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Page

Ah Love! Could thou and I with Fate conspire
To grasp this sorry Scheme of Things entire
Would we not shatter it to bits and then
Re-mould it nearer to the Heart's Desire!

Edward Fitzgerald's translation of Omar Khayyám

The Optimum Population Trust (UK): Manchester

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INTRODUCTION

Continuing his much admired synopsis of Clive Ponting's *A Green History of the World*, Martin Desvaux succeeds in compressing into six pages two interesting chapters in Ponting's book: *Creating the Third World* and *The Changing Face of Death*. The first of these two chapters brings out Ponting's singular ability to stand above the prejudices of the society he has been brought up in. The schedule ahead for this synopsis, by the way, is for Martin to finish his work on the 1991 book by the end of 2008. This will allow time for Martin to study the revised version, due for publication this year, and appraise for us the changes in perspective which have occurred over fifteen years. I hope, too, that by then OPT Journal readers will be as convinced as I am that *A Green History of the World* contains most of what needs to be said about how the human race has reached its present predicament.

There is a tendency for the OPT Journal to focus on the importance of energy matters, so a welcome change is the paper, on pages 9-12, by James Duguid on *Food Shortage and Population: Past, Present and Future*. James, or Jim as I know him, you may recall is Professor Emeritus of Bacteriology, but for the last decades has focused on population matters. He has written a useful handbook, *Population, Resources and the Quality of Life*. That brief introduction to Jim reminds me that I have not yet introduced someone who has contributed two papers to previous editions of the OPT Journal, namely John Nunn. He is author of *Nunn's Applied Respiratory Physiology*, but is also an expert in the field of geology and ancient Egyptian medicine, some of his wide ranging interests being reflected in the letters after his name, MD, DSc, PhD, FRCS, FRCA, FGS.

Pages 13-23 contain five short papers which are closely interwoven, and sometimes overlapping, on the key subjects of the human tendencies to self-delusion and its close cousin, suppression of uncomfortable thoughts. Since these often relate to energy matters, there is again substantial attention to energy. Although the papers are nominally by me, they have taken some time to develop, and would not have reached their present form without considerable help from Martin Desvaux, David Gosden, and David Pimentel.

Pages 24-28 comprise a compressed version (reduced to about half the length) of a recent paper by Virginia Abernethy titled, *Population-Environment Balance*. Her permission is much appreciated. Her subject is particularly relevant to the USA, where she notes that due to immigration the real rate of expansion in population is far higher than that promulgated by the Census Bureau, and hence the the Population Reference Bureau. It is probably in the range of 1.4 to 1.7 percent per year. The first figure gives a doubling time of 50 years. This problem arises in part due to the wishes of politicians and the commercial world, but also in part due to the porosity of the large borders of the USA. Similar problems are evident due to the borders of the enlarged European Union. As many parts of the world become less suitable for habitation, because of the combined forces of global warming and excessive population density, the difficulty of defending the borders will multiply. For those reasons, Abernethy's paper is of pre-eminent importance.

Finally, Sandy Irvine, pp 29-32, contributes a personal account of his path to wisdom, that is the path to seeing the world as it is rather than as we are brought up to think of it! These personal stories are interesting, and I make an appeal for others to tell me how they found the 'path to wisdom' and arrived at the destination to which Ponting guides us.

In addition to the acknowledgements already made, I would like to say that I am as usual grateful to Yvette Willey for once again accomplishing that task which is surprisingly difficult to do well – proof reading.

CLIVE PONTING'S *A GREEN HISTORY OF THE WORLD.* Part 4

A synopsis by Martin Desvaux PhD CPhys MInstP

"The average American cat now eats more beef than an inhabitant of Cost Rica."
Clive Ponting 1991

Introduction to the Fourth Instalment

The nine chapters covered in the first three instalments opened with the history of Easter Island and then stepped back many thousands of years to take us through the impact of humans on the environment before and after the Neolithic transformation. This impact built up as populations, cities, politics and technologies developed. The first population 'explosion', from 7 million in 4000 BC to 50 million people by 1000 BC, rose further to 200 million by 200 AD. Subsequently, the world population only grew by 50% over the next 1000 years to 360 million, kept in check by disease, wars and famines. After 1500, European influence expanded throughout the world affecting the environment and native societies. Their attitudes to indigenous populations (human, flora and fauna) were coloured by the contemporary Christian thinking based on Genesis, namely that man should subdue the earth and everything that crawled upon it. Life was cheap and native people were ruthlessly exploited for their labour and animals for their meat and furs. The Europeans' impact lay like a trail of death, misery and ecological destruction in what amounted to nothing less than a remorseless and conspicuous land grab – for which adequate recompense has yet to be made. Introduction of non-native species spread environmental havoc; hunting drove many animals to extinction. Wherever Europeans went, this process of expansion through settlement and exploitation overseas inevitably led, among other things, to the expansion of slavery on a scale hitherto unseen. While Europeans of that age believed that God created the world, it was *Europeans* who created the Third World. This is where the story now continues.

I am grateful to Clive Ponting[1] for his permission to quote text and reproduce tables and diagrams.

Chapter 10: Creating the Third World

Prior to 1450, the world evolved in relative isolation and major continents and island groups were unknown to Europeans or each other. Their inhabitants lived predominantly as subsistence farmers, doing only limited damage to the environment. From 1500 (when the expansion began) to 1850, Europeans dominated the growth of a world economy which was largely agricultural but included increasing amounts of luxury goods, raw materials and precious metals.

"*The creation of the third world was a complex process that took many centuries, but important features can be identified in the very first decades of European expansion even before the Portuguese sailed into the Indian Ocean and the Spanish conquered Mexico and Peru."*

Starting with the Azores, Madeira, the Canary Islands and Cape Verde islands, the die was cast by Spain and Portugal, who colonized them for the production of crops and luxury foods by taking the best land. In the 1420s, the Portuguese who had settled in an unoccupied Madeira, destroyed the entire forests and woodlands by fire to gain agricultural land and introduced pigs and cattle which did further environmental damage. By 1450, these self-sufficient farming communities were well established, but by 1500 they had been

transformed further into plantations growing sugar cane for export to Portugal. Slaves from North Africa were used to do all the work. In return, they were given only the poorest land for their own needs. A similar pattern followed in the Cape Verde islands to produce cotton. Spain invaded the Canary Islands and enslaved the Guanches to grow their crops. *"The slaves suffered from the introduction of European diseases and terrible conditions on the plantations. Guanche numbers fell rapidly in the 16th century and by 1600 they were all dead – only a few half breeds remained."* This human catastrophe necessitated the import of further large numbers of slaves from Africa. The pattern emerged that territories were exploited to produce crops on large plantations of the best land by Europeans who, being only a small part of the population, made others do all the work.

Slavery was nothing new. It was commonplace in the earliest human societies, being a form of energy when wood was the only source available. Empires were built on slavery. Venice was a hub of transportation of Slavs and Greeks to Tuscany and Catalonia. From the 12th century, sugar plantations in Cyprus and Sicily were fuelled by slave labour. During the 15th century, the Portuguese transported over 150,000 slaves to their possessions and Spain issued vast allocations of slaves (encomiendas) to settlers in Mexico. England initially used native Indians on mainland America and Barbados, but by the 17th century it had become cheaper to import slaves from Africa who soon greatly outnumbered Europeans in many American and West Indian colonies.

As colonisation spread around the globe, slavery followed. Initially, the Dutch (in the East Indies) and Spanish (in America) dominated the trade, but "*by the 18th century the British shipped three-quarters of the Africans taken to the Americas."* These were mainly taken from the African west coast while Arabs dominated the slave trade from the east coast. Between 1500 and the abolition of slavery in the 19th century, Europeans had enslaved 12 million West Africans for the Americas and the Arabs had removed two million from East Africa.

Other sources of forced labour for the colonies were deported convicts and indentured servants. These were whites who had to pay for their voyage and upkeep by working a number of years for their masters – often under conditions little better than slaves. After Abolition, cheap indentured labour was obtained by recruiting people from India, China and the Pacific Islands. Thirty million Indians migrated to man the sugar plantations mainly in Fiji, Mauritius, Natal, Malaya, East Africa, Ceylon and Burma. Another thirty million Chinese were sent to South East Asia and Peru *"to replace the Hawaiians who had died there digging out the guano beds to provide fertilizer for Europe"*. Another 386,000 Japanese, Chinese and Filipino labourers went to the Hawaiian sugar and pineapple plantations. This mass migration produced a *"social legacy of ethnic tension for many of the countries left with minority populations or, in the case of Fiji, with Indians outnumbering the native islanders"*

The Europeans inherited stable indigenous agricultural systems involving small plots with varied crops and cultivation techniques which caused little or no soil erosion. By comparison, their large plantations producing only a few (sometimes single) crops which were susceptible to pests, diseases, caused soil erosion and disrupted native societies. The new plantations, designed for exportable mass-produced cash crops, created a new world economy and had severe repercussions for the native peasants. These had lost much land and their meagre incomes became dependent on world prices for the crops they helped to grow. In Java, for example, when world prices for exportable cash-crops (sugar, coffee, indigo, etc.) fell, peasants turned to intensive rice production to feed themselves. Coupled with the plantation, system this action was further deleterious to the environment.

Sugar cane was the first crop to be grown in the colonies which changed the environment. It was taken from the Atlantic islands to Brazil, which became the largest producer in the

world by 1700. After Brazil's temporary occupation by the Dutch, the crop was spread to the European controlled islands of the West Indies.
Tobacco became the next export crop to take hold. It required less investment in processing plant and storage facilities than sugar and it transformed the economies of Virginia and Maryland after its introduction.

Cotton became much in demand, especially by Britain which bought in the raw material to feed its thriving mills to produce cotton products for export. *"By 1807 the United States was supplying 60% of Britain's cotton and by 1820 it had become the biggest producer in the world."* As cotton spread throughout many southern US states, the overall production peaked at 30 million acres in around 1900 but later declined to about 9 million in 1990 as a result of the boll weevil pest and soil exhaustion.

In Asia, tea, rice and rubber were the dominant cash crops. Tea production was initially the preserve of China and Japan. However, once Britain developed a taste for it, production in India and Ceylon grew rapidly. Forests were cleared to grow the crop at an alarming rate typified by Ceylon where "*plantations … increased from 1000 acres in 1875 to 373,000 acres in 1900*."

Rice, the staple food of South East Asia, was first grown for export to Britain in Burma aided by the opening of the Suez Canal (1869). As production under British and French landlords (in Burma and Indo-china respectively) expanded rapidly (1860 – 1940), peasants were reduced to being in debt to money lenders or tied as quasi-serfs to their masters. In Thailand, exports grew from 50,000 tons (1860) to 1.5 million tons (1940) at the expense of adequately feeding the indigenous population.

The discovery of vulcanisation (1840) caused a rapid increase in demand for rubber. Brazil had a natural source from wild trees in the Amazon forest, but, after the British and Dutch took seeds to Malaya and invested in large efficient plantations, the Asian exports boomed and those of Brazil declined.

Coffee – indigenous to Africa – became the major export of the Dutch East Indies which had 300 million coffee trees in 1850. When blight struck, Brazil became a major supplier, using European immigrants as cheap labour after slavery ended. Later, in the late 19th century, Britain introduced coffee to Malawi, Kenya and Uganda.

All the above crops, along with cocoa, palm oil and bananas, were grown on the plantation system, which were characterised by cheap indigenous or imported labour. Either way, "*By the early 20th century, Europe, and increasingly the United States, brought about a major transformation …now known as the Third World."*

In addition to edible crops, Europeans also exploited the third world for its vast timber resources. Teak was in high demand. Consequently, the British stripped India's Malabar Coast, moved on into Burma in 1826 and stripped the Tenasserim province in 20 years, then on to the Irrawaddy delta which was cleared of its hardwood. The plunder continued with mahogany and sandalwood, where the latter was stripped island by island in the Pacific as each became exhausted.

Exploitation of precious metals and minerals was another part of the picture which showed how the industrialised nations created the Third World. Beginning with gold and silver in Mexico and Peru, the major bulk exportation of minerals did not take off until Africa was divided up between European powers in the 1880s. Copper and aluminium deposits were mined by companies which grew into major multinational corporations and in some cases virtually ruled the lands they exploited. Having bought the rights to mine mineral deposits for a pittance, their activities dominated the fate of the locals in the same way as plantation owners were doing with crop growing. *"The companies also exclude many Third World countries from the most profitable parts of the industry by refusing to build smelters and processing plants as both Ghana and Guinea found when even cheap*

energy supplies were available." Natives could only look on as the wealth of their countries (in the form of ores containing iron, copper, aluminium, nickel) passed them by as it was transported to ports by rail to be shipped to processing plants in other countries. Thus, the source countries lost the value added and the opportunity to increase their own wealth – which instead passed to the industrialised nations.

Fertilisers form the final part of the picture. As agricultural output grew, Europe had to turn to Morocco and Tunisia as well as to the large guano deposits off the coast of Chile. Exports of Chilean guano reached over 1 million tons per year – to the detriment of the Chinese labourers who had to dig it out under terrible conditions.

The prize for unfair exploitation, however, must go to Britain, New Zealand and Australia for the way they treated the Banabans on two small pacific islands called Ocean Island and Nauru. The total population comprised some 3800 people. They had the misfortune to live on the richest phosphate deposits in the world. The British government bought the mining rights for £50 per year and proceeded to strip the islands of eighty million tons of phosphate. This totally destroyed the fertility of the land, all top soil having been removed, and left only a narrow coastal strip on Nauru for the inhabitants to live.

Chapter 11: The Changing Face of Death

Disease affected populations in three ways: a) epidemics and plagues; b) persistent local sources of infections (e.g. sleeping sickness and river blindness); c)inadequate diet which mostly affected the poor by reducing their immunity to (a) and (b).

Hunter-gatherers were relatively free of disease because groups had infrequent contact with each other or with animals. However, this situation changed markedly as groups settled down to agriculture, domesticating animals and inevitably growing in size as a result of the more abundant food supply. *"After living for 10,000 years in close proximity with animals, humans now share 65 diseases with dogs, 50 with cattle, 46 with sheep and goats and 42 with pigs.*[2]*"* The outcome was that a whole new range of diseases affected humans, as some bacteria and viruses present in animals changed into forms that could thrive in humans. The table below lists just some of the main human diseases which are related to animals.

Human disease	**Animal**	**Animal disease**[3]
Smallpox	Cattle	Cowpox
Measles	Cattle	Rinderpest
TB	Cattle	[TB]
Diphtheria	Cattle	
Influenza	Pigs[dogs, horses]	[Influenza]
Common cold	Horses	[Common Cold]
Leprosy	Water buffalo	

The immunity of local populations evolved by the survival of the fittest, but as these expanded, they carried their infections into new areas and the consequences were disastrous. As already touched upon in chapter 7, this was nowhere more dramatic than in islands and countries invaded by the Europeans during the great expansion after 1492 when some native populations dropped by 90% or became extinct. Most especially, the peoples on the South American continent were particularly susceptible as their lack of domesticated animals meant they had no resistance to European diseases.

As communities grew from small groups into settled villages, towns and then into cities, the problems of sanitation, irrigation and close proximity provide a fertile combination for bacteria and viruses to thrive with the result that: *"Until well into the 19th century in*

Europe and North America … cities required a constant influx of people in order to sustain their numbers because of the very high death rates among their inhabitants." Within cities, immunity will have gradually built up in the population, but a proportion of newcomers will have succumbed. The pattern appears to have been "*one of a continuous low level of disease punctuated by virulent outbreaks killing large numbers.*" What caused these peaks in the death toll is not clear. Childhood diseases such as measles may have been the main culprit. Ancient records refer only to 'plagues' – a term reserved latterly for the 'bubonic' plague which first arrived in Europe in the sixth century AD.

The mutual isolation between the Far East, Europe and the Near East as well the Americas meant their diseases were self-contained. With growing populations that was all set to change. Between 160-165 AD, a virulent form of smallpox spread to China and Rome, killing 40% and 25% of their respective populations. There were many recurrences in later centuries with equally devastating results. Smallpox, leprosy and the bubonic plague were all thought to have originated in India. The bubonic plague deserves a special mention because of the speed and ferocity with which it spread. As long-distance travel developed – especially by ship – those awaiting the arrival of exotic goods from faraway lands got more than they bargained for on the quayside. Flea-carrying rats! After the first-known outbreak in the Mediterranean (542) there were further major occurrences: China in 610 and1331; Crimea 1346; Europe 1346-49.[4] Thereafter, in Europe it continued to occur at regular ten-to-fifteen-year intervals until 1670. The last outbreak of bubonic plague in Western Europe was in Marseilles in 1720-1721 and after that it remained in Eastern Europe and the Near East.

Before 1500 nothing is known of the diseases in the Americas. Because of crowded conditions in their cities, natives will have suffered from parasitic and intestinal illnesses, but major endemic Eurasian diseases had not spread to them. It began only when the Spanish conquistadors introduced smallpox. The first outbreak in Hispaniola in 1518, which spread to Peru by 1525, was followed by outbreaks of measles in 1530, typhus in 1546 and influenza in 1558. The impact was catastrophic. Overall estimates of the death toll are only vague because of unreliable information about the initial populations. As a guide, *"The most reliable figure suggest that in the Valley of Mexico, the centre of the Aztec state, the population fell from about 25 million, just before the conquest to six million by the mid-16th century and to about one million in 1600. The effect … (together with the brutality of the military conquest and its aftermath) was to destroy the flourishing and powerful Aztec society and its culture."*

It was thought in the 15th century that, in return, the Americas "transmitted" 'Montezuma's revenge' or syphilis to the Europeans. The origins of syphilis are not certain; some propose it to be a sexually transmitted transmutation of the European *yaws* but "*the place and date of its first recorded appearance in Europe – Barcelona in 1493 (a year after the first voyage of Christopher Columbus to the Americas) – lends weight to the contemporary theory of American origins."*

Eventually, the mortality rate from such major 'plagues' declined from catastrophic epidemics to low-level infection rates due to developing immunity and other factors. But the diseases persisted in conditions of overcrowding, poor diet and inadequate sanitation such as those found in cities and armies. "*Until the present century armies nearly always lost more soldiers to disease than they did as casualties to the enemy.*" In the Crimean war, dysentery was ten times more effective than the Russians at killing the British.

During the last two hundred years, the ravages of disease have diminished markedly. Historically, up to 2/3rds of children died in early childhood; now less than 1 in 20 die before maturity[5]. Life expectancy has doubled from around 35 years to well over 70 and the death rate since the mid-19th century has fallen from 20 down to 5 per 1000 of

population (England and Wales). This was because of i) the transmutation of some diseases into less virulent forms, ii) the introduction of inoculation (possibly used against smallpox in China as long ago as the 11th century, in Turkey during the 13th century but not in England until 1721, followed by Europe in the 1790's - when it became much safer), iii) better diet, iv) more availability of food, v) cleaner water supply and improved sanitation. The last two developments may have accounted for as much as 25% of the reduction of mortality in the 19th century. A further 25% is attributed to the control of TB by the slaughter of infected cattle and the prohibition of spitting in public places.

Despite all these advances, it has only been possible to ring fence the diseases of the past. Although immunisation has virtually eradicated smallpox, other diseases have only been controlled, not eradicated; the 1918 world flu wiped out over 20 million people – possibly helped by poor diet due to lack of nutrition following WW1.

In industrialised countries, the face of death has changed. Where control of traditional diseases has enabled longevity, cancer and heart disease as well as others have become more common not just due to advancing years but also to changes in life-style especially among the more affluent. Some modern western dietary changes have been a two-edged sword. Healthier food has resulted in "*contemporary British children being 20% taller than those of mid-eighteenth century*" but less fibre intake has increased constipation and intestinal diseases. Increased sugar consumption has led to obesity and diabetes; increased fat intake – helped by modern preservation techniques and fast distribution methods to make meat widely available – has also led to the increase incidence of heart disease. Consumption of more processed – and therefore of less fresh – food has decreased the intake of nutrients and simultaneously increased the ingestion of potentially harmful additives thereby encouraging cancers and heart disease.

Ponting underlines the impact of these changes with a few *killer* comparisons:
"*Heart disease was almost unknown a hundred years ago except among the rich … It now kills forty per cent of men and twenty per cent of women in industrialised countries … one in three Americans contracts cancer compared to one in twenty-seven in 1900 … Male deaths from cancer in the western world rose by fifty-five per cent between 1960 and 1980 and female deaths rose by forty per cent. … Before 1940, Africans in Kenya and Uganda did not have rising blood pressure with increasing age, and coronary heart disease was not diagnosed at all in Uganda until 1956 and not until 1968 in Kenya and Tanzania."* And finally in 1991, "*Processing food … introduces additives such as antioxidants, emulsifiers, thickeners, dyes, sweeteners and bleaching agents. The average Briton now consumes three pounds of chemical additives every year* [and] *on average middle-aged males are now twenty pounds overweight and in the United States the figure is even bigger*." I do not know if Clive Ponting intended the pun in the last sentence but in 2007 average 'figures' are bigger still!

Endnotes

1. Clive Ponting is currently working on a revised edition to be published in paperback by Pimlico in 2007.
2. Ponting doesn't mention birds; bird flu is a modern threat.
3. Ponting only mentions the animal diseases for the first two entries in this table.
4. The timing and geography clearly trace its progress from the Far East to Europe.
5. Readers should note that these figures – as all others in this essay – apply at the time of writing, 1991.

FOOD SHORTAGE AND POPULATION: PAST, PRESENT AND FUTURE

by James P. Duguid, CBE, MD, BSc, FRCPath. Oaklands, Merlewood Road, IV2 4NI.

The ultimate danger facing our children and grandchildren in the coming century is shortage of food caused by the continued growth of population and consumption. Other dangers, such as shortages of energy and fresh water, nuclear warfare, pandemic infections, environmental degradation, and global warming, may strike first, but will also exacerbate shortage of food.

The relation between food supply and population is crucial, for enough food is needed to give a healthful diet to every person multiplied by the number of people. A worldwide shortage of food would kill off much of mankind by malnutrition and the infections it exacerbates, and by conflicts for the control of food-producing territory.

Food Supply and Population: Historical

The danger of food shortage arises from the innate tendency of mankind to produce far more children than needed to replace the adults dying at maturity. Unless restrained by economic forces, pandemics, warfare or social aspirations, populations grow rapidly up to and beyond the limit of the food resources in their territories (Malthus, 1798, 1803). Growth is then checked by the death of a majority of children and many young mothers from malnutrition and infections, and the death of young men in conflicts for the control of territory.

Until 1750, this natural control of population kept mankind's numbers below about 600 million. Then, the industrial exploitation of the energy in fossil fuels — first coal, then oil and gas — increased the output of food through the use of powered machinery for the drainage, cultivation, harvesting and irrigation of hitherto poorly productive land, for the production and distribution of artificial fertilisers and pesticides, and for the transport of supplies between farms and towns.

The increase of food supply and paid industrial jobs promoted marriages and births, and reduced the deaths of children and mothers from want. It caused an explosion of population, first in the early developing countries. In the UK the number of people grew from about 7 million in 1750 to 50 million in 1950. Trade and the transfer of technologies then increased growth in the later developing countries, mainly after 1950, as shown in the graphs in W. I. Stanton's book, *The Rapid Growth of Human Populations 1750-2000*, Multi-Science Publishing Co. Ltd (2003). The global population increased from about 600 million in 1750 to 6000 million in 2000.

In the early developing western nations, improved education and contraception, and the aspiration for a better lifestyle unburdened by many children, eventually brought about a voluntary reduction in the birth rate to and below the replacement level, the Total Fertility Rate (TFR) of 2.1 children per woman. By 2004, the TFR was 1.8 in the UK, 2.0 in the USA, 1.65 in North and West Europe, and 1.35 in South and East Europe (2006 World Population Data Sheet, Population Reference Bureau) But populations were still increasing by heavy net immigration in some of those nations.

In most of the less developed nations, including about three-quarters of mankind, the birth rates remained well above the replacement level. In 2004, the TFRs were 2.5 in Latin America and the Caribbean, 2.4 in Asia (but 1.6 in China), and 5.1 in Africa. They were highest in the most famine-prone African countries, e.g. 5.4 in Ethiopia, 6.0 in Malawi, 6.1 in Rwanda, 6.9 in Somalia, 7.1 in Mali and 7.9 in Niger.

Food Supply and Population: the Present Day

In 2003, the UN Food and Agriculture Organization reported that about half the world's people were malnourished: 842 million were severely deficient in calories and proteins, and over 2000 million were deficient in particular nutrients, vitamins or minerals. Each year, over 9 million children die from hunger and infections, and 600,000 malnourished mothers die in childbirth or from its immediate consequences.

Cereal grains such as wheat and rice make up about 80% of the world's food. After 1960, annual production was boosted by the introduction of high-yielding varieties. It rose from 250 kg to 350 kg per world inhabitant. But after 1984 it declined and was only 290 kg per person by 1996. The trend is downwards and the demand is outstripping supply. By 2003, wheat stocks were down to a 30 days supply.

Even distribution. Optimists claim that the world's present supply of food would be sufficient for everyone if it were distributed evenly between the rich and the poor, and if the rich nations reduced the content of animal food in their diet. But an even distribution and that change of diet would be impossible to achieve voluntarily.

Foreign aid. A small move towards equal distribution is attempted by the giving of aid in food, money, medicine and technology from the rich to the poor countries. The aid increases the number of children surviving to reproductive life, but because it is given without the provision of offsetting birth control, it makes the population grow faster than its wealth and so increases the number of poor, malnourished people.

This adverse effect of aid was seen in the World Bank's 1989 report on Sub-Saharan Africa, where much aid given after 1960 was associated with a doubling of population and an increase of unemployment and want. In Ethiopia, massive aid given after the 1984/85 famine was by 2005 associated with a 57% increase of population and a 31% fall in the average income per person (figures from UN Development Program).

Vegetarian diet. The diet in rich nations contains much meat, poultry and dairy products from livestock fed on cereals, soya and other vegetables. The animal products contain less calories and protein than the animals' vegetable fodder, and if replaced by vegetables in the human diet, two to three times as many people could be fed from the same amount of cropland.

Staple vegetables are deficient in some of the nutrients needed for human health, whereas animal products contain them all. A healthful diet could be made up from a careful balance of different cereals, beans, fruit and nuts, but most people would find it too difficult and troublesome to assemble.

A hint of the extra population that could be fed by a switch away from animal food is seen in the 'footprint' figures in the Living Planet Report 2004 of the WWF-World Wide Fund for Nature. Production of the animal-rich diet of the 920 million people in the high-income countries requires 1.41 'global hectares' of cropland, grazing land and fishing grounds per person. That of the sparser diet of the 2971 people in the middle-income countries requires only 0.80 gha/person, and that of the poor diet with little animal content eaten by the 2227 million people in the low-income countries requires only 0.47 gha/person.

So, if the people in the high-income countries switched to the animal-poorer diet of those in the middle-income countries, they would free 561 million gha of productive area, enough to improve the diet in the low-income countries to 0.73 gha/person.

Food Supply and Population: the Future

Whilst under present conditions of production and consumption, the world's output of food leaves about half of mankind malnourished, predictions about the future are uncertain.

Present trends suggest that shortages will worsen as populations increase and food production falls. But outcomes may be improved by new technologies or worsened by catastrophes such as run-away global warming.

Population trends. UN figures for birth and death rates suggest that the natural increase of world population is now about +1.2% (80 million) a year (PRB 2006 Data Sheet). If it should take 70 years to steadily slow that rate to zero, then by 2076 population will be 9900 million. If that time could be reduced to 50 years, then by 2056 population will be 8800 million. If the steady reduction to zero could take only 24 years, then by 2030 population will be 7500 million. The last figure may seem unlikely, but the UN's World Population Prospects 2002 Revision has suggested 7500 million as possible for 2050.

International migration. Heavy migration increases the world's population. The migrants leave poor countries where want limits their ability to rear children, and go to rich countries where they can earn enough to rear large families and increase their consumption of animal-rich food. The high fertility in their poor homelands prevents their departure from reducing the populations there.

Immigration into the UK. In 2003 the fertility rate in the UK was only 1.64, and a calculation made by the Government Actuary's Department for OPT showed that if the TFR and life expectancy remained unchanged, and if net immigration were zero (no more in than out) the population would fall to half by 2121. But immigration is rapidly increasing the UK's population.

In 2003, the Government Actuary assumed net immigration would continue at about 103,000 a year, and calculated that the population would increase by 5.6 million to 64.8 million in 2031, 54% attributable to immigration. But he counted the migrants' children as part of the natural increase of the indigenous inhabitants. When counted as migrants, the increase is 85% attributable to immigration. Moreover, in the five years to 2004, net immigration averaged 158,000 a year, suggesting the population will increase 7.6 million by 2031, 89% due to immigration (MigrationWatchUK).

The increase of population will increase the demand for food. Even now, the UK has to import about 40% of its food, including 27% of the kinds normally grown here (DEFRA figures for 2005). In future it may become difficult for the UK to find and pay for imports, as consumers multiply and demand increases in the supplying countries and as the UK's annual deficit in the balance of its overseas trade in food, goods and services goes on growing. In 2005, the deficit was £47 billion, i.e. 2.6% of GDP (Annual Abstract of Statistics, 2006 edition, tables 19.10 and 19.11).

Food supply trends. People's efforts to obtain food are degrading large areas of cropland and grazing land, leading to a reduction in output. In most countries, fertile topsoil is being lost by wind and water erosion due to intensive cropping and grazing without the replacement of essential minerals and humus, and by the removal of forest breaks. In dry countries, land irrigated without drainage becomes infertile by salt accumulation or water-logging.

In industrial countries, farmland is being lost to housing, roads and other urban-related developments, and soils are being acidified and poisoned by airborne pollutants from homes, traffic and industries. Large amounts of phosphates and other plant nutrients are extracted from the soil in cropping, then eaten and flushed down sewers into the sea. Toxic metals and chemicals in sewage sludge limit its use as a fertiliser.

Excluding Antarctica, the world's land area is 13.4 billion hectares, of which about 1.5 billion are cropland, 3.5 billion grazings, 3.8 billion forest, and the rest unproductive. Ongoing losses from the productive land are estimated as about 10 million ha a year (D. Pimentel and colleagues, Environment, Development and Sustainability,1999, vol. 1: 19-39, and World Futures, 2003, 59: 145-167). They estimate that in the USA, modern farming methods are reducing the average depth of topsoil by 0.15 cm a year. In the dry mid-west, irrigation from underground reservoirs is depleting their stocks far faster than their recharge by rainfall.

Similar damage to food production in Asia and the Middle East is reported by Sir H Charles Pereira, former chief scientist to the UK Ministry of Agriculture, Fisheries and Food (Chapter 3 in *Where Next?*, Royal Botanic Gardens, Kew). The gravest threats are the erosion of stream-source areas and the salination of irrigated land.

The foothills of India, Nepal, Bhutan and Bangladesh are under attack by expanding populations struggling to live by farming on ever steeper slopes. The clearing of land for cultivation and the felling of trees for fuel have turned the slopes into wastelands eroded by rainfall. Attempts over 30 years by UN agencies to reclaim the eroded slopes by replanting have had little overall effect. Large areas of irrigated land in the plains of the Ganges, Indus, Euphrates and Nile have been made infertile by water-logging and salination. Pakistan has 3 million hectares affected by salinity and another 40,000 ha are being added each year.

In 2000, the European Environment Agency reported that Europe's soil resource was being degraded and lost at an unprecedented rate. In 2004, the UK had a land area of 24 million hectares, about 5 million of cropland, 7 million of grassland, 5.5 million rough grazing, 2.7 million woodland, and 3.5 million urban and built-up. Between 1997 and 2004, about 400,000 ha of the cropland was lost to urban-related developments.

The world's food output might be increased by more intensive use of poor land by mechanical cultivation, careful irrigation, and heavy applications of fertilisers, pesticides and the humus in excreta and waste, but worldwide development of those methods would be hindered by the scarcity of fossil fuels and other resources.

Depletion of fossil fuels. As the exploitation of cheap fossil fuels greatly boosted the production of food after 1750, their increasing scarcity and cost will pose a threat to the future production of food.

Petroleum experts have calculated that oil and gas extraction will peak about 2015 and may fall to under a half by 2050. The costs of extraction from difficult locations and the demand from industrialising nations will raise prices. Coal, oil shale and tar sands will last longer, but the energy cost of their extraction and purification will diminish their usefulness as energy sources and cause much environmental damage.

Electricity from nuclear and 'renewable' sources cannot serve many of the uses of fossil fuels, e.g. as liquid fuels for transport, and cannot be stored in bulk for use when required. Safe methods for the large-scale production, storage and distribution of hydrogen have not yet been developed. Liquid fuel can be made from wood, corn and oil seeds, but the production of significant amounts would take up too much cropland and timber land, from the limited areas producing food and wood in the UK.

CONCLUSION

Mankind is unlikely to choose or be able to reduce population and fuel consumption quickly enough to avert damage from global warming and rising seas, and is likely to suffer a devastating loss of life from food shortages and conflicts for the possession of land and resources.

ENERGY AND POPULATION

by Andrew R.B. Ferguson

Many people have hinted, if not stated, that they are puzzled why the OPT Journal is so much oriented to energy matters, although the subject is population. So when someone wrote me an email expressing this view at length, I thought it time to set out clearly the fundamental importance of energy to population.

I only became fully aware of the importance of energy to society after reading *Food, Energy, and Society*, a book edited by, and largely written by, David and Marcia Pimentel.[1] Even though OPT's assessment of sustainable populations stems from eco-footprinting, this book was fundamental to our attempts to assess sustainable populations.

As was set out in the *2nd Footprint forum, Part I, Energy Component of the Ecological Footprint* (OPTJ 2/2), the carbon absorption paradigm (which is generally advanced as the method of assessing the energy component of the Ecological Footprint) is flawed in many ways. Since that 2002 forum, the flaws have become more apparent. For one thing, it is now evident that oceanic absorption of a large fraction of the emitted carbon dioxide comes with a heavy cost, namely the cost of acidifying the oceans. Also much doubt now surrounds the extent to which land will continue to be a useful carbon sink. It has even been suggested that as the Earth warms it will release more carbon than is absorbed.

Fortunately those problems do not affect the assessments of optimum populations emanating from the Optimum Population Trust, since we have always argued that the only convincing method of dealing with the need for energy is the 'renewable energy paradigm'. That paradigm is based on the need for 'energy land;' or more precisely the amount of ecologically productive land needed to produce the required amount of 'free energy' (energy needed in addition to that contained in the food we consume).

The reason that this change of paradigm can continue to work happily with the data produced by those most heavily engaged in the task of eco-footprinting is that the absorption capacity implied by the 'carbon absorption paradigm' is about 3 kilowatts per hectare, and that, as near as it can be assessed, is the power density that can be achieved using a realistic mix of renewable energy sources. Why it is so hard to raise the power density using renewable energy sources can be seen by considering first the fundamental problem of intermittent energy sources (the "uncontrollables"), and then the low power density of the main "controllable", namely biomass.

The "uncontrollables"

Although photovoltaics have the considerable merit of not taking up much space, their essential problem is that their peak output is about four or five times their average output. Even taking the more favourable "four times," the result is that to produce a steady flow of electricity, three quarters of it has to be produced by a controllable power source.

Wind has a similar problem. In some places, a capacity factor of 30% can be achieved by a large group of wind turbines (not in Denmark, Sweden, Germany or the Netherlands though). Even taking the more favourable figure of 30%, to produce a steady amount of electricity, at least 60% of it has to be produced by a controllable power source.

This problem is greatly amplified by the fact that the uncontrollables interact. Wind and waves may be producing at their peak at the same time as photovoltaics are producing at their peak. Thus all these uncontrollables taken together are unlikely to be able to produce much more than 20% of *electricity*. Note, too, that it is *electricity* that is produced, and we only use about a third of our fossil fuels for producing electricity.

The "controllables" and the "energy fantasists"

A pretty ideal controllable is hydro power, but the amount that hydro can contribute to power demand is diminishing rather than increasing, and although it is largely controllable, there are times, such as long periods of dry weather, when availability is low.

Biomass is the other, and potentially larger, controllable. The difficulty there is its low power density. This is particularly apparent with liquid fuels. In a recent paper, David Pimentel, Tad Patzek and Gerald Cecil pointed out that if the production of ethanol from corn (maize) was stepped up to the extent of using 100% of the corn produced in the U.S., it would provide only 6% of the liquid fuel used in the U.S. Moreover, while this would produce liquid fuel, the whole production process would result in very little, if any, energy, since about the same amount (whether more or less is hotly debated) of energy would go into producing the ethanol as would be contained in the ethanol produced.

Until very recently, the low power density of "renewable controllables" is something that has been routinely ignored by The Worldwatch Institute, The World Policy Institute, Green Peace, Friends of the Earth, and NATTA in their renewable energy newsletter, *Renew*. Some signs of recognition appeared in the 25 September issue of *New Scientist*, in an article titled *Fuel's Gold* (meaning Fool's Gold) by Fred Pearce, which appeared to be largely drawing on a forthcoming article in *Worldwatch*.

One complaint voiced in the email mentioned at the outset was that the articles in the OPT Journal are one-sided. Maybe, but they do however represent one voice against many others purveying largely unquantified optimism about renewable energy. I did my best to bring out that point in the paper *Lagoons of Silence within the Renewables Lobby* (OPTJ 6/2 pp. 28-29).

There are many obvious things that are being missed by what I jovially call the 'renewable energy fantasists'. For instance, many of the sources mentioned above enthuse about the advantages of using Combined Heat and Power (CHP). However, they never mention that Denmark has introduced CHP as far as possible, and wind turbines to an extent that would be impossible without the benefit of having adjacent nations that produce most of their electrical power from hydroelectricity, and yet Denmark's carbon emissions are similar to those of the UK (which are at least 6 times what they should be to be sustainable). The OPT Journal is still something of a lone voice which brings out such unpalatable truths; truths which are doubly unpalatable in view of the fact that current population levels are only sustainable while fossil fuels last.

The renewable energy field is complicated, but every now and again one can pick up a clue from the "real world" of experience. Perhaps one such is that despite the fact that the U.S. has awoken to the need for "energy security", intrusion of wind into the system is forecast to be almost negligible. In its Annual Energy Outlook, the US Energy Information Administration forecast that by 2030 wind will be supplying 1% of electrical demand and 0.4% of total energy demand.

Let me finish by saying that in editing the OPT Journal my objective is not to prove any particular angle or point, but rather to establish the truth by looking at the evidence. If there is contrary evidence on the subjects dealt with in the OPT Journal, then I will be glad to publish it.

1. Pimentel, D, Pimentel, M. 1996. *Food, Energy, and Society*. Niwot Co., University Press of Colorado. 363 pp. (£30). This is a revised edition; the first edition was published by John Wiley and Sons in 1979.

THREE DEADLY DELUSIONS

by Andrew R.B. Ferguson

The most pervasive delusion throughout human history has been the belief by the followers of every religion that their own religion is more true than any of the others. According to the dictates of reason, insofar as religions entail a belief in gods or a God, they are all equally improbable. Polytheistic religions have a slight margin in favour of their probability over monotheistic ones, since nothing could be more improbable than that one all powerful God has been keeping a watchful and kindly eye on the human race throughout its long struggle with disease and natural disaster.{1} However, it is hard to analyse the balance of good and bad aspects contained within religious belief. Many people, Napoleon as well as Marx, thought that religion was essential to reconcile those who are poor in society with the inequalities which are inevitable (Marx of course was further deluded into thinking that those inequalities can be eliminated). So, while maintaining a somewhat ambivalent attitude to the goods and bads of religions as a whole, let us look at delusions which seem likely to bring death on a massive scale.

Fred Halliday, professor of international relations at the LSE and visiting professor at the Barcelona Institute of International Studies, recently provided a list of 12 of the world's "worst ideas." His description of Number One was apposite:

> Number one: *The world's population problems, and the spread of Aids, can be solved without the use of condoms*.
>
> This is not only the most dangerous, but also the most criminal, error of the modern world. Millions of people will suffer, and die premature and humiliating deaths, as a result of the policies pursued in this regard through the United Nations and related aid and public-health programmes. Indeed, there is no need to ask where the first mass murderers of the 21st century are; we already know, and their addresses besides: the Lateran Palace, Vatican City, Rome, and 1600 Pennsylvania Avenue, Washington DC. Timely arrest and indictment would save many lives.

In wider contraceptive terms, that has been the view of the OPT for a long while. Our founder, David Willey, wrote a piece on just such lines, pointing out that, however sincere were the current pope's beliefs, over time the inevitable consequence would be millions of extra deaths. I would add this point, that these delusions — those of the papacy in recent decades — will cause a far greater number of deaths than the delusions of Pope Innocent VIII who, in his famous Bull of 1488, set in train the persecution of witches, lasting for centuries; or even the delusions of Pope Urban II who, towards the end of the eleventh century, set alight the flame of the Crusades, a torch that was to burn for hundreds of years.

Allowing ourselves to express the OPT view, rather than following Fred Halliday, a strong contender for Number two is the *confident* belief that there will be a transition to a renewable energy world. That is to say, when we run out of fossil fuels we will be able to make a transition to renewable energy. Note the word "confident." It is not *impossible* that something unexpected will turn up fairly soon to solve the immense problems of collecting the diffuse energy of the sun in "real time," despite the fact that it took plants millions of years to capture the energy that we are now using in such a profligate manner. While it is not impossible, there is at present little sign that the problems of intermittency and low power density of renewable sources of energy are likely to be significantly overcome, so there are no grounds for *confidence* in the belief of a transition to a renewable energy world. Yet if we don't make that transition, then when fossil fuels become scarce — in about fifty years time — the rate of die off (presently in the tens of

millions a year) will greatly accelerate, until population is eventually brought down by billions. That is inevitable, because supporting the present population has only been made possible by the energy provided by fossil fuels.{2} Yet confidence in the mooted "transition" is voiced in the great majority of scientific papers and journalistic articles. This therefore is Number Two delusion:

> Number two: *There is no need to address the critical problem of over-population because we can be confident of a transition to a world based on renewable energy.*

A strong contender for Number three is the belief that we are likely to be able to significantly reduce carbon emissions from their present level. Yet it is easy to see that the large populations in the relatively undeveloped world, China, India and Indonesia for example, which want to improve their quality of life by using more energy, will cancel out any success that developed nations have in reducing carbon emissions. On present evidence moreover, we should not even be confident that the developed nations will significantly reduce their carbon emissions.{3} A favourite delusion of nearly all reports and investigations of climate change is the belief that the world might well reduce carbon emissions to a level which would greatly diminish the chances of massive climate changes occurring. Thus Number three dangerous delusion is this:

> Number three: *There is no need to address the critical problem of over-population, because we can be confident that we can reduce carbon emissions sufficiently to make it improbable that the dire effects of climate change will be realised.*

While many other delusions afflict mankind today, none, I think, will prove to be as deadly as these three.

Endnotes

1. On page 275 of his immensely impressive book *World History: a New Perspective* (2000), Clive Ponting drew attention to this point about monotheistic religions having insuperable logical weaknesses.
2. In 1865, in *The Coal Question*, William Stanley Jevons wrote about our society's vital dependence on energy sources. In 1972, Dennis Meadows adumbrated the interdependence of food supplies and energy resources. For instance, he wrote that in the imminent future his models foresaw that:

   > The industrial capital stock grows to a level that requires an enormous input of resources. In the very process of that growth it depletes a large fraction of the resource reserves available. As resource price rises and mines are depleted, more and more capital must be used for obtaining resources, leaving less to be invested for future growth. Finally investment cannot keep up with depreciation, and the industrial base collapses, taking with it the service and agricultural systems, which have become dependent upon industrial inputs (such as fertilizers, pesticides, hospital laboratories, computers and especially energy for mechanisation). … Population finally decreases when the death rate is driven upward by food and health services.

   Valuable though that is, by far the most irrefutable demonstration of the relationship between energy and food supply, and the type of society that it supports, was the 1979 book (with a revised edition in 1996), by David and Marcia Pimentel, titled *Food, Energy, and Society*.

   A book which deserves to be singled out because of its compact treatment of the energy problem and its impact on population is *The Collapsing Bubble*, by Lindsey Grant (2005, *The Collapsing Bubble; Growth and Fossil Energy*. Santa Ana, CA. Seven Locks Press. (800) 354-5348. US$9.95.).
3. Denmark provides an irrefutable example of the improbability of developed nations significantly reducing their carbon emissions. Denmark has: (a) invested heavily in wind power; (b) encouraged maximum use of biomass; (c) done all it can to make use of combined heat and power; (e) put a high tax on cars and provided an excellent public transport system. Despite all this, its emissions are not much changed from 1990. Such is the tendency to delusion, that UK think tanks and academic institutions advocate all these changes for the UK, while allowing themselves to imply that such changes will remedy the excessive emissions of the UK, Europe, and perhaps even the USA.

SIX INCONVENIENT TRUTHS

by Andrew R.B. Ferguson

In the film *An Inconvenient Truth*, ex vice-president Al Gore presents the facts about climate change. It is a bravura performance. He makes use of brilliant presentational techniques to put before us all the relevant current knowledge about climate change. He lightens the factual burden with humour, and by including some interesting autobiographical vignettes showing how various things in his life brought him to see the subject as being of pre-eminent importance.

Although I am fairly familiar with the subject, he introduced me to a telling statistic. He said that over 900 scientific peer reviewed papers had been published, yet none had argued that global warming was not taking place. As part of the same survey, over 600 popular media articles were analysed. More than fifty per cent of them presented the subject in such a way as to appear that it was still an open question whether global warming was taking place. Doubtless the media do this partly because they think that controversy is more interesting, but as Al Gore pointed out, they are helped by the industrial lobby, which thinks that it is to their benefit to create uncertainty where none should exist. Such activities have been manifest in the tobacco industry as well as in the energy industry.

As a presentation of the inconvenient fact of climate change, the film can be recommended merely on the basis of the pleasure of seeing something being done as well as it possibly could be. But there are five other inconvenient truths which are of equal importance which were largely ignored by Al Gore.

The second inconvenient truth is the immense difficulty of replacing fossil fuels. Fossil fuels contain energy by virtue of having accumulated millions of years of solar energy. To replace fossil fuels we have two options. One is to tap nuclear energy. Nuclear fission — of uranium and thorium — is limited by the restricted supply of suitable resources (apart from any other dangers). Nuclear fusion is at a stage where it needs still to be regarded as a possibility rather than a probability, and there is a good chance that even if it becomes possible to achieve, so much waste heat would be released in the process that the 'cure' would be worse than the 'disease' of inadequate energy supplies. Nuclear fission leads to the overheating of rivers, and is already a problem in that regard.

The second possibility, in addition to nuclear energy, is that of capturing solar energy as it arrives on the Earth. There are intractable problems to which evolution has not provided a solution, so we would be wise to withhold judgement as to whether the human race will be able to. Where power density is fairly high, as with wind, photovoltaics and tidal stream, uncontrollability (i.e. intermittency) is an immense problem. Where uncontrollability is either no problem or little problem, as with biomass and hydroelectricity respectively, power density is low. Biomass captures and stores in its mass only about one thousandth part of the energy that falls on it, which is why I say that evolution has not provided an answer to how to store the immense quantity of energy that is needed to make it possible to sustain our present population.

These difficulties lead those who have studied the matter to conclude that without fossil fuels the Earth is only likely to support about 2 billion people, rather than the 9 billion that are likely to be here by 2050. Al Gore did not mention the number of people who might live on Earth in reasonable comfort with diminished energy resources.

The third inconvenient truth is that even a large reduction in fossil fuel usage by the developed nations — one so large as to be barely conceivable, a 60% reduction — is likely

to be cancelled by a wholly justifiable increase by China, India and Indonesia. If this 60% reduction could be achieved by 2050, China, India and Indonesia are likely to have increased their present per capita consumption by an amount that would match the decrease in the developed world. Moreover their per capita emissions would still be less than the developed world *after the mooted 60% reduction*. Thus the overall effect is likely to be little reduction in present emissions, even according to the most optimistic hopes. Yet the world is currently emitting about two and a half times as much carbon as it should be to have a hope of stabilizing atmospheric carbon at a 'safe' level. The conclusion to this is that while taking action to reduce carbon emissions may help to mitigate some of the dire problems seen by Al Gore, it will not prevent most of them, so preparing for those problems needs to be as high on the agenda as attempting to reduce the emissions. Al Gore sees hundreds of millions of refugees as the inevitable outcome of substantial sea level increase. One of the most sensible methods of preparing for this is to do all that can be done to slow population growth. Failing to take note of this inconvenient truth, Al Gore did not mention that much remains to be done to (a) change the Vatican's belief that only 'natural' methods of contraception are permissible, and (b) combat the influence of the 'right to lifers'. In short to ensure that contraception is easily available to all those who wish to use it, and that abortion is readily available when contraception has failed and the mother does not want another child. That inconvenient truth is about as inconvenient as inconvenient truths come!

The fourth inconvenient truth arises from the fact that it is bound to be a slow process to reduce the per capita emissions of the developed nations. Thus the action that would most rapidly ensure that there was some mitigation in burgeoning use of fossil fuels would be to prevent the populations of the developed nations growing by net immigration (as is happening in the USA and to a lesser extent in the European Union).

The fifth inconvenient truth is that a powerful driver for fossil fuel consumption is globalization. There is little hope of making frugal use of energy while globalization requires that goods and consumables are unnecessarily transported around the world. There are many problems associated with globalization, but this aspect is the one which is relevant to excessive use of fossil fuels, thus overloading the Earth with carbon.

The sixth inconvenient truth is that the belief of economists and the commercial world in *ever continuing* growth is impossible. We need to change our capitalist system so that it works reasonably well without growth, with goods lasting as long as possible and designed so that they can be repaired when they go wrong, and with products being made only to satisfy real needs, not 'needs' invented by business to expand their markets.

Every one of those six inconvenient truths is of great importance, yet Al Gore attended in depth to only the first. While he did mention population as a problem, he gave no indication of the immense reduction in population that is needed if everyone is to live even moderately well. He indicated, with a passing remark, how he justifies that to himself, namely that he is himself party to the delusion that renewable energy can replace fossil fuels. As to the other inconvenient truths, perhaps he did give an implicit explanation of why he kept quiet about so many important matters. He mentioned that he had observed long ago that it is almost impossible to persuade someone of the truth of an argument if that person's salary depends on their believing the argument not to be true. After the above survey, I think we might extend that observation to conclude that it is almost impossible to persuade a politician of the truth of an argument, if that politician's chance of office depends on their believing the argument not to be true!

REVIEWING THE STERN REVIEW

by Andrew R.B. Ferguson

In the OPT Journal of April 2002, concerns about climate change were stated in a short paper, *Ice Age, Glacial and Interglacial*. The sources of reference were John Houghton's *Global Warming, the Complete Briefing* (1997) and *Earth Story* by Simon Lamb and David Sington (1998). The essential point being made was that humans have been on Earth only during a period when there have been glacial periods (when the polar ice creeps towards the equator) and interglacials (when it recedes) — with these cycles lasting about 120,000 years. But on a wider time perspective, human history has existed only in a period of a continuous 'ice age;' that is in the sense of there having always been polar ice caps while humans have been around. In 2002, it was clear that human carbon emissions had already raised atmospheric carbon dioxide above the level of the last interglacial, meaning that there was a distinct possibility that the human race would push the Earth back into what the article termed a 'water age' — the sort of age the dinosaurs lived in. What speed the effects of climate change would manifest themselves was by no means evident at that time at. The amount of evidence for rapid climate change has been growing at a rate that very few would have predicted only four years ago. In 2002 even the Intergovernmental Panel on Climate Change would not give a clear indication of what was an 'unsafe' level of global warming gases.

However, the imminence of the dangers have become more apparent, and Nicholas Stern, former chief economist of the World Bank, was asked by the UK government to report on the economic costs of climate change. The result was the 570 page Stern Report, published in October 2006. I can claim to have read only the 27 page introductory review, but perhaps that suffices for my present purposes, for I am mainly asking whether the Stern Report has a similar failing to Al Gore's film *An Inconvenient Truth*. While admiring that film in some respects, I have already written about that failing. The failing consists of omitting to properly address five other inconvenient truths. I won't attempt here to prove the truth of all six 'inconvenient truths', since that has occupied many issues of the OPT Journal. But by way of brief rehearsal, these are the six inconvenient truths:

The six inconvenient truths

1. Climate change due to greenhouse gases needs to be taken very seriously indeed.
2. There is immense difficulty in finding a way to replace the energy provided by fossil fuels. The consensus view of ecologists is that without them, a world population of only about 2 billion could be supported in comfort.
3. An *improbable* 60% cut in emissions by the USA and Europe, by 2050, would be cancelled out by a *probable* 130% increase by China, India and Indonesia (after which per capita emissions in the latter group would still be below those of the former).
4. Allowing only balanced migration into developed countries is one very important aspect of holding down carbon emissions.
5. Globalization is a powerful driver of carbon emissions so needs to be abandoned.
6. To continue — as economists and the commercial world would have us do —with ever continuing growth is just about certain to be fatal. Overdeveloped nations need to 'undevelop', and populations need to shrink, with 2 billion as the eventual aim.

The Stern Report recommendations

The Stern Report makes as good a job as Al Gore of getting over the message that climate change has such disastrous consequences that every effort needs to be made taken to effect mitigation. Item 1 is thus dealt with very well. Also the report is sound in some respects about what needs to be done to reduce carbon emissions, for instance there is no doubt it is correct in saying (p. xvi): "Carbon capture and storage is essential to maintain the role of coal in providing secure and reliable energy for many economies." There is much else that is good sense regarding item 1, but we need not dwell on that.

Regarding item 2, the extent of the difficulty of finding replacements for fossil fuels is not dealt with in the report. Perhaps this is not surprising, as the fundamental nature of the problem is not widely understood even in the academic community.

The report tends to be misleading with regard to item 3. For instance it says (p. xxxiii):

> Securing broad-based and sustained co-operation requires an equitable distribution of effort across both developed and developing countries. There is no single formula that captures all dimensions of equity, but calculations based on income, historic responsibility and per capita emissions all point to rich countries taking responsibility for emissions reductions of 60-80% from 1990 levels by 2050.

So far so good, but it does not go on to point out that, by the same tokens of equity, the undeveloped nations should be allowed to increase to the level to which the developed world has reached *after* achieving the mooted 60% reduction. Yet as item 3 states, if America and Europe decreased their emissions by 60%, this is likely to be cancelled out by increases in China, India and Indonesia, which would be fully justifiable in that they would only have achieved about the same per capita level as the developed world. In other words, a 60% reduction by the developed world would most likely lead to little change in overall emissions from the rate today.

With regard to item 4, the report notes the probability of large migrations occurring, but fails to notice the consequence, in carbon terms, of large numbers of people from undeveloped nations coming into developed nations. For instance, the 5 million annual increase in population in the United States is largely a result of such movements, and makes the United States a 'rogue nation', in that it is continually increasing its already excessive emissions in step with its population growth.

With regard to item 5, the report seems to take the same line as most governments, namely that globalization is an unstoppable force which it is useless to oppose (or alternatively that it is something to be welcomed).

With regard to item 6, it is clear that the thought of anything but continued economic growth hardly crosses Stern's mind. He is no Thomas Malthus, John Stuart Mill or Maynard Keynes. Thus item 6 is not dealt with.

Conclusions

The report could be welcomed for the stress it places on the need to reduce carbon emissions, but it is also dangerous, in that it implies that the task is easier than it is, mainly by failing to deal with the items 2 to 6. They too need to be addressed to get a rounded picture of the world's predicament.

The dangers of the report being misinterpreted are very great. For instance, Anatole Kaletsky, associate editor of the *Times* newspaper, wrote thus on 2nd November:

> To appeal for more ambitious policies on global warming, therefore, is not to demand self-sacrifice and austerity; but on the contrary, to create conditions for higher living standards, more consumption and faster economic growth. This is by far the most important message of the Stern report.

GERMANY'S EXPERIENCE OF 'UNCONTROLLABLES.'

by Andrew R.B. Ferguson

As well as leading the world in making use of wind and photovoltaics (PV), Germany is doing a valuable job in providing others with information about their progress in this field, e.g. the *Wind Reports 2004* and *2005* by E.ON Netz. This information is useful as the world is on a steep learning curve, as nations see how far they can fit 'uncontrollables' into their electrical systems. E.ON Netz produced an eight page update to their *Wind Report 2005*. It is titled *Data and facts relating to Wind Power in Germany; supplement 2006 to the E.ON Netz Wind Report*.[1] It covers events in 2005.

Some salient points from this update are:

(1) Increase in wind power capacity on the German grid was about 12% during 2005, but it was a poor year for wind, and the increase in output over the previous year was only 1.5%. Wind provided 4.7% of Germany's gross electrical demand.

(2) On the E.ON Netz part of the system (41% of the whole) peak infeed[2] occurred in December of 2005, when installed capacity must have been approaching the end of year figure of 7558 MW, thus the peak infeed of 6234 MW would have been about 6234 / 7558 = 82% of capacity. Peak infeed was a bit higher in 2004, but a bit lower in 2003, about 80%. Of course the higher the peak infeed, the more troublesome wind is to integrate into the grid. Nevertheless, for convenience, one can round out the peak infeed factor as being about 80% of capacity.

(3) Minimum infeed on the E.ON Netz part of the system was 8 MW, which is about 0.1% of capacity, thereby further justifying the previous claim of E.ON Netz that there must be controllable capacity available equal to the peak infeed of the uncontrollable wind source (i.e. about 80% of capacity as in the previous item).

Drawing wind data from E.ON Netz, and PV data from the *Renew* newsletter,[3] the German wind and PV capacities, and the output from them, are as follows (bold for the given data, with the remaining figures being calculated):

	Wind	PV
End of 2005 capacity	**18,400** MW`	**1400** MW
End of 2004 capacity	**16,400** MW	**794** MW
So average capacity for 2005	17,400 MW	1097 MW
Output during 2005	**26.5** TWh	**1.0** TWh
So average power output	3025 MW	114 MW
Therefore capacity factor	17.4%[4]	10.4%

The 2005 capacity and output figures appeared in the *Renew* report; but are these figures good, bad, or indifferent? Further analysis is needed to see that, and to see what part 'uncontrollables' can play in providing electrical energy to the grid. Making use of the calculated figures in the table above, we can make a rough estimate of the extent that these two uncontrollables (in the proportions shown there) could contribute to electrical demand.

As already mentioned, the peak output of a large group of wind turbines is generally equal to about 80% of their rated capacity. Thus the peak infeed from the mean 17,400 MW of capacity, in Germany, is about 13,920 MW. On the other hand, PV at times produces its full rated power (when there is wall-to-wall sunshine). Because average PV capacity in 2005 was about 1097 MW then with both wind and PV producing at peak (total output of 1097 + 13,920 = 15,017 MW), wind will be producing 13,920 / 15,017 = 93% and PV

1097 / 15,017 = 7%. However, as calculated in the above table, over the course of the year wind will contribute 3025 / (3025 + 114) = 96% of the electricity and PV the remaining 4%. The overall capacity factor for wind and PV together is (3025 + 114) / (17,400 + 1097) = 17.0%, only a slight drop from the 17.4% of wind alone. This shows that because PV produces only a small proportion of the total output, the mean capacity factor is barely influenced by the use of PV. So, as a slightly optimistic approximation, *and a simplification*, let us assume that wind fills all the electrical demand that such uncontrollable power sources are capable of filling. Uncontrollable power sources are obviously only able to contribute up to a certain point otherwise they will sometimes produce more power than is needed by the system, as happens in Denmark. It is possible to deal with this if there are good connections to countries that makes ample use of hydroelectricity, which can be turned down to make room for wind, but that advantage applies only to a few countries. Let us return to the analysis of the figures.

Because the peak infeed from the mean 17,400 MW capacity in Germany is about 13,920 MW (see earlier), wind can fill 3025 / 13,920 = 22% of the 'block of electrical demand that it intrudes upon. This leaves 78% of that 'block' to be filled in by a controllable power supply. If Germany is in line with the UK, then low demand for electricity is about 60% of mean demand. Thus wind and PV in Germany could ultimately — according to this approximation in which we treat all the 'block' as being supplied by wind — fill 0.22 x 60 = 13% of mean electrical demand.

If no wind energy existed, and there were no fixed inputs (e.g. nuclear and tidal flow), and PV alone filled the 60% 'block' of electricity which would be available, then PV could fill 114 / 1097 = 10% of the 60% represented by mean demand, i.e. 6% of total electrical demand. Note again that it is only because PV is such a small proportion of the whole that we can adopt the simplification of doing the calculation based on the idea that wind produces all the infeed. The situation would grow worse as the amount of PV increases.

The situation in the UK is better insofar as the wind capacity factor is higher. Applying the same calculations to the UK, but using a capacity factor of 30% instead of 17.4%, wind could satisfy (0.30 / 0.80) x 0.60 = 23% of electrical demand. But that is on the unrealistic assumption that there are no other fixed inputs. If we allow for 20% of electrical power to be filled by nuclear, then uncontrollables could satisfy (0.30 / 0.80) x (0.60 - 0.20) = 15% of electrical demand, which is about 5% of total energy demand.

There are many finer points that have not been dwelt on in this analysis, such as whether high winds and wall-to-wall summer sunshine ever coincide, but such matters are more or less details, and the broad overview of the problem of 'uncontrollables' is made evident in the above analysis in a way that is not at all obvious from merely reading about installed capacities and output, which is almost invariably all that is reported in renewable energy newletters such as *Renew*, and in environmental magazines such as *Earthwatch*. Will the world come to realize the limitations of renewables before it is faced with disaster? If it fails, then it will not be the fault of Germany, which has shown the world empirically what a theoretical analysis should make fairly obvious, namely that 'uncontrollables' can contribute only a small amount to total energy demand.

1. The 2006 update is available from www.eon-netz.com as a pdf download (about 664 kb) but finding requires it skilful navigation (starting with clicking on English at the top of the screen).
2. For the meaning of wind terms see OPT Journal 6/1, April 2006, pp. 29-30.
3. The information is taken from page 13 of the newsletter *Renew* 163, the Sept/Oct 2006 edition (produced by the Network for Alternative Technology and Technology Assessment, NATTA), except for the 16,400 MW for wind at end of 2004, which was taken from the E.ON Netz *Wind Report 2005*.
4. This is for Germany as a whole. The E.ON Netz update gives 18% for the E.ON Netz control area.

ETHANOL AND WORLD PRODUCTION OF MAIZE (CORN)

by Andrew R.B. Ferguson

Science journalist Bernard Gilland sent me a calculation which showed that if all the world's maize (corn in the U.S.) was used to produce ethanol, the net energy gain would be equivalent to 5% of the world's gasoline production. Using the same data, I checked his work by using a different method of calculation, and also looked at the "useful" ethanol produced. That is the ethanol left over after providing for only the *liquid* inputs needed for producing ethanol (mainly for growing the maize). This led to the following conclusion.

> If all 695 million tonnes of the world's maize production were used to make ethanol, the "useful" ethanol produced would be sufficient to displace **11%** of world gasoline use; but the net energy gain *according to the most optimistic of all assessments* (U.S. Dept. of Energy , 2004) would amount to the equivalent of only **5%** of world gasoline use; moreover according to some of the meticulously carried out energy balance assessments, there would be a **net energy loss** rather than a 5% gain.

The doing of the calculation does not imply endorsement of the morality of producing *any* ethanol from maize. That is best judged in the light of the following three facts. (1) growing maize causes soil erosion, and the pesticides and fertilizers used have detrimental ecological effects; (2) grain production, having peaked at 342 kg/cap in 1984, declined to 299 in 2003 (i.e. more food is needed); (3) if the present population growth rate slows steadily to zero by 2075, then by that date world population will be 10,000 million.

The full extent of the unresolved problem of producing liquid fuels from renewable resources, *in sufficient quantities*, becomes even more apparent when it is considered that the energy in world gasoline consumption is about a third of that in all the oil we consume.

The calculation

2.8 U.S. gallons are produced from a bushel of maize (National Corn Growers association, 2006).
1 U.S. gallon = 3.785 litres. 1 bushel of maize = 56 lb. 1 tonne = 2205 lb.
So 1 tonne of maize will produce (2205 / 56) x 2.8 x 3.785 = 417 litres of ethanol.
Heat content of ethanol is 21.25 MJ/litre
So 1 tonne of maize will produce 417 x 21.25 MJ = 8.86 GJ as ethanol.
Ratio "output energy/input energy," for ethanol production from corn, is 1.67 (U.S. Dept. of Energy , 2004).
So input energy per tonne of maize is 8.86 / 1.67 = 5.31 GJ.
So energy gain per tonne of maize is 8.86 - 5.31 =3.55 GJ.
World maize production in 2005 was 695 Mt (FAO).
So total energy gain is 3.55 GJ x 695 x 10^6 = 2.47 x 10^{18} J.
1 tonne of gasoline contains 43.7 GJ.
So energy gain is equivalent to the heat content of 2.47 x 10^{18} / 43.7 GJ = 56.5 Mt of gasoline.
World gasoline consumption in 2005 was 25.32 million barrels per day = 1166 Mt per year (BP Statistical Review of World Energy, 2006).
So the net energy produced from the maize would be 56.5 / 1166 = 4.8% (**say 5%**) of total world gasoline consumption.

"Useful" ethanol production.

Since 1 tonne of maize will produce 8.86 GJ as ethanol,
the total world maize production in 2005 of 695 Mt will produce 6.16 x 10^{18} J as ethanol.
1 tonne of gasoline contains 43.7 GJ.
So gasoline equivalent of total ethanol produced is 6.16 x 10^{18} / 43.7 GJ = 141 Mt of gasoline.
This is 141 / 1166 = 12% of total world gasoline consumption.
But about 10% of the output (17% of the input) is needed as liquid inputs for production processes (U.S. Dept. of Energy , 2002), so the "useful" ethanol production is 12 x 0.90 = **11**%.

Virginia Deane Abernethy, Professor of Psychiatry (Anthropology) Emeritus, was for a long time editor of the academic journal *Population and Environment.* She has kindly allowed me to take comprehensive excerpts (comprising at least half) from a paper[1] written for the organization which she now chairs, *Population-Environment Balance*. While the paper focuses on the problems that exist in defending the borders of the USA, it is easy to see that the borders of the European Union might also be hard to defend.

THE EXTENT OF THE IMMIGRATION PROBLEM IN THE USA

by Virginia Deane Abernethy PhD, Vanderbilt University School of Medicine

Publications on the size and growth rate of the U.S. population seemed designed to confuse rather than enlighten. The Census Bureau made up for large annual underestimates of population growth during the 1990s with a 12 million person bump in the census year. Unfazed, it perpetuates error through massively undercounting illegal aliens.

The Census Bureau (CB) is not unique in massaging statistics, possibly in the service of policy rather than accuracy. …

The 12 million person bump in one year

A recent smoking gun that reflects on the CB's underreporting is that as much as a 12 million increase in the U.S. population, from 272.7 million in 1999 to 284.5 million in 2000, had to be accommodated in one year. For comparison, the CB's population growth estimates in other years of the 1990s decade center approximately on 2.5 million annually.

Allowing for the standard 2.5 million increase in the tenth year, and spreading the remaining 9.5 million increase over each year of the decade would add 0.9 million in annual growth. A better estimate of U.S. population growth during the 1990s would have been 3.4 million annually.

The startling 12 million person one-year increase in the CB's 2000 report reflects findings of the 10-year census. With introspection, someone might have asked if the 12 million leap was enough, particularly in view of reports that illegal alien border crossings were increasing dramatically.

Much was made of failure to count the homeless in censuses before 2000, but the 1990s underestimates seem mostly the result of not taking into account the illegal aliens settling in the United States. For example, the CB estimated 5 to 7 million illegal aliens present in 2000, whereas other sources (see below) were quick to estimate 18 to 28 million illegal aliens at the least.

If 11 to 23 million more illegal aliens than the CB expected – and failed to count – actually were in the United States in 2000, then the real population of that year was already close to exceeding 300 million. In fact, *the evidence overwhelmingly indicates that the 300 million mark was passed in the year 2000.* This October's much-heralded announcement that the United States just reached 300 million in 2006 will be another scene in a great charade.

Long term estimates also revised but still short

The CB also revises upward its *long-term* projections but perhaps not enough. An example pointed out in demographer Lindsey Grant's newest book, *The Collapsing Bubble,* is that the CB projects the likeliest size of the U.S. population in 2100 to be 600 million. This is 100 million greater than the CB's middle projection made as recently as 1994 – a 20 percent revision upward!

Reviewing Grant's book, Andrew Ferguson hazards that the CB's new middle projection should have been still higher. If the "U.S. population continues to grow at the rate of the three closing decades of the last century, 1.06% per year, then by 2100 the U.S. population would be 810 million."[2]

The Census Bureau perpetuates error

Going forward from year 2000, a chastened CB might have been expected to correct the assumptions that had led to massive underestimation. But no, the 2001 through 2005 estimates return to the fiction that the U.S. population grows each year at the relatively stately pace of slightly less than 3 million, at a rate of 0.9 percent annually in the latest year, 2005.[3] The illegal alien addition to the population is assumed to be 500,000 annually. …

Massive undercounting of illegal aliens

Reports of much higher-than-reported illegal aliens entering, and in, the United States can be tracked almost back to the 2000 census.

In February, 2002, a Border Patrol Supervisor of 27 years service testified before Congress that the number of illegal aliens was several times the CB estimate. He stated, "According to various Mexican media and official Mexican government sources, the country of Mexico has 18 million of its citizens residing illegally in the United States at this very minute."[4] Besides Mexicans, what of Filipinos, Indians, Chinese, Koreans, Vietnamese, Eastern Europeans, Irish, Brazilians, Guatemalans, Hondurans and Haitians illegally in the United States?

Using financial and employment data, analysts for Bear Stearns Asset Management also estimate a number much higher than anything considered by the Census Bureau. They concluded in early 2004 that, "The number of illegal immigrants in the United States may be as high as 20 million people, more than double the official 9 million people estimated by the Census Bureau."[5]

Patrick Buchanan's 2006 book, *State of Emergency: Third World Invasion and Conquest of America* states that the Border Patrol (BP) apprehends 150,000 illegal aliens breaking into the United States each month, amounting to 1.8 million apprehensions annually.[6]

Some illegal border crossers may be apprehended more than once, although most – 70 percent – make it in a first or second attempt, and 92 percent make it eventually according to the Center for Comparative Immigration Studies at UC, San Diego.[7] In recent testimony before the House Judiciary Committee, Wayne Cornelius, director of the Center, stated that 92 to 97 percent succeed on two tries or less.[8]

The BP estimates that, for each illegal alien apprehended, 3 to 5 succeed in entering. Taking the middle figure of 4, then 4 x 1.8 million annual apprehensions = 7.2 million aliens enter illegally each year.

Moreover, many foreigners enter supposedly for a visit but never leave. In 1992, approximately 150,000 more foreign passengers arrived in US airports than left.[9] …

Conservatively, assume that 5 million – rather than 7.2. million plus visa overstayers – actually enter the United States each year. Of these 5 million, assume that 40 percent remain indefinitely. This calculation suggests that 2 million illegal aliens melt permanently into U.S. population annually. If 60 per cent stay, then approximately 3 million new illegal aliens remain in the United States annually. Compare that to the Census Bureau's puny estimate of 500,000 illegal aliens staying annually!

A high proportion of illegal aliens planning to stay on a permanent basis seems reasonable on various counts. Recent polls show that 46 percent of Mexicans would like to move to the United States.[10] Once here, illegal aliens seemingly wish to stay: A 2005 poll found that 4-to-1, or 80 percent, would stay if given a good opportunity.[11] Rather than risk repeatedly recrossing, illegal alien men are increasingly likely to be joined by their families.[12] …

Massive undercounting begins with legal immigration

Throughout the 1990s, the CB has nailed legal immigration at approximately 1 million annually. This entails omitting the annual refugee number, which has varied from 45,000 to 142,000 and the asylee number, approximately 150,000 annually. …

Real population numbers

The U.S. population passed 300 million in year 2000. The current U.S. population is approximately 327 million.

The latest year for which vital statistics are reported, 2004, saw approximately 1.7 million more total births than deaths. Of the approximately 4.1 million total births, 945,000 or nearly one quarter were Hispanic births.[13] Additionally, the data suggest that between 2 and 3 million *illegal* aliens stay in the United States and more than 1 million *legal* immigrants arrive in the United States annually.

These numbers indicate a faster rate of population growth and a shorter doubling time than either the annual rate calculated over a 30-year rate interval by Andrew Ferguson (1.06 percent annually, projecting 66 years to double) or the CB rate reported for the 1990s (1.2 percent annual growth, projecting 58 years to double).[14]

Summing annual growth figures (1.7 million natural increase, 1 million legal immigrants, and 2 or 3 million illegal aliens who stay), one sees that, each year, the population grows by 4.7 to 5.7 million. The annual growth rate is between 1.4 and 1.7 percent. If 1.4 percent, the population doubling time is 50 years.

The *rate* of growth has itself been growing. If acceleration of the growth *rate* continues, we are on trend to pass the 1 billion mark in approximately 70 years. …

Implications of rapid U.S. population growth

Some ecologists, labor economists, and conservationists say that rapid population growth, regardless of its source, is a danger. This concern departs from the United Nations and *Wall Street Journal* view, which decries European and Japanese economic and social health because these countries' populations are on the verge of stabilizing.

So what, if anything, is wrong with an exploding US population?

First, *native-born Americans spontaneously chose small family size starting in approximately 1970.* The majority would probably be better off economically and ecologically today if, congruent with the recommendations of the 1972 Rockefeller Report,[15] the U.S. population had begun to stabilize 30 years ago.

Second, *current population growth is being forced on native-born Americans by immigration.* Approximately 90 percent of growth results from the annual immigration flow and the descendants of post-1970 immigrants.[16] …

Moreover, immigration accelerates *world* population growth. Steven Camarota of the Center for Immigration Studies writes, "Analysis of data collected by Census Bureau in

2002 shows that women from the top-10 immigrant-sending countries living in the United States collectively tend to have higher fertility than women in their home countries. As a group, immigrants from these countries have 23 percent more children than women in their home countries, adding to world population growth. .... Among Mexican immigrants in the United States, for example, fertility averages 3.5 children per woman compared to 2.4 children per woman in Mexico."[17] …

Economist George Borjas observes that immigration depresses wages and displaces Americans from jobs, costing native-born American workers $195 billion annually.[18, 19] In 2000, the wages of native-born American workers were reduced by an average 3.2 percent.[20]

The impact is not even. Citing a current Northeastern University study, the New York Times states that "illegal immigrants contributed to a sharp decline in employment of teenage and young adult Americans."[21] The effect on young and less-educated workers is not new news. Most recently, however, Borjas reported that the wage impact is "most intense" at the two ends of the native-born education range.[22]

In addition to depressing wages, immigrant workers displace Americans. Steven Camarota analyzes CB data, finding that "between March 2000 and March 2004, the number of adults working actually increased, but all of the net change went to immigrant workers."[23]

Andrew Sum and his colleagues at Northeastern University concur. Since 2000, immigrants have taken more than 100 percent of net new jobs, that is, both capturing new jobs and displacing Americans from existing jobs.[24] …

Economist Lester Thurow's 1990s analysis of the cost of population growth – without reference to whether the growth is organic or from immigration – concludes that maintaining the quality of infrastructure requires a nation to commit 12.5 percent of its GDP for each 1 percent of population growth.[25] A community study on infrastructure costs associated with population growth is congruent. Eben Fodor calculated in the 1990s that each new three-person residential unit burdened taxpayers with an average of more than $15,000 in new requirements for capital improvements, not counting annual operating costs.[26] …

One acre of land is lost to highways and urbanization for each person added to the U.S. population; each person uses 2,800 gallons of oil equivalents and 530,000 gallons of water per year.[27, 28, 29, 30] …

Such ecological losses and challenges are separate from the loss of community public spiritedness that follows rapid growth and multiplying languages and cultures. *Immigration advocates are challenged to show one fast-growing, multicultural society that is cohesive, democratic and smoothly functioning. …*

The tally of losses from mass immigration suggests that a large price is paid for so-called cheap labor and for advancing the financial and political elite's agenda of erasing borders and integrating Canada, Mexico and the United States into the Partnership for Prosperity and Security, a.k.a. North American Union.[31] Middle class Americans, possibly to be joined by Canadians, would pay the greater part of the bill.

A healthy respect for probable errors in Census Bureau data advances the case for putting *enforcement* with the purpose of stopping illegal immigration and dramatically reducing legal immigration at the top of the legislative and executive branch agenda.

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This is the third contribution to this series, which chronicles how some people, living at the start of the twenty-first century, reached their understanding of the human condition. Sandy Irvine was for 7 years the editor and main contributor to *Real World*, a magazine referred to by Val Stevens in her contribution in the last issue of the OPT Journal.

PATHS TO WISDOM, NUMBER 3

By Sandy Irvine.
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My growing appreciation of both ecological sustainability in general and the population dimension in particular has followed a rather uneven and indeed rocky road. There has been no sudden flash of light, rather a diversity of experiences that led me to conclude that the biggest single issue on planet earth is the sheer number of one species, humankind.

My first vague thoughts came as a child. I grew up in Huddersfield in the industrial conurbation of west Yorkshire. Many of my relatives lived in Scotland and indeed further north, my father being a Shetlander. The contrast between the crowded towns of industrial England and the big open spaces around my uncle's croft made a big impression on my youthful mind.

However, in my teens, my path was to take a radical change of direction. At the age of 18, I left for Newcastle and university in 1968, year of the Paris events and big anti-Vietnam war protests in England. I already called myself a socialist, mainly because of the influence of my great uncle, a former coal miner in Yorkshire and subscriber to the Communist newspaper, the *Daily Worker*. I often read his papers on our regular Sunday visits (his family raised my mother). I never bought the notion of the USSR as the workers' paradise but the case against capitalism seemed overwhelming (and one which I still accept today).

I joined a group called the International Socialists group (now Socialist Workers Party) in 1968 and was active for many years in left-wing politics, including a period as a paid full-time organiser in Newcastle. The socialist emphasis on economic exploitation, inequality and on the need to distribute the fruits of human labour to each according to his/her needs pushed to the back of my mind the extent to which the Earth was able to underwrite human expectations and how soon rising human numbers in and of themselves would make those demands unsustainable.

During this period, however, I read *Blueprint for Survival*[1] and *Limits to Growth*.[2] I also heard the American biologist Barry Commoner give a lecture in 1972. The two books did lodge in my brain the nagging thought that, on a finite planet, there could not be infinite growth. Commoner did not agree with campaigners like Paul Ehrlich about the threat from overpopulation and since then has attacked the idea. Yet he forcefully explained the dangers of messing around with Mother Earth.

Ironically, the International Socialists group also encouraged greener thoughts, albeit more by chance. It took a different stance to that of most left-wing groups. Its theorists, like economist Michael Kidron, argued that the Communist Bloc was nothing to do with real socialism but was in fact a variant of capitalism, namely what the International Socialists and others called 'state capitalism'. The defining feature of both systems was a compulsive search for open-ended economic expansion.

Growth, then, was the issue. My appreciation of the population element in the growth dynamic was encouraged by a year I spent as a Town Planning student (I subsequently transferred to History, repulsed by the horrid developments that planners were helping to create). As a trainee planner, I had to do various exercises, relating to new housing and the like. Though some could be said to be driven by demands for greater affluence, the root

factor always seemed to come back to human numbers. The fewer people, I came to appreciate, the lower demand there would be for more development (usually meaning more urban sprawl).

During my time at university, I spent every summer working as a relief lock-keeper on the Thames. It was a great job at lovely places like the locks at Windsor and Marlow. It too provided more education, this time about the so-called 'tragedy of the commons'. The river was essentially a common property finite resource. As a result, more and more people kept hiring or buying boats and trying to sail them on the river. The result was routine congestion, which sometimes, especially on sunny Sundays, led to a two hour wait to get through our lock, due to the sheer number of boats. Such growth seemed counter-productive, destroying the very pleasures people sought in the first place. It was also one which could only be resolved by the setting of public limits on boating.

Through the 1970s, these vague thoughts about the significance of the Earth's life-support systems and the nature of threats to them began to firm up. I did more reading Paul Ehrlich,[3] Garrett Hardin,[4] and Edward Goldsmith[5] in particular made a big impact on me. I still think that Hardin is a much misunderstood writer, nowhere near as reactionary as some critics allege. Because I had always enjoyed wild environments, I had no problem in accepting notions about the intrinsic worth of the Earth as a whole and of individual non-human species, when I came across books that argued this position. Writings by David Ehrenfeld,[6] John Livingston[7] and Arne Naess[8] stand out. Utilitarian arguments about environmental conservation seemed a limited and limiting standpoint, one which would eventually lead to acquiescence in the destruction of life and landforms not deemed to be useful. The conclusion was now obvious: the more people and associated artefacts there were, the less non-human nature there would be.

Direct contact with the Earth's marvels has been a truly life-enhancing experience and education in its own right. Three events stand out. First was a hike through the Pacific Rim National Park in Canada. At one point, the trail crosses from secondary growth into primal forest. My memory of the contrast between the two, between ecological poverty and wealth, makes me angry whenever I see stupid claims that, quantitatively speaking, the Earth's forest cover is increasing. Shortly after that walk, we went out on the Pacific in a little motorboat and found ourselves right next to a huge whale. The magnificence of this creature only underlined the folly of people who destroy the wonders of creation. Thirdly, on another visit to western Canada (my wife's brother lives there), we went for a hike across Sunshine Meadows above Banff in the Rockies. We walked for a while with a Park Ranger, and I always remember her saying that the bears had been driven from the area simply because the sheer number of people who now regularly hike there (which included us, of course!).

A number of summers spent under canvas with my wife and two children in the mountainous Cevennes in southern France near lovely villages like Cantobre always reminded me that humans too can create things of great beauty. So too do museums and galleries. Last year, for example, I went to see the famous Vermeer exhibition in the Hague. Yet the Dutch 'golden age' as well as periods like the Italian renaissance were products of comparatively small populations, and I cannot but look at today's teeming cities and see a general cultural debasement, numerous wonderful exceptions notwithstanding. More seems to be less in all kinds of ways.

In the late 1970s, my path took another detour. I had joined the Ecology Party (soon rebranded as the Green Party). The well-know campaigner Jonathon Porritt made a particularly big impression on me (even though I now strongly disagree with some of his positions, I still greatly admire the work he continues to do). Later, I was elected to the

Green party's first National Executive. I also became a member of the *Ecologist* editorial board.

However the realisation quickly dawned that the environmentalism of most greens was actually very shallow. Their agenda was a human-centred one, at whose core was a belief in expanding entitlements. The Green Party quickly distanced itself from any serious stance on overpopulation and soon began to dump environmental issues on the back burner. I was amazed, for example, when, not long after joining the Green Party, I was told by the then co-chair Jo Robins that the party went on too much about the environment.

Indeed the party gradually shifted towards an agenda founded on expanding human rights, with little consideration of balancing responsibilities. There was simply no assessment of how the Earth could possibly sustain the concomitant increase in demands placed on her life-support systems. At best people would tell me that conversion of industry from arms production to more socially useful products would do the trick, not realising that Nature's accounts make no distinction between armoured cars and ambulances.

Such ecological myopia was true of other wings of the movement too. Thus the *Ecologist* magazine had changed radically since its early days. No longer addressing the realities of overpopulation, it began to talk about reproductive rights instead. I sometimes think that its name now breaches the Trades Description Act.

For such reasons, I conceived the idea of a publication that would try to seriously address the issues so neglected by others. With my good friend Alec Ponton, I tried to launch a deeply green magazine which we named *Real World*, since we thought most other publications inhabited some kind of fantasy world. Alec and I had written a book together, *A Green Manifesto*, and now thought we could produce a quarterly journal. We survived 19 issues before the pressure of work and family forced us to cease production.

However the experience brought me into contact with many individuals who further advanced my understanding of the people-planet conundrum — and its overriding importance. There are too many to name so I'll only identify a few merely to illustrate their variety: Ted Trainer (an Australian academic), Stan Rowe (a brilliant Canadian botanist but, sadly, now dead), David Orr (an American educationalist), and George Sessions (an American philosopher). Though I think that the USA is still the heart of 'the beast', it has been reassuring to discover how many thoughtful souls reside in its midst. Here I'd like to mention what I now consider to be the best magazine I discovered *Wild Earth*, again of American provenance, though sadly it is now defunct.

There is one last part to this story. I had spent the first 18 years of my life living on a council estate. It housed all sorts of people. As a full-time political organiser I also met a wide variety of working class people. For the past 30 years, I've taught in a Further Education college, again mainly teaching students from quite ordinary backgrounds. Observation of popular lifestyles, and the opinions which informed them, led me to conclude that many ordinary people play a conscious, willing and indeed wilful part of the destruction that has trashed and continues to trash the Earth.

Though I remain hopeful about the better side of humans, I cannot swallow the romantic image of the masses lodged in the minds of many radicals, a lot of whom come from well-to-do circumstances. Indeed many leading lights in both red and green circles were born with rather big silver spoons in their mouths. Perhaps it is that which makes them suffer from a kind of inverted snobbery that, in turn, leads them to idealise the masses. Therefore I've always been doubtful whether the empowerment and direct democracy demanded by many radical groups were the road to sustainability, unless other changes accompanied them. At the very least, fewer people may mean fewer wreckers (the very opposite of

Julian Simon's[9] argument that more people means more problem-solvers, and were what he termed 'the ultimate resource').

The same pattern repeats itself when western white radicals find ways of excusing the part played by other cultures and countries in planetary destruction. Generally I came to the conclusion that the eco-crisis is ultimately a crisis of culture and character and cannot be reduced to economics, important though factors like poverty can be. The fact remains that even the most thoroughly democratic and equitable social system could set totally unsustainable goals. Most people, however, either worship at the shrine of ever higher consumption or imbibe the poison of religious fundamentalism.

Over the years, I have been actively involved in many campaigns, lately opposition to American imperial ambitions in the Middle East. Some were successful, many were not, but I've always thought it important to take a stand, whatever the chances of success. Looking back, it now seems so obvious that, even if all these campaigns had been triumphant, none would have achieved anything of lasting value unless we humans find the right relationship to the rest of nature. Furthermore, in each and every one of those campaigns, the particular problem would have been less serious and more easily resolved if humankind had not been so numerous.

Yet it seems as if this most fundamental of all truths is being denied on almost a daily basis. Many organisations are proclaiming the need for population growth. One of the leaders of Ukraine's 'orange revolution' was recently telling her countryman to go home and make more babies. Across the Channel, the French government is offering incentives for larger families. Our own rulers want to encourage more immigration into our already crowded islands.

Meanwhile, as human numbers continue to go up, the number and diversity of 'non-humans' continues to go down. On the day these words were typed, a report from the UN, Global Biodiversity Outlook 2, recorded the "worst mass extinction in 65 million years," primarily due to habitat destruction. Climate change seems to be accelerating while shortages of critical resources like fresh water loom ahead. Other time bombs such as soil erosion still tick away. But most of our fellow citizens neither know nor, more importantly, care to know.

Sadly I have to conclude that we have collectively passed the point of no return. The juggernaut of destruction is too big and moving too fast to be stopped before vast and irreparable damage to planet Earth has taken place. The industrialisation of countries like China and India is probably that final straw which will break the proverbial camel's back. Thus the population explosion will be solved but in the most awful way. I feel convinced that the analysis presented above is absolutely right. I most sincerely hope that the conclusions I have drawn are utterly wrong.

Endnotes

1. *Blueprint for Survival*, Edward Goldsmith (editor). 1972. Penguin.
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3. *The Population Bomb*, Paul Ehrlich. 1971. Pan.
4. *Stalking the Wild Taboo*, Garrett Hardin. 1978.Kaufmann.
5. *The Way*, Edward Goldsmith. 1992.Rider.
6. *The Arrogance of Humanism*. David Ehrenfeld. 181. OUP.
7. *One Cosmic Instant: Man's Fleeting Supremacy*. 1973. Houghton Miflin.
8. Ecology, Community and Life Style. Arne Naess. 1988. CUP.
9. The Ultimate Resource, Julian Simons. 1981. Princeton UP.