publications on Population*, United Nations, New York, (1977).
54. United Nations Fund for Population Activities, *The State of World Population*, UNPF, 220 East 42nd Street, New York, 10017, (published annually).
55. United Nations Secretariat, *World Population Prospects Beyond the Year 2000*, U.N., New York, (1973).
56. J. van Klinken, *Het Dierde Punte*, Uitgiversmaatschappij J.H. Kok-Kampen, Netherlands (1989).
57. B. Ward and R. Dubos, *Only One Earth*, Penguin Books Ltd., (1973).

58. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
59. E.O. Wilson, *Sociobiology*, Harvard University Press, (1975).
60. E.O. Wilson (ed.), *Biodiversity*, National Academy Press, Washington D.C., (1988).
61. E.O. Wilson, *The Diversity of Life*, Allen Lane, The Penguin Press, London, (1992).
62. G. Woodwell (ed.), *The Earth in Transition: Patterns and Processes of Biotic Impoverishment*, Cambridge University Press, (1990).
63. World Resources Institute (WRI), *Global Biodiversity Strategy*, The World Conservation Union (IUCN), United Nations Environment Programme (UNEP), (1992).
64. World Resources Institute, *World Resources 200-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
65. D.W. Pearce and R.K. Turner, *Economics of Natural Resources and the Environment*, Johns Hopkins University Press, Baltimore, (1990).
66. P. Bartelmus, *Environment, Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, New York, (1994).
67. H.E. Daly and K.N. Townsend, (editors), *Valuing the Earth. Economics, Ecology, Ethics*, MIT Press, Cambridge, Massachusetts, (1993)
68. C. Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Paper 91, Worldwatch Institute, Washington D.C., (1989).
69. S.H. Schneider, *The Genesis Strategy: Climate and Global Survival*, Plenum Press, (1976).
70. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
71. World Commission on Environment and Development, *Our Common Future*, Oxford University Press, (1987).
72. W. Jackson, *Man and the Environment*, Wm. C. Brown, Dubuque, Iowa, (1971).
73. T. Berry, *The Dream of the Earth*, Sierra Club Books, San Francisco, (1988).
74. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).

Chapter 8

THE REFUGEE CRISIS

8.1 Right-wing politics and climate change

What are the connections between right-wing politics and climate change? Noam Chomsky recently stated that he considered the US Republican Party to be the most dangerous organization in the history of the world. What did he mean by that?

In the 2016 US presidential election, which disastrously brought Donald Trump to power, every single Republican candidate with a chance for party nomination was a climate change denier. Donald Trump has withdrawn the United States from the Paris Agreement. Should he be impeached, Mike Pence, who would take his place, is equally a denier of the overwhelming body of scientific evidence warning that if extraction and burning of fossil fuels does not stop within one or two decades, tipping points will be passed, beyond which feedback loops will take over, and human efforts to avoid catastrophic climate change will be futile.

A second connection between right-wing politics and climate change can be seen in the world's inhospitable reaction to the refugee crisis. Brexit was motivated by fears that the EU refugee policies would force Britain to accept large numbers of refugees. All over Europe there has been a political swing to the right, as neofascist parties appeal to fears that refugees from war and climate change may take away jobs, accommodation and other benefits. As both climate change and sea level rise continue, the refugee crisis is certain to become much worse. The world needs to find an answer to this crisis, hopefully a more humane one than has been shown until now.

Nearly 69 million people were forcibly displaced in 2017, a record for the fifth straight year, according to an annual report from the UN refugee agency. In Canada, asylum claims doubled from the previous year.

8.2 Climate change as genocide

Climate change does not affect all parts of the world equally. The harshest effects of the extreme weather that we are already experiencing are disproportionately felt by the poorest

people of the world.

In March, 2017, the Security Council was informed ¹ that 20 million people in four countries, Nigeria, Somalia, South Sudan and Yemen, were in danger of dying unless provided with immediate help. The cost of the necessary aid was estimated to be \$4.4 billion. The developed world's response has been a shrug of indifference. By the midsummer, 2017 only a tenth of the amount needed had been raised.

Conflicts and famine are interlinked. The struggle for food produces conflicts; and famine is often used as an instrument of war. Food aid, when available, is often deliberately blocked or destroyed by warring factions. Boko Haram in Nigeria, al-Shabaab in Somalia, assorted militias and the government in South Sudan, and Saudi-backed forces in Yemen all interfered with the delivery of aid supplies.

In the future, the effects of rising temperatures and reduced rainfall will disproportionately affect poor farmers of Africa, the Middle East, South Asia, and Latin America. If the more affluent parts of the world continue to produce greenhouse gasses in a business-as-usual scenario, and if they continue to ignore calls for help from starving people, these actions will amount to genocide.

8.3 The United Nations High Commission on Refugees

In an article on *Climate Change and Disasters* the United Nations High Commission on Refugees makes the following statement:

“The Earth’s climate is changing at a rate that has exceeded most scientific forecasts. Some families and communities have already started to suffer from disasters and the consequences of climate change, forced to leave their homes in search of a new beginning.

“For UNHCR, the consequences of climate change are enormous. Scarce natural resources such as drinking water are likely to become even more limited. Many crops and some livestock are unlikely to survive in certain locations if conditions become too hot and dry, or too cold and wet. Food security, already a concern, will become even more challenging.

“People try to adapt to this situation, but for many this will mean a conscious move to another place to survive. Such moves, or the effects of climate change on natural resources, may spark conflict with other communities, as an increasing number of people compete for a decreasing amount of resources.

“Since 2009, an estimated one person every second has been displaced by a disaster, with an average of 22.5 million people displaced by climate- or weather-related events since 2008 (IDMC 2015). Disasters and slow onsets, such as droughts in Somalia in 2011 and 2012, floods in Pakistan between 2010 and 2012, and the earthquake in Nepal in 2015, can leave huge numbers of people traumatized without shelter, clean water and basic supplies.”

¹by Stephen O'Brian, UN Under Secretary General for Humanitarian Affairs

8.4 Populations displaced by sea level rise

In a recent article² discussed the long-term effects of sea level rise and the massive refugee crisis that it might create. By 2060, about 1.4 billion people could be climate change refugees, according to the paper, and that number could reach 2 billion by 2100.

The lead author, Prof. Emeritus Charles Geisler of Cornell University says: “The colliding forces of human fertility, submerging coastal zones, residential retreat, and impediments to inland resettlement is a huge problem. We offer preliminary estimates of the lands unlikely to support new waves of climate refugees due to the residues of war, exhausted natural resources, declining net primary productivity, desertification, urban sprawl, land concentration, ‘paving the planet’ with roads and greenhouse gas storage zones offsetting permafrost melt.”

We should notice that Prof. Geisler’s estimate of 2 billion climate refugees by 2100 includes all causes, not merely sea level rise. However, the number of refugees from sea level rise alone will be very large, since all the world’s coastal cities, and many river deltas will be at risk.

8.5 Populations displaced by drought and famine

Climate change could produce a refugee crisis that is “unprecedented in human history”, Barack Obama has warned as he stressed global warming was the most pressing issue of the age.

Speaking at an international food conference in Milan, the former US President said rising temperatures were already making it more difficult to grow crops and rising food prices were “leading to political instability”.

If world leaders put aside “parochial interests” and took action to reduce greenhouse gas emissions by enough to restrict the rise to one or two degrees Celsius, then humanity would probably be able to cope.

Failing to do this, Mr Obama warned, increased the risk of “catastrophic” effects in the future, “not only real threats to food security, but also increases in conflict as a consequence of scarcity and greater refugee and migration patterns”.

“If you think about monsoon patterns in the Indian subcontinent, maybe half a billion people rely on traditional rain patterns in those areas,”

8.6 Populations displaced by rising temperatures

A new study published in *Nature: Climate Change* has warned that up to 75% of the world’s population could face deadly heat waves by 2100 unless greenhouse gas emissions are rapidly controlled.³ The following is an excerpt from the article:

²Geisler C. et al., *Impediments to inland resettlement under conditions of accelerated sea level rise*, Land Use Policy, Vol 55, July 2017, Pages 322-330

³Mora, C. et al., *Global risk of deadly heat*, *Nature: Climate Change*, 19 June 2017

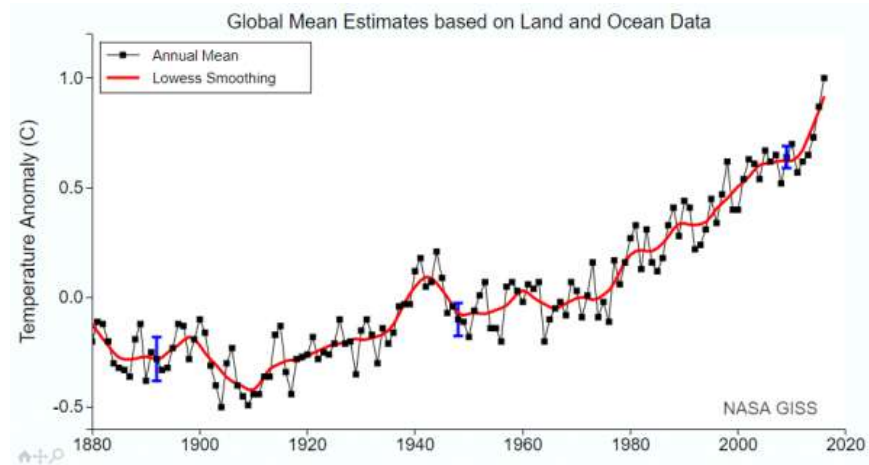


Figure 8.1: This figure shows an alarming upward turn in the average global temperature

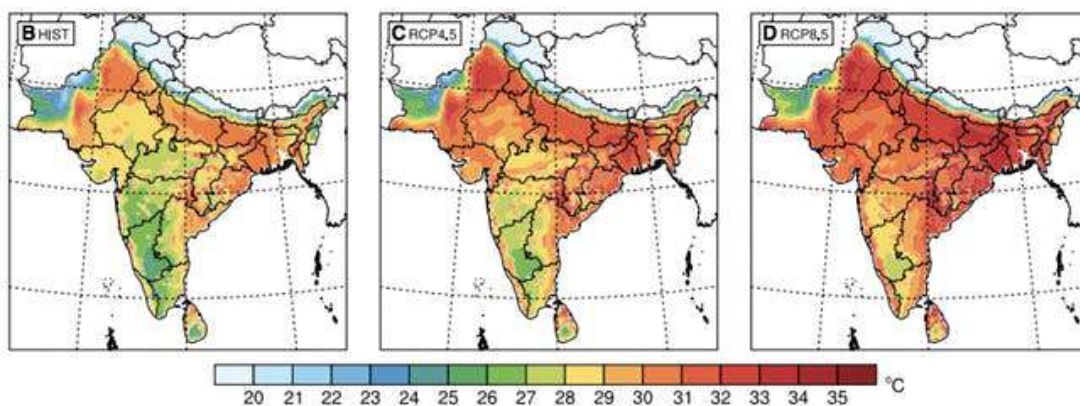


Figure 8.2: Maps show wet-bulb temperature maximums in Celsius in the historical record (B); and projected to 2100 under aggressive climate change action (C); and limited climate action (D). At 35 degrees, humans can only survive a few hours.



Figure 8.3: A starving child in Somalia. It is estimated that 11 million children currently die every year from starvation or from diseases related to poverty. After the end of the fossil fuel era, modern high-yield agriculture will become impossible to maintain, and the world will face the danger of a famine of enormous proportions, involving billions, rather than millions, of people.

“Here we conducted a global analysis of documented lethal heat events to identify the climatic conditions associated with human death and then quantified the current and projected occurrence of such deadly climatic conditions worldwide. We reviewed papers published between 1980 and 2014, and found 783 cases of excess human mortality associated with heat from 164 cities in 36 countries.

“Based on the climatic conditions of those lethal heat events, we identified a global threshold beyond which daily mean surface air temperature and relative humidity become deadly. Around 30% of the world’s population is currently exposed to climatic conditions exceeding this deadly threshold for at least 20 days a year.

“By 2100, this percentage is projected to increase to 48% under a scenario with drastic reductions of greenhouse gas emissions and 74% under a scenario of growing emissions. An increasing threat to human life from excess heat now seems almost inevitable, but will be greatly aggravated if greenhouse gases are not considerably reduced.”⁴

⁴See also <https://phys.org/news/2017-08-deadly-south-asia-century.html> and <https://cleantechnica.com/2017/09/28/extreme-heatwaves-like-recent-lucifer-heatwave-become-normal-europe-2050s/>

8.7 Populations displaced by war

A recent article in *The Guardian*⁵ discusses the relationship between climate change and war, Here are some excerpts from the article:

“Climate change is set to cause a refugee crisis of ‘unimaginable scale’, according to senior military figures, who warn that global warming is the greatest security threat of the 21st century and that mass migration will become the ‘new normal’.

“The generals said the impacts of climate change were already factors in the conflicts driving a current crisis of migration into Europe, having been linked to the Arab Spring, the war in Syria and the Boko Haram terrorist insurgency.

“Military leaders have long warned that global warming could multiply and accelerate security threats around the world by provoking conflicts and migration. They are now warning that immediate action is required.

“‘Climate change is the greatest security threat of the 21st century,’ said Maj Gen Muniruzzaman.

“Muniruzzaman, chairman of the Global Military Advisory Council on climate change and a former military adviser to the president of Bangladesh. He said one meter of sea level rise will flood 20% of his nation. ‘We’re going to see refugee problems on an unimaginable scale, potentially above 30 million people.’

“Previously, Bangladesh’s finance minister, Abul Maal Abdul Muhith, called on Britain and other wealthy countries to accept millions of displaced people.

“Brig Gen Stephen Cheney, a member of the US Department of State’s foreign affairs policy board and CEO of the American Security Project, said: ‘Climate change could lead to a humanitarian crisis of epic proportions. We’re already seeing migration of large numbers of people around the world because of food scarcity, water insecurity and extreme weather, and this is set to become the new normal’.

8.8 Political reactions to migration

Brexit

Across the developed world, the reaction to threatened migration of refugees from climate change has been less than generous, to say the least. The recent decision of Britain to leave the European Union was motivated largely by the fear of British workers that EU laws would force their country to accept large numbers of refugees.

Swings to the right in Europe

In Germany, Angela Merkel’s generous policies towards refugees have cost her votes, while an openly racist party, the Alternative for Germany (AfD) party, has gained in strength. Frauke Petry, 40, the party’s leader, has said border guards might need to turn guns on

⁵Thursday, 1 December, 2016

anyone crossing a frontier illegally. The party's policy platform says "Islam does not belong in Germany" and calls for a ban on the construction of mosques.

In September, 2017, eight people from the neo-Nazi Freital Group were put on trial in Dresden for bomb attacks on homes for asylum applicants. Hundreds of similar assaults occur in Germany every year, but they had never before been tried as terrorism in a federal court.

In the German election, which took place on Sunday, October 1, 2017, Angela Merkel won a fourth term as Chancellor, but her party won only 33% of the votes, a percentage much reduced from the 41% won in the election of 2013. Angela Merkel was paying a high price for her refugee-friendly policies.

Meanwhile the far right anti-immigration AfD party made a historic breakthrough, winning 13.5% of the vote, thus becoming the first overtly nationalist party to sit in the Bundestag in 60 years. The Greens have already complained that "Nazis have returned to parliament". In fact, members of the AfD party have begun to say that Germans should stop being ashamed of their country's Nazi past.

In France, the National Front is a nationalist party that uses populist rhetoric to promote its anti-immigration and anti-European Union positions. The party favors protectionist economic policies and would clamp down on government benefits for immigrants.

Similarly, in the Netherlands, the anti-European Union, anti-Islam Party for Freedom has called for closing all Islamic schools and recording the ethnicity of all Dutch citizens. In early November, the party was leading in polls ahead of next year's parliamentary elections.

Other far-right anti-immigrant parties in Europe include Golden Dawn (Greece), Jobbic (Hungary), Sweden Democrats (Sweden), Freedom Party (Austria), and People's Party - Our Slovakia (Slovakia). All of these parties have gained in strength because of the widespread fear of immigration.

Populism in the United States

The election of Donald Trump, who ran for President in 2016 on an openly racist and anti-immigrant platform, can also be seen as the result of fear of immigration, especially on the part of industrial workers.

8.9 A more humane response to the refugee crisis

In the long-term future, climate change will make the refugee crisis much more severe. Heat and drought will make large regions of the world uninhabitable, and will threaten many populations with famine. The severity of the refugee crisis will depend on how quickly we reduce greenhouse gas emissions.

While making many parts of the world uninhabitable, long-term climate change will make other regions more suitable for human habitation and agriculture. For example,

farming will become more possible in Siberia, Greenland, the Canadian Arctic, Alaska and Patagonia. A humane response to the refugee crisis could include the generous opening of these regions to refugees.

The global population of humans is currently increasing by almost a billion people every decade. Global population must be stabilized, and in the long run, gradually reduced. Money currently wasted (or worse than wasted) on armaments could be used instead to promote universal primary health care, and with it, universal access to the knowledge and materials needed for family planning.

Finally, reduced consumption of meat, particularly beef, would shorten the food chain thus make more food available for famine relief.

Suggestions for further reading

1. P. Dasgupta, *Population, Resources and Poverty*, *Ambio*, **21**, 95-101, (1992).
2. L.R. Brown, *Who Will Feed China?*, W.W. Norton, New York, (1995).
3. L.R. Brown, et al., *Saving the Planet. How to Shape and Environmentally Sustainable Global Economy*, W.W. Norton, New York, (1991).
4. L.R. Brown, *Postmodern Malthus: Are There Too Many of Us to Survive?*, *The Washington Post*, July 18, (1993).
5. L.R. Brown and H. Kane, *Full House. Reassessing the Earth's Population Carrying Capacity*, W.W. Norton, New York, (1991).
6. L.R. Brown, *Seeds of Change*, Praeger Publishers, New York, (1970).
7. L.R. Brown, *The Worldwide Loss of Cropland*, Worldwatch Paper 24, Worldwatch Institute, Washington, D.C., (1978).
8. L.R. Brown, and J.L. Jacobson, *Our Demographically Divided World*, Worldwatch Paper 74, Worldwatch Institute, Washington D.C., (1986).
9. L.R. Brown, and J.L. Jacobson, *The Future of Urbanization: Facing the Ecological and Economic Constraints*, Worldwatch Paper 77, Worldwatch Institute, Washington D.C., (1987).
10. L.R. Brown, and others, *State of the World*, W.W. Norton, New York, (published annually).
11. H. Brown, *The Human Future Revisited. The World Predicament and Possible Solutions*, W.W. Norton, New York, (1978).
12. H. Hanson, N.E. Borlaug and N.E. Anderson, *Wheat in the Third World*, Westview Press, Boulder, Colorado, (1982).
13. A. Dil, ed., *Norman Borlaug and World Hunger*, Bookservice International, San Diego/Islamabad/Lahore, (1997).
14. N.E. Borlaug, *The Green Revolution Revisited and the Road Ahead*, Norwegian Nobel Institute, Oslo, Norway, (2000).
15. N.E. Borlaug, *Ending World Hunger. The Promise of Biotechnology and the Threat of Antiscience Zealotry*, *Plant Physiology*, **124**, 487-490, (2000).

16. M. Giampietro and D. Pimental, *The Tightening Conflict: Population, Energy Use and the Ecology of Agriculture*, in **Negative Population Forum**, L. Grant ed., Negative Population Growth, Inc., Teaneck, N.J., (1993).
17. H.W. Kendall and D. Pimental, *Constraints on the Expansion of the Global Food Supply*, *Ambio*, **23**, 198-2005, (1994).
18. D. Pimental et al., *Natural Resources and Optimum Human Population*, *Population and Environment*, **15**, 347-369, (1994).
19. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, *Science*, **267**, 1117-1123, (1995).
20. D. Pimental et al., *Natural Resources and Optimum Human Population*, *Population and Environment*, **15**, 347-369, (1994).
21. D. Pimental and M. Pimental, *Food Energy and Society*, University Press of Colorado, Niwot, Colorado, (1996).
22. D. Pimental et al., *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, *Science*, **267**, 1117-1123, (1995).
23. RS and NAS, *The Royal Society and the National Academy of Sciences on Population Growth and Sustainability*, *Population and Development Review*, **18**, 375-378, (1992).
24. A.M. Altieri, *Agroecology: The Science of Sustainable Agriculture*, Westview Press, Boulder, Colorado, (1995).
25. G. Conway, *The Doubly Green Revolution*, Cornell University Press, (1997).
26. J. Dreze and A. Sen, *Hunger and Public Action*, Oxford University Press, (1991).
27. G. Bridger, and M. de Soissons, *Famine in Retreat?*, Dent, London, (1970).
28. W. Brandt, *World Armament and World Hunger: A Call for Action*, Victor Gollanz Ltd., London, (1982).
29. A.K.M.A. Chowdhury and L.C. Chen, *The Dynamics of Contemporary Famine*, Ford Foundation, Dacca, Pakistan, (1977).
30. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
31. M.E. Clark, *Ariadne's Thread: The Search for New Modes of Thinking*, St. Martin's Press, New York, (1989).
32. J.-C. Chesnais, *The Demographic Transition*, Oxford, (1992).
33. C.M. Cipola, *The Economic History of World Population*, Penguin Books Ltd., (1974).
34. E. Draper, *Birth Control in the Modern World*, Penguin Books, Ltd., (1972).
35. Draper Fund Report No. 15, *Towards Smaller Families: The Crucial Role of the Private Sector*, Population Crisis Committee, 1120 Nineteenth Street, N.W., Washington D.C. 20036, (1986).
36. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
37. E. Havemann, *Birth Control*, Time-Life Books, (1967).
38. J. Jacobsen, *Promoting Population Stabilization: Incentives for Small Families*, Worldwatch Paper 54, Worldwatch Institute, Washington D.C., (1983).
39. N. Keyfitz, *Applied Mathematical Demography*, Wiley, New York, (1977).

40. W. Latz (ed.), *Future Demographic Trends*, Academic Press, New York, (1979).
41. World Bank, *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*, Washington D.C., (1986).
42. J.E. Cohen, *How Many People Can the Earth Support?*, W.W. Norton, New York, (1995).
43. J. Amos, *Climate Food Crisis to Deepen*, BBC News (5 September, 2005).
44. J. Vidal and T. Ratford, *One in Six Countries Facing Food Shortage*, The Guardian, (30 June, 2005).
45. J. Mann, *Biting the Environment that Feeds Us*, The Washington Post, July 29, 1994.
46. G.R. Lucas, Jr., and T.W. Ogletree, (editors), *Lifeboat Ethics. The Moral Dilemmas of World Hunger*, Harper and Row, New York.
47. J.L. Jacobson, *Gender Bias: Roadblock to Sustainable Development*, Worldwatch Paper 110, Worldwatch Institute, Washington D.C., (1992).
48. J. Gever, R. Kaufmann, D. Skole and C. Vorosmarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Ballinger, Cambridge MA, (1986).
49. M. ul Haq, *The Poverty Curtain: Choices for the Third World*, Columbia University Press, New York, (1976).
50. H. Le Bras, *La Planète au Village*, Datar, Paris, (1993).
51. E. Mayr, *Population, Species and Evolution*, Harvard University Press, Cambridge, (1970).
52. Patz, J. A., Campbell-Lendrum, D., Holloway, T. and Foley, J. A. *Impact of regional climate change on human health*. *Nature* **438**, 310-317 (2005).
53. Basu, R. and Samet, J. M. *Relation between elevated ambient temperature and mortality: a review of the epidemiologic evidence*. *Epidemiol. Rev.* **24**, 190-202 (2002).
54. Kovats, R. S. and Hajat, S. *Heat stress and public health: a critical review*. *Annu. Rev. Publ. Health* **29**, 41-55 (2008).
55. Leon, L. R. *Pathophysiology of Heat Stroke* **Vol. 7** (Colloquium Series on Integrated Systems Physiology: From Molecule to Function to Disease, Morgan Claypool Life Sciences, 2015).
56. Ostro, B. D., Roth, L. A., Green, R. S. and Basu, R. *Estimating the mortality effect of the July 2006 California heat wave*. *Environ. Res.* **109**, 614-619 (2009).
57. Glas er, J. et al. *Climate change and the emergent epidemic of CKD from heat stress in rural communities: the case for heat stress nephropathy*. *Clin. J. Am. Soc. Nephrol.* **11**, 1472-1483 (2016).
58. Robine, J.-M. et al. *Death toll exceeded 70,000 in Europe during the summer of 2003*. *C. R. Biol.* **331**, 171-178 (2008).
59. Sillmann, J. and Roeckner, E. *Indices for extreme events in projections of anthropogenic climate change*. *Climatic Change* **86**, 83-104 (2008).
60. Meehl, G. A. and Tebaldi, C. *More intense, more frequent, and longer lasting heat waves in the 21st century*. *Science* **305**, 994-997 (2004).
61. Orłowsky, B. and Seneviratne, S. *Global changes in extreme events: regional and seasonal dimension*. *Climatic Change* **110**, 669-696 (2012).

62. Tebaldi, C., Hayhoe, K., Arblaster, J. M. and Meehl, G. A. *Going to the extremes*. Climatic Change **79**, 185-211 (2006).
63. Tebaldi, C. and Wehner, M. F. *Benefits of mitigation for future heat extremes under RCP4.5 compared to RCP8.5*. Climatic Change <http://dx.doi.org/10.1007/s10584-016-1605-5> (2016).
64. Sterl, A. et al. *When can we expect extremely high surface temperatures?* Geophys. Res. Lett. **35**, L14703 (2008).
65. Huang, C. et al. *Projecting future heat-related mortality under climate change scenarios: a systematic review*. Environ. Health Persp. **119**, 1681-1690 (2011).
66. Guo, Y. et al. *Global variation in the effects of ambient temperature on mortality: a systematic evaluation*. J. Epidemiol. **25**, 781-789 (2014).
67. Luber, G. and McGeehin, M. *Climate change and extreme heat events*. Am. J. Prev. Med. **35**, 429-435 (2008).
68. Bouchama, A. and Knochel, J. P. *Heat stroke*. New. Engl. J. Med. **346**, 1978-1988 (2002).
69. Bobb, J. F., Peng, R. D., Bell, M. L. and Dominici, F. *Heat-related mortality and adaptation to heat in the United States*. Environ. Health Persp. **122**, 811-816 (2014).
70. Gasparrini, A. et al. *Temporal variation in heat-mortality associations: a multi-country study*. Environ. Health Persp. **123**, 1200-1207 (2015).
71. Lowe, D., Ebi, K. L. and Forsberg, B. *Heatwave early warning systems and adaptation advice to reduce human health consequences of heatwaves*. Int. J. Environ. Res. Public Health **8**, 4623-4648 (2011).
72. Hanna, E. G. and Tait, P. W. *Limitations to thermoregulation and acclimatization challenge human adaptation to global warming*. Int. J. Environ. Res. Publ. Health. **12**, 8034-8074 (2015).
73. Sherwood, S. C. and Huber, M. *An adaptability limit to climate change due to heat stress*. Proc. Natl Acad. Sci. USA **107**, 9552-9555 (2010).
74. Whitman, S. et al. *Mortality in Chicago attributed to the July 1995 heat wave*. Am. J. Public Health **87**, 1515-1518 (1997).
75. Dousset, B. et al. *Satellite monitoring of summer heat waves in the Paris metropolitan area*. Int. J. Climatol. **31**, 313-323 (2011).
76. Shaposhnikov, D. et al. *Mortality related to air pollution with the Moscow heat wave and wildfire of 2010*. Epidemiology **25**, 359-364 (2014).
77. Barnett, A. G., Tong, S. and Clements, A. *What measure of temperature is the best predictor of mortality?* Environ. Res. **110**, 604-611 (2010).
78. Willett, K. M. and Sherwood, S. *Exceedance of heat index thresholds for 15 regions under a warming climate using the wet-bulb globe temperature*. Int. J. Climatol. **32**, 161-177 (2012).
79. Argüeso, D., Di Luca, A., Perkins-Kirkpatrick, S. and Evans, J. P. *Seasonal mean temperature changes control future heatwaves*. Geophys. Res. Lett. **43**, 7653-7660 (2016).
80. Jones, B. and O'Neill, B. *Spatially explicit global population scenarios consistent with the Shared Socioeconomic Pathways*. Environ. Res. Lett. **11**, 084003 (2016).

81. Diffenbaugh, N. S. and Field, C. B. *Changes in ecological ly critical terrestrial climate conditions*. Science **341**, 486-492 (2013).
82. Mitchell, D. et al. *Attributing human mortality during extreme heat waves to anthropogenic climate change*. Environ. Res. Lett. **11**, 074006 (2016).

Chapter 9

AVOIDING EXTINCTION

Introduction

Scientists warn that if the transition to renewable energy does not happen within very few decades, there is a danger that we will reach a tipping point beyond which feedback loops, such as the albedo effect and the methane hydrate feedback loop, will take over and produce an out-of-control and fatal increase in global temperature.

In 2012, the World Bank issued a report warning that without quick action to curb CO₂ emissions, global warming is likely to reach 4 °C during the 21st century. This is dangerously close to the temperature which initiated the Permian-Triassic extinction event: 6 °C above normal. During the Permian-Triassic extinction event, which occurred 252 million years ago, 96% of all marine species were wiped out, as well as 70% of all terrestrial vertebrates.¹

¹<http://science.nationalgeographic.com/science/prehistoric-world/permian-extinction/>
<http://www.worldbank.org/en/news/feature/2012/11/18/Climate-change-report-warns-dramatically-warmer-world-this-century>

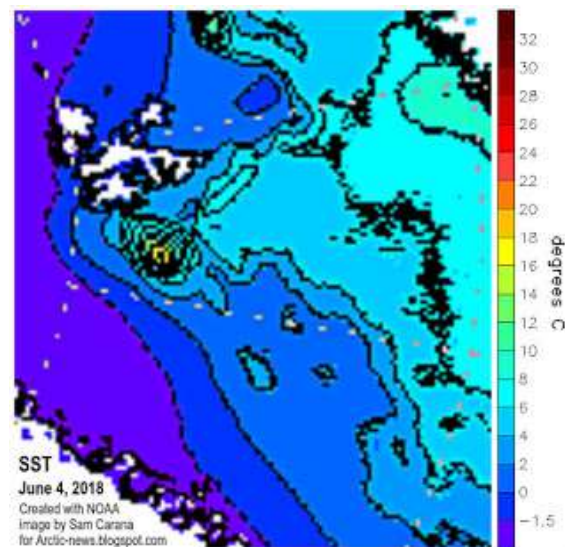


Figure 9.1: Near Svalbard, north of the Arctic Circle, water was as as warm as 16.1°C or 61°F on June 4, 2018, versus 3°C or 37.4°F in 1981-2011.

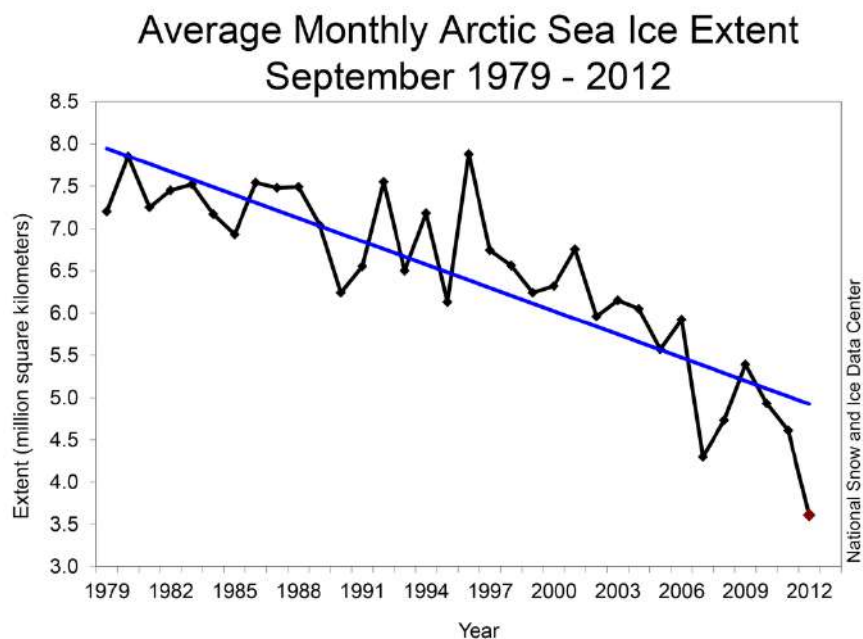


Figure 9.2: Monthly September ice extent for 1979 to 2012 shows a decline of 13.0% per decade. One can also see that the straight line does not really fit the data, which more nearly resemble a downward curve will that reach zero in the period 2016-2019. Source: National Snow and Ice Data Center. Wikimedia Commons

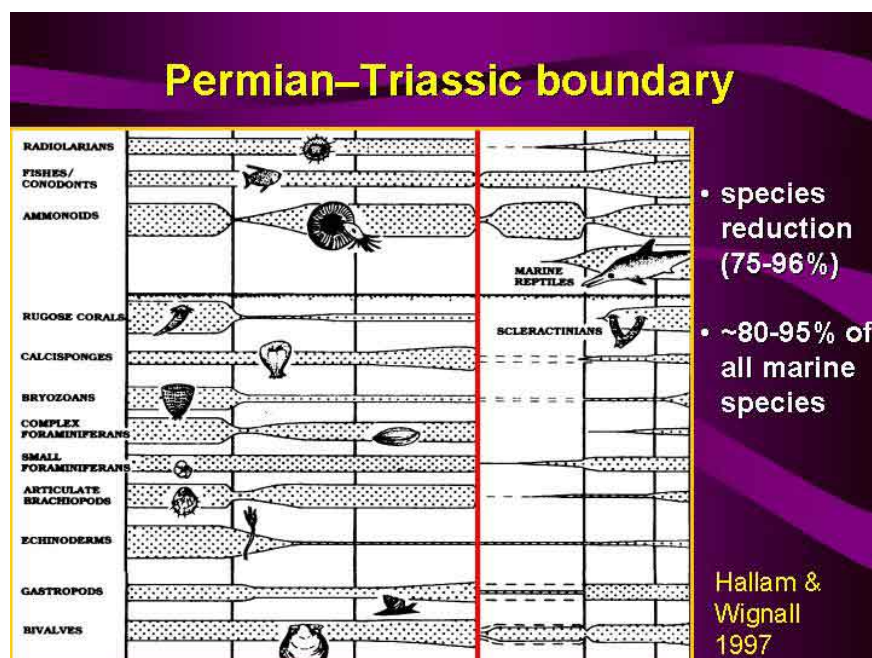


Figure 9.3: Loss of species caused by the Permian-Triassic extinction event. Unless quick steps are taken to lower our greenhouse gas emissions, we may cause a similar extinction event, which will threaten the survival of our own species. Source: Australian Frontiers of Science, www.sciencearchive.org.au

9.1 A warning from the World Bank

In 2012, the World Bank issued a report warning that without quick action to curb CO₂ emissions, global warming is likely to reach 4 °C during the 21st century. This is dangerously close to the temperature which initiated the Permian-Triassic extinction event: 6 °C above normal. During the Permian-Triassic extinction event, which occurred 252 million years ago, 96% of all marine species were wiped out, as well as 70% of all terrestrial vertebrates.²

The 4°C scenarios are devastating: the inundation of coastal cities; increasing risks for food production potentially leading to higher malnutrition rates; many dry regions becoming dryer, wet regions wetter; unprecedented heat waves in many regions, especially in the tropics; substantially exacerbated water scarcity in many regions; increased frequency of high-intensity tropical cyclones; and irreversible loss of biodiversity, including coral reef systems.

And most importantly, a 4°C world is so different from the current one that it comes with high uncertainty and new risks that threaten our ability to anticipate and plan for future adaptation needs. The lack of action on climate change not only risks putting prosperity out of reach of millions of people in the developing world, it threatens to roll back decades of sustainable development. It is clear that we already know a great deal about the threat before us. The science is unequivocal that humans are the cause of global warming, and major changes are already being observed: global mean warming is 0.8°C above pre industrial levels; oceans have warmed by 0.09°C since the 1950s and are acidifying; sea levels rose by about 20 cm since pre-industrial times and are now rising at 3.2 cm per decade; an exceptional number of extreme heat waves occurred in the last decade; major food crop growing areas are increasingly affected by drought.

Despite the global community's best intentions to keep global warming below a 2°C increase above pre-industrial climate, higher levels of warming are increasingly likely. Scientists agree that countries' current United Nations Framework Convention on Climate Change emission pledges and commitments would most likely result in 3.5 to 4°C warming. And the longer those pledges remain unmet, the more likely a 4°C world becomes.

Data and evidence drive the work of the World Bank Group. Science reports, including those produced by the Intergovernmental Panel on Climate Change, informed our decision to ramp up work on these issues, leading to, a World Development Report on climate change designed to improve our understanding of the implications of a warming planet; a Strategic Framework on Development and Climate Change, and a report on Inclusive Green Growth. The World Bank is a leading advocate for ambitious action on climate change, not only because it is a moral imperative, but because it makes good economic sense.

But what if we fail to ramp up efforts on mitigation? What are the implications of a 4°C world? We commissioned this report from the Potsdam Institute for Climate Impact

²<http://science.nationalgeographic.com/science/prehistoric-world/permian-extinction/>
<http://www.worldbank.org/en/news/feature/2012/11/18/Climate-change-report-warns-dramatically-warmer-world-this-century>

Research and Climate Analytics to help us understand the state of the science and the potential impact on development in such a world.

It would be so dramatically different from today's world that it is hard to describe accurately; much relies on complex projections and interpretations. We are well aware of the uncertainty that surrounds these scenarios and we know that different scholars and studies sometimes disagree on the degree of risk. But the fact that such scenarios cannot be discarded is sufficient to justify strengthening current climate change policies. Finding ways to avoid that scenario is vital for the health and welfare of communities around the world. While every region of the world will be affected, the poor and most vulnerable would be hit hardest. A 4°C world can, and must, be avoided.

The World Bank Group will continue to be a strong advocate for international and regional agreements and increasing climate financing. We will redouble our efforts to support fast growing national initiatives to mitigate carbon emissions and build adaptive capacity as well as support inclusive green growth and climate smart development. Our work on inclusive green growth has shown that, through more efficiency and smarter use of energy and natural resources, many opportunities exist to drastically reduce the climate impact of development, without slowing down poverty alleviation and economic growth.

This report is a stark reminder that climate change affects everything. The solutions don't lie only in climate finance or climate projects. The solutions lie in effective risk management and ensuring all our work, all our thinking, is designed with the threat of a 4°C degree world in mind. The World Bank Group will step up to the challenge.

9.2 Permian-Triassic extinction event

The geological record shows five major extinction events.

- Ordovician-Silurian Extinction. around 439 million years ago.
- Late Devonian Extinction. 375-360 million years ago.
- Permian-Triassic extinction. 352 million years ago.
- Triassic-Jurassic extinction, 201 million years ago.
- Cretaceous-Paleogene extinction, 66 million years ago.

The most devastating of these was the Permian-Triassic extinction, which occurred 252 million years ago.³ In the Permian-Triassic extinction, 96% of all marine species and 76% of all terrestrial vertebrates disappeared forever. The cause of this extremely severe

³ <https://www.thomhartmann.com/bigpicture/last-hours-climate-change>
The Last Hours of Humanity: Warming the World To Extinction (book), by Thom Hartmann
<https://www.amazon.com/Last-Hours-Humanity-Warming-Extinction/dp/1629213640>
<http://www.mediaite.com/online/leonardo-dicaprio-boosts-thom-hartmann-apocalyptic-global-warming-film-last-hours/>

event is disputed, but according to one of the most plausible theories it was triggered by a massive volcanic eruption in Siberia, which released enormous amounts of CO₂ into the earth's atmosphere.

The region where massive volcanic eruptions are known to have occurred 252 million years ago called the "Siberian Traps". (The "Traps" part of the name comes from the fact that many of the volcanic rock formations in the region resemble staircases. The Swedish word for staircase is "trappe".) The eruptions continued for about a million years.

Today the area covered is about 2 million square kilometers, roughly equal to western Europe in land area. Estimates of the original coverage are as high as 7 million square kilometers. The original volume of lava is estimated to range from 1 to 4 million cubic kilometers.

The CO₂ released by the Siberian Traps eruption is believed to have caused a global temperature increase of 6°C, and this was enough to trigger the methane-hydrate feedback loop, which will be discussed below. The earth's temperature is thought to have continued to rise for 85,000 years, finally reaching 15° above normal.

9.3 The Holocene (Anthropocene) extinction

We are now living in the midst of a sixth, human-caused, mass extinction. How severe it becomes is up to us.

Recently a group of scientists stated that the scope of human impact on planet Earth is so great that the *Anthropocene* warrants a formal place in the Geological Time Scale.

In a statement issued by University of Leicester Press Office on 2 October 2017, professor Jan Zalasiewicz from the University of Leicester's School of Geography, Geology, and the Environment said: "Our findings suggest that the Anthropocene should follow on from the Holocene Epoch that has seen 11.7 thousand years of relative environmental stability, since the retreat of the last Ice Age, as we enter a more unstable and rapidly evolving phase of our planet's history,"⁴

"We conclude that human impact has now grown to the point that it has changed the course of Earth history by at least many millennia, in terms of the anticipated long-term climate effects (e.g. postponement of the next glacial maximum: see Ganopolski et al., 2016; Clark et al., 2016), and in terms of the extensive and ongoing transformation of the biota, including a geologically unprecedented phase of human-mediated species invasions, and by species extinctions which are accelerating (Williams et al., 2015, 2016)."

The report stated that defining characteristics of the period include "marked acceleration of rates of erosion and sedimentation; large-scale chemical perturbations to the cycles of carbon, nitrogen, phosphorus and other elements; the inception of significant change in global climate and sea level; and biotic changes including unprecedented levels of species invasions across the Earth. Many of these changes are geologically long-lasting, and some are effectively irreversible."

⁴<http://www2.le.ac.uk/offices/press/press-releases/2017/october/significant-scale-of-human-impact-on-planet-has-changed-course-of-earth2019s-history-scientists-suggest>

Loss of biodiversity

Tropical rain forests are the most biologically diverse places in the world. This is because they have not been affected by the periods of glaciation that have periodically destroyed the forests of temperate and boreal regions. The destruction of species-rich tropical rain forests is one of the mechanisms driving the present high rate of species loss.

According to a recent article published in *The Guardian*⁵ “Conservation experts have already signalled that the world is in the grip of the “sixth great extinction” of species, driven by the destruction of natural habitats, hunting, the spread of alien predators and disease, and climate change.

“The IUCN⁶ created shock waves with its major assessment of the world’s biodiversity in 2004, which calculated that the rate of extinction had reached 100-1,000 times that suggested by the fossil records before humans.

“No formal calculations have been published since, but conservationists agree the rate of loss has increased since then, and Stuart said it was possible that the dramatic predictions of experts like the renowned Harvard biologist E O Wilson, that the rate of loss could reach 10,000 times the background rate in two decades, could be correct.”

A recent article by Profs. Gerardo Ceballos, Paul R. Ehrlich and Rodolfo Dirzo in the *Proceedings of the National Academy of Sciences* was entitled “Biological Annihilation via the Ongoing Sixth Mass Extinction Signaled by Vertebrate Population Losses and Declines”.

The Abstract of the paper reads as follows: “The population extinction pulse we describe here shows, from a quantitative viewpoint, that Earth’s sixth mass extinction is more severe than perceived when looking exclusively at species extinctions. Therefore, humanity needs to address anthropogenic population extirpation and decimation immediately. That conclusion is based on analyses of the numbers and degrees of range contraction (indicative of population shrinkage and/or population extinctions according to the International Union for Conservation of Nature) using a sample of 27,600 vertebrate species, and on a more detailed analysis documenting the population extinctions between 1900 and 2015 in 177 mammal species. We find that the rate of population loss in terrestrial vertebrates is extremely high, even in ‘species of low concern.’ In our sample, comprising nearly half of known vertebrate species, 32% (8,851/27,600) are decreasing; that is, they have decreased in population size and range. In the 177 mammals for which we have detailed data, all have lost 30% or more of their geographic ranges and more than 40% of the species have experienced severe population declines (>80% range shrinkage). Our data indicate that beyond global species extinctions Earth is experiencing a huge episode of population declines and extirpations, which will have negative cascading consequences on ecosystem functioning and services vital to sustaining civilization. We describe this as a ‘biological annihilation’ to highlight the current magnitude of Earth’s ongoing sixth major extinction event.”

⁵<https://www.theguardian.com/environment/2010/mar/07/extinction-species-evolve>

⁶International Union for the Conservation of Nature

9.4 Global warming and atmospheric water vapor

A feedback loop is a self-re-enforcing trend. One of the main positive feedback loops in global warming is the tendency of warming to increase the atmospheric saturation pressure for water vapor, and hence amount of water vapor in the atmosphere, which in turn leads to further warming, since water vapor is a greenhouse gas.

Wikipedia's article on greenhouse gases states that, "Water vapor accounts for the largest percentage of the greenhouse effect, between 36% and 66% for clear sky conditions and between 66% and 85% when including clouds."

9.5 The albedo effect

Albedo is defined to be the fraction of solar energy (shortwave radiation) reflected from the Earth back into space. It is a measure of the reflectivity of the earth's surface. Ice, especially with snow on top of it, has a high albedo: most sunlight hitting the surface bounces back towards space.

Loss of sea ice

Especially in the Arctic and Antarctic regions, there exists a dangerous feedback loop involving the albedo of ice and snow. As is shown in Figure 4.1, Arctic sea ice is rapidly disappearing. It is predicted that during the summers, the ice covering arctic seas may disappear entirely during the summers. As a consequence, incoming sunlight will encounter dark light-absorbing water surfaces rather than light-reflecting ice and snow.

This effect is self-re-enforcing. In other words, it is a feedback loop. The rising temperatures caused by the absorption of more solar radiation cause the melting of more ice, and hence even more absorption of radiation rather than reflection, still higher temperatures, more melting, and so on.

The feedback loop is further strengthened by the fact that water vapor acts like a greenhouse gas. As polar oceans become exposed, more water vapor enters the atmosphere, where it contributes to the greenhouse effect and rising temperatures.

Darkened snow on Greenland's icecap

Greenland's icecap is melting, and as it melts, the surface becomes darker and less reflective because particles of soot previously trapped in the snow and ice become exposed. This darkened surface absorbs an increased amount of solar radiation, and the result is accelerated melting.

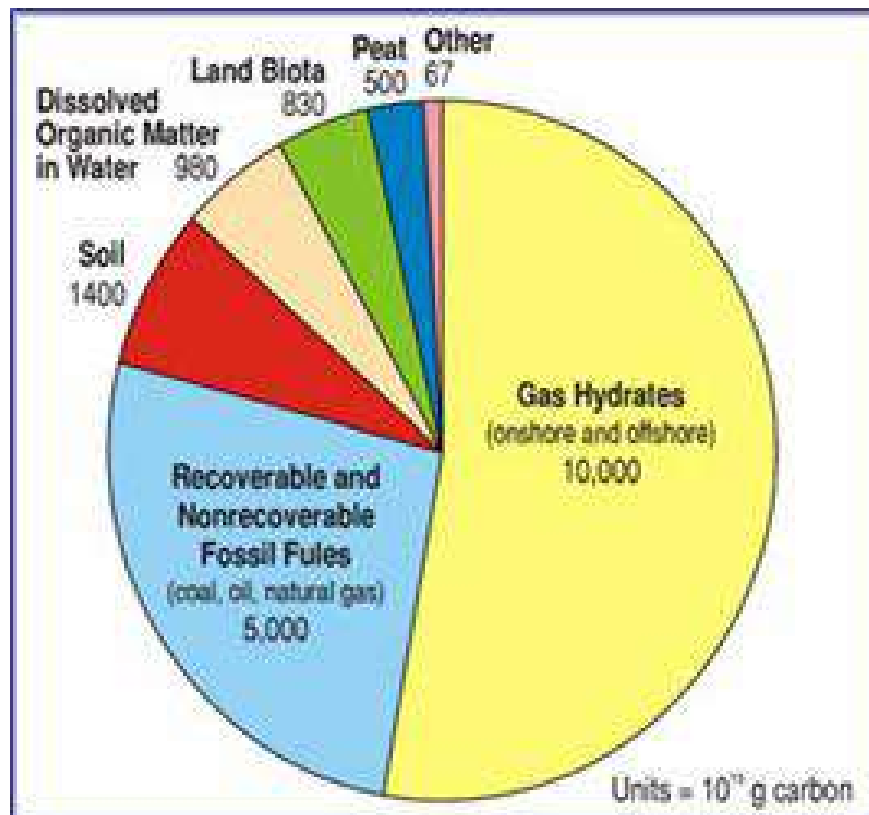


Figure 9.4: The worrying thing about the methane/hydrate feedback loop is the enormous amount of carbon in the form of hydrate crystals, 10,000 gigatons most of it on the continental shelves of oceans. This greater than the amount of carbon in all other forms that might potentially enter the earth's atmosphere.



Figure 9.5: When ocean temperatures rise, methane hydrate crystals become unstable, and methane gas bubbles up to ocean surfaces.

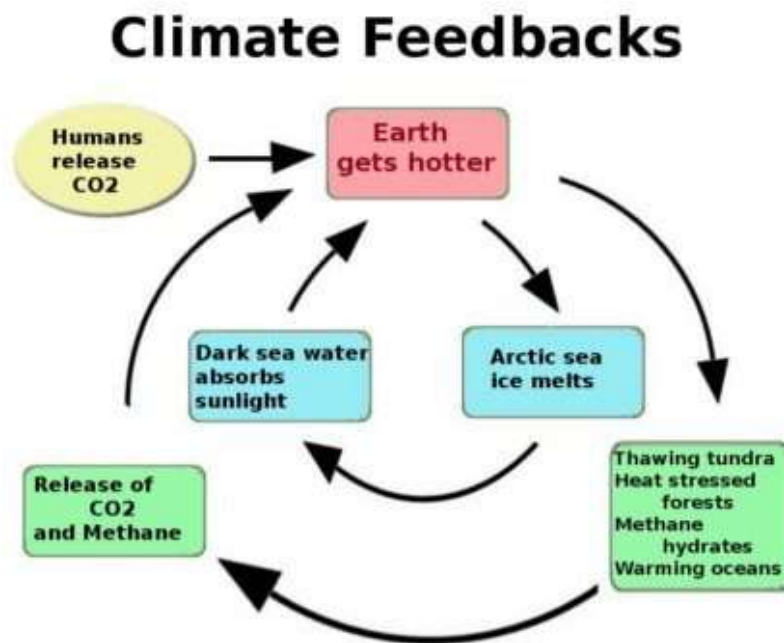


Figure 9.6: This diagram shows two important feedback loops, one involving the albedo effect, and the other involving methane hydrates.

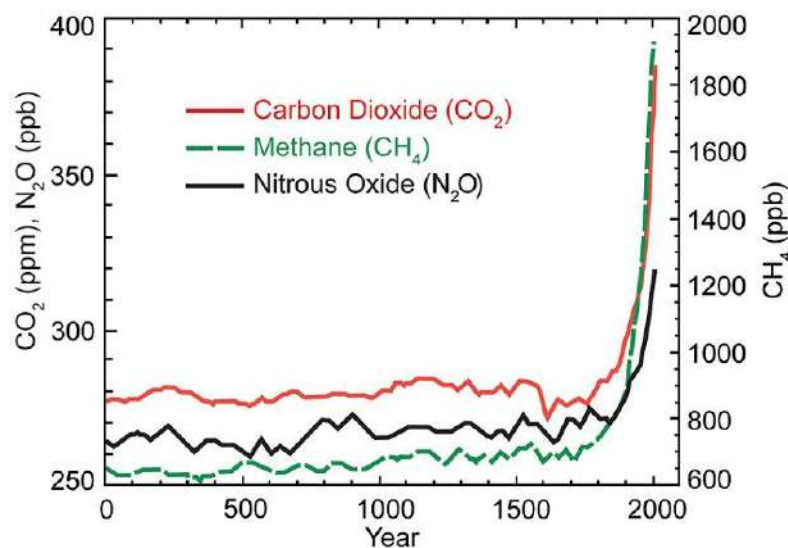


Figure 9.7: A “hockey stick” graph showing atmospheric concentrations of three important greenhouse gasses during the last 2,000 years. The most dramatically increasing of these is methane.

9.6 The methane hydrate feedback loop

If we look at the distant future, by far the most dangerous feedback loop involves methane hydrates or methane clathrates. When organic matter is carried into the oceans by rivers, it decays to form methane. The methane then combines with water to form hydrate crystals, which are stable at the temperatures and pressures which currently exist on ocean floors. However, if the temperature rises, the crystals become unstable, and methane gas bubbles up to the surface. Methane is a greenhouse gas which is 70 times as potent as CO_2 .

The worrying thing about the methane hydrate deposits on ocean floors is the enormous amount of carbon involved: roughly 10,000 gigatons. To put this huge amount into perspective, we can remember that the total amount of carbon in world CO_2 emissions since 1751 has only been 337 gigatons.

A runaway, exponentially increasing, feedback loop involving methane hydrates could lead to one of the great geological extinction events that have periodically wiped out most of the animals and plants then living. This must be avoided at all costs.

9.7 A feedback loop from warming of soils

On October 6, 2017, the journal *Science* published an article entitled *Long-term pattern and magnitude of soil carbon feedback to the climate system in a warming world*⁷. The

⁷J.M. Melillo et al., *Long-term pattern and magnitude of soil carbon feedback to the climate system in a warming world*, *Science*, Vol. 358, pp. 101-105, (2017).

lead author, Jerry Melillo, is an ecologist working at the Marine Biological Laboratory, Woods Hole Massachusetts. In an interview with *Newsweek*, he said: “This self-reinforcing feedback is potentially a global phenomenon with soils, and once it starts it may be very difficult to turn off. It’s that part of the problem that I think is sobering... We think that one of the things that may be happening is both a reorganization of the microbial community structure and its functional capacity,”

The study reported on three decades of observations of heated sections of a forest owned by Harvard University. The heated sections were 5°C warmer than control sections.

9.8 Drying of forests and forest fires

According to a recent article in *Nature*⁸, “Across the American west, the area burned each year has increased significantly over the past several decades, a trend that scientists attribute both to warming and drying and to a century of wildfire suppression and other human activities. Allen suggests that the intertwined forces of fire and climate change will take ecosystems into new territory, not only in the American west but also elsewhere around the world. In the Jemez, for example, it could transform much of the ponderosa pine (*Pinus ponderosa*) forest into shrub land. ‘We’re losing forests as we’ve known them for a very long time,’ says Allen. ‘We’re on a different trajectory, and we’re not yet sure where we’re going.’

“All around the American west, scientists are seeing signs that fire and climate change are combining to create a ‘new normal’. Ten years after Colorado’s largest recorded fire burned 56,000 hectares southwest of Denver, the forest still has not rebounded in a 20,000-hectare patch in the middle, which was devastated by an intense crown fire. Only a few thousand hectares, which the US Forest Service replanted, look anything like the ponderosa-pine stands that previously dominated the landscape.”

⁸<http://www.nature.com/news/forest-fires-burn-out-1.11424>



Figure 9.8: Maude Barlow (born 1947). The Wikipedia article on her states that she is a “Canadian author and activist. She is the National Chairperson of the Council of Canadians, a citizens’ advocacy organization with members and chapters across Canada. She is also the co-founder of the Blue Planet Project, which works internationally for the human right to water. Maude chairs the board of Washington-based Food and Water Watch, is a founding member of the San Francisco-based International Forum on Globalization, and a Councillor with the Hamburg-based World Future Council. In 2008/2009, she served as Senior Advisor on Water to the 63rd President of the United Nations General Assembly and was a leader in the campaign to have water recognized as a human right by the UN. She has authored and co-authored 16 books.” Maude Barlow’s work on the issue of water is especially important because fresh water is becoming increasingly scarce throughout the world.

9.9 Tipping points and feedback loops

A tipping point is usually defined as the threshold for an abrupt and irreversible change⁹. To illustrate this idea, we can think of a book lying on a table. If we gradually push the book towards the edge of the table, we will finally reach a point after which more than half of the weight of the book will not be supported by the table. When this “tipping point” is passed the situation will suddenly become unstable, and the book will fall to the floor. Analogously, as the earth’s climate gradually changes, we may reach tipping points. If we pass these points, sudden instabilities and abrupt climatic changes will occur.

Greenland ice cores supply a record of temperatures in the past, and through geological evidence we have evidence of sea levels in past epochs. These historical records show that abrupt climatic changes have occurred in the past.

Timothy Michael Lenton, FRS, Professor of Climate Change and Earth System Science at the University of Exeter, lists the following examples of climatic tipping points:

- Boreal forest dieback
- Amazon rainforest dieback
- Loss of Arctic and Antarctic sea ice (Polar ice packs) and melting of Greenland and Antarctic ice sheets
- Disruption to Indian and West African monsoon
- Formation of Atlantic deep water near the Arctic ocean, which is a component process of the thermohaline circulation.
- Loss of permafrost, leading to potential Arctic methane release and clathrate gun effect

It can be seen from this list that climate tipping points are associated with feedback loops. For example, the boreal forest dieback and the Amazon rainforest dieback tipping points are associated with the feedback loop involving the drying of forests and forest fires, while the tipping point involving loss of Arctic and Antarctic sea ice is associated with the Albedo effect feedback loop. The tipping point involving loss of permafrost is associated with the methane hydrate feedback loop.

Once a positive feedback loop starts to operate in earnest, change may be abrupt.

⁹Other definitions of tipping points are possible. A few authors define these as points beyond which change is inevitable, emphasizing that while inevitable, the change may be slow.



Figure 9.9: Fighting a fire in California, caused by the unusually hot and dry weather of the summer of 2018. The very dry weather also caused uncontrollable fires in the Arctic, in Sweden, Russia, Northern Canada and Alaska.

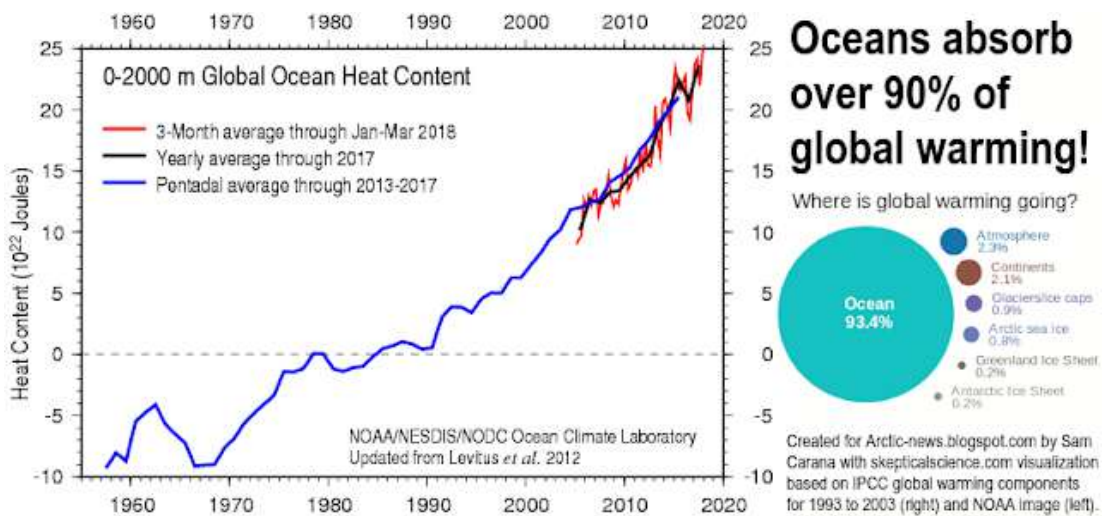


Figure 9.10: The heat content of the oceans is rapidly increasing.

9.10 Climate change denial

In a recent article, climate expert Dr. Andrew Glickson wrote: “The train has left the station and global heating is advancing toward +2 and then toward +4 degrees Celsius, as projected by the IPCC and in the words of Joachim Hans Schellnhuber, Germany’s chief climate scientist, signifies the breakdown of civilization. Largely ignored or watered down by much of the mainstream media, betrayed by most political parties, including those who used to regard climate change as “the greatest moral issue of our time”, the population continues to be distracted by bread and circuses. Nowadays even some of the Greens appear to consider plastic bags and the tampon tax as greater vote winners than the demise of the biosphere.”

Why did Professor Noam Chomsky call the US Republican Party “The most dangerous organization in the history of the world”? In the primary that preceded the 2016 presidential election, every single Republican candidate with a chance of being nominated was a climate change denier. All received amazingly generous checks from giant fossil fuel organizations. When elected, Donald Trump not only pulled the United States out of the Paris Agreement; he also sabotaged the Environmental Protection Agency to such an extent that the carefully collected facts on climate change that the agency had accumulated had to be secretly saved by scientists to prevent their destruction by the Trump administration. Furthermore, Donald Trump not only subsidizes giant coal corporations. He also has sabotages renewable energy initiatives in the United States.



Figure 9.11: Is this the person to whom we ought to entrust the future of our planet?

9.11 Humanity betrayed by the mass media

The predicament of humanity today has been called “a race between education and catastrophe”: How do the media fulfil this life-or-death responsibility? Do they give us insight? No, they give us pop music. Do they give us an understanding of the sweep of evolution and history? No, they give us sport. Do they give us an understanding of the ecological catastrophes that threaten our planet because of unrestricted growth of population and industries? No, they give us sit-coms and soap operas. Do they give us unbiased news? No, they give us news that has been edited to conform with the interests of powerful lobbys. Do they present us with the urgent need to leave fossil fuels in the ground? No, they do not, because this would offend the powerholders. Do they tell of the danger of passing tipping points after which human efforts to prevent catastrophic climate change will be useless? No, they give us programs about gardening and making food.

A consumer who subscribes to the “package” of broadcasts sold by a cable company can often search through all 95 channels without finding a single program that offers insight into the various problems that are facing the world today. What the viewer finds instead is a mixture of pro-establishment propaganda and entertainment. Meanwhile the neglected global problems are becoming progressively more severe.

In general, the mass media behave as though their role is to prevent the peoples of the world from joining hands and working to change the world and to save it from thermonuclear war, environmental catastrophes and threatened global famine. The television viewer sits slumped in a chair, passive, isolated, disempowered and stupefied. The future of the world hangs in the balance, the fate of children and grandchildren hangs in the balance,

but the television viewer feels no impulse to work actively to change the world or to save it. The Roman emperors gave their people bread and circuses to numb them into political inactivity. The modern mass media seem to be playing a similar role.

The most dangerous idea that the mass media peddle to a betrayed world is that there is no emergency, no crisis of civilization. Everything is fundamentally normal. We can continue to behave more or less as we always have behaved. We can continue to extract and use fossil fuels, continue to fly to vacations in foreign countries, and continue to rely on our trusted and most loved friend, the private automobile. But this is a lie. They are lying to us because no one wants to shoot Santa Claus. No one wants to undermine "consumer confidence".

The true situation is that the future looks extremely dark, especially the long-term future, because of human greed and folly. The greatest threats are catastrophic climate change and thermonuclear war, but a large-scale global famine also has to be considered.

We give our children loving care, but it makes no sense to do so and at the same time to neglect to do all that is within our power to ensure that they and their descendants will inherit an earth in which they can survive. We also have a responsibility to all the other living organisms with which we share the gift of life.

Inaction is not an option. We have to act with courage and dedication, even if the odds are against success, because the stakes are so high. No one is exempt from this duty. Every single person on earth has the duty to work with dedication and courage to save the future.

None of us asked to be born at a time of crisis. But we have been born at such a time, and history has given us an enormous responsibility. If we do not work with courage and dedication to save our beautiful world for future generations, all the treasures that past generations have given us will be lost.

What are the great tasks that history has given to us? If true democracy has decayed into oligarchy in our own countries, democracy must be restored. Global population must be stabilized, and in the long run, reduced. Nuclear weapons must be completely abolished. The institution of war must be abolished by turning the United Nations into a federation. Our consumption of fossil fuels must quickly end, through changes in lifestyle, and through an all-out effort to rapidly develop renewable energy.

Soldiers in war are asked to give their lives for their countries. We, who are opposed to war, must be equally willing to devote our lives to a cause - the cause of saving civilization - the cause of saving the biosphere - the cause of saving the future.

Suggestions for further reading

1. Ehrlich P-R (1995) *The scale of the human enterprise and biodiversity loss*, in *Extinction Rates*, eds Lawton JH, May RM (Oxford Univ Press, Oxford, UK), pp 214-226.
2. Dirzo R, et al. (2014) *Defaunation in the Anthropocene*. *Science* **345**:401-406.
3. Young HS, McCauley DJ, Galletti M, Dirzo R (2016) *Patterns, causes, and consequences of Anthropocene defaunation*. *Annu Rev Ecol Evol Syst* **47**:433-458.

4. World Wide Fund for Nature (2016) *Living Planet Report 2016. Risk and resilience in a new era.* (WWF International, Gland, Switzerland), 2017.
5. Maxwell SL, Fuller RA, Brooks TM, Watson JEM (2016) *Biodiversity: The ravages of guns, nets and bulldozers.* Nature **536**:143-145.
6. Laliberte AS, Ripple WJ (2004) *Range contractions of North American carnivores and ungulates.* BioScience **54**:123-138.
7. Worm B, Tittensor DP (2011) *Range contraction in large pelagic predators.* Proc Natl Acad Sci USA **108**:11942-11947.
8. Ripple WJ, et al. (2014) *Status and ecological effects of the world's largest carnivores.* Science **343**:1241484.
9. Barnosky AD, et al. (2011) *Has the Earth's sixth mass extinction already arrived?* Nature **471**:51-57.
10. Ceballos G, Garcia A, Ehrlich PR (2010) *The sixth extinction crisis: Loss of animal populations and species.* J. Cosmology **8**:1821-1831.
11. Ceballos G, et al. (2015) *Accelerated modern human-induced species losses: Entering the sixth mass extinction.* Sci Adv **1**:e1400253.
12. Wake DB, Vredenburg VT (2008) *Colloquium paper: Are we in the midst of the sixth mass extinction? A view from the world of amphibians.* Proc Natl Acad Sci USA **105**:11466-11473.
13. McCallum ML (2015) *Vertebrate biodiversity losses point to a sixth mass extinction.* Biol Conserv **24**:2497-2519.
14. Pimm SL, et al. (2014) *The biodiversity of species and their rates of extinction, distribution, and protection.* Science **344**:1246752.
15. McCauley DJ, et al. (2015) *Marine defaunation: Animal loss in the global ocean.* Science **347**:1255641.
16. Collen B, Böhm M, Kemp R, Baillie J (2012) *Spineless: Status and Trends of the World's Invertebrates* (Zoological Society of London, London). Red List
17. Daily G (1997) *Nature's Services: Societal Dependence on Natural Ecosystems.* (Island Press, Covello, CA).
18. Naeem S, Duffy JE, Zavaleta E (2012) *The functions of biological diversity in an age of extinction.* Science **336**:1401-1406.
19. Estes JA, et al. (2011) *Trophic downgrading of planet Earth.* Science **333**:301-306.
20. Brosi BJ, Briggs HM (2013) *Single pollinator species losses reduce floral fidelity and plant reproductive function.* Proc Natl Acad Sci USA **110**:13044-13048.
21. Briggs JC (2014) *Global biodiversity gain is concurrent with decreasing population sizes.* Biodiver J **5**:447-452.
22. Hooper DU, et al. (2012) *A global synthesis reveals biRed Listodiversity loss as a major driver of ecosystem change.* Nature **486**:105-108.
23. Ehrlich PR (2014) *The case against de-extinction: It's a fascinating but dumb idea.* Yale Environment 360 (Yale University, New Haven, CT). Available at bit.ly/1gAIuJF. Accessed JunStudiese 10, 2017.
24. Hobbs RJ, Mooney HA (1998) *Broadening the extinction debate: Population deletions and additions in California and Western Australia.* Conserv Biol **12**:271-283. Studies

25. Hughes JB, Daily GC, Ehrlich PR (1997) *Population diversity: Its extent and extinction*. Science **278**:689-692.
26. Ceballos G, Ehrlich PR (2002) *Mammal population losses and the extinction crisis*. Science **296**:904-907.
27. Gaston KJ, Fuller RA (2008) *Commonness, population depletion and conservation biology*. Trends Ecol Evol **23**:14-19.
28. International Union of Conservation of Nature (2015) *The IUCN Red List of Threatened Species, Version 2015.2* (IUCN, 2015). Available at www.iucnredlist.org. Accessed February 10, 2016. Revised January 10, 2017.
29. Durant SM, et al. (2017) *The global decline of cheetah *Acinonyx jubatus* and what it means for conservation*. Proc Natl Acad Sci USA **114**:528-533.
30. Henschel P, et al. (2014) *The lion in West Africa is critically endangered*. PLoS One **9**:e83500.
31. Challender D, et al. (2016) *On scaling up pangolin conservation*. Traffic Bulletin **28**: 19-21.
32. Fennessy J, et al. (2016) *Multi-locus analyses reveal four giraffe species instead of one*. Curr Biol **26**:2543-2549.
33. Butchart S, Dunn E (2003) *Using the IUCN Red List criteria to assess species with declining populations*. Conserv Biol **17**:1200-1202.
34. Gaston K, Blackburn T (2008) *Pattern and Process in Macroecology* (Blackwell Publishing, Hoboken, NJ). Red List
35. Thomas JA (2016) ECOLOGY. *Butterfly communities under threat*. Science **353**:216-218.
36. Régnier C, et al. (2015) *Mass extinction in poorly known taxa*. Proc Natl Acad Sci USA **112**:7761-7766.25.
37. Hughes JB, Daily GC, Ehrlich PR (1997) *Population diversity: Its extent and extinction*. Science **278**:689-692.
38. Ceballos G, Ehrlich PR (2002) *Mammal population losses and the extinction crisis*. Science **296**:904-907.
39. Cardinale BJ, et al. (2012) *Biodiversity loss and its impact on humanity*. Nature **486**: 59-67.
40. Hurlbert AH, Jetz W (2007) *Species richness, hotspots, and the scale dependence of range maps in ecology and conservation*. Proc Natl Acad Sci USA **104**:13384-13389.
41. Peterson AT, Navarro-Sigüenza AG, Gordillo A (2016) *Assumption- versus data-based approaches to summarizing species' ranges*. Conserv Biol, 10.1111/cobi.12801.
42. Martnez-Ramos M, Ortz-Rodrguez I, Pinero D, Dirzo R, Sarukhn J (2016) *Humans disrupt ecological processes within tropical rainforest reserves*. Proc Natl Acad Sci USA **113**:5323-5328.
43. Camargo-Sanabria AA, Mendoza E, Guevara R, Martnez-Ramos M, Dirzo R (2015) *Experimental defaunation of terrestrial mammalian herbivores alters tropical rainforest understorey diversity*. Proc Biol Sci **282**:20142580.
44. Petipas RH, Brody AK (2014) *Termites and ungulates affect arbuscular mycorrhizal richness and infectivity in a semiarid savanna*. Botany **92**:233-240.

45. Wardle DA, et al. (2004) *Ecological linkages between aboveground and belowground biota*. Science **304**:1629-1633.
46. Ceballos G, Ehrlich AH, Ehrlich PR (2015) *The Annihilation of Nature: Human Extinction of Birds and Mammals*, (Johns Hopkins Univ Press, Baltimore).
47. Knoll AH (2015) *Life on a Young Planet: The First Three Billion Years of Evolution on Earth*, (Princeton Univ Press, Princeton, NJ).
48. Barnosky AD, et al. (2014) *Introducing the scientific consensus on maintaining humanity's life support systems in the 21st century: Information for policy makers*. The Anthropocene Review **1**:78-109.
49. Ceballos G, Ehrlich PR, Soberón J, Salazar I, Fay JP (2005) *Global mammal conservation: What must we manage?* Science **309**:603-607.
50. Brown IL, Ehrlich PR (1980) *Population biology of the checkerspot butterfly, *Euphydryas chalcedona* structure of the Jasper Ridge colony*. Oecologia **47**:239-251.
51. Environmental Systems Research Institute (2011) *Release 10. Documentation Manual*, (Environmental Systems Research Institute, Redlands, CA).
52. Balling, R. C. 1988. *The climate impact of Sonoran vegetation discontinuity*. Climate Change **13**: 99-109.
53. Balling, R. C. 1991. *Impact of desertification on regional and global warming*. Bulletin of the American Meteorological Society **72**: 232-234.
54. Barigozzi, C. (ed.). 1986. *The Origin and Domestication of Cultivated Plants*. Amsterdam: Elsevier.
55. Botkin, D. B. 1989. *Science and the global environment*. In: D. B. Botkin et al., **Global Change**. New York: Academic Press, pp. 1-14.
56. Bryson, R. 1972. *Climate modification by air pollution*. In: N. Polunin (ed.), *The Environmental Future*. London: Macmillan, pp. 133-174.
57. Dregne, H. E., M. Kassas, and B. Rozanov. 1991. *A new assessment of the world status of desertification*. Desertification Control Bulletin, **no. 20**: 6-18.
58. FAO (Food and Agriculture Organization). 1991. *Protection of land resources: Deforestation* UNCED Prepcomm., 2nd session, Doc. A/CONF. 15/PC/27.
59. Hare, F. K. and L. A. J. Ogallo. 1993. *Climate Variation, Drought and Desertification*. WMO-No. 653. Geneva: WMO.
60. Houghton, J. T., B. A. Callander, and S. K. Varney (eds.). 1992. *Climate Change 1992. The Supplementary Report to the IPCC Scientific Assessment*. (Cambridge: Cambridge University Press.
61. Hulme, M. and M. Kelly. 1993. *Exploring the links between desertification and climate change*. Environment **35**(6): 5-11, 39-45.
62. Jackson, R. D. and S. B. Idso. 1975. *Surface albedo and desertification*. Science **189**: 1012-1013.
63. Matthews, E. 1983. *Global vegetation and land use: New high-resolution databases for climatic studies*. Journal of Climate and Meteorology **22**: 474-487.
64. Schlesinger, W. H., et al. 1990. *Biological feedback in global desertification*. Science **247**: 1043-1048.

65. Turner, B. L., et al. 1990. *Two types of global environmental changes: Definitional and special-scale issues in their human dimensions*. Global Environmental Change 1: 14-22.
66. UNESCO. 1960. *Medicinal plants of arid zones*. Arid Zone Research 13.
67. Vavilov, N. I. 1949. *The Origin, Variation, Immunity and Breeding of Cultivated Plants*. Waltham, Mass.: Chronica Botanica

Chapter 10

TOWARDS A SUSTAINABLE FUTURE

10.1 The Rights of Mother Earth

The World People's Conference on Climate Change and the Rights of Mother Earth

This conference took place in Tiquipaya, just outside the city of Cochabamba, Bolivia, from April 19-22, 2010. The event was attended by around 30,000 people from over 100 countries. It was hosted by the Bolivian government, and the proceedings were transmitted online by the organizations OneClimate and Global Campaign for Climate Action.

One of the outstanding results of the conference was the drafting of a Universal Declaration of the Rights of Mother Earth, modeled on the United Nations' Universal Declaration of Human Rights. Both Declarations might be criticized for being unrealistic,¹ but both have great normative value. They define the goals towards which we ought to be striving.

Proposed Universal Declaration of the Rights of Mother Earth²

Preamble

We, the peoples and nations of Earth:

- *considering that we are all part of Mother Earth, an indivisible, living community of interrelated and interdependent beings with a common destiny;*
- *gratefully acknowledging that Mother Earth is the source of life, nourishment and learning and provides everything we need to live well;*

¹<https://www.transcend.org/tms/2012/12/human-rights-a-letter-to-santa-claus/>

²<https://www.theguardian.com/environment/2011/apr/10/bolivia-enshrines-natural-worlds-rights>
<https://pwccc.wordpress.com>

- *recognizing that the capitalist system and all forms of depredation, exploitation, abuse and contamination have caused great destruction, degradation and disruption of Mother Earth, putting life as we know it today at risk through phenomena such as climate change;*
- *convinced that in an interdependent living community it is not possible to recognize the rights of only human beings without causing an imbalance within Mother Earth;*
- *affirming that to guarantee human rights it is necessary to recognize and defend the rights of Mother Earth and all beings in her and that there are existing cultures, practices and laws that do so;*
- *conscious of the urgency of taking decisive, collective action to transform structures and systems that cause climate change and other threats to Mother Earth;*
- *proclaim this Universal Declaration of the Rights of Mother Earth, and call on the General Assembly of the United Nation to adopt it, as a common standard of achievement for all peoples and all nations of the world, and to the end that every individual and institution takes responsibility for promoting through teaching, education, and consciousness raising, respect for the rights recognized in this Declaration and ensure through prompt and progressive measures and mechanisms, national and international, their universal and effective recognition and observance among all peoples and States in the world.*

Article 1: Mother Earth

- 1. Mother Earth is a living being.*
- 2. Mother Earth is a unique, indivisible, self-regulating community of interrelated beings that sustains, contains and reproduces all beings.*
- 3. Each being is defined by its relationships as an integral part of Mother Earth.*
- 4. The inherent rights of Mother Earth are inalienable in that they arise from the same source as existence.*
- 5. Mother Earth and all beings are entitled to all the inherent rights recognized in this Declaration without distinction of any kind, such as may be made between organic and inorganic beings, species, origin, use to human beings, or any other status.*
- 6. Just as human beings have human rights, all other beings also have rights which are specific to their species or kind and appropriate for their role and function within the communities within which they exist.*
- 7. The rights of each being are limited by the rights of other beings and any conflict between their rights must be resolved in a way that maintains the integrity, balance and health of Mother Earth.*

Article 2. Inherent Rights of Mother Earth

1. *Mother Earth and all beings of which she is composed have the following inherent rights:*
 - (a) *the right to life and to exist;*
 - (b) *the right to be respected;*
 - (c) *the right to regenerate its bio-capacity and to continue its vital cycles and processes free from human disruptions;*
 - (d) *the right to maintain its identity and integrity as a distinct, self-regulating and interrelated being;*
 - (e) *the right to water as a source of life;*
 - (f) *the right to clean air;*
 - (g) *the right to integral health;*
 - (h) *the right to be free from contamination, pollution and toxic or radioactive waste;*
 - (i) *the right to not have its genetic structure modified or disrupted in a manner that threatens its integrity or vital and healthy functioning;*
 - (j) *the right to full and prompt restoration the violation of the rights recognized in this Declaration caused by human activities;*
2. *Each being has the right to a place and to play its role in Mother Earth for her harmonious functioning.*
3. *Every being has the right to wellbeing and to live free from torture or cruel treatment by human beings.*

Article 3. Obligations of human beings to Mother Earth

1. *Every human being is responsible for respecting and living in harmony with Mother Earth.*
2. *Human beings, and all States guarantee peace and eliminate nuclear, chemical and biological weapons;*
 - (a) *act in accordance with the rights and obligations recognized in this Declaration;*
 - (b) *recognize and promote the full implementation and enforcement of the rights and obligations recognized in this Declaration;*
 - (c) *promote and participate in learning, analysis, interpretation and communication about how to live in harmony with Mother Earth in accordance with this Declaration;*



Figure 10.1: **The earth is our mother.**



Figure 10.2: **Love and respect Mother Earth.**

- (d) *ensure that the pursuit of human wellbeing contributes to the wellbeing of Mother Earth, now and in the future;*
- (e) *establish and apply effective norms and laws for the defense, protection and conservation of the rights of Mother Earth;*
- (f) *respect, protect, conserve and where necessary, restore the integrity, of the vital ecological cycles, processes and balances of Mother Earth;*
- (g) *guarantee that the damages caused by human violations of the inherent rights recognized in this Declaration are rectified and that those responsible are held accountable for restoring the integrity and health of Mother Earth;*
- (h) *empower human beings and institutions to defend the rights of Mother Earth and of all beings;*
- (i) *establish precautionary and restrictive measures to prevent human activities from causing species extinction, the destruction of ecosystems or the disruption of ecological cycles;*
- (j) *guarantee peace and eliminate nuclear, chemical and biological weapons;*
- (k) *promote and support practices of respect for Mother Earth and all beings, in accordance with their own cultures, traditions and customs;*
- (l) *promote economic systems that are in harmony with Mother Earth and in accordance with the rights recognized in this Declaration.*



Figure 10.3: **We need reverence for all life, and even reverence for inanimate nature. We need respect and love for Mother Earth. She will return out love.**

Article 4: Definitions

1. *The term “being” includes ecosystems, natural communities, species and all other natural entities which exist as part of Mother Earth.*
2. *Nothing in this Declaration restricts the recognition of other inherent rights of all beings or specified beings.*

10.2 Limits to growth

The Industrial Revolution marked the start of massive human use of fossil fuels. The stored energy from several hundred million years of plant growth began to be used at roughly a million times the rate at which it had been formed. The effect on human society was like that of a narcotic. There was a euphoric (and totally unsustainable) surge of growth of both population and industrial production. Meanwhile, the carbon released into the atmosphere from the burning of fossil fuels began to duplicate the conditions which led to the 5 geologically-observed mass extinctions, during each of which more than half of all living species disappeared forever.

Economists (with a few notable exceptions, such as Nicholas Georgescu-Roegen, Herman Daly and Aurelio Peccei) have long behaved as though growth were synonymous with economic health. If the gross national product of a country increases steadily by 4% per year, most economists express approval and say that the economy is healthy. If the economy could be made to grow still faster (they maintain), it would be still more healthy. If



Figure 10.4: **Coalbrookdale by Night** by Philip James de Loutherbourg, painted 1801. This shows Madeley Wood (or Bedlam) Furnaces, which belonged to the Coalbrookdale Company from 1776 to 1796. Depicted place: Madeley Wood Furnaces, Coalbrookdale, Wikimedia Commons

the growth rate should fall, economic illness would be diagnosed.

However, it is obvious that on a finite Earth, neither population growth nor economic growth can continue indefinitely. A 4% rate of growth corresponds to an increase by a factor of 50 every century. No one can maintain that this is sustainable in the long run except by refusing to look more than a short distance into the future.

Of course, it is necessary to distinguish between industrial growth, and growth of culture and knowledge, which can and should continue to grow. Qualitative improvements in human society are possible and desirable, but resource-using and pollution-producing industrial growth is reaching its limits, both because of ecological constraints and because of the exhaustion of petroleum, natural gas and other non-renewable resources, such as metals. The threat of catastrophic climate change makes it imperative for us to stop using fossil fuels within very few decades.

Today, as economic growth falters, the defects and injustices of our banking system have come sharply into focus, and light has also been thrown onto the much-too-cozy relationship between banking and government. The collapse of banks during the sub-prime mortgage crisis of 2008 and their subsequent bailout by means of the taxpayer's money can give us an insight into both phenomena, the faults of our banking system and its infiltration into the halls of government. The same can be said of the present national debt crisis in the Euro zone and elsewhere.

One feature of banking that cries out for reform is "fractional reserve banking", i.e. the practice whereby private banks keep only a tiny fraction of the money entrusted to them by their depositors, and lend out all the remaining amount. By doing so, the banks are in effect coining their own money and putting it into circulation, a prerogative that ought

to be reserved for governments. Under the system of fractional reserve banking, profits from any expansion of the money supply go to private banks rather than being used by the government to provide social services. This is basically unjust; the banks are in effect issuing their own counterfeit money.

When the economy contracts instead of expanding, the effect of fractional reserve banking is still worse. In that case the depositors ask the banks for their money, which it is their right to do. But the banks do not have the money; they have lent it out, and thus they fail. However, the bankers have insured themselves against this eventuality by buying the votes of government officials. Thus the banks are bailed out and the taxpayers are left with the bill, as in the recent example in which the US Federal Reserve secretly gave 7.7 trillion of the taxpayers' dollars to bail out various banks.

In a later section (on entropy and economics) we will discuss in detail Frederick Soddy's criticisms of the fractional reserve banking system, and his proposals for monetary reform.

The fact that our fractional reserve banking system is stable when the economy is expanding, but collapses when the economy contracts explains, in part, the irrational and almost religious belief of governments and economists in perpetual growth. Also contributing to growth-worship are the unearned profits that investors reap when they own property in growing cities, or shares of growing businesses. But growth cannot continue forever. It is destroying the earth.

Pope Francis has called for economic reform. Our battered earth calls for it. The case of Greece shows clearly that our present economic system is not working; it is destroying nature and at the same time producing human misery. We need to replace our present economic system by one that has both an ecological conscience and a social conscience.³

The Club of Rome

In 1968 Aurelio Peccei, Thorkil Kristensen and others founded the Club of Rome, an organization of economists and scientists devoted to studying the predicament of human society. One of the first acts of the organization was to commission an MIT study of future trends using computer models. The result was a book entitled "Limits to Growth", published in 1972. From the outset the book was controversial, but it became a best-seller. It was translated into many languages and sold 30 million copies. The book made use of

³<http://eruditio.worldacademy.org/issue-5/article/urgent-need-renewable-energy>
<http://www.theguardian.com/environment/2015/jul/08/exxon-climate-change-1981-climate-denier-funding>
<http://human-wrongs-watch.net/2015/06/25/militarisms-hostages/>
<http://www.commondreams.org/news/2015/07/13/pope-calls-world-youth-rise-against-global-capitalism>
<https://www.transcend.org/tms/2015/07/tpp-ttip-tisa-a-tipping-edge-from-democracy/>
<http://dissidentvoice.org/2015/05/secret-and-democracy-are-incompatible/>
<http://www.countercurrents.org/roberts100715.htm>
<http://eruditio.worldacademy.org/issue-6/article/institutional-and-cultural-inertia>
<http://human-wrongs-watch.net/2015/07/04/will-the-real-issues-be-discussed-in-2016/>
<https://www.youtube.com/watch?v=AjZaFjXfLec>
<http://www.theguardian.com/environment/video/2012/oct/25/david-attenborough-climate-change-video>

an exponential index for resources, i.e. the number of years that a resource would last if used at an exponentially increasing rate.

Today the more accurate Hubbert Peak model is used instead to predict rate of use of a scarce resource as a function of time. Although the specific predictions of resource availability in “Limits to Growth” lacked accuracy, its basic thesis, that unlimited industrial growth on a finite planet is impossible, was indisputably correct. Nevertheless the book was greeted with anger and disbelief by the community of economists, and these emotions still surface when it is mentioned.

Economic activity is usually divided into two categories, 1) production of goods and 2) provision of services. It is the rate of production of goods that will be limited by the carrying capacity of the global environment. Services that have no environmental impact will not be constrained in this way. Thus a smooth transition to a sustainable economy will involve a shift of a large fraction the work force from the production of goods to the provision of services.

In his recent popular book “The Rise of the Creative Class” the economist Richard Florida points out that in a number of prosperous cities, for example Stockholm, a large fraction of the population is already engaged in what might be called creative work, a type of work that uses few resources, and produces few waste products, work which develops knowledge and culture rather than producing material goods. For example, producing computer software requires few resources and results in few waste products. Thus it is an activity with a very small ecological footprint.

Similarly, education, research, music, literature and art are all activities that do not weigh heavily on the carrying capacity of the global environment. Furthermore, cultural activities lead in a natural way to global cooperation and internationalism, since cultural achievements are shared by the people of the entire world. Indeed, the shared human inheritance of culture and knowledge is growing faster than ever before.

Florida sees this as a pattern for the future, and maintains that everyone is capable of creativity. He visualizes the transition to a sustainable future economy as one in which a large fraction of the work force moves from industrial jobs to information-related work. Meanwhile, as Florida acknowledges, industrial workers feel uneasy and threatened by such trends.⁴

Biological Carrying capacity and Economics

Classical economists pictured the world as largely empty of human activities. According to the empty-world picture of economics, the limiting factors in the production of food and goods are shortages of human capital and labor. The land, forests, fossil fuels, minerals, oceans filled with fish, and other natural resources upon which human labor and capital operate, are assumed to be present in such large quantities that they are not limiting

⁴<http://www.clubofrome.org/?p=326>
<http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf>
<http://www.donellameadows.org/archives/a-synopsis-limits-to-growth-the-30-year-update/>

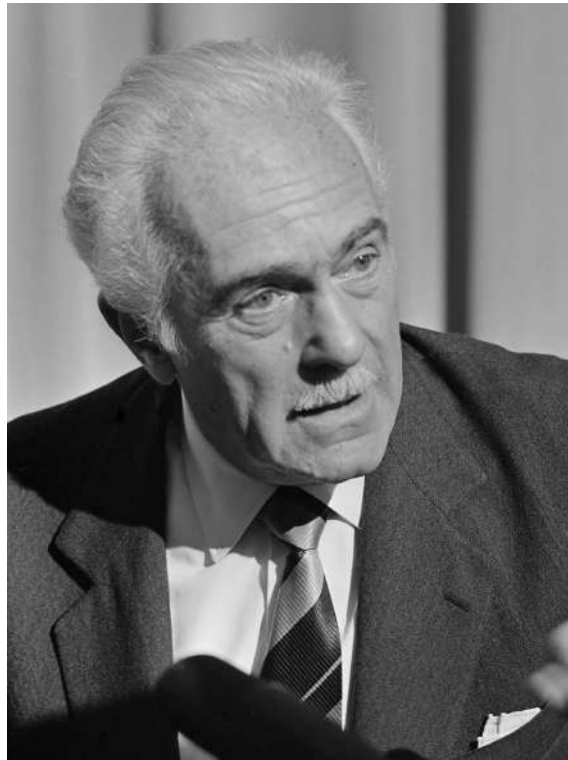


Figure 10.5: Aurelio Peccei (1908-1984), main founder of the Club of Rome. Concerning our present economic system, he wrote: “The only way we have devised to meet the surging waves of our rampant militarism and consumerism is to draw increasingly on the natural environment and to exploit, indiscriminately, the most accessible mineral and fuel deposits and all living resources we can lay our hands on. Such actions irreversibly impoverish our unique, irreplaceable, world, whose bounty and generosity are not infinite. Even if all the other adverse situations we find ourselves in today were to be alleviated, in itself, our high-handed treatment of Nature can bring about our doom.” Photograph by Koen Suyk/Anefo (Nationaal Archief), CC BY-SA 3.0, Wikimedia Commons



Figure 10.6: **When a forest is destroyed, topsoil is often lost to erosion. Source: United Nations.**

factors. In this picture, there is no naturally-determined upper limit to the total size of the human economy. It can continue to grow as long as new capital is accumulated, as long as new labor is provided by population growth, and as long as new technology replaces labor by automation.

Biology, on the other hand, presents us with a very different picture. Biologists remind us that if any species, including our own, makes demands on its environment which exceed the environment's carrying capacity, the result is a catastrophic collapse both of the environment and of the population which it supports. Only demands which are within the carrying capacity are sustainable. For example, there is a limit to regenerative powers of a forest.

It is possible to continue to cut trees in excess of this limit, but only at the cost of a loss of forest size, and ultimately the collapse and degradation of the forest. Similarly, cattle populations may for some time exceed the carrying capacity of grasslands, but the ultimate penalty for overgrazing will be degradation or desertification of the land. Thus, in biology, the concept of the carrying capacity of an environment is extremely important; but in economic theory this concept has not yet been given the weight which it deserves.

Exponential growth of human population and economic activity have brought us, in a surprisingly short time, from the empty-world situation to a full-world situation. In today's world, we are pressing against the absolute limits of the earth's carrying capacity, and further growth carries with it the danger of future collapse.

Full-world economics, the economics of the future, will no longer be able to rely on industrial growth to give profits to stockbrokers or to solve problems of unemployment or to alleviate poverty. In the long run, neither the growth of industry nor that of population is sustainable; and we have now reached or exceeded the sustainable limits.

The limiting factors in economics are no longer the supply of capital or human labor or even technology. The limiting factors are the rapidly vanishing supplies of petroleum



Figure 10.7: Our global food system is broken. Source: Oxfam

and metal ores, the forests damaged by acid rain, the diminishing catches from over-fished oceans, and the cropland degraded by erosion or salination, or lost to agriculture under a cover of asphalt.

Neoclassical economists have maintained that it is generally possible to substitute man-made capital for natural resources; but a closer examination shows that there are only very few cases where this is really practical. (See G.E. Tverberg, “Thoughts on why energy use and CO₂ emissions are rising as fast as GDP”, www.ourfinitemworld.com, November 30, 2011.)

The size of the human economy is, of course, the product of two factors the total number of humans, and the consumption per capita. If we are to achieve a sustainable global society in the future, a society whose demands are within the carrying capacity of of the global environment, then both these factors must be reduced.

The responsibility for achieving sustainability is thus evenly divided between the North and the South: Where there is excessively high consumption per capita, it must be reduced; and this is primarily the responsibility of the industrialized countries. High birth rates must also be reduced; and this is primarily the responsibility of the developing countries. Both of these somewhat painful changes are necessary for sustainability; but both will be extremely difficult to achieve because of the inertia of institutions, customs and ways of thought which are deeply embedded in society, in both the North and the South.

Population and food supply

Let us look first at the problem of high birth rates: The recent spread of modern medical techniques throughout the world has caused death rates to drop sharply; but since social customs and attitudes are slow to change, birth rates have remained high. As a result, between 1930 and 2011, the population of the world increased with explosive speed from

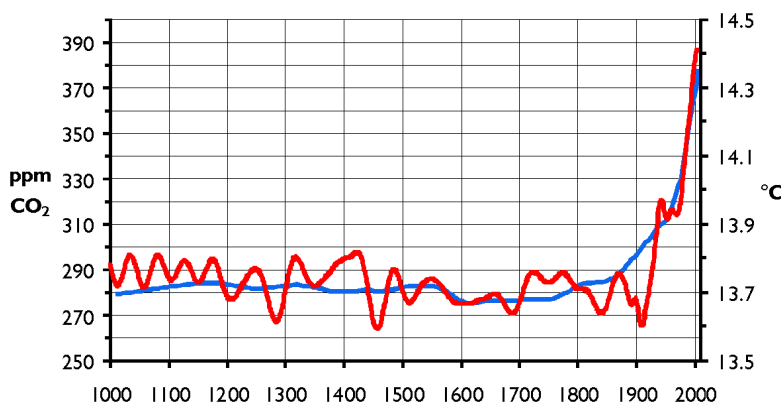


Figure 10.8: The Hanning graph used by the United Nations Climate Change Compendium 2009. Source: wattsupwiththat.com

two billion to seven billion.

During the last few decades, the number of food-deficit countries has lengthened; and it now reads almost like a United Nations roster. The food-importing nations are dependent, almost exclusively, on a single food-exporting region, the grain belt of North America. In the future, this region may be vulnerable to droughts produced by global warming.

An analysis of the global ratio of population to cropland shows that we probably already have exceeded the sustainable limit of population through our dependence on petroleum: Between 1950 and 1982, the use of cheap petroleum-derived fertilizers increased by a factor of 8, and much of our present agricultural output depends their use. Furthermore, petroleum-derived synthetic fibers have reduced the amount of cropland needed for growing natural fibers, and petroleum-driven tractors have replaced draft animals which required cropland for pasturage. Also, petroleum fuels have replaced fuelwood and other fuels derived for biomass. The reverse transition, from fossil fuels back to renewable energy sources, will require a considerable diversion of land from food production to energy production.

As population increases, the cropland per person will continue to fall, and we will be forced to make still heavier use of fertilizers to increase output per hectare. Also marginal land will be used in agriculture, with the probable result that much land will be degraded through erosion or salination.

Reserves of oil are likely to be exhausted by the middle of this century. Thus there is a danger that just as global population reaches the unprecedented level of 9 billion or more, the agricultural base for supporting it may suddenly collapse. The resulting catastrophe, possibly compounded by war and other disorders, could produce famine and death on a scale unprecedented in history, a disaster of unimaginable proportions, involving billions rather than millions of people. The present tragic famine in Africa is to this possible future disaster what Hiroshima is to the threat of thermonuclear war a tragedy of smaller scale, whose horrors should be sufficient, if we are wise, to make us take steps to avoid the larger catastrophe.

At present a child dies from starvation every six seconds. Five million children die from hunger every year. Over a billion people in today's world are chronically undernourished. There is a threat that unless prompt and well-informed action is taken by the international community, the tragic loss of life that is already being experienced will increase to unimaginable proportions.

As glaciers melt in the Himalayas, threatening the summer water supplies of India and China; as ocean levels rise, drowning the fertile rice-growing river deltas of Asia; as aridity begins to decrease the harvests of Africa, North America and Europe; as populations grow; as aquifers are overdrawn; as cropland is lost to desertification and urban growth; and as energy prices increase, the billion people who now are undernourished but still survive, might not survive. They might become the victims of a famine whose proportions could exceed anything that the world has previously experienced.

It is vital for the world to stabilize its population, not only because of the threat of a catastrophic future famine, but also because rapid population growth is closely linked with poverty. Today, a large fraction of the world's people live in near-poverty or absolute poverty, lacking safe water, sanitation, elementary education, primary health care and proper nutrition. Governments struggling to solve these problems, and to provide roads, schools, jobs and medical help for all their citizens, find themselves defeated by the rapid doubling times of populations. For example, in Liberia, the rate of population growth is 4% per year, which means that the population of Liberia doubles in size every eighteen years.

Under such circumstances, despite the most ambitious development programs, the infrastructure per capita decreases. Also, since new jobs must be found for the new millions added to the population, the introduction of efficient modern methods in industry and agriculture aggravates the already-serious problem of unemployment.

Education of women and higher status for women are vitally important measures, not only for their own sake, but also because in many countries these social reforms have proved to be strongly correlated with lower birth rates. Religious leaders who oppose programs for the education of women and for family planning on "ethical" grounds should think carefully about the scope and consequences of the catastrophic global famine which will undoubtedly occur within the next 50 years if population is allowed to increase unchecked.

One of the most important keys to controlling the global population explosion is giving women better education and equal rights. These goals are desirable for the sake of increased human happiness, and for the sake of the uniquely life-oriented point of view which women can give us; but in addition, education and improved status for women have shown themselves to be closely connected with lowered birth rates.

When women lack education and independent careers outside the home, they can be forced into the role of baby-producing machines by men who do not share in the drudgery of cooking, washing and cleaning; but when women have educational, legal, economic, social and political equality with men, experience has shown that they choose to limit their families to a moderate size.

Sir Partha Dasgupta of Cambridge University has pointed out that the changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides



Figure 10.9: **Child laborers.** The changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor, and general economic development.

education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor and general economic development.⁵

Social Values and Levels of Consumption

Let us next turn to the problem of reducing the per-capita consumption in the industrialized countries. The whole structure of western society seems designed to push its citizens in the opposite direction, towards ever-increasing levels of consumption. The mass media hold before us continually the ideal of a personal utopia filled with material goods. Every young man in a modern industrial society feels that he is a failure unless he fights his way to the “top”; and in recent years, women too have been drawn into this competition.

Of course not everyone can reach the top; there would not be room for everyone; but society urges all us to try, and we feel a sense of failure if we do not reach the goal. Thus, modern life has become a struggle of all against all for power and possessions.

One of the central problems in reducing consumption is that in our present economic and social theory, consumption has no upper bound; there is no definition of what is enough; there is no concept of a state where all of the real needs of a person have been satisfied. In our growth-oriented present-day economics, it is assumed that, no matter how

⁵<http://www.poverties.org/famine-in-africa.html>



Figure 10.10: **FAO, IFAD and WFP joint project “Mainstreaming food loss reduction initiatives for smallholders in food deficit areas” aims to improve food security and income generation through reduction of food losses in food grains and pulses value chains. Photo: FAO/Alessandra Benedetti**

much a person earns, he or she is always driven by a desire for more.

The phrase “conspicuous consumption” was invented by the Norwegian-American economist Thorstein Veblen (1857-1929) in order to describe the way in which our society uses economic waste as a symbol of social status. In “The Theory of the Leisure Class”, first published in 1899, Veblen pointed out that it was wrong to believe that human economic behavior is rational, or that it can be understood in terms of classical economic theory. To understand it, Veblen maintained, one might better make use of insights gained from anthropology, psychology, sociology, and history.

The sensation caused by the publication of Veblen’s book, and the fact that his phrase, “conspicuous consumption”, has become part of our language, indicate that his theory did not completely miss its mark. In fact, modern advertisers seem to be following Veblen’s advice: Realizing that much of the output of our economy will be used for the purpose of establishing the social status of consumers, advertising agencies hire psychologists to appeal to the consumer’s longing for a higher social position.

When possessions are used for the purpose of social competition, demand has no natural upper limit; it is then limited only by the size of the human ego, which, as we know, is boundless. This would be all to the good if unlimited economic growth were desirable. But today, when further industrial growth implies future collapse, western society urgently needs to find new values to replace our worship of power, our restless chase after excitement, and our admiration of excessive consumption.

The values which we need, both to protect nature from civilization and to protect civilization from itself, are perhaps not new: Perhaps it would be more correct to say that we need to rediscover ethical values which once were part of human culture, but which were lost during the process of industrialization, when technology allowed us to break traditional environmental constraints.

Our ancestors were hunter-gatherers, living in close contact with nature, and respecting the laws and limitations of nature. There are many hunter-gatherer cultures existing today, from whose values and outlook we could learn much. Unfortunately, instead of learning from them, we often move in with our bulldozers and make it impossible for their way of life to continue. During the past several decades, for example, approximately one tribe of South American forest Indians has died out every year. Of the 6000 human languages now spoken, it is estimated that half will vanish during the next 50 years.

In some parts of Africa, before cutting down a tree, a man will offer a prayer of apology to the spirit of the tree, explaining why necessity has driven him to such an act. The attitude involved in this ritual is something which industrialized society needs to learn, or relearn. Older cultures have much to teach industrial society because they already have experience with full-world situation which we are fast approaching.

In a traditional culture, where change is extremely slow, population has an opportunity to expand to the limits which the traditional way of life allows, so that it reaches an equilibrium with the environment. For example, in a hunter-gatherer culture, population has expanded to the limits which can be supported without the introduction of agriculture. The density of population is, of course, extremely low, but nevertheless it is pressing against the limits of sustainability. Overhunting or overfishing would endanger the future. Respect for the environment is thus necessary for the survival of such a culture.

Similarly, in a stable, traditional agricultural society which has reached an equilibrium with its environment, population is pressing against the limits of sustainability. In such a culture, one can usually find expressed as a strong ethical principle the rule that the land must not be degraded, but must be left fertile for the use of future generations.

Today, the whole world seems to be adopting values, fashions, and standards of behavior presented in the mass media of western society. The unsustainable, power-worshipping, consumption-oriented values of western society are so strongly propagandized by television, films and advertising, that they overpower and sweep aside the wisdom of older societies. This is unfortunate, since besides showing us unsustainable levels of affluence and economic waste, the western mass media depict values and behavior patterns which are hardly worthy of imitation. We need to reverse this trend. The industrialized countries must learn from the values of older traditional cultures. The wisdom of our ancestors, their respect for nature and their hospitable traditions of sharing, can help us to create a new economic system founded on social and environmental ethics.⁶

⁶<http://www.learndev.org/dl/harmony8.pdf>
<http://dissidentvoice.org/2015/05/gandhi-as-an-economist/>
<http://www.encyclopedia.com/doc/1G2-3401804813.html>



Figure 10.11: Helena Norberg-Hodge (born in 1946) is the founder and director of Local Futures, which was previously named International Society for Ecology and Culture. She states that the organization is “dedicated to the revitalization of cultural and biological diversity, and the strengthening of local communities and economies worldwide”. In her important book, *Ancient Futures*, Norberg-Hodge says that modern industrial societies ought to learn from more sustainable traditional cultures, rather than the reverse.

10.3 Entropy and economics

We urgently need to shift quickly from fossil fuels to renewable energy if we are to avoid a tipping point after which human efforts to avoid catastrophic climate change will be futile because feedback loops will have taken over. The dangerous methane hydrate feedback loop is discussed in an excellent short video made by Thom Hartmann and the Leonardo DiCaprio Foundation.⁷

Celebrated author and activist Naomi Klein has emphasized the link between need for economic reform and our urgent duty to address climate change.⁸

Rebel economist Prof. Tim Jackson discusses the ways in which our present economic system has failed us, and the specific reforms that are needed. In one of his publications, he says: “The myth of growth has failed us. It has failed the two billion people who still live on 2 dollars a day. It has failed the fragile ecological systems on which we depend for survival. It has failed, spectacularly, in its own terms, to provide economic stability and secure people’s livelihood.”⁹

What is entropy?

Entropy is a quantity, originally defined in statistical mechanics and thermodynamics. It is a measure of the statistical probability of any state of a system: The greater the entropy, the greater the probability. The second law of thermodynamics asserts that entropy of the universe always increases with time. In other words, the universe as a whole is constantly moving towards states of greater and greater probability.

For any closed system, the same is true. Such systems move in time towards states of greater and greater probability. However, the earth, with its biosphere, is not a closed system. The earth constantly receives an enormous stream of light from the sun. The radiation which we receive from the sun brings us energy that can be used to perform work, and in physics this is called “free energy”. Because of this flood of incoming sunlight, plants, animals and humans are able to create structures which from a statistical point of view are highly unlikely.

The disorder and statistical probability of the universe is constantly increasing, but because the earth is not a closed system, we are able to create local order, and complex, statistically improbable structures, like the works of Shakespeare, the Mona Lisa and the Internet. The human economy is driven by the free energy which we receive as income from the sun. Money is, in fact, a symbol for free energy, and free energy might be thought of as “negative entropy”. There is also a link between free energy and information.¹⁰

⁷<https://www.youtube.com/watch?v=sRGVTK-AAvw>
<http://lasthours.org/>

⁸<http://thischangeseverything.org/naomi-klein/>
<http://www.theguardian.com/profile/naomiklein>

⁹<http://www.theguardian.com/sustainable-business/rio-20-tim-jackson-leaders-green-economy?newsfeed=true>

<http://www.theguardian.com/sustainable-business/consumerism-sustainability-short-termism>
¹⁰<http://www.amazon.com/Information-Theory-And-Evolution-Edition/dp/9814401234>

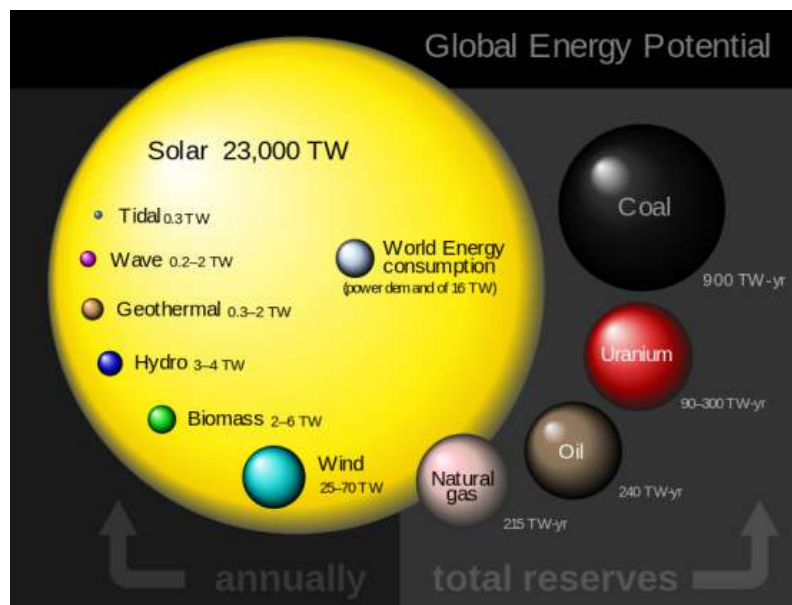


Figure 10.12: Global energy potential. Comparison of renewable and conventional planetary energy reserves and sources. While renewables display their power potential in terawatts (TW) with the corresponding annual amount of energy, conventional sources display their total recoverable energy reserves in terawatt-years (TW-yr). Author: Rfassbind, Wikimedia Commons

Human society as a superorganism, with the global economy as its digestive system

A completely isolated human being would find it as difficult to survive for a long period of time as would an isolated ant or bee or termite. Therefore it seems correct to regard human society as a superorganism. In the case of humans, the analog of the social insects' nest is the enormous and complex material structure of civilization. It is, in fact, what we call the human economy. It consists of functioning factories, farms, homes, transportation links, water supplies, electrical networks, computer networks and much more.

Almost all of the activities of modern humans take place through the medium of these external "exosomatic" parts of our social superorganism. The terms "exosomatic" and "endosomatic" were coined by the American scientist Alfred Lotka (1880-1949). A lobster's claw is endosomatic; it is part of the lobster's body. The hammer used by a human is exosomatic, like a detachable claw. Lotka spoke of "exosomatic evolution", including in this term not only cultural evolution but also the building up of the material structures of civilization.

The economy associated with the human superorganism "eats" resources and free energy. It uses these inputs to produce local order, and finally excretes them as heat and waste. The process is closely analogous to food passing through the alimentary canal of an individual organism. The free energy and resources that are the inputs of our economy drive it just as food drives the processes of our body, but in both cases, waste products are finally excreted in a degraded form.

Almost all of the free energy that drives the human economy came originally from the sun's radiation, the exceptions being geothermal energy which originates in the decay of radioactive substances inside the earth, and tidal energy, which has its origin in the slowing of the motions of the earth-moon system. However, since the start of the Industrial Revolution, our economy has been using the solar energy stored in of fossil fuels. These fossil fuels were formed over a period of several hundred million years. We are using them during a few hundred years, i.e., at a rate approximately a million times the rate at which they were formed.

The present rate of consumption of fossil fuels is more than 13 terawatts and, if used at the present rate, fossil fuels would last less than a century. However, because of the very serious threats posed by climate change, human society would be well advised to stop the consumption of coal, oil and natural gas well before that time.

The rate of growth of of new renewable energy sources is increasing rapidly. These sources include small hydro, modern biomass, solar, wind, geothermal, wave and tidal energy. There is an urgent need for governments to set high taxes on fossil fuel consumption and to shift subsidies from the petroleum and nuclear industries to renewables. These changes in economic policy are needed to make the prices of renewables more competitive.

The shock to the global economy that will be caused by the end of the fossil fuel era will be compounded by the scarcity of other non-renewable resources, such as metals. While it is true (as neoclassical economists emphasize) that "matter and energy can neither be created nor destroyed", free energy can be degraded into heat, and concentrated deposits of

minerals can be dispersed. Both the degradation of free energy into heat and the dispersal of minerals involve increases of entropy.

Frederick Soddy

One of the first people to call attention to the relationship between entropy and economics was the English radiochemist Frederick Soddy (1877-1956). Soddy won the Nobel Prize for Chemistry in 1921 for his work with Ernest Rutherford demonstrating the transmutation of elements in radioactive decay processes. His concern for social problems then led him to a critical study of the assumptions of classical economics. Soddy believed that there is a close connection between free energy and wealth, but only a very tenuous connection between wealth and money.

Soddy was extremely critical of the system of “fractional reserve banking” whereby private banks keep only a small fraction of the money that is entrusted to them by their depositors and lend out the remaining amount. He pointed out that this system means that the money supply is controlled by the private banks rather than by the government, and also that profits made from any expansion of the money supply go to private corporations instead of being used to provide social services. Fractional reserve banking exists today, not only in England but also in many other countries. Soddy’s criticisms of this practice cast light on the subprime mortgage crisis of 2008 and the debt crisis of 2011.

As Soddy pointed out, real wealth is subject to the second law of thermodynamics. As entropy increases, real wealth decays. Soddy contrasted this with the behavior of debt at compound interest, which increases exponentially without any limit, and he remarked:

“You cannot permanently pit an absurd human convention, such as the spontaneous increment of debt [compound interest] against the natural law of the spontaneous decrement of wealth [entropy]”. Thus, in Soddy’s view, it is a fiction to maintain that being owed a large amount of money is a form of real wealth.

Frederick Soddy’s book, “Wealth, virtual wealth and debt: The solution of the economic paradox”, published in 1926 by Allen and Unwin, was received by the professional economists of the time as the quixotic work of an outsider. Today, however, Soddy’s common-sense economic analysis is increasingly valued for the light that it throws on the problems of our fractional reserve banking system, which becomes more and more vulnerable to failure as economic growth falters.¹¹

Currency reform, and nationalization of banks

Frederick Soddy was writing at a time when England’s currency was leaving the gold standard, and in order to replace this basis for the currency, he proposed an index system. Soddy’s index was to be based on a standard shopping basket containing household items, such as bread, milk, potatoes and so on. If the price of the items in the basket rose, more

¹¹www.fadedpage.com/link.php?file=20140873-a5.pdf
<http://human-wrongs-watch.net/2015/07/08/debt-slavery/>



Figure 10.13: **Prof. Muhammad Yunus, founder of the Grameen Bank. The bank and its founder shared a Nobel Peace Prize for their work. Prof. Yunus continues to work with businesses which aim at fulfilling social needs rather than at profit for stockholders. Source: www.grameen-info.org**

currency would be issued by the nationalized central bank. If the price fell, currency would be withdrawn.

Nationalization of banks was proposed by Soddy as a means of avoiding the evils of the fractional reserve banking system. Today we see a revival of the idea of nationalized banks, or local user-owned cooperative banks. The Grameen Bank, founded by Prof. Muhammad Yunus, pioneered the idea of socially-motivated banks for the benefit poor people who would ordinarily be unable to obtain loans. The bank and its founder won a Nobel Peace Prize in 2006.¹²

Nicholas Georgescu-Roegen

The incorporation of the idea of entropy into economic thought also owes much to the mathematician and economist Nicholas Georgescu-Roegen (1906-1994), the son a Romanian army officer. Georgescu-Roegen's talents were soon recognized by the Romanian school system, and he was given an outstanding education in mathematics, which later

¹²<http://www.grameen-info.org/history/>
<http://www.ibtimes.com/greece-drawing-contingency-plans-nationalize-banks-bring-parallel-currency-report-1868830>
<http://www.quora.com/Why-were-banks-nationalized-in-India>
<http://www.bloomberg.com/news/articles/2015-01-28/greek-bank-investors-hammered-as-3-day-slump-wipes-12-billion>
<http://www.armstrongeconomics.com/archives/30531>
<https://en.wikipedia.org/wiki/Nationalization>
<http://www.theguardian.com/world/2015/jul/23/beppe-grillo-calls-for-nationalisation-of-italian-banks-and-exit-from-euro>
<http://dissidentvoice.org/2015/07/whats-wrong-with-our-monetary-system-and-how-to-fix-it/>

contributed to his success and originality as an economist.

Between 1927 and 1930 the young Georgescu studied at the Institute de Statistique in Paris, where he completed an award-winning thesis: "On the problem of finding out the cyclical components of phenomena". He then worked in England with Karl Pearson from 1930 to 1932, and during this period his work attracted the attention of a group of economists who were working on a project called the Harvard Economic Barometer. He received a Rockefeller Fellowship to join this group, but when he arrived at Harvard, he found that the project had been disbanded.

In desperation, Georgescu-Roegen asked the economist Joseph Schumpeter for an appointment to his group. Schumpeter's group was in fact a remarkably active and interesting one, which included the future Nobel laureate Wassely Leontief; and there followed a period of intense intellectual activity during which Georgescu-Roegen became an economist.

Despite offers of a permanent position at Harvard, Georgescu-Roegen returned to his native Romania in the late 1930's and early 1940's in order to help his country. He served as a member of the Central Committee of the Romanian National Peasant Party. His experiences at this time led to his insight that economic activity involves entropy. He was also helped to this insight by Borel's monograph on Statistical Mechanics, which he had read during his Paris period.

Georgescu-Roegen later wrote: "The idea that the economic process is not a mechanical analogue, but an entropic, unidirectional transformation began to turn over in my mind long ago, as I witnessed the oil wells of the Ploesti field of both World Wars' fame becoming dry one by one, and as I grew aware of the Romanian peasants' struggle against the deterioration of their farming soil by continuous use and by rains as well. However it was the new representation of a process that enabled me to crystallize my thoughts in describing the economic process as the entropic transformation of valuable natural resources (low entropy) into valueless waste (high entropy)."

After making many technical contributions to economic theory, Georgescu-Roegen returned to this insight in his important 1971 book, "The Entropy Law and the Economic Process" (Harvard University Press), where he outlines his concept of bioeconomics. In a later book, "Energy and Economic Myths" (Pergamon Press, New York, 1976), he offered the following recommendations for moving towards a bioeconomic society:

1. The complete prohibition of weapons production, thereby releasing productive forces for more constructive purposes;
2. Immediate aid to underdeveloped countries;
3. Gradual decrease in population to a level that could be maintained only by organic agriculture;
4. Avoidance, and strict regulation if necessary, of wasteful energy use;
5. Abandon our attachment to "extravagant gadgetry";
6. "Get rid of fashion";
7. Make goods more durable and repairable; and
8. Cure ourselves of workaholic habits by re-balancing the time spent on work and leisure, a shift that will become incumbent as the effects of the other changes make themselves felt.

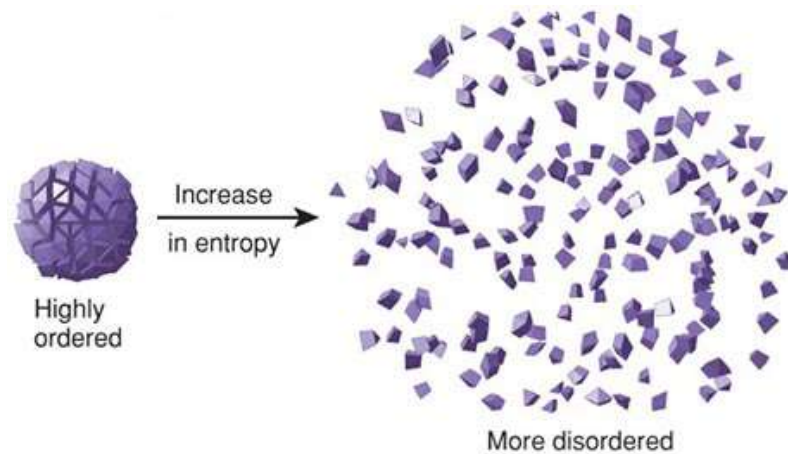


Figure 10.14: According to the second law of thermodynamics, the entropy of the universe constantly increases. Increase of entropy corresponds to increase of disorder, and also to increase of statistical probability. Living organisms on the earth are able to achieve a high degree of order and highly improbable structures because the earth is not a closed system. It constantly receives free energy (i.e. energy capable of doing work) from the sun, and this free energy can be thought of as carrying thermodynamic information, or “negative entropy”. Source: flowchainsensel.wordpress.co,

Georgescu-Roegen did not believe that his idealistic recommendations would be adopted, and he feared that human society is headed for a crash.

Limits to Growth: A steady-state economy

Nicholas Georgescu-Roegen’s influence continues to be felt today, not only through his own books and papers but also through those of his students, the distinguished economists Herman E. Daly and Kozo Mayumi, who for many years have been advocating a steady-state economy. As they point out in their books and papers, it is becoming increasingly apparent that unlimited economic growth on a finite planet is a logical impossibility. However, it is important to distinguish between knowledge, wisdom and culture, which can and should continue to grow, and growth in the sense of an increase in the volume of material goods produced. It is growth in the latter sense that is reaching its limits.

Daly describes our current situation as follows: “The most important change in recent times has been the growth of one subsystem of the Earth, namely the economy, relative to the total system, the ecosphere. This huge shift from an ‘empty’ to a ‘full’ world is truly ‘something new under the sun’... The closer the economy approaches the scale of the whole Earth, the more it will have to conform to the physical behavior mode of the Earth... The remaining natural world is no longer able to provide the sources and sinks for the metabolic throughput necessary to sustain the existing oversized economy, much less a growing one. Economists have focused too much on the economy’s circulatory system and



Figure 10.15: **Wind, solar, and biomass are three emerging renewable sources of energy. Wind turbines in a rapeseed field in Sandesneben, Germany. Author: J'urgen from Sandesneben, Germany, Wikimedia Commons**

have neglected to study its digestive tract.”¹³

In the future, the only way that we can avoid economic collapse is to build a steady-state economy. There exists much literature on how this can be achieved, and these writings ought to become a part of the education of all economists and politicians.

10.4 A new social contract

Our present situation is this:

The future looks extremely dark because of human folly, especially the long-term future. The greatest threats are catastrophic climate change and thermonuclear war, but a large-scale global famine also has to be considered.

We give our children loving care, but it makes no sense to do so and at the same time to neglect to do all that is within our power to ensure that they and their descendants will inherit an earth in which they can survive. We also have a responsibility to all the other living organisms with which we share the gift of life.

Inaction is not an option. We have to act with courage and dedication, even if the odds are against success, because the stakes are so high. The mass media could mobilize us to action, but they have failed in their duty. Our educational system could also wake us up and make us act, but it too has failed us. The battle to save the earth from human greed and folly has to be fought in the alternative media.

¹³<http://dalynnews.org/learn/blog/>
<http://steadystate.org/category/herman-daly/>
<https://www.youtube.com/watch?v=EN5esbvAt-w>
<https://www.youtube.com/watch?v=wIR-VsXtM4Y>
<http://www.imf.org/external/pubs/ft/survey/so/2015/car031315a.htm>



Figure 10.16: **Otro mundo es posible. Another world is possible.** Source: <http://dailytheology.org>

We need a new economic system, a new society, a new social contract, a new way of life. Here are the great tasks that history has given to our generation: We must achieve a steady-state economic system. We must restore democracy. We must decrease economic inequality. We must break the power of corporate greed. We must leave fossil fuels in the ground. We must stabilize and ultimately reduce the global population. We must eliminate the institution of war. And finally, we must develop a more mature ethical system to match our new technology.

We must achieve a steady-state economic system

A steady-state economic system is necessary because neither population growth nor economic growth can continue indefinitely on a finite earth. No one can maintain that exponential industrial growth is sustainable in the long run except by refusing to look more than a short distance into the future.

Of course, it is necessary to distinguish between industrial growth, and growth of culture and knowledge, which can and should continue to grow. Qualitative improvements in human society are possible and desirable, but resource-using and pollution-producing industrial growth is reaching its limits, both because of ecological constraints and because of the exhaustion of petroleum, natural gas and other non-renewable resources, such as metals. The threat of catastrophic climate change makes it imperative for us to stop using fossil fuels within very few decades.

We discussed Nicholas Georgescu-Roegen's reasons for viewing our present economic system as unidirectional and entropic: Low-entropy resources are converted into high-entropy waste, a unidirectional process. By contrast, to be sustainable in the long run, a process must be cyclic, like the growth and regeneration of a forest.

Georgescu-Roegen's list of desiderata remains valid today: We need drastic cuts in



Figure 10.17: **Nicholas Georgescu-Roegen, a great pioneer of Ecological Economics. His writings cast much light on our present situation. Source: elcomercio.ep**

weapons production, thereby releasing productive forces for more constructive purposes. We need immediate aid to underdeveloped countries and gradual decrease in population to a level that can be maintained by organic agriculture. We also need avoidance, and strict regulation if necessary, of wasteful energy use. Finally, we need to abandon our attachment to extravagant gadgetry and fashion, and we must cure ourselves of workaholic habits by re-balancing the time spent on work and leisure.

Today, the distinguished economist Herman Daly (a student of Georgescu-Roegen) continues to write perceptive articles and books documenting the need for a steady-state economy. Among his books, the following are noteworthy: “Steady-State Economics” (1977); “For the Common Good” (1989, with John B. Cobb, Jr.); “Valuing the Earth” (1993, with Kenneth Townsend); “Beyond Growth” (1996); “Ecological Economics and the Ecology of Economics” (1999); “Local Politics of Global Sustainability” (2000, with Thomas Prugh and Robert Costanza), and “Ecological Economics: Principles and Applications” (2003, with Joshua Farley. Prof. Daly is a recipient of the Right Livelihood Award, which is sometimes called the Alternative Nobel Prize.¹⁴

We must restore democracy

It is obvious, almost by definition, that excessive governmental secrecy and true democracy are incompatible. If the people of a country have no idea what their government is doing, they cannot possibly have the influence on decisions that the word “democracy” implies.

Governmental secrecy is not something new. Secret diplomacy contributed to the outbreak of World War I, and the secret Sykes-Picot Agreement later contributed to the

¹⁴<http://steadystate.org/category/herman-daly/>
https://en.wikipedia.org/wiki/Herman_Daly
<http://grist.org/article/bank/>
<http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf>
<http://www.clubofrome.org/?p=326>



Figure 10.18: We must restore democracy in countries where it has been replaced by oligarchy.

bitterness of conflicts in the Middle East. However, in recent years, governmental secrecy has grown enormously.

The revelations of Edward Snowden have shown that the number of people involved in secret operations of the United States government is now as large as the entire population of Norway: roughly 5 million. The influence of this dark side of government has become so great that no president is able to resist it.

Many modern governments have become very expert in manipulating public opinion through mass media. They only allow the public to hear a version of the “news” that has been handed down by powerholders. Of course, people can turn to the alternative media that are available on the Internet. But on the whole, the vision of the world presented on television screens and in major newspapers is the “truth” that is accepted by the majority of the public, and it is this picture of events that influences political decisions. Censorship of the news by the power elite is a form of secrecy, since it withholds information that is needed for a democracy to function properly.

Snowden has already said most of what he has to say. Nevertheless, Washington was willing to break international law and the rules of diplomatic immunity by forcing its European allies to ground the plane of Bolivian President Evo Morales following a rumor that Snowden was on board. This was not done to prevent Snowden from saying more, but with the intention of making a gruesome example of him, as a warning to other whistleblowers.

In a democracy, the power of judging and controlling governmental policy is supposed to be in the hands of the people. It is completely clear that if the people do not know what their government is doing, then they cannot judge or control governmental policy, and democracy has been abolished. There has always been a glaring contradiction between democracy and secret branches of the government, such as the CIA, which conducts its assassinations and its dirty wars in South America and elsewhere without any public knowledge or control.

The gross, wholesale electronic spying on citizens revealed by Snowden seems to be specifically aimed at eliminating democracy. It is aimed at instilling universal fear and conformity, fear of blackmail and fear of being out of step, so that the public will not dare to oppose whatever the government does, no matter how criminal or unconstitutional.

We must restore democracy wherever it has been replaced by oligarchy. When we do so, we will free ourselves from many evils, including excessive economic inequality, violation of civil rights, and the suffering produced by perpetual wars.

We must decrease economic inequality

In his Apostolic Exhortation, “*Evangelii Gaudium*”, Pope Francis said:

“In our time humanity is experiencing a turning-point in its history, as we can see from the advances being made in so many fields. We can only praise the steps being taken to improve people’s welfare in areas such as health care, education and communications. At the same time we have to remember that the majority of our contemporaries are barely living from day to day, with dire consequences. A number of diseases are spreading. The hearts of many people are gripped by fear and desperation, even in the so-called rich



Figure 10.19: Edward Snowden, Author: Laura Poitras / Praxis Films, Creative Commons Attribution 3.0 Unported license. Wikimedia Commons



Figure 10.20: Hong Kong rally to support Snowden, June 15, 2013, Author: See-ming Lee, Creative Commons Attribution 2.0 Generic license, Wikimedia Commons

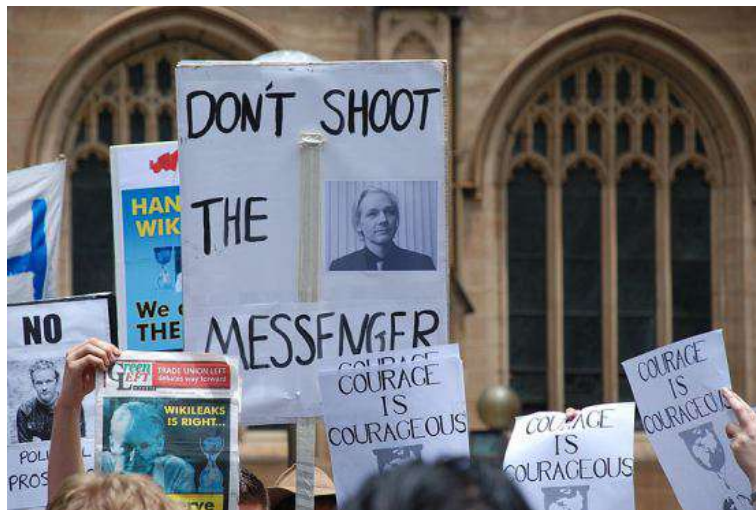


Figure 10.21: Demonstration in support of Assange in front of Sydney Town Hall, 10 December 2010, Author: Elekh, Creative Commons Attribution-Share Alike 3.0 Unported license. Wikimedia Commons

countries. The joy of living frequently fades, lack of respect for others and violence are on the rise, and inequality is increasingly evident. It is a struggle to live and, often, to live with precious little dignity.”

“This epochal change has been set in motion by the enormous qualitative, quantitative, rapid and cumulative advances occurring in the sciences and in technology, and by their instant application in different areas of nature and of life. We are in an age of knowledge and information, which has led to new and often anonymous kinds of power.”

“Just as the commandment ‘Thou shalt not kill’ sets a clear limit in order to safeguard the value of human life, today we also have to say ‘thou shalt not’ to an economy of exclusion and inequality. Such an economy kills. How can it be that it is not a news item when an elderly homeless person dies of exposure, but it is news when the stock market loses two points? This is a case of exclusion. Can we continue to stand by when food is thrown away while people are starving? This is a case of inequality. Today everything comes under the laws of competition and the survival of the fittest, where the powerful feed upon the powerless. As a consequence, masses of people find themselves excluded and marginalized: without work, without possibilities, without any means of escape.”

“In this context, some people continue to defend trickle-down theories which assume that economic growth, encouraged by a free market, will inevitably succeed in bringing about greater justice and inclusiveness in the world. This opinion, which has never been confirmed by the facts, expresses a crude and naive trust in the goodness of those wielding economic power and in the sacralized workings of the prevailing economic system. Meanwhile, the excluded are still waiting.”

In a recent speech, Senator Bernie Sanders quoted Pope Francis extensively and added: “We have a situation today, Mr. President, incredible as it may sound, where the wealthiest 85 people in the world own more wealth than the bottom half of the world’s population.”¹⁵

The social epidemiologist Prof. Richard Wilkinson, has documented the ways in which societies with less economic inequality do better than more unequal societies in a number of areas, including increased rates of life expectancy, mathematical performance, literacy, trust, social mobility, together with decreased rates of infant mortality, homicides, imprisonment, teenage births, obesity and mental illness, including drug and alcohol addiction.¹⁶ We must also remember that according to the economist John A. Hobson, the basic problem that led to imperialism was an excessively unequal distribution of incomes in the industrialized countries. The result of this unequal distribution was that neither the rich nor the poor could buy back the total output of their society. The incomes of the poor were insufficient, and rich were too few in number.

¹⁵https://www.youtube.com/watch?v=9_LJpN893Vg
<https://www.oxfam.org/en/tags/inequality>
https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/cr-even-it-up-extreme-inequality-291014-en.pdf

¹⁶<https://www.youtube.com/watch?v=cZ7LzE3u7Bw>
https://en.wikipedia.org/wiki/Richard_G._Wilkinson



Figure 10.22: Greed: one of the seven deadly sins. Pecados Capitaes. Avaricia.
Author: Jesus Solana from Madrid, Spain, Wikimedia Commons

We must break the power of corporate greed

When the United Nations was established in 1945, the purpose of the organization was to abolish the institution of war. This goal was built into many of the articles of the UN Charter. Accordingly, throughout the world, many War Departments were renamed and became Departments of Defense. But the very name is a lie. In an age of nuclear threats and counter-threats, populations are by no means protected. Ordinary citizens are just hostages in a game for power and money. It is all about greed.

Why is war continually threatened? Why is Russia threatened? Why is war with Iran threatened? Why fan the flames of conflict with China? Is it to “protect” civilians? Absolutely not! In a thermonuclear war, hundreds of millions of civilians would die horribly everywhere in the world, also in neutral countries. What is really being protected are the profits of arms manufacturers. As long as there are tensions; as long as there is a threat of war, military budgets are safe; and the profits of arms makers are safe. The people in several “democracies”, for example the United States, do not rule at the moment. Greed rules.

As Institute Professor Noam Chomsky of MIT has pointed out, greed and lack of ethics are built into the structure of corporations. By law, the Chief Executive Officer of a corporation must be entirely motivated by the collective greed of the stockholders. He must maximize profits. If the CEO abandons this single-minded chase after corporate profits for ethical reasons, or for the sake of humanity or the biosphere or the future, he (or she) must, by law, be fired and replaced.

Occasionally, for the sake of their public image, corporations seem to do something for other motives than their own bottom line, but it is usually window dressing. For example, Shell claims to be supporting research on renewable energy. Perhaps there is indeed a small renewable energy laboratory somewhere in that vast corporation; but the real interest of the organization is somewhere else. Shell is sending equipment on a large scale to drill for more and more environment-destroying oil in the Arctic.¹⁷

We must leave fossil fuels in the ground

The threat of catastrophic climate change requires prompt and dedicated action by the global community. Unless we very quickly make the transition from fossil fuels to 100% renewable energy, we will reach a tipping point after which uncontrollable feedback loops could take over, leading to a human-caused 6th geological extinction event. This might even be comparable to the Permian-Triassic event, during which 96% of all marine species and 70% of terrestrial vertebrates became extinct.

New hope that such a catastrophe for human civilization and the biosphere can be avoided comes from two recently-released documents: The Encyclical “*Laudato Si*” by

¹⁷<http://www.countercurrents.org/avery170715.htm>
<http://human-wrongs-watch.net/2015/06/25/militarisms-hostages/>
<https://www.youtube.com/watch?v=FJUA4cm0Rck>

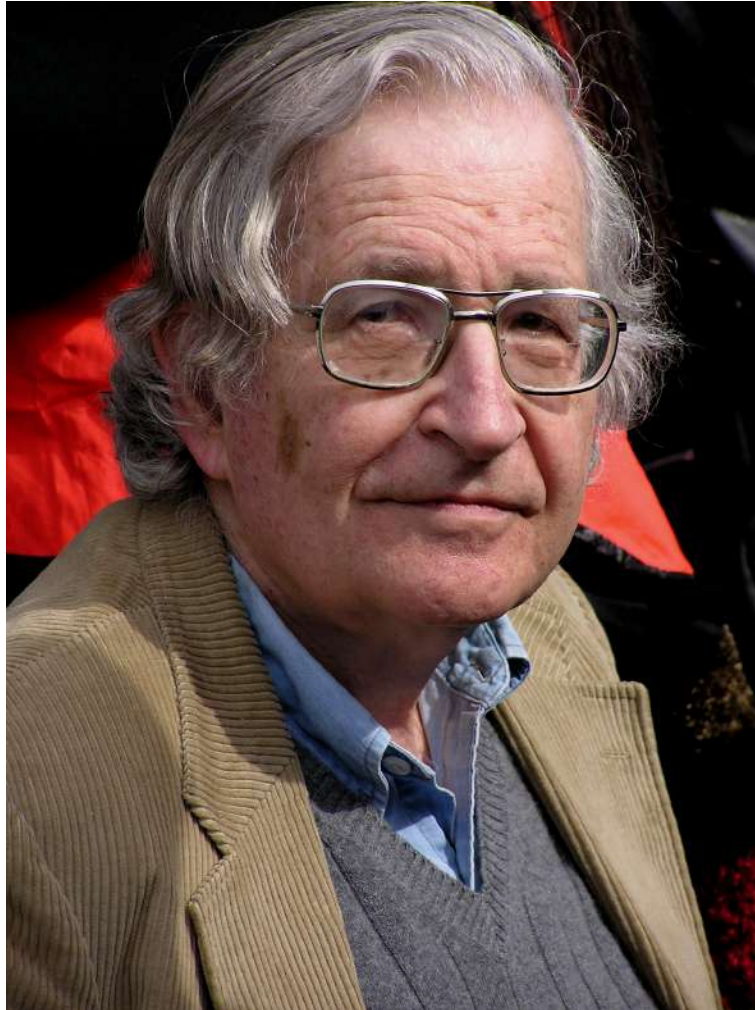


Figure 10.23: Institute Professor Noam Chomsky of MIT has pointed out that greed and lack of ethics are built into the structure of corporations. If the CEO abandons the single-minded chase after corporate profits for ethical reasons, or for the sake of humanity or the biosphere or the future, he (or she) must, by law, be fired and replaced. Photo by Duncan Rawlinson. [CC BY 2.0], Wikimedia Commons



Figure 10.24: **Pope Francis among the people at St. Peter's Square - 12 May 2013.**

Pope Francis, and the statistics on the rate of growth of renewable energy newly released by the Earth Policy Institute.

Arctic sea-ice is melting at an increasingly rapid rate, because of several feedback loops. One of these feedback loops, called the albedo effect, is due to the fact that white snow-covered sea-ice in the Arctic reflects sunlight, while dark water absorbs it, raising the temperature and leading to more melting.

Another feedback loop is due to the fact that rising temperatures mean that more water is evaporated. The water vapor in the atmosphere acts like a greenhouse gas, and raises the temperature still further.

If we consider long-term effects, by far the most dangerous of the feedback loops is the melting of methane hydrate crystals and the release of methane into the atmosphere, where its effects as a greenhouse gas are roughly twenty times great as those of CO_2 .

When organic matter is carried into the oceans by rivers, it decays to form methane. The methane then combines with water to form hydrate crystals, which are stable at the temperatures which currently exist on ocean floors. However, if the temperature rises, the crystals become unstable, and methane gas bubbles up to the surface.

The worrying thing about methane hydrate deposits on ocean floors is the enormous amount of carbon involved: roughly 10,000 gigatons. To put this huge amount into perspective, we can remember that the total amount in world CO_2 emissions since 1751 has been only 337 gigatons.

Despite the worrying nature of the threats that we are facing, there are reasons for hope. One of the greatest of these is the beautiful, profound and powerful encyclical that

has just been released by Pope Francis.¹⁸

Pope Francis tells us that the dictates of today's economists are not sacred: In the future, if we are to survive, economics must be given both a social conscience and an ecological conscience. Nor are private property and profits sacred. They must be subordinated to the common good, and the preservation of our global commons. Less focus on material goods need not make us less happy. The quality of our lives can be increased, not decreased, if we give up our restless chase after power and wealth, and derive more of our pleasures from art, music and literature, and from conversations with our families and friends.

Another reason for hope can be found in the extremely high present rate of growth of renewable energy, and in the remarkable properties of exponential growth. According to figures recently released by the Earth Policy Institute,¹⁹ the global installed photovoltaic capacity is currently able to deliver 242,000 megawatts, and it is increasing at the rate of 27.8% per year. Wind energy can now deliver 370,000 megawatts, and it is increasing at the rate of roughly 20% per year.

Because of the astonishing properties of exponential growth, we can calculate that if these growth rates are maintained, renewable energy can give us 24.8 terawatts within only 15 years! This is far more than the world's present use of all forms of energy.

All of us must still work with dedication to provide the political will needed to avoid catastrophic climate change. However, the strong and friendly voice of Pope Francis, and the remarkable rate of growth of renewable energy can guide our work, and can give us hope and courage.

The award-winning author and activist Naomi Klein has emphasized that the climate crisis changes everything. Environmentalists and antiwar activists must unite! We need a new economic system! The people of the world don't want climate change; they want system change!²⁰

¹⁸http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html

¹⁹<http://www.earth-policy.org/books/tgt>

²⁰<https://www.transcend.org/tms/2015/03/naomi-klein-the-economic-system-we-have-created-global-warming/>
<http://thischangeseverything.org/naomi-klein/>
<http://eruditio.worldacademy.org/issue-5/article/urgent-need-renewable-energy>
<http://www.worldbank.org/en/news/feature/2012/11/18/Climate-change-report-warns-dramatically-warmer-world-this-century>
<https://www.youtube.com/watch?v=sRGVTK-AAvw>
<https://www.youtube.com/watch?v=MVwmi7HCmSI>
<https://www.youtube.com/watch?v=AjZaFjXfLec>
<https://www.youtube.com/watch?v=m6pFDu7ILV4>
<https://www.youtube.com/watch?v=MVwmi7HCmSI>
<http://therightsofnature.org/universal-declaration/>



Figure 10.25: The award-winning author and activist Naomi Klein has emphasized that the climate crisis changes everything. Environmentalists and antiwar activists must unite! We need a new economic system! The people of the world don't want climate change; they want system change! The photo shows Naomi Klein in Warsaw Nov.20 2008, by Mariusz Kubik, (own work). [CC BY 3.0], Wikimedia Commons

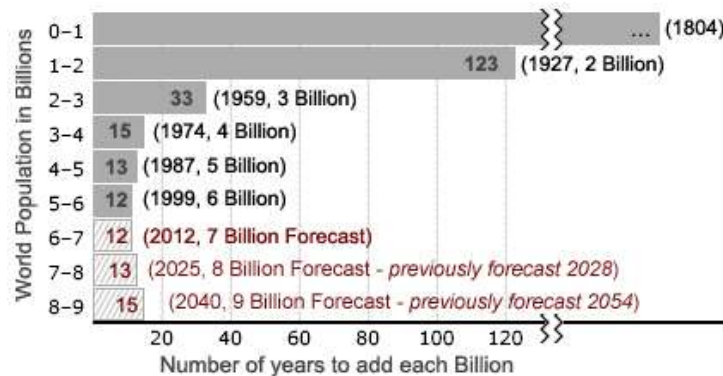


Figure 10.26: The years taken for every billion people to be added to the world's population, and the years that population was reached. (with future estimates). Updated from original version with improved annotation and all data (years) revised in light of currently known information published on World Population Milestones. Fully revised by BS based on original by User:ELT

We must stabilize and ultimately reduce the global population

According to the World Resources Institute and the United Nations Environment Programme, "It is estimated that since World War II, 1.2 billion hectares...[of agricultural land] has suffered at least moderate degradation as a result of human activity. This is a vast area, roughly the size of China and India combined." This area is 27% of the total area currently devoted to agriculture 5 . The report goes on to say that the degradation is greatest in Africa.

David Pimental and his associates at Cornell University pointed out in 1995 that "Because of erosion-associated loss of productivity and population growth, the per capita food supply has been reduced over the past 10 years and continues to fall. The Food and Agricultural Organization reports that the per capita production of grains which make up 80% of the world's food supply, has been declining since 1984."

Pimental et al. add that "Not only is the availability of cropland per capita decreasing as the world population grows, but arable land is being lost due to excessive pressure on the environment. For instance, during the past 40 years nearly one-third of the world's cropland (1.5 billion hectares) has been abandoned because of soil erosion and degradation. Most of the replacement has come from marginal land made available by removing forests. Agriculture accounts for 80% of the annual deforestation."

The phrase "developing countries" is more than a euphemism; it expresses the hope that with the help of a transfer of technology from the industrialized nations, all parts of the world can achieve prosperity. An important factor that prevents the achievement of worldwide prosperity is population growth.

In the words of Dr. Halfdan Mahler, former Director General of the World Health Organization, "Country after country has seen painfully achieved increases in total output, food production, health and educational facilities and employment opportunities reduced

or nullified by excessive population growth.”

The growth of population is linked to excessive urbanization, infrastructure failures and unemployment. In rural districts in the developing countries, family farms are often divided among a growing number of heirs until they can no longer be subdivided. Those family members who are no longer needed on the land have no alternative except migration to overcrowded cities, where the infrastructure is unable to cope so many new arrivals. Often the new migrants are forced to live in excrement-filled makeshift slums, where dysentery, hepatitis and typhoid are endemic, and where the conditions for human life sink to the lowest imaginable level. In Brazil, such shanty towns are called “favelas”.

If modern farming methods are introduced in rural areas while population growth continues, the exodus to cities is aggravated, since modern techniques are less labor-intensive and favor large farms. In cities, the development of adequate infrastructure requires time, and it becomes a hopeless task if populations are growing rapidly. Thus, population stabilization is a necessary first step for development.

It can be observed that birth rates fall as countries develop. However, development is sometimes blocked by the same high birth rates that economic progress might have prevented. In this situation (known as the “demographic trap”), economic gains disappear immediately because of the demands of an exploding population.

For countries caught in the demographic trap, government birth control programs are especially important, because one cannot rely on improved social conditions to slow birth rates. Since health and lowered birth rates should be linked, it is appropriate that family-planning should be an important part of programs for public health and economic development.

A recent study conducted by Robert F. Lapham of Demographic Health Surveys and W. Parker Maudlin of the Rockefeller Foundation has shown that the use of birth control is correlated both with socio-economic setting and with the existence of strong family-planning programs. The implication of this study is that even in the absence of increased living standards, family planning programs can be successful, provided they have strong government support.

Education of women and higher status for women are vitally important measures, not only for their own sake, but also because in many countries these social reforms have proved to be the key to lower birth rates. As Sir Partha Dasgupta of Cambridge University has pointed out, the changes needed to break the cycle of overpopulation and poverty are all desirable in themselves. Besides education and higher status for women, they include state-provided social security for old people, provision of water supplies near to dwellings, provision of health services to all, abolition of child labor and general economic development. The money required to make these desirable changes is a tiny fraction of the amount that is currently wasted on war.

In order to avoid a catastrophic future famine, it is vitally important that all of the countries of the world should quickly pass through a demographic transition from a situation characterized by high birth rates and high death rates to a new equilibrium, where low death rates are balanced by low birth rates.

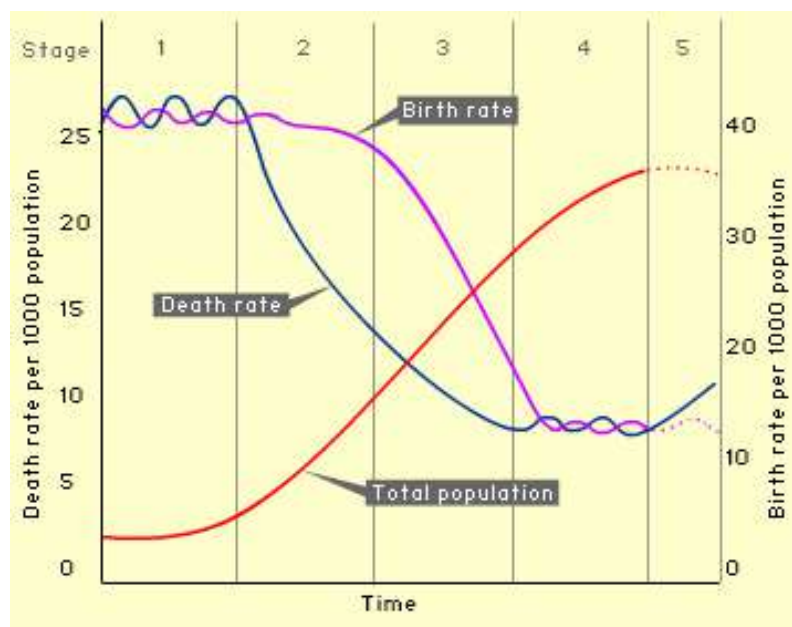


Figure 10.27: The demographic transition, from an equilibrium with high birth rates and high death rates to a new equilibrium where both birth and death rates are low. Author: en>User:Charmed88. Public domain, Wikimedia Commons

We must stop using material goods for social competition

In the future, population will continue to grow for some time. One hopes that the global population of humans population can be stabilized and gradually reduced instead of crashing catastrophically. In the meantime, in order to avoid an environmental megadisaster, we will have to reduce our consumption to what is actually necessary. It is important to recognize that many of the things that we buy are not actually needed to support life, but are used for social competition. The economist and sociologist Thorstein Veblen (1857-1929) recognized this fact, and he introduced the phrase “conspicuous consumption” to characterize the use of material goods for social competition. Modern advertisers agree with the correctness of Veblen’s insight, and they employ psychologists to compose advertisements that appeal specifically to the customer’s desire for higher social status.

The 19th century American writer, Henry David Thoreau (1817-1862), pioneered the concept of a simple life, in harmony with nature. Today, his classic book, *Walden*, has become a symbol for the principles of ecology, simplicity, and respect for nature. “Most of the luxuries”, Thoreau wrote, “and many of the so-called comforts of life, are not only not indispensable, but positive hindrances to the elevation of mankind. With respect to luxuries, the wisest have ever lived a more simple and meager life than the poor. The ancient philosophers, Chinese, Hindoo, Persian, and Greek, were a class than which none has been poorer in outward riches, none so rich in inward.”

It will be very difficult for humans to give up the use of material goods for social



Figure 10.28: Charles Darwin explained the evolution of the beautiful feathers of male peacocks by introducing sexual selection as a component of natural selection.

competition, since the tendency to do so is so much a part of our inherited emotional nature. Perhaps social competition (mating displays) can be shifted to non-material tests, such as the ability to make interesting and intelligent conversation, or ability in art or music.



Figure 10.29: The mating display of the superb bird of paradise



Figure 10.30: An expensive automobile can be viewed as a mating display.



Figure 10.31: Who has the biggest house? (Another form of social competition by means of material goods.)



Figure 10.32: An etching by Francisco Goya (1791-1818) from the series “The Disasters of War”. Public Domain, Wikimedia Commons

We must eliminate the institution of war

The problem of achieving internal peace over a large geographical area is not insoluble. It has already been solved. There exist today many nations or regions within each of which there is internal peace, and some of these are so large that they are almost worlds in themselves. One thinks of China, India, Brazil, Australia, the Russian Federation, the United States, and the European Union. Many of these enormous societies contain a variety of ethnic groups, a variety of religions and a variety of languages, as well as striking contrasts between wealth and poverty. If these great land areas have been forged into peaceful and cooperative societies, cannot the same methods of government be applied globally?

But what are the methods that nations use to achieve internal peace? Firstly, every true government needs to have the power to make and enforce laws that are binding on individual citizens. Secondly the power of taxation is a necessity. Thirdly, within their own territories, almost all nations have more military power than any of their subunits. For example, the US Army is more powerful than the State Militia of Illinois.

This unbalance of power contributes to the stability of the Federal Government of the United States. When the FBI wanted to arrest Al Capone, it did not have to bomb Chicago. Agents just went into the city and arrested the gangster. Even if Capone had been enormously popular in Illinois, the the government of the state would have realized in advance that it had no chance of resisting the US Federal Government, and it still would have allowed the “Feds” to make their arrest. Similar considerations hold for almost all nations within which there is internal peace. It is true that there are some nations within



Figure 10.33: **Building peace in the minds of men and women.** Source: UNESCO

which subnational groups have more power than the national government, but these are frequently characterized by civil wars.

Of the large land areas within which internal peace has been achieved, the European Union differs from the others because its member states still maintain powerful armies. The EU forms a realistic model for what can be achieved globally in the near future by reforming and strengthening the United Nations. In the distant future, however, we can imagine a time when a world federal authority will have much more power than any of its member states, and when national armies will have only the size needed to maintain local order.

Today there is a pressing need to enlarge the size of the political unit from the nation-state to the entire world. The need to do so results from the terrible dangers of modern weapons and from global economic interdependence. The progress of science has created this need, but science has also given us the means to enlarge the political unit: Our almost miraculous modern communications media, if properly used, have the power to weld all of humankind into a single supportive and cooperative society.

It is useful to consider the analogy between the institution of war and the institution of slavery. We might be tempted to say, "There has always been war, throughout human history; and war will always continue to exist." As an antidote to this kind of pessimism, we can think of slavery, which, like war, has existed throughout most of recorded history. The cultures of ancient Egypt, Greece and Rome were all based on slavery, and, in more recent times, millions of Africans were captured and forced into a life of slavery in the New World and the Middle East. Slavery was as much an accepted and established institution as war is today. Many people made large profits from slavery, just as arms manufacturers today make enormous profits. Nevertheless, despite the weight of vested interests, legal slavery has now been abolished throughout most of the world.

Today we look with horror at drawings of slave ships, where human beings were packed

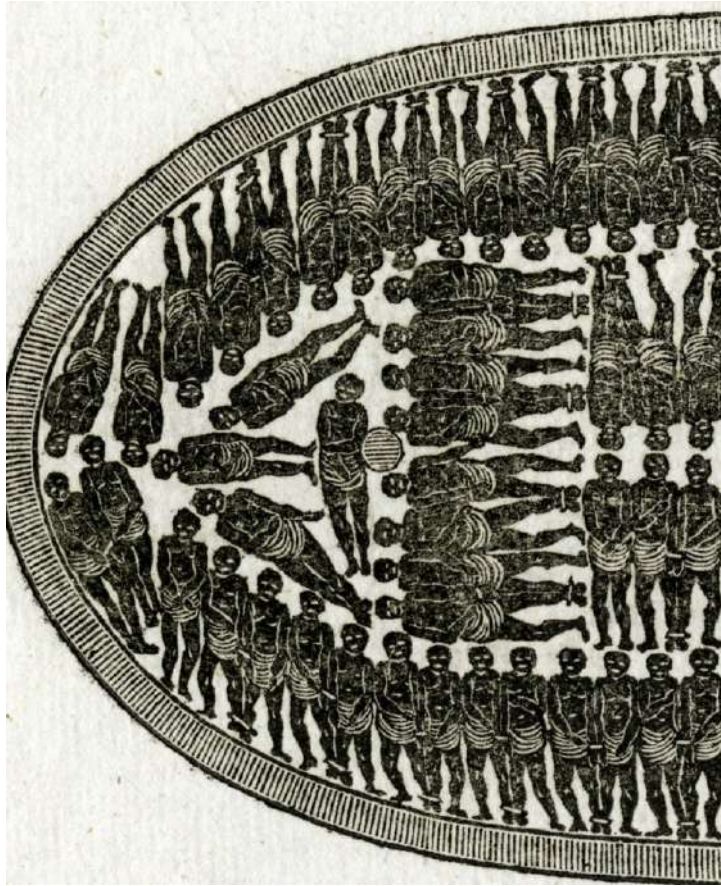


Figure 10.34: “Description of a slave ship”, by an anonymous artist, wood engraving. A model of the ship was used by William Wilberforce in the House of Commons. The example of the men and women who worked to rid the world of slavery can give us courage as we strive for a time when war will exist only as a dark memory fading into the past. Public domain, Wikimedia Commons

together like cord-wood, and we are amazed that such cruelty could have been possible. Can we not hope for a time when our descendants, reading descriptions of the wars of our own time, will be equally amazed that such cruelty and stupidity could have been possible? If we use them constructively, the vast resources now wasted on war can initiate a new era of happiness and prosperity for the family of man. It is within our power to let this happen. The example of the men and women who worked to rid the world of slavery can give us courage as we strive for a time when war will exist only as a dark memory fading into the past.

New ethics to match new technology

Modern science has, for the first time in history, offered humankind the possibility of a life of comfort, free from hunger and cold, and free from the constant threat of death through infectious disease. At the same time, science has given humans the power to obliterate their civilization with nuclear weapons, or to make the earth uninhabitable through overpopulation and pollution.

The question of which of these paths we choose is literally a matter of life or death for ourselves and our children. Will we use the discoveries of modern science constructively, and thus choose the path leading towards life? Or will we use science to produce more and more lethal weapons, which sooner or later, through a technical or human failure, may result in a catastrophic nuclear war? Will we thoughtlessly destroy our beautiful planet through unlimited growth of population and industry? The choice among these alternatives is ours to make. We live at a critical moment of history, a moment of crisis for civilization.

No one living today asked to be born at such a moment, but by an accident of birth, history has given us an enormous responsibility, and two daunting tasks: If civilization is to survive, we must not only stabilize the global population but also, even more importantly, we must eliminate the institution of war. We face these difficult tasks with an inherited emotional nature that has not changed much during the last 40,000 years. Furthermore, we face the challenges of the 21st century with an international political system based on the anachronistic concept of the absolutely sovereign nation-state. However, the human brain has shown itself to be capable of solving even the most profound and complex problems. The mind that has seen into the heart of the atom must not fail when confronted with paradoxes of the human heart.

We must replace the old world of international anarchy, chronic war and institutionalized injustice, by a new world of law. The United Nations Charter, the Universal Declaration of Human Rights and the International Criminal Court are steps in the right direction, but these institutions need to be greatly strengthened and reformed.²¹

²¹<http://www.countercurrents.org/zuesse050815.htm>
<https://www.youtube.com/watch?t=16&v=hDsPWmioSHg>
<http://www.commondreams.org/views/2014/04/14/us-oligarchy-not-democracy-says-scientific-study>
<http://www.treehugger.com/renewable-energy/striking-chart-showing-solar-power-will-take-over-world.html>

We also need a new global ethic, where loyalty to one's family and nation is supplemented by a higher loyalty to humanity as a whole. The Nobel laureate biochemist Albert Szent-Györgyi once wrote:

"The story of man consists of two parts, divided by the appearance of modern science.... In the first period, man lived in the world in which his species was born and to which his senses were adapted. In the second, man stepped into a new, cosmic world to which he was a complete stranger.... The forces at man's disposal were no longer terrestrial forces, of human dimension, but were cosmic forces, the forces which shaped the universe. The few hundred Fahrenheit degrees of our flimsy terrestrial fires were exchanged for the ten million degrees of the atomic reactions which heat the sun."

"This is but a beginning, with endless possibilities in both directions; a building of a human life of undreamt of wealth and dignity, or a sudden end in utmost misery. Man lives in a new cosmic world for which he was not made. His survival depends on how well and how fast he can adapt himself to it, rebuilding all his ideas, all his social and political institutions."

"...Modern science has abolished time and distance as factors separating nations. On our shrunken globe today, there is room for one group only: the family of man."

Suggestions for further reading

1. Naomi Klein, *This Changes Everything: Capitalism and the Climate*, Simon and Schuster, New York, (2014).
2. Naomi Klein, *The Shock Doctrine: The Rise of Disaster Capitalism*, Knopf Canada, (2007).
3. Noam Chomsky, *Because We Say So*, City Lights Open Media, (2015).
4. Noam Chomsky, *Democracy and Power: The Delhi Lectures*, Open Book Publishers, (2014).

<http://www.countercurrents.org/richard120815.htm>

http://priceofoil.org/content/uploads/2015/08/OCI-Untouchable_Arctic_FINAL.pdf

<http://priceofoil.org/2015/08/13/untouchable-the-climate-case-against-arctic-drilling/>

<http://www.commondreams.org/views/2015/08/14/untouchable-climate-case-against-arctic-drilling>

https://www.youtube.com/watch?t=124&v=9_LJpN893Vg

<http://americamagazine.org/content/all-things/which-candidate-quotes-pope-most>

<http://www.truth-out.org/news/item/32336-our-united-states-of-indebtedness>

<http://www.commondreams.org/news/2015/08/17/ahead-australia-visit-naomi-klein-brands-pm-abbott-climate-villain>

http://www.footprintnetwork.org/ecological_footprint_nations/

<http://ecowatch.com/2015/08/16/earth-overshoot-day/2/>

<http://www.commondreams.org/news/2015/08/18/islamic-declaration-blasts-short-sighted-capitalism-demands-action-climate>

<http://islamicclimatedeclaration.org/islamic-declaration-on-global-climate-change/>

<http://ecowatch.com/2015/06/29/dalai-lama-pope-encyclical/>

<http://www.theguardian.com/music/2015/jun/28/dalai-lama-glastonbury-verdict-isis-unthinkable>

<http://ecowatch.com/2015/07/02/naomi-klein-people-planet-first/>

5. Noam Chomsky, *Masters of Mankind: Essays and Lectures, 1969-2013*, Haymarket Books, (2014).
6. Noam Chomsky, *Nuclear War and Environmental Catastrophe*, Seven Stories Press, New York, (2013).
7. A. Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, Rodale Books, New York, (2006).
8. A. Gore, *Earth in the Balance: Forging a New Common Purpose*, Earthscan, (1992).
9. A.H. Ehrlich and P.R. Ehrlich, *Earth*, Thames and Methuen, (1987), Simon and Schuster, (1990).
10. P.R. Ehrlich and A.H. Ehrlich, *Healing the Planet: Strategies for Resolving the Environmental Crisis*, Addison-Wesley, (1991).
11. P.R. Ehrlich and A.H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens our Future*, Island Press, (1998).
12. P.R. Ehrlich and A.H. Ehrlich, *One With Nineveh: Politics, Consumption and the Human Future*, Island Press, (2004).
13. A.H. Ehrlich and U. Lele, *Humankind at the Crossroads: Building a Sustainable Food System*, in *Draft Report of the Pugwash Study Group: The World at the Crossroads*, Berlin, (1992).
14. P.R. Ehrlich, *The Population Bomb*, Sierra/Ballentine, New York, (1972).
15. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Human Ecology*, W.H. Freeman, San Francisco, (1972).
16. P.R. Ehrlich, A.H. Ehrlich and J. Holdren, *Ecoscience: Population, Resources, Environment*, W.H. Freeman, San Francisco, (1977).
17. P.R. Ehrlich and A.H. Ehrlich, *Extinction*, Victor Gollancz, London, (1982).
18. D.H. Meadows, D.L. Meadows, J. Randers, and W.W. Behrens III, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Books, New York, (1972).
19. D.H. Meadows et al., *Beyond the Limits. Confronting Global Collapse and Envisioning a Sustainable Future*, Chelsea Green Publishing, Post Mills, Vermont, (1992).
20. D.H. Meadows, J. Randers and D.L. Meadows, *Limits to Growth: the 30-Year Update*, Chelsea Green Publishing, White River Jct., VT 05001, (2004).
21. A. Peccei and D. Ikeda, *Before it is Too Late*, Kodansha International, Tokyo, (1984).
22. A. Peccei, *The Human Quality*, Pergamon Press, Oxford, (1977).
23. A. Peccei, *One Hundred Pages for the Future*, Pergamon Press, New York, (1977).
24. V.K. Smith, ed., *Scarcity and Growth Reconsidered*, Johns Hopkins University Press, Baltimore, (1979).
25. R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability*, Colombia University Press, New York, (1991).
26. M. McCarthy, *China Crisis: Threat to the Global Environment*, The Independent, (19 October, 2005).
27. L.R. Brown, *The Twenty-Ninth Day*, W.W. Norton, New York, (1978).
28. N. Myers, *The Sinking Ark*, Pergamon, New York, (1972).

29. N. Myers, *Conservation of Tropical Moist Forests*, National Academy of Sciences, Washington D.C., (1980).
30. National Academy of Sciences, *Energy and Climate*, NAS, Washington D.C., (1977).
31. W. Ophuls, *Ecology and the Politics of Scarcity*, W.H. Freeman, San Francisco, (1977).
32. E. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects*, W.W. Norton, New York, (1975).
33. E. Eckholm, *The Picture of Health: Environmental Sources of Disease*, New York, (1976).
34. Economic Commission for Europe, *Air Pollution Across Boundaries*, United Nations, New York, (1985).
35. G. Hagman and others, *Prevention is Better Than Cure*, Report on Human Environmental Disasters in the Third World, Swedish Red Cross, Stockholm, Stockholm, (1986).
36. G. Hardin, "The Tragedy of the Commons", *Science*, December 13, (1968).
37. K. Newland, *Infant Mortality and the Health of Societies*, Worldwatch Paper 47, Worldwatch Institute, Washington D.C., (1981).
38. D.W. Orr, *Ecological Literacy*, State University of New York Press, Albany, (1992).
39. E. Pestel, *Beyond the Limits to Growth*, Universe Books, New York, (1989).
40. D.C. Pirages and P.R. Ehrlich, *Ark II: Social Responses to Environmental Imperatives*, W.H. Freeman, San Francisco, (1974).
41. Population Reference Bureau, *World Population Data Sheet*, PRM, 777 Fourteenth Street NW, Washington D.C. 20007, (published annually).
42. R. Pressat, *Population*, Penguin Books Ltd., (1970).
43. M. Rechcigl (ed.), *Man/Food Equation*, Academic Press, New York, (1975).
44. J.C. Ryan, *Life Support: Conserving Biological Diversity*, Worldwatch Paper 108, Worldwatch Institute, Washington D.C., (1992).
45. J. Shepard, *The Politics of Starvation*, Carnegie Endowment for International Peace, Washington D.C., (1975).
46. B. Stokes, *Local Responses to Global Problems: A Key to Meeting Basic Human Needs*, Worldwatch Paper 17, Worldwatch Institute, Washington D.C., (1978).
47. L. Timberlake, *Only One Earth: Living for the Future*, BBC/ Earthscan, London, (1987).
48. UNEP, *Environmental Data Report*, Blackwell, Oxford, (published annually).
49. UNESCO, *International Coordinating Council of Man and the Biosphere*, MAB Report Series No. 58, Paris, (1985).
50. United Nations Fund for Population Activities, *A Bibliography of United Nations Publications on Population*, United Nations, New York, (1977).
51. United Nations Fund for Population Activities, *The State of World Population*, UNPF, 220 East 42nd Street, New York, 10017, (published annually).
52. United Nations Secretariat, *World Population Prospects Beyond the Year 2000*, U.N., New York, (1973).

53. J. van Klinken, *Het Dierde Punte*, Uitgiversmaatschappij J.H. Kok-Kampen, Netherlands (1989).
54. B. Ward and R. Dubos, *Only One Earth*, Penguin Books Ltd., (1973).
55. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
56. E.O. Wilson, *Sociobiology*, Harvard University Press, (1975).
57. E.O. Wilson (ed.), *Biodiversity*, National Academy Press, Washington D.C., (1988).
58. E.O. Wilson, *The Diversity of Life*, Allen Lane, The Penguin Press, London, (1992).
59. G. Woodwell (ed.), *The Earth in Transition: Patterns and Processes of Biotic Impoverishment*, Cambridge University Press, (1990).
60. World Resources Institute (WRI), *Global Biodiversity Strategy*, The World Conservation Union (IUCN), United Nations Environment Programme (UNEP), (1992).
61. World Resources Institute, *World Resources 200-2001: People and Ecosystems: The Fraying Web of Life*, WRI, Washington D.C., (2000).
62. D.W. Pearce and R.K. Turner, *Economics of Natural Resources and the Environment*, Johns Hopkins University Press, Baltimore, (1990).
63. T. Jackson, *Material Concerns: Pollution, Profit and the Quality of Life*, Routledge, (2004).
64. T. Jackson, *Motivating Sustainable Consumption*, Report to the Sustainable Development Research Network, January (2005).
65. T. Jackson, *The Earthscan Reader in Sustainable Consumption*, Earthscan, (2006).
66. J.S. Avery, *Information Theory and Evolution, 2nd Edition*, World Scientific, (2012).
67. A.J. Lotka, *Elements of Mathematical Biology*, Dover, (1956).
68. E.O. Wilson *Sociobiology: The New Synthesis*, Harvard University Press, (1975).
69. E.O. Wilson, *The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies*, W.W. Norton, (2009).
70. F. Soddy, *Wealth, Virtual Wealth and Debt. The solution of the economic paradox*, George Allen and Unwin, (1926).
71. F. Soddy, *The Role of Money*, George Routledge and Sons, London, (1934)
72. N. Georgescu-Roegen, *Energy and Economic Myths : Institutional and Analytical Economic Essays*, Pergamon Press, (1976).
73. N. Georgescu-Roegen, *The Entropy Law and the Economic Process*, Harvard University Press, (1971).
74. J. Rifkin and T. Howard, *Entropy: A New World View* The Viking Press, New York (1980).
75. P. Bartelmus, *Environment, Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, New York, (1994).
76. H.E. Daly and K.N. Townsend, (editors), *Valuing the Earth. Economics, Ecology, Ethics*, MIT Press, Cambridge, Massachusetts, (1993)
77. C. Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Paper 91, Worldwatch Institute, Washington D.C., (1989).
78. S.H. Schneider, *The Genesis Strategy: Climate and Global Survival*, Plenum Press, (1976).

79. WHO/UNFPA/UNICEF, *The Reproductive Health of Adolescents: A Strategy for Action*, World Health Organization, Geneva, (1989).
80. World Commission on Environment and Development, *Our Common Future*, Oxford University Press, (1987).
81. W. Jackson, *Man and the Environment*, W.C. Brown, Dubuque, Iowa, (1971).
82. T. Berry, *The Dream of the Earth*, Sierra Club Books, San Francisco, (1988).
83. T.M. Swanson, ed., *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*, Cambridge University Press, (1995).
84. F.H. Bormann, *Unlimited Growth: Growing, Growing, and Gone?*, *BioScience* 22: 706-9, (1972).
85. L.G. Brookes, *A Low-Energy Strategy for the United Kingdom*, *Atom* 269: 73-8, (1979).
86. J. Cherfas, *Skeptics and Visionaries Examine Energy Saving*, *Science* 251: 154-6, (1991).
87. C.J. Cleveland, *Energy Quality and Energy Surplus in the Extraction of Fossil Fuels in the US*, *Ecological Economics* 6: 139-S62, (1992).
88. C.J. Cleveland, Robert Costanza, Charlie A.S. Hall and Robert Kaufmann, *Energy and the US Economy: A Biophysical Perspective*, *Science* 225 (4665): 890-7, (1984).
89. P. Cloud, *Entropy, Materials, and Prosperity*, *Geologische Rundschau* 66: 678-96, (1978).
90. H.E. Daly, *From Empty-World Economics to Full-World Economics: Recognizing a Historical Turning Point in Economic Development*, in R. Goodland, H. E. Daly and S. Serafy (eds) *Population, Technology, and Lifestyle*, pp. 23-37. Washington, DC: Island Press, (1992).
91. H.E. Daly, *On Nicholas Georgescu-Roegen's Contributions to Economics: An Obituary Essay*, *Ecological Economics* 13: 149-54, (1995).
92. H.E. Daly, *Georgescu-Roegen versus Solow/Stiglitz*, *Ecological Economics* 22: 267-8, (1997).
93. M. Eigen, *Selforganization of Matter and the Evolution of Biological Macro- molecules*, *Naturwissenschaften* 58(10): 465-523, (1971).
94. S.O. Funtowicz and Jerry R. Ravetz, *Post Normal Science: A New Science for New Times*, *Scientific European* 266: 20-2, (1990).
95. N. Georgescu-Roegen, *Fixed Coefficients of Production and the Marginal Productivity Theory*, *Review of Economic Studies* 3: 40-9, (1935a).
96. N. Georgescu-Roegen, (1935b) *Note on a Proposition of Pareto*, *Quarterly Journal of Economics* 49: 706-14.
97. N. Georgescu-Roegen, *Marginal Utility of Money and Elasticities of Demand*, *Quarterly Journal of Economics* 50: 533-9, (1936a).
98. N. Georgescu-Roegen, *The Pure Theory of Consumer's Behavior*, *Quarterly Journal of Economics* 50: 545-93, (1936b).
99. N. Georgescu-Roegen, *Process in Farming versus Process in Manufacturing: A Problem of Balanced Development*, in U. Papi and C. Nunn (eds) *Economic Problems of Agriculture in Industrial Societies*, pp. 497-528. London: Macmillan, (1969).

100. N. Georgescu-Roegen, *The Entropy Law and the Economic Process*, Cambridge, MA: Harvard University Press, (1971).
101. N. Georgescu-Roegen, *Energy and Economic Myths*, Southern Economic Journal 41: 347-81, (1975).
102. N. Georgescu-Roegen, *Energy and Economic Myths*. New York: Pergamon Press, (1976).
103. N. Georgescu-Roegen, *Inequality, Limits and Growth from a Bioeconomic Viewpoint*, Review of Social Economy 35: 361-75, (1977a).
104. N. Georgescu-Roegen, *The Steady State and Ecological Salvation: A Thermodynamic Analysis*, BioScience 27: 266-70, (1977b).
105. N. Georgescu-Roegen, *Energy Analysis and Economic Valuation*, Southern Economic Journal 45: 1023-58, (1979a).
106. N. Georgescu-Roegen, *Methods in Economic Science*, Journal of Economic Issues 13 (2): 317-28, (1979b).
107. N. Georgescu-Roegen, *Methods in Economic Science: A Rejoinder*, Economic Issues 15: 188-93, (1981).
108. N. Georgescu-Roegen, *The Promethean Condition of Viable Technologies*, Materials and Society 7: 425-35, (1983).
109. Georgescu-Roegen, Nicholas, *Man and Production*, in M. Baranzini and R. Scazzieri (eds) Foundations of Economics: Structures of Inquiry and Economic Theory, pp. 247-80. Oxford: Basil Blackwell, (1986).
110. N. Georgescu-Roegen, *An Emigrant from a Developing Country: Autobiographical Notes-I*, Banca Nazionale del Lavoro Quarterly Review 164: 3-31, (1988a).
111. N. Georgescu-Roegen, *The Interplay between Institutional and Material Factors: The Problem and Its Status*, in J.A. Kregel, E. Matzner and A. Roncaglia (eds) Barriers to Employment, pp. 297-326. London: Macmillan, (1988b).
112. N. Georgescu-Roegen, *Production Process and Dynamic Economics*, in M. Baranzini and R. Scazzieri (eds) The Economic Theory of Structure and Change, pp. 198-226. Cambridge: Cambridge University Press, (1990).
113. N. Georgescu-Roegen, *Nicholas Georgescu-Roegen about Himself*, in M. Szenberg (ed.) Eminent Economists: Their Life Philosophies, pp. 128-59. Cambridge: Cambridge University Press, (1992).
114. J. Gever, Robert Kaufmann, David Skole and Charles V'or'somarty, *Beyond Oil: The Threat to Food and Fuel in the Coming Decades*, Niwot, CO: University Press of Colorado, (1991).
115. M. Giampietro, *Sustainability and Technological Development in Agriculture: A Critical Appraisal of Genetic Engineering*, BioScience 44(10): 677-89, (1994).
116. M. Giampietro and Kozo Mayumi, *Another View of Development, Ecological Degradation and North-South Trade*, Review of Social Economy 56: 21-37, (1998).
117. M. Giampietro and Kozo Mayumi, *The Biofuel Delusion: The Fallacy of Large Scale Agro-biofuel Production*, London: Earthscan, (2009).
118. R. Goldschmidt, *Some Aspects of Evolution*, Science 78: 539-47, (1933).
119. S.J. Gould, *The Return to Hopeful Monsters*, Natural History 86: 22-30, (1977).

120. S.J. Gould and Niles Eldredge, *Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered*, *Paleobiology* 3: 115-51, (1977).
121. J. Gowdy, *The Value of Biodiversity: Markets, Society and Ecosystems*, *Land Economics* 73(1): 25-41, (1997).
122. J. Gribbin, *The Death of the Sun* New York: Delacorte Press, (1980).
123. C.A.S. Hall, Cutler J. Cleveland and Robert Kaufman, *Energy and Resource Quality* New York: John Wiley and Sons, (1986).
124. S.R. Ichtiaque and Stephen H. Schneider, *Atmospheric Carbon Dioxide and Aerosols: Effects of Large Increases on Global Climate*, *Science* 173: 138-41, (1971).
125. K. Ito, *Setting Goals and Action Plan for Energy Efficiency Improvement*. Paper presented at the EAS Energy Efficiency and Conservation Conference, Tokyo (19 June), (2007).
126. F. Jevons, *Greenhouse: A Paradox*, *Search* 21: 171-2, (1990).
127. W.S. Jevons, *The Coal Question* (reprint of 3rd edn, 1906). New York: Augustus M. Kelley, (1965).
128. N. Kawamiya, *Entropii to Kougyoushakai no Sentaku (Entropy and Future Choices for the Industrial Society)*, Tokyo: Kaimei, (1983).
129. J.D. Khazzoom, *Economic Implications of Mandated Efficiency Standards for Household Appliances*, *Energy Journal* 1: 21-39, (1980).
130. J.D. Khazzoom, *Energy Saving Resulting from the Adoption of More Efficient Appliances*, *Energy Journal* 8: 85-9, (1987).
131. T.C. Koopmans, *Three Essays on the State of Economic Science*, New York: McGraw-Hill Book Company, (1957).
132. T.S. Kuhn, *The Structure of Scientific Revolutions*, Chicago, IL: The University of Chicago Press, (1962).
133. J. von Liebig, *Letters on Modern Agriculture* (J. Blyth ed.). New York: John Wiley, (1959).
134. A.J. Lotka, *Elements of Mathematical Biology*, New York: Dover Publications, (1956).
135. G. Luft, *Fueling the Dragon: China's Race Into the Oil Market*. <http://www.iags.org/china.htm>, (2007).
136. K. Mayumi, *The Origins of Ecological Economics: The Bioeconomics of Georgescu-Roegen*, London: Routledge, (2001).
137. K. Mayumi, *An Epistemological Critique of the Open Leontief Dynamic Model: Balanced and Sustained Growth, Delays, and Anticipatory Systems Theory*, *Structural Change and Economic Dynamics* 16: 540-56m (2005).
138. K. Mayumi, Mario Giampietro and John Gowdy, *Georgescu-Roegen/Daly versus Solow/Stiglitz Revisited*, *Ecological Economics* 27: 115-17. Legacies: Nicholas Georgescu-Roegen 1253, (1998).
139. W.H. Miernyk, *Economic Growth Theory and the Georgescu-Roegen Paradigm*, in K. Mayumi and J. Gowdy (eds) *Bioeconomics and Sustainability: Essays in Honour of Nicholas Georgescu-Roegen*, pp. 69-81. Cheltenham: Edward Elgar, (1999).
140. Newman, Peter, *Greenhouse, Oil and Cities*, *Futures* May: 335-48, (1991).

141. D. Pearce, *Substitution and Sustainability: Some Reflections on Georgescu-Roegen*, *Ecological Economics* 22: 295-7, (1997).
142. D. Pearce, Edward Barbier and Anil Markandya, *Sustainable Development*, Hampshire: Edward Elgar, (1990).
143. J. Polimeni, Kozo Mayumi, Mario Giampietro and Blake Alcott, *The Jevons Paradox and the Myth of Resource Efficiency Improvements*, London: Earthscan, (2008).
144. J.F. Randolph, *Basic Real and Abstract Analysis*, New York: Academic Press, (1968).
145. D. Ricardo, *On the Principles of Political Economy and Taxation*, in P. Sraffa (ed.) *The Works and Correspondence of David Ricardo*, Vol. 1. Cambridge: Cambridge University Press, (1951).
146. E. Schrödinger, *What is Life? With Mind and Matter and Autobiographical Sketches*, Cambridge: Cambridge University Press, (1967).
147. J.A. Schumpeter, *The Theory of Economic Development*, Cambridge, MA: Harvard Economic Press, (1951).
148. G.T. Seaborg, *The Erehwon Machine: Possibilities for Reconciling Goals by Way of New Technology*, in S.H. Schurr (ed.) *Energy, Economic Growth, and the Environment*, pp. 125-38. Baltimore, MD: Johns Hopkins University Press, (1972).
149. M.R. Simmons, *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* New Jersey: John Wiley and Sons, Inc., (2005).
150. B.J. Skinner, *Earth Resource (3rd edn)*, New Jersey: Prentice Hall, (1986).
151. V. Smil, *Global Catastrophes and Trends: The Next Fifty Years* Cambridge, MA: MIT Press, (2008).
152. R. Solow, *Technical Change and the Aggregate Production Function*, *Review of Economics and Statistics* 39: 312-20, (1957).
153. R. Solow, *The Economics of Resources or the Resources of Economics*, *American Economic Review* 64: 1-14, (1974).
154. R.E. Ulanowicz, *Growth and Development: Ecosystem Phenomenology* New York: Springer-Verlag, (1986).
155. US Geological Survey, *Commodity Statistics and Information*, (2005).
156. G.K. Zipf, *National Unity and Disunity: The Nation as a Bio-social Organism*. Bloomington, IN: Principia Press, (1941).

Appendix A

GODWIN

A.1 *Political Justice*

In 1793 the English novelist and philosopher William Godwin published an enormously optimistic book, *Political Justice*. As the eighteenth century neared its end, this book became the focus of hopes for political reform and the center of the debate on human progress. Godwin was lifted briefly to enormous heights of fame and adulation, from which he plunged, a few years later, into relative obscurity.

In *Political Justice*, Godwin predicted a future society where scientific progress would liberate humans from material want. Godwin predicted that in the future, with the institution of war abolished, with a more equal distribution of property, and with the help of scientific improvements in agriculture and industry, much less labour would be needed to support life. Luxuries are at present used to maintain artificial distinctions between the classes of society, Godwin wrote, but in the future values will change; humans will live more simply, and their efforts will be devoted to self-fulfillment and to intellectual and moral improvement, rather than to material possessions. With the help of automated agriculture, the citizens of a future society will need only a few hours a day to earn their bread.

Godwin went on to say, “The spirit of oppression, the spirit of servility and the spirit of fraud - these are the immediate growth of the established administration of property. They are alike hostile to intellectual improvement. The other vices of envy, malice, and revenge are their inseparable companions. In a state of society where men lived in the midst of plenty, and where all shared alike the bounties of nature, these sentiments would inevitably expire. The narrow principle of selfishness would vanish. No man being obliged to guard his little store, or provide with anxiety and pain for his restless wants, each would lose his own individual existence in the thought of the general good. No man would be the enemy of his neighbor, for they would have nothing to contend; and of consequence philanthropy would resume the empire which reason assigns her. Mind would be delivered from her perpetual anxiety about corporal support, and free to expatiate in the field of thought which is congenial to her. Each man would assist the inquiries of all.”

Godwin insisted that there is an indissoluble link between politics, ethics and knowledge. *Political Justice* is an enthusiastic vision of what humans could be like at some future period when the trend towards moral and intellectual improvement has lifted men and women above their present state of ignorance and vice. Much of the savage structure of the penal system would then be unnecessary, Godwin believed. (At the time when he was writing, there were more than a hundred capital offenses in England, and this number had soon increased to almost two hundred. The theft of any object of greater value than ten shillings was punishable by hanging.)

In its present state, Godwin wrote, society decrees that the majority of its citizens "should be kept in abject penury, rendered stupid with ignorance and disgusted with vice, perpetuated in nakedness and hunger, goaded to the commission of crimes, and made victims to the merciless laws which the rich have instituted to oppress them". But human behavior is produced by environment and education, Godwin pointed out. If the conditions of upbringing were improved, behavior would also improve. In fact, Godwin believed that men and women are subject to natural laws no less than the planets of Newton's solar system. "In the life of every human", Godwin wrote, "there is a chain of causes, generated in that eternity which preceded his birth, and going on in regular procession through the whole period of his existence, in consequence of which it was impossible for him to act in any instance otherwise than he has acted."

The chain of causality in human affairs implies that vice and crime should be regarded with the same attitude with which we regard disease. The causes of poverty, ignorance, vice and crime should be removed. Human failings should be cured rather than punished. With this in mind, Godwin wrote, "our disapprobation of vice will be of the same nature as our disapprobation of an infectious distemper."

With improved environment and education, humans will reach a higher moral level. But what is morality? Here Godwin draws heavily on his Christian background, especially on the moral principles of the Dissenting community. The Parable of the Good Samaritan illustrates the central principle of Christian ethics: We must love our neighbor as much as we love ourselves; but our neighbor is not necessarily a member of our immediate circle. He or she may be distant from us, in culture, in ethnic background or in geographical distance. Nevertheless, that person is still our neighbor, a member of the human family, and our duty to him or her is no less than our duty to those who are closest to us. It follows that narrow loyalties must be replaced or supplemented by loyalty to the interests of humanity as a whole.

Judging the benevolence of our actions is the responsibility of each individual conscience, Godwin says, not the responsibility of the State, and the individual must follow his or her conscience even if it conflicts with the dictates of the State. Each individual case should be judged by itself. If our institutions and laws meet the criteria of benevolence, justice and truth, we should give them our enthusiastic support; if not, we should struggle to change them. In giving personal judgement such a dominant role, Godwin anticipates the ideas of Thoreau, Tolstoy and Gandhi.

The exercise of individual judgement requires great honesty and objectivity. In order for the power of truth and reason to overcome prejudice and error, Godwin says, it is

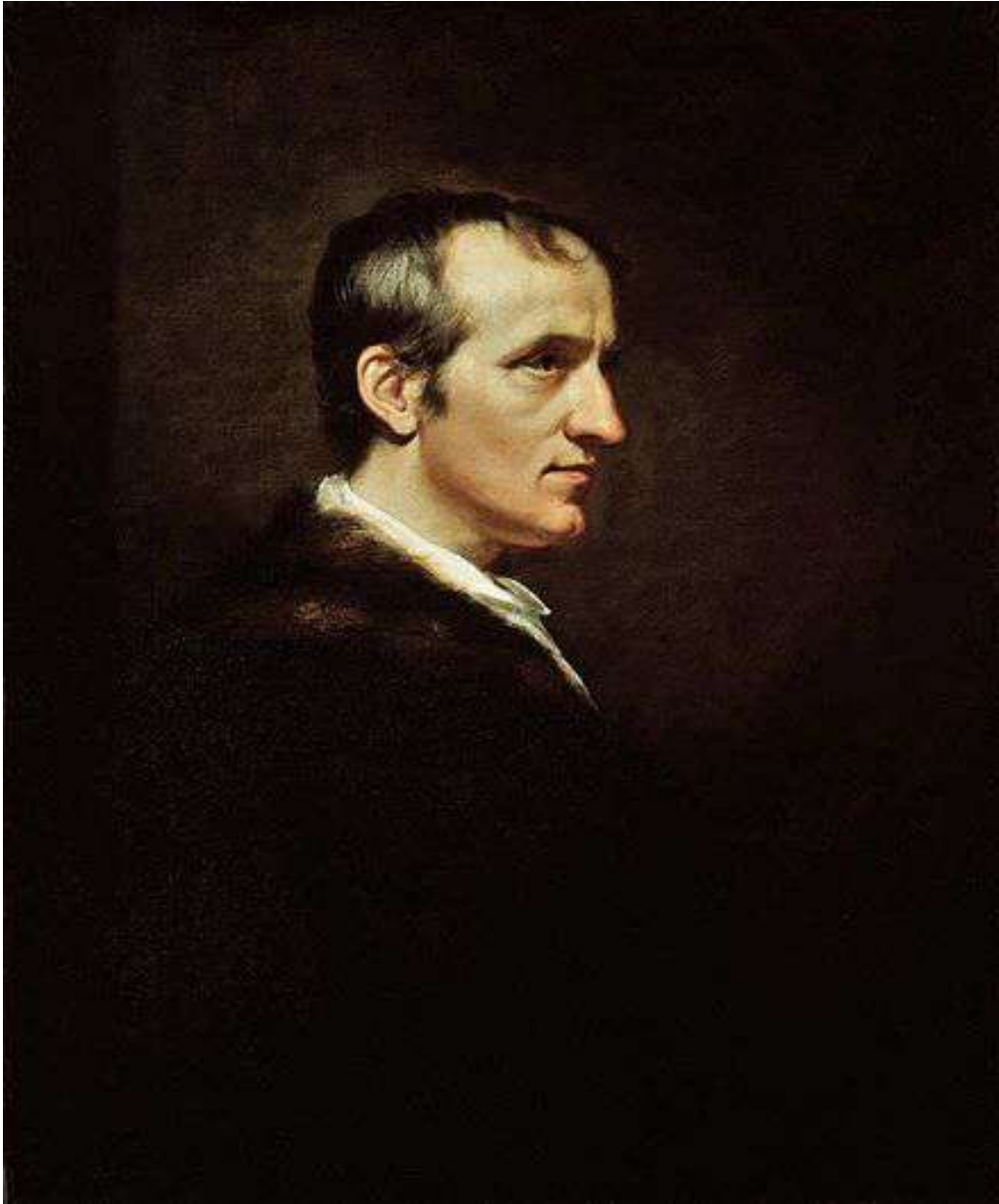


Figure A.1: *William Godwin in a painting by James Northcote (Wikipedia).*

necessary for each person always to speak and act with complete sincerity. Even the degree of insincerity necessary for elegant manners is wrong in Godwin's opinion.

Starting with these ethical principles, Godwin proceeds with almost mathematical logic to deduce the consequences, intoxicated by his enthusiasm and not stopping even when the conclusions to which he is driven conflict with conventional wisdom and intuition. For example, he denies that humans have rights and maintains that they only have duties.

Regarding the right to dispose of private property as one chooses, Godwin says: "To whom does any article, suppose a loaf of bread, justly belong? I have an hundred loaves in my possession, and in the next street there is a poor man expiring with hunger, to whom one of these loaves would be a means of preserving his life. If I withhold this loaf from him, am I not unjust? If I impart it, am I not complying with what justice demands?"

In other words, according to Godwin, our duty to act for the benefit of humanity implies a sacrifice of our private rights as individuals. Private property is not really our own, to be used as we wish; it is held in trust, to be used where it will do the greatest amount of good for humanity as a whole.

Godwin also denies that several commonly admired virtues really are virtues. Keeping promises, he says, is not a virtue because at any given moment we have a duty to do the greatest possible good through our actions. If an act is good, we should do it because we believe it to be good, not because we have promised to do it; and a promise should not force us to perform an act which we believe to be bad. A virtuous person therefore does not make promises. Similarly, Godwin maintains that gratitude is a vice since it distorts our judgement of the benevolence of our actions. When he heard of Godwin's doctrine on gratitude, Edmund Burke remarked "I would save him from that vice by not doing him any service!"

Godwin saw the system of promises, loyalty, and gratitude as a means by which individual judgement can be suspended and tyranny maintained. People can be forced to act against their consciences because of promises which they have made or services which they have received. An example of this is the suspension of private ethical judgement which follows a soldier's induction into an army. We should perform an act, Godwin maintains, not because of fear of punishment or hope of reward or in return for favors that we have received, but rather because we believe the act to be of the highest benefit to humanity as a whole.

Many of our political institutions may be needed now, Godwin said, because of mankind's present faults; but in the future, when humanity has reached a higher level of perfection, they will be needed less and less. The system of nation states might then be replaced by a loose federation of small communities, within each of which problems could be resolved by face-to-face discussion. Regarding this future ideal system, Godwin writes: "It is earnestly to be desired that each man was wise enough to govern himself without the interference of any compulsory restraint; and since government in its best state is an evil, the object principally to be aimed at is, that we should have as little of it as the general peace of human society will permit."

Political Justice is a vision or prophesy of what human life might be like, not in the world as it is but in an ideal world of the future. As Godwin's disciple, Percy Bysshe

Shelley, later expressed it in his verse-drama *Prometheus Unbound*,

*The loathsome mask has fallen, the man remains
Sceptreless, free, uncircumscribed, but man
Equal, unclassed, tribeless, and nationless,
Exempt from awe, worship, degree, the king
Over himself; just, gentle, wise...*

A.2 Enormous instant fame; The New Philosophy

The quarto edition of *Political Justice* was a best seller and the book was soon republished in a less expensive octavo edition which sold equally well. It was pirated in Ireland, Scotland, and America and hundreds of groups of workers who could not afford to buy the book individually bought joint copies, which then circulated among the subscribers or were read aloud to groups. The doctrines advocated in *Political Justice* were soon being called the “New Philosophy”.

Godwin became famous overnight: “I was nowhere a stranger”, he wrote later, “...I was everywhere received with curiosity and kindness. If temporary fame ever was an object worthy to be coveted by the human mind, I certainly obtained it in a degree that has seldom been exceeded.”

Godwin’s friend, the essayist William Hazlitt, described this sudden burst of fame in the following words: “... he blazed as a sun in the firmament of reputation; no-one was more talked of, more looked up to, more sought after, and wherever liberty, truth, justice was the theme, his name was not far off”.

William Wordsworth read *Political Justice* in 1794 and was greatly influenced by it. Between February and August 1795, Wordsworth met Godwin seven times for long private discussions. Much of Wordsworth’s writing from the Great Decade shows the mark of Godwin’s ideas, as can be seen, for example in the following lines from *The Prelude*:

*How glorious! in self-knowledge and self-rule,
To look through all the frailties of the world,
And, with a resolute mastery shaking off
Infirmities of nature, time and place,
Build social upon personal Liberty,
Which, to the blind restraints of general laws
Superior, magisterially adopts
One guide, the light of circumstances, flashed
Upon an independent intellect*

A.3 *Things as they are*

On 26 May 1794, Godwin added to his already great reputation by publishing a powerful and original psychological novel, *Things as They Are*, later renamed *Caleb Williams*. Godwin's purpose in writing this novel was to illustrate some of the themes of *Political Justice* and to bring his ideas to readers who might not be directly interested in philosophy.

In *Caleb Williams*, Godwin makes several literary innovations which were to influence such writers as Edgar Allan Poe, Charles Dickens, Balzac, and Victor Hugo. *Caleb Williams* is, in fact, the ancestor of the modern thriller and detective story.

A.4 A few hangings needed to cast a chill over discussion

Godwin had written a Preface to *Caleb Williams* in which he said: "The question now afloat in the world respecting THINGS AS THEY ARE, is the most interesting which can be presented to the human mind. While one party pleads for reformation and change, the other extols in the warmest terms the existing constitution of society... It is now known to philosophers that the spirit and character of a government intrudes itself into every rank of society. But this is a truth highly worthy to be communicated to persons whom books of philosophy and science are never likely to reach. Accordingly it was proposed in the invention of the following work, to comprehend, as far as the progressive nature of a single story would allow, a general review of the modes of domestic and unrecorded tyranny." .

This Preface was never printed, because Godwin's publisher, Crosby, was afraid of prosecution. In fact, the publication of *Caleb Williams* coincided with a decision by Pitt's government that a few hangings were needed in order to cast a chill on public discussion of political reform. On the day of publication, orders went out for the arrest of Godwin's friends in the reform movement, Hardy, Thelwall, and Horne Tooke. Although the radical leaders were arrested in May, *habeas corpus* was suspended, and it was not until 2 October 1794 that a charge was brought against them. A few days later, on a trip to Warwickshire, Godwin heard that his closest friend, Thomas Holcroft, also had been arrested.

Godwin hurried back to London and locked himself in his home, studying the charges that had been brought by Lord Chief Justice Eyre against Holcroft and the others. The charge was high treason and the law under which Eyre brought this charge had been passed in the fourteenth century, during the reign of Edward III. It defined high treason as any act which could "compass or imagine the Death of a King". The penalty for this offense was to be hanged by the neck, to be cut down while still living, to be disembowelled, to have one's bowels burnt before one's eyes, and then to be beheaded and quartered. It was rumored that as soon as the 12 prisoners were convicted, 800 further arrest warrants were ready to go out and Godwin's own name might well have been among them.

Godwin soon saw that Eyre's argument involved an unprecedented broadening of the definition of high treason. Essentially Eyre was arguing that the actions of the accused might cause events in England to follow the same course as in France, where Louis XVI

had recently been executed. On 21 October Godwin published an anonymous article in the *Morning Chronicle* entitled *Cursory Strictures on the Charge Delivered by Lord Chief Justice Eyre*. It was a carefully written legal argument, completely different in style from anything that Godwin had written previously. In this article, he argued that in broadening the interpretation of high treason without precedent, Eyre was in effect creating a new law and judging the prisoners *ex post facto*. It was especially necessary for high treason to have a narrow definition, Godwin pointed out, since a broad definition could lead to the abridgement of all English civil liberties.

After the publication of *Cursory Strictures* it became clear to everyone that Eyre's charge lay outside the boundary of the law and that it would probably not be upheld. Nevertheless, the atmosphere in the courtroom was tense as the jury returned its verdicts. As soon as Holcroft was acquitted, he left the dock and went to sit beside Godwin. The artist, Sir Thomas Lawrence, made a sketch of the two friends sitting side-by-side and waiting for the verdict on the other prisoners, Godwin's bending and contemplative figure contrasting with Holcroft's upright and defiant stance. In the end, all charges were dropped.

A.5 William and Mary

Soon after these dramatic events, William Godwin met Mary Wollstonecraft for a second time. On 8 January 1796, Mary Hayes, a friend and admirer of Mary Wollstonecraft, invited her to tea together with William Godwin and Thomas Holcroft. The tea was a success, and Godwin found Mary Wollstonecraft very much changed from the carelessly dressed and irritating woman who had dominated the conversation at Johnson's dinner when he had wanted to hear Thomas Paine. Now, several years later, she had become much more attractive. Mary's beauty and her charming, intelligent conversation won Godwin's heart. He also greatly admired her recently published book, *Letters Written during a Short Residence in Sweden, Norway and Denmark*.

On 13 February, Godwin called on Mary Wollstonecraft, but she was not at home. On 14 April, she broke the social rules of the time and returned his call. During the next few months they often appeared together at literary and artistic dinners in London. They had many friends in common and both of them had many admirers of the opposite sex. Godwin was not a tall man and his nose was rather large. On the other hand, he had fine eyes and a high, impressive brow; his manners had become more gallant and fame is a powerful aphrodisiac. A number of attractive intellectual women fluttered around him. Mary's admirers included the poet Robert Southey, the distinguished artist John Opie, and Godwin's closest friend, Thomas Holcroft.

Gradually, during the spring and summer of 1796, the friendship between Mary Wollstonecraft and William Godwin deepened into love. Outwardly, nothing was changed. Both partners were hard at work, Godwin preparing a new edition of *Political Justice* and Mary writing a novel, *The Wrongs of Woman*. Like *Caleb Williams*, Mary's novel was designed to illustrate the themes of the New Philosophy. They kept their relationship a secret, continued to live separately, and continued to meet their friends as before, but they

had become lovers. For Godwin, this was the first real love affair of his life and he was at first very awkward, afraid of the strong emotions he was experiencing. Mary tenderly and good-humouredly guided him through his difficulties.

As winter approached, a crisis occurred: Johnson, Mary's publisher insisted that she should settle her debts and refused to give her more credit. At the same time, Mary realized that she was pregnant. She had experienced some of the harsh penalties with which English society of that time punished unwed mothers. Many of her former friends had dropped away. Her remaining friends called her Mrs Imlay, maintaining the fiction that she had been legally married; but with the new baby no such cover would be possible. Johnson offered a solution: He knew of a rich but somewhat elderly admirer who was willing to solve all of Mary's problems, both financial and social, by marrying her. Mary felt insulted and would not hear of this solution. In her books she had often denounced marriage for the sake of property as "legalized prostitution". Instead, she asked Godwin to marry her. He did this in spite of his own disapproval of the institution of marriage as practised at that time in Europe, an institution which he had called "the most odious of all monopolies".

Godwin and Mary were in fact extremely happy together. They were not at all alike: He relied on reason, while she placed more trust in her emotions. These differences meant that each revealed a new world for the other. For Godwin, Mary opened a world of strong feelings; and he acquired from her a taste for the writings of Rousseau, whom she called "the Prometheus of Sentiment". Godwin was never the same again. All his later novels and books of philosophy were to stress the importance of domestic affections and sensitivity to the force of emotion.

A.6 Mary's tragic death in childbirth

Mary's baby was due at the end of August 1797. She insisted that no doctor was needed, only a midwife. After a long labour, she gave birth to a baby girl at 11 p.m. and Godwin was overjoyed that all had gone well. However, at 2 a.m. the midwife warned Godwin that his wife was still in danger, since the afterbirth had not yet appeared. A doctor was sent for; and following the accepted medical practice of the time, he removed the afterbirth surgically. Mary at first seemed to be recovering well; but in a few days it became clear that she was fatally ill with an infection, very likely the result of the operation to remove the afterbirth. On 10 September she died, brave and affectionate to the end. In her last words, she spoke of Godwin as "the kindest, best man in the world".

Godwin was left heartbroken by Mary's death. In a letter to Holcroft he wrote: "My wife is now dead. I firmly believe that there does not exist her equal in the world. I know from experience that we were formed to make each other happy. I have not the least expectation that I can now ever know happiness again". In his sorrow, he sat rereading Mary's books and letters, seeming to hear her voice again through the words that she had written.

Soon Godwin found consolation for his grief by editing the unpublished works of his

dead wife and by writing her biography. Believing strongly in the principle of absolute honesty, he tried to describe her life and work as simply and as accurately as he could, not hiding her human weaknesses, but at the same time doing full justice to her stature as a great pioneer of woman's rights. He included her letters to Imlay, and a description of an affair between Mary and the Swiss artist Fuseli, which had taken place before her departure for France.

On 29 January 1798, Johnson published Godwin's *Memoirs of the Author of the Vindication of the Rights of Woman*, together with four small volumes of Mary's posthumous works, including her unfinished novel, *The Wrongs of Woman*.

A.7 The wave of hope crashes down

Godwin's moving and honest portrait of his wife is one of his most enduring and readable books but its honesty shocked his contemporaries more than anything else that he had written. The European Magazine, for example, said that it would be read "with disgust by every female who has any pretensions to delicacy; with detestation by everyone attached to the interests of religion and morality; and with indignation by any one who might feel any regard for the unhappy woman, whose frailties should have been buried in oblivion".

This reaction against the *Memoirs* was part of a much more general reaction against all liberal ideas. In 1798, Napoleon's armies were victorious on the continent, and the French were massing their forces for an invasion of England. Napoleon believed that the ordinary people of England would welcome him as a liberator and, in fact, the English government was facing a mutiny in its own navy, massive riots, and rebellion in Ireland. The Establishment was fighting for its life and was not in the mood to make fine distinctions about whether the blows that it struck were above or below the belt. Pitt and Grenville had already introduced the "Gagging Acts", which effectively put an end to freedom of speech and assembly. The government now sponsored, by means of a secret subsidy, the *Anti-Jacobin Review*, a periodical which savagely attacked all of the leading liberals in turn, including both William and Mary.

Godwin had been carried to great heights by the wave of hope which accompanied the French Revolution; and as the wave crashed he was carried down with it. Despite the abuse and ridicule which were increasingly heaped upon him, he maintained a philosophical attitude, confident that he had already made a permanent contribution to the idea of human progress. His ideas, and those of his pioneering wife Mary Wollstonecraft, can speak to our present dangerous situation.

Appendix B

CONDORCET

B.1 A vision of human progress

In France the Marquis de Condorcet had written an equally optimistic book, *Esquisse d'un Tableau Historique des Progrès de l'Esprit Humain*. Condorcet's optimism was unaffected even by the fact that at the time when he was writing he was in hiding, under sentence of death by Robespierre's government. Like Godwin's *Political Justice*, this book offers an optimistic vision of how human society can be improved. Together, the two books provoked Malthus to write his book on population.

B.2 Condorcet becomes a mathematician

Marie-Jean-Antoine-Nicolas Caritat, Marquis de Condorcet, was born in 1743 in the town of Ribemont in southern France. He was born into an ancient and noble family of the principality of Orange but there was nothing in his background to suggest that he might one day become a famous scientist and social philosopher. In fact, for several generations before, most of the men in the family had followed military or ecclesiastical careers and none were scholars.

After an initial education received at home from his mother, Condorcet was sent to his uncle, the Bishop of Lisieux, who provided a Jesuit tutor for the boy. In 1758 Condorcet continued his studies with the Jesuits at the College of Navarre. After he graduated from the College, Condorcet's powerful and independent intelligence suddenly asserted itself. He announced that he intended to study mathematics. His family was unanimously and violently opposed to this idea. The privileges of the nobility were based on hereditary power and on a static society. Science, with its emphasis on individual talent and on progress, undermined both these principles. The opposition of Condorcet's family is therefore understandable but he persisted until they gave in.

From 1765 to 1774, Condorcet focused on science. In 1765, he published his first work on mathematics entitled *Essai sur le calcul intégral*, which was well received, launching his career as a mathematician. He would go on to publish many more papers, and in 1769, at

the age of 26, he was elected to the Academie royale des Sciences (French Royal Academy of Sciences)

Condorcet worked with Leonhard Euler and Benjamin Franklin. He soon became an honorary member of many foreign academies and philosophic societies including the Royal Swedish Academy of Sciences (1785), Foreign Honorary Member of the American Academy of Arts and Sciences (1792), and also in Prussia and Russia.

B.3 Human rights and scientific sociology

In 1774, at the age of 31, Condorcet was appointed Inspector-General of the Paris Mint by his friend, the economist Turgot. From this point on, Condorcet shifted his focus from the purely mathematical to philosophy and political matters. In the following years, he took up the defense of human rights in general, and of women's and blacks' rights in particular (an abolitionist, he became active in the Society of the Friends of the Blacks in the 1780s). He supported the ideals embodied by the newly formed United States, and proposed projects of political, administrative and economic reforms intended to transform France.

The year 1785 saw the publication of Condorcet's highly original mathematical work, *Essai sur l'application de l'analyse à la probabilité des décisions rendues à la pluralité des voix*, in which he pioneered the application of the theory of probability in the social sciences. A later, much enlarged, edition of this book extended the applications to games of chance. Through these highly original works, Condorcet became a pioneer of scientific sociology.

In 1786, Condorcet married one of the most beautiful women of the time, Sophie de Grouchy (1764-1822). Condorcet's position as Inspector-General of the Mint meant that they lived at the Hotel des Monnaies. Mme Condorcet's salon there was famous.



Figure B.1: The Marquis de Condorcet (public domain).

B.4 The French Revolution

Ever since the age of 17, Condorcet had thought about questions of justice and virtue and especially about how it is in our own interest to be both just and virtuous. Very early in his life he had been occupied with the idea of human perfectibility. He was convinced that the primary duty of every person is to contribute as much as possible to the development of mankind, and that by making such a contribution, one can also achieve the greatest possible personal happiness. When the French Revolution broke out in 1789 he saw it as an unprecedented opportunity to do his part in the cause of progress and he entered the arena wholeheartedly.

Condorcet was first elected as a member of the Municipality of Paris; and then, in 1791, he became one of the six Commissioners of the Treasury. Soon afterwards he was elected to the Legislative Assembly, of which he became first the Secretary and finally the President. In 1792, Condorcet proposed to the Assembly that all patents of nobility should be burned. The motion was carried unanimously; and on 19 June his own documents were thrown on a fire with the others at the foot of a statue of Louis XIV.

Condorcet was one of the chief authors of the proclamation which declared France to be a republic and which summoned a National Convention. As he remained above the personal political quarrels that were raging at the time, Condorcet was elected to the National Convention by five different constituencies. When the Convention brought Louis XVI to trial, Condorcet maintained that, according to the constitution, the monarch was inviolable and that the Convention therefore had no legal right to try the King. When the King was tried despite these protests, Condorcet voted in favor of an appeal to the people.

B.5 Drafting a new constitution for France

In October 1792, when the Convention set up a Committee of Nine to draft a new constitution for France, Condorcet sat on this committee as did the Englishman, Thomas Paine. Under sentence of death in England for publishing his pamphlet *The Rights of Man*, Paine had fled to France and had become a French citizen. He and Condorcet were the chief authors of a moderate (Gerondist) draft of the constitution. However, the Jacobin leader, Robespierre, bitterly resented being excluded from the Committee of Nine and, when the Convention then gave the responsibility for drafting the new constitution to the Committee for Public Safety, which was enlarged for this purpose by five additional members. The result was a hastily produced document with many glaring defects. When it was presented to the Convention, however, it was accepted almost without discussion. This was too much for Condorcet to stomach and he published anonymously a letter entitled *Advice to the French on the New Constitution*, in which he exposed the defects of the Jacobin constitution and urged all Frenchmen to reject it.

B.6 Hiding from Robespierre's Terror

Condorcet's authorship of this letter was discovered and treated as an act of treason. On 8 July 1793, Condorcet was denounced in the Convention; and an order was sent out for his arrest. The officers tried to find him, first at his town house and then at his house in the country but, warned by a friend, Condorcet had gone into hiding.

The house where Condorcet took refuge was at Rue Servandoni, a small street in Paris leading down to the Luxembourg Gardens, and it was owned by Madame Vernet, the widow of a sculptor. Madame Vernet, who sometimes kept lodgings for students, had been asked by Condorcet's friends whether she would be willing to shelter a proscribed man. 'Is he a good man?', she had asked; and when assured that this was the case, she had said, 'Then let him come at once. You can tell me his name later. Don't waste even a moment. While we are speaking, he may be arrested.' She did not hesitate, although she knew that she risked death, the penalty imposed by the Convention for sheltering a proscribed man.

B.7 Condorcet writes the *Esquisse*

Although Robespierre's agents had been unable to arrest him, Condorcet was sentenced to the guillotine *in absentia*. He knew that in all probability he had only a few weeks or months to live and he began to write his last thoughts, racing against time. Hidden in the house at Rue Servandoni, and cared for by Madame Vernet, Condorcet returned to a project which he had begun in 1772, a history of the progress of human thought, stretching from the remote past to the distant future. Guessing that he would not have time to complete the full-scale work he had once planned, he began a sketch or outline: *Esquisse d'un Tableau Historique des progrès de l'Esprit Humain*.

Condorcet's *Esquisse*, is an enthusiastic endorsement of the idea of infinite human perfectibility which was current among the philosophers of the 18th century, and in this book, Condorcet anticipated many of the evolutionary ideas of Charles Darwin. He compared humans with animals, and found many common traits. Condorcet believed that animals are able to think, and even to think rationally, although their thoughts are extremely simple compared with those of humans. He also asserted that humans historically began their existence on the same level as animals and gradually developed to their present state.

Since this evolution took place historically, he reasoned, it is probable, or even inevitable, that a similar evolution in the future will bring mankind to a level of physical, mental and moral development which will be as superior to our own present state as we are now superior to animals.

In his *Esquisse*, Condorcet called attention to the unusually long period of dependency which characterize the growth and education of human offspring. This prolonged childhood is unique among living beings. It is needed for the high level of mental development of the human species; but it requires a stable family structure to protect the young during their long upbringing. Thus, according to Condorcet, biological evolution brought into existence a moral precept, the sanctity of the family.

Similarly, Condorcet maintained, larger associations of humans would have been impossible without some degree of altruism and sensitivity to the suffering of others incorporated into human behavior, either as instincts or as moral precepts or both; and thus the evolution of organized society entailed the development of sensibility and morality.

Condorcet believed that ignorance and error are responsible for vice; and he listed what he regarded as the main mistakes of civilization: hereditary transmission of power, inequality between men and women, religious bigotry, disease, war, slavery, economic inequality, and the division of humanity into mutually exclusive linguistic groups.

Condorcet believed the hereditary transmission of power to be the source of much of the tyranny under which humans suffer; and he looked forward to an era when republican governments would be established throughout the world. Turning to the inequality between men and women, Condorcet wrote that he could see no moral, physical or intellectual basis for it. He called for complete social, legal, and educational equality between the sexes.

Condorcet predicted that the progress of medical science would free humans from the worst ravages of disease. Furthermore, he maintained that since perfectibility (i.e. evolution) operates throughout the biological world, there is no reason why mankind's physical structure might not gradually improve, with the result that human life in the remote future could be greatly prolonged. Condorcet believed that the intellectual and moral facilities of man are capable of continuous and steady improvement; and he thought that one of the most important results of this improvement will be the abolition of war.

At the end of his *Esquisse*, Condorcet said that any person who has contributed to the progress of mankind to the best of his ability becomes immune to personal disaster and suffering. He knows that human progress is inevitable and can take comfort and courage from his inner picture of the epic march of mankind, through history, towards a better future.

Shortly after Condorcet completed the *Esquisse*, he received a mysterious warning that soldiers of the Convention were on their way to inspect Madame Vernet's house. Wishing to spare his generous hostess from danger, he disguised himself as well as he could and slipped past the portress. However, Condorcet had only gone a few steps outside the house when he was recognized by Madame Verdet's cousin, who risked his life to guide Condorcet past the sentinels at the gates of Paris, and into the open country beyond.

Condorcet wandered for several days without food or shelter, hiding himself in quarries and thickets. Finally, on 27 March 1794, hunger forced him to enter a tavern at the village of Clamart, where he ordered an omelette. When asked how many eggs it should contain, the exhausted and starving philosopher replied without thinking, 'twelve'. This reply, together with his appearance, excited suspicion. He was asked for his papers and, when it was found that he had none, soldiers were sent for and he was arrested. He was taken to a prison at Bourg-la-Reine, but he was so weak that he was unable to walk there, and had to be carried in a cart. The next morning, Condorcet was found dead on the floor of his cell. The cause of his death is not known with certainty. It was listed in official documents as congestion sanguine, congestion of the blood but the real cause may have been cold, hunger, exhaustion or poison. Many historians believe that Condorcet was murdered by Robespierre's agents, since he was so popular that a public execution would have been

impossible.

After Condorcet's death the currents of revolutionary politics shifted direction. Robespierre, the leader of the Terror, was himself soon arrested. The execution of Robespierre took place on 25 July 1794, only a few months after the death of Condorcet.

Condorcet's *Esquisse d'un Tableau Historique des Progrès de l'Esprit Humain* was published posthumously in 1795. In the post-Thermidor reconstruction, the Convention voted funds to have it printed in a large edition and distributed throughout France, thus adopting the *Esquisse* as its official manifesto. Condorcet's name will always be linked with this small prophetic book. It was destined to establish the form in which the eighteenth-century idea of progress was incorporated into Western thought, and (as was mentioned in Chapter 1) it provoked Robert Malthus to write *An Essay on the Principle of Population*.

B.8 Condorcet's *On the Admission of Women to the Rights of Citizenship* (1790)

Custom may familiarise mankind with the extent, that even among those who have violation of their natural rights to such an lost or been deprived of these rights, no one thinks of reclaiming them, or is even conscious that they have suffered any injustice.

Certain of these violations (of natural right) have escaped the notice of philosophers and legislators, even while concerning themselves zealously to establish the common rights of individuals of the human race, and in this way to lay the foundation of political institutions. For example, have they not all violated the principle of the equality of rights in tranquilly depriving one-half of the human race of the right of taking part in the formation of laws by the exclusion of women from the rights of citizenship? Could there be a stronger proof of the power of habit, even among enlightened men, than to hear invoked the principle of equal rights in favour of perhaps some 300 or 400 men, who had been deprived of it by an absurd prejudice, and forget it when it concerns some 12,000,000 women?

To show that this exclusion is not an act of tyranny, it must be proved either that the natural rights of women are not absolutely the same as those of men, or that women are not capable of exercising these rights.

But the rights of men result simply from the fact that they are rational, sentient beings, susceptible of acquiring ideas of morality, and of reasoning concerning those ideas. Women having, then, the same qualities, have necessarily the same rights. Either no individual of the human species has any true rights, or all have the same; and he or she who votes against the [6] rights of another, whatever may be his or her religion, colour, or sex, has by that fact abjured his own.

It would be difficult to prove that women are incapable of exercising the rights of citizenship. Although liable to become mothers of families, and exposed to other passing indispositions, why may they not exercise rights of which it has never been proposed to deprive those persons who periodically suffer from gout, bronchitis, etc.? Admitting for the moment that there exists in men a superiority of mind, which is not the necessary result of

a difference of education (which is by no means proved, but which should be, to permit of women being deprived of a natural right without injustice), this inferiority can only consist in two points. It is said that no woman has made any important discovery in science, or has given any proofs of the possession of genius in arts, literature, etc.; but, on the other hand, it is not pretended that the rights of citizenship should be accorded only to men of genius. It is added that no woman has the same extent of knowledge, the same power of reasoning, as certain men; but what results from that? Only this, that with the exception of a limited number of exceptionally enlightened men, equality is absolute between women and the remainder of the men; that this small class apart, inferiority and superiority are equally divided between the two sexes. But since it would be completely absurd to restrict to this superior class the rights of citizenship and the power of being entrusted with public functions, why should women be excluded any more than those men who are inferior to a great number of women? Lastly, shall it be said that there exists in the minds and hearts of women certain qualities which ought to exclude them from the enjoyment of their natural rights? Let us interrogate the facts. Elizabeth of England, Maria Theresa, the two Catharines of Russia - have they not shown that neither in courage nor in strength of mind are women wanting?

Elizabeth possessed all the failings of women. Did these failings work more harm during her reign than resulted from the failings of men during the reign of her father, Henry VIII., or her successor, James I.? Have the lovers of certain empresses exercised a more dangerous influence than the mistresses of Louis XIV., of Louis XV., or even of Henry IV.?

Will it be maintained that Mistress Macaulay would not have expressed her opinions in the House of Commons better than many representatives of the British nation? In dealing with the question of liberty of conscience, would she not have expressed more elevated principles than those of Pitt, as well as more powerful reasoning? Although as great an enthusiast on behalf of liberty as Mr. Burke could be on behalf of its opposite, would she, while defending the French Constitution, have made use of such absurd and offensive nonsense as that which this celebrated rhetorician made use of in attacking it? Would not the adopted daughter of Montaigne have better defended the rights of citizens in France, in 1614, than the Councillor Courtin, who was a believer in magic and occult powers? Was not the Princesse des Ursins superior to Chamillard? Could not the Marquise de Chatelet have written equally as well as M. RouillÃ©? Would Mme. de Lambert have made laws as absurd and as barbarous as those of the "garde des Sceaux," of Armenouville, against Protestants, invaders of domestic privacy, robbers and negroes? In looking back over the list of those who have governed the world, men have scarcely the right to be so very uplifted.

Women are superior to men in the gentle and domestic virtues; they, as well as men, know how to love liberty, although they do not participate in all its advantages; and in republics they have been known to sacrifice themselves for it. They have shown that they possess the virtues of citizens whenever chance or civil disasters have brought them upon a scene from which they have been shut out by the pride and the tyranny of men in all nations.

It has been said that women, in spite of much ability, of much sagacity, and of a power

of reasoning carried to a degree equalling that of subtle dialecticians, yet are never governed by what is called "reason."

This observation is not correct. Women are not governed, it is true, by the reason (and experience) of men; they are governed by their own reason (and experience).

Their interests not being the same (as those of men) by the fault of the law, the same things not having the same importance for them as for men, they may, without failing in rational conduct, govern themselves by different principles, and [8] tend towards a different result. It is as reasonable for a woman to concern herself respecting her personal attractions as it was for Demosthenes to cultivate his voice and his gestures.

It is said that women, although superior in some respects to man - more gentle, more sensitive, less subject to those vices which proceed from egotism and hardness of heart - yet do not really possess the sentiment of justice; that they obey rather their feelings than their conscience. This observation is more correct, but it proves nothing; it is not nature, it is education, it is social existence which produces this difference.

Neither the one nor the other has habituated women to the idea of what is just, but only to the idea of what is "honest", or respectable. Excluded from public affairs, from all those things which are judged of according to rigorous ideas of justice, or according to positive laws, the things with which they are occupied and which are affected by them are precisely those which are regulated by natural feelings of honesty (or, rather, propriety) and of sentiment. It is, then, unjust to allege as an excuse for continuing to refuse to women the enjoyment of all their natural rights motives which have only a kind of reality because women lack the experience which comes from the exercise of these rights.

If reasons such as these are to be admitted against women, it will become necessary to deprive of the rights of citizenship that portion of the people who, devoted to constant labour, can neither acquire knowledge nor exercise their reason; and thus, little by little, only those persons would be permitted to be citizens who had completed a course of legal study. If such principles are admitted, we must, as a natural consequence, renounce the idea of a liberal constitution. The various aristocracies have only had such principles as these for foundation or excuse. The etymology of the word is a sufficient proof of this.

Neither can the subjection of wives to their husbands be alleged against their claims, since it would be possible in the same statute to destroy this tyranny of the civil law. The existence of one injustice can never be accepted as a reason for committing another.

There remain, then, only two objections to discuss. And, in truth, these can only oppose motives of expediency against the admission of [9] women to the right of voting; which motives can never be upheld as a bar to the exercise of true justice. The contrary maxim has only too often served as the pretext and excuse of tyrants; it is in the name of expediency that commerce and industry groan in chains; and that Africa remains afflicted with slavery: it was in the name of public expediency that the Bastille was crowded; that the censorship of the press was instituted; that accused persons were not allowed to communicate with their advisers; that torture was resorted to. Nevertheless, we will discuss these objections, so as to leave nothing without reply.

It is necessary, we are warned, to be on guard against the influence exercised by women over men. We reply at once that this, like any other influence, is much more to be feared

when not exercised openly; and that, whatever influence may be peculiar to women, if exercised upon more than one individual at a time, will in so far become proportionately lessened. That since, up to this time, women have not been admitted in any country to absolute equality; since their empire has none the less existed everywhere; and since the more women have been degraded by the laws, the more dangerous has their influence been; it does not appear that this remedy of subjection ought to inspire us with much confidence. Is it not probable, on the contrary, that their special empire would diminish if women had less interest in its preservation; if it ceased to be for them their sole means of defence, and of escape from persecution?

If politeness does not permit to men to maintain their opinions against women in society, this politeness, it may be said, is near akin to pride; we yield a victory of no importance; defeat does not humiliate when it is regarded as voluntary. Is it seriously believed that it would be the same in a public discussion on an important topic? Does politeness forbid the bringing of an action at law against a woman?

But, it will be said, this change will be contrary to general expediency, because it will take women away from those duties which nature has reserved for them. This objection scarcely appears to me well founded. Whatever form of constitution may be established, it is certain that in the present state of civilisation among European nations there will never be more than a [10] limited number of citizens required to occupy themselves with public affairs. Women will no more be torn from their homes than agricultural labourers from their ploughs, or artisans from their workshops. And, among the richer classes, we nowhere see women giving themselves up so persistently to domestic affairs that we should fear to distract their attention; and a really serious occupation or interest would take them less away than the frivolous pleasures to which idleness, a want of object in life, and an inferior education have condemned them.

The principal source of this fear is the idea that every person admitted to exercise the rights of citizenship immediately aspires to govern others. This may be true to a certain extent, at a time when the constitution is being established, but the feeling can scarcely prove durable. And so it is scarcely necessary to believe that because women may become members of national assemblies, they would immediately abandon their children, their homes, and their needles. They would only be the better fitted to educate their children and to rear men. It is natural that a woman should suckle her infant; that she should watch over its early childhood. Detained in her home by these cares, and less muscular than the man, it is also natural that she should lead a more retired, a more domestic life. The woman, therefore, as well as the man in a corresponding class of life, would be under the necessity of performing certain duties at certain times according to circumstances. This may be a motive for not giving her the preference in an election, but it cannot be a reason for legal exclusion. Gallantry would doubtless lose by the change, but domestic customs would be improved by equality in this as in other things.

Up to this time the manners of all nations have been more or less brutal and corrupt. I only know of one exception, and that is in favour of the Americans of the United States, who are spread, few in number, over a wide territory. Up to this time, among all nations, legal inequality has existed between men and women; and it would not be difficult to show

B.8. CONDORCET'S ON THE ADMISSION OF WOMEN TO THE RIGHTS OF CITIZENSHIP (1790)3

that, in these two phenomena, the second is one of the causes of the first, because inequality necessarily introduces corruption, and is the most common cause of it, if even it be not the sole cause. [11]

I now demand that opponents should condescend to refute these propositions by other methods than by pleasantries and declamations; above all, that they should show me any natural difference between men and women which may legitimately serve as foundation for the deprivation of a right.

The equality of rights established between men by our new constitution has brought down upon us eloquent declamations and never-ending pleasantries; but up till now no one has been able to oppose to it one single reason, and this is certainly neither from lack of talent nor lack of zeal. I venture to believe that it will be the same with regard to equality of rights between the two sexes. It is sufficiently curious that, in a great number of countries, women have been judged incapable of all public functions yet worthy of royalty; that in France a woman has been able to be regent, and yet that up to 1776 she could not be a milliner or dressmaker ("marchande des modes") in Paris, except under cover of her husband's name; and that, lastly, in our elective assemblies they have accorded to rights of property what they have refused to natural right. Many of our noble deputies owe to ladies the honour of sitting among the representatives of the nation. Why, instead of depriving of this right women who were owners of landed estates, was it not extended to all those who possessed property or were heads of households? Why, if it be found absurd to exercise the right of citizenship by proxy, deprive women of this right, rather than leave them the liberty of exercising it in person?

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