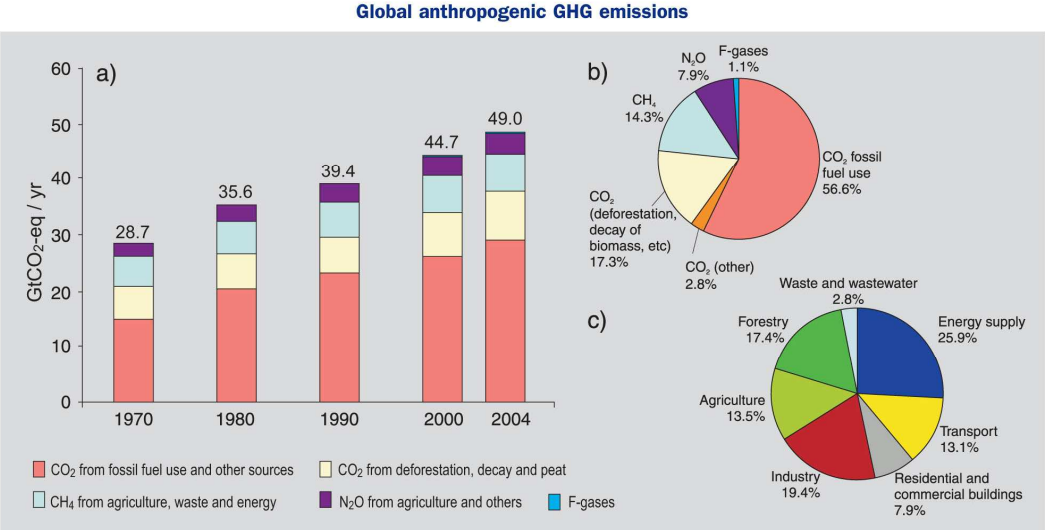
BIOSFERA: CAMBIAMENTI CLIMATICI E CONSEGUENZE

NOTA: come accade con la minaccia nucleare, la prospettiva di un disastroso cambiamento climatico è inconsciamente allontanata dalla coscienza perché 'insostenibile', con la semplice motivazione che gli scienziati esagerino o sbaglino i calcoli. Vi si aggiunge la sensazione che le possibili misure correttive siano impedite o troppo in ritardo a causa delle non convergenti politiche adottate dagli stati. Comunque sia, riteniamo doveroso prendere atto delle previsioni attuali sui rischi per la vita della biosfera. A tal fine abbiamo utilizzato tre autorevoli fonti scientifiche.

Seguono alcuni commenti conclusivi a p. 4.

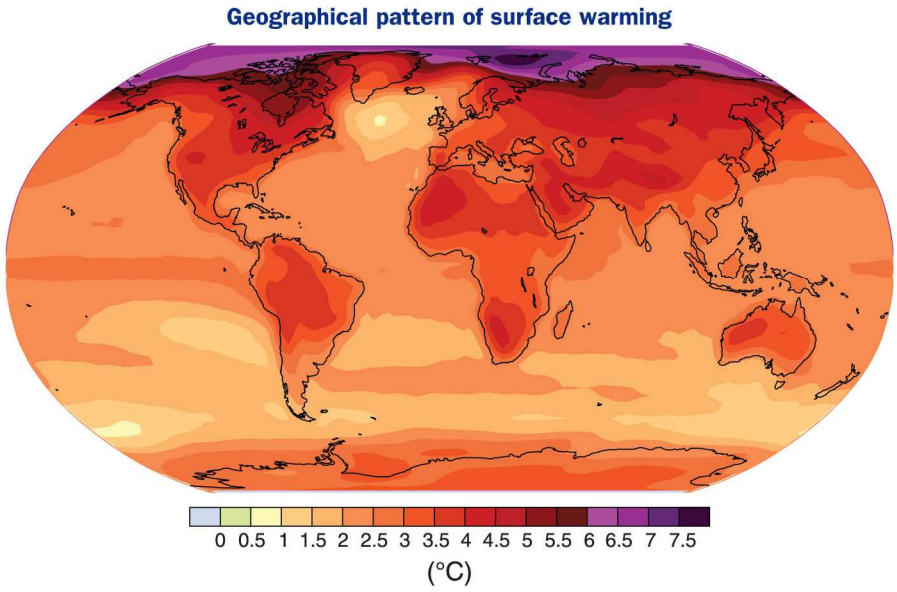
1. L'Intergovernmental Panel on Climate Change (IPCC),[1] che il 10 Dicembre 2007 ha ricevuto il Premio Nobel per la Pace, ha pubblicato il *"Climate Change 2007: Synthesis Report"*[2] ed un suo *"Summary for Policymakers"*,[3] di cui evidenziamo alcune informazioni:

- in tutti i continenti e negli oceani, molti sistemi naturali sono modificati dai cambiamenti climatici, soprattutto dall'aumento della temperatura;
- la salute umana è soggetta a maggiore mortalità a causa di elevate temperature, di malattie infettive e di allergie da polline alle medie ed alte latitudini dell'emisfero boreale;
- le emissioni di gas serra dovute ad attività umane sono cresciute del 70% dal 1970 al 2004 (cfr. diagramma sotto riportato). L'ossido di carbonio (CO_2), prodotto da combustibili fossili, è in maggiore percentuale, seguito dal metano (CH_4) e dal protossido di azoto (N_2O);



[1] Cfr. http://www.ipcc.ch/index.htm
[2] Cfr. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf
[3] Cfr. http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

- le attività umane hanno *molto probabilmente* contribuito all'innalzamento del livello dei mari nella seconda metà del XX secolo e, *probabilmente*, all'estensione degli uragani in aree extra-tropicali;
- in assenza di provvedimenti adeguati, si stima che fra il 2000 e il 2030 i gas-serra aumenteranno del 25- 90%;
- nei due prossimi decenni è previsto l'aumento di 0,2° C ogni dieci anni e, forse, di un altro 0,1° C per decennio;
- per la fine del XXI secolo (2090-2099) le proiezioni d'innalzamento della temperatura (cfr. nella mappa sottostante), sono catastrofiche: desertificazione, aumento di eventi meteorologici estremi, vulnerabilità delle popolazioni sulle coste e sulle isole minori, aumento della mortalità dovuta all'aumento della temperatura specialmente fra le popolazioni povere, i bambini e gli anziani, aumento dell'acidificazione degli oceani con conseguenze sulla biosfera marina;



- si stima che circa il 20-30% delle specie sinora monitorate corrano il rischio di estinguersi se la temperatura aumenta di 1,5 - 2,5° C. Con un aumento di circa 3,5°C, le estinzioni di dette specie salirebbero al 40-70%.

L'adattamento e la mitigazione dei fattori negativi possono ridurre di molto le conseguenze dei cambiamenti climatici. Nessuna singola tecnologia può avere successo nella riduzione dei rischi in ciascun settore. La diffusione di tecnologie a basso uso di carbone può richiedere ancora molti decenni.

2. Sulla rivista Nature (gennaio 2004) è comparsa una lettera, sottoscritta da numerosi scienziati, che riassume le conclusioni di un studio effettuato, con tre metodi diversi, sul "Rischio di estinzione provocato dal cambiamento climatico" (*Extinction risk from climate change*).[4] Lo studio è stato compiuto su alcune aree-campione che rappresentano complessivamente il 20% della superficie terrestre.

Secondo uno scenario che prevede un riscaldamento di grado *medio*, nel 2050 il 15-37% delle specie (ora dislocate nelle regioni-campione) è destinato all'estinzione, per distruzione dei loro habitat o per impossibilità di adattamento climatico.
Le capacità delle specie di trasferirsi in aree climatiche accettabili sarebbero impedite dalla mancanza o dalla frammentazione del loro habitat e da nuove specie invasive.
Se il cambiamento climatico, nel 2050, fosse quello *minimo* (inevitabile), le specie destinate all'estinzione sarebbero mediamente del 18%. In caso di cambiamento climatico *massimo*, del 35%.
Il ritorno, in tempi brevi, alle temperature pre-industriali eviterebbe che gran parte di queste previsioni si realizzino.

3. The Linnean Society of London - nel Vol. 23, n° 2 di Aprile 2007 di "Newsletter and Proceedigs"- ha pubblicato, a p. 28: *"Thoughts on Climatic Change and Human Extinction" [Riflessioni sul cambiamento climatico e sull'estinzione umana"]* di J. L. Cloudsley - Thompson.[5] Questa relazione, molto interessante, è riportata per intero a p. 5.

In sintesi, l'Autore ritiene che sia già cominciata la sesta grande estinzione biologica nella storia del pianeta. A differenza delle altre, questa sarebbe dovuta principalmente alle attività dell'uomo, avverrebbe con catastrofica rapidità e causerebbe in futuro anche la fine della specie umana.

Quando un ecosistema collassa, le prime specie che scompaiono sono quelle a grossa taglia; orbene, negli ultimi 300 anni si è riscontrata una correlazione fra l'aumento della popolazione umana e il numero di tipi di mammiferi eliminati durante lo stesso periodo. Il rapporto fra predatori e prede non può essere eccessivamente squilibrato perché può portare all'estinzione di una specie. Tale regola dovrebbe suggerire qualcosa alla specie umana. Infatti l'A. è del pa-

[4] Cfr. http://www.fishclimate.ca/pdf/Extinction_risk_from_climate_change_Nature_2004.pdf
[5] Cfr. http://www.linnean.org/fileadmin/images/Publications/Linnean_23-2_29-04-07_complete_web_FINAL.pdf

rere che la crescita incontrollata della popolazione umana abbia funeste conseguenze. Per il 2050 si prevede che la popolazione umana ammonterà a 9,5 miliardi; il controllo delle nascite non sembra dare risultati concreti nemmeno in India e in Cina, dove l'aumento della popolazione è del 9,5% annuo, malgrado si faccia parecchio per contenerlo. D'altra parte, la disponibilità di alimenti (sia pure geneticamente modificati) non è illimitata. Il riscaldamento del pianeta sta già provocando la desertificazione, la distruzione di foreste su larga scala, la scarsità d'acqua in varie regioni del mondo. Benché le guerre, la fame e le malattie possano fungere ancora da freno allo sviluppo demografico, l'A. ritiene che la combinazione degli effetti malattie-riscaldamento globale provocherà la drastica riduzione della popolazione umana, cui seguirà la sua estinzione. Infatti, i sopravvissuti non disporrebbero di sufficiente variabilità genetica e di adeguate capacità di adattamento. Il colpo di grazia sarebbe inferto da virus che intaccano le capacità mentali dell'uomo e che mutano così rapidamente da non permettere contromisure immediate. La fine di Homo Sapiens, secondo l'Autore, sarà provocata dalla virulenza di qualche terribile pandemia.

COMMENTO CONCLUSIVO

1. La storia evolutiva del pianeta è contrassegnata da eventi catastrofici verificatisi lentamente o repentinamente, cosicché è irrealistico immaginare che la biosfera rimanga sempre la stessa. D'altronde la biosfera è trasformata in modo continuo dall'uomo. È infatti innegabile che quest'ultimo sta causando la graduale estinzione di varie specie e pericolosi squilibri nella biodiversità.

2. L'innalzamento della temperatura del pianeta, dovuto ai gas-serra, e l'aumento iperbolico della popolazione mondiale sono le due principali "variabili" su cui sarebbe necessario intervenire. Per come stanno andando gli accordi di Kyoto[6], sembra invece che la speranza debba essere soprattutto riposta nella prospettiva alquanto lontana di poter utilizzare la fusione termonucleare per proteggere l'ecosistema e per soddisfare il crescente bisogno d'energia (cfr. il progetto ITER http://www.iter.org/).
Non rallenta la crescita della popolazione mondiale, malgrado buona parte di essa sia già sottonutrita. La "soluzione" di questo squilibrio è perciò fatalmente lasciata alle forze cieche della selezione naturale e alle carneficine belliche.

3. Le capacità intellettive e decisionali della Noosfera (cfr. *"Noosfera: necessità di un'unica definizione"*, in questo sito) sono in stato embrionale. Il maggior pericolo sta proprio in questo: la specie umana non dispone ancora di un "cervello collettivo" in grado di salvaguardare se stessa e l'intera biosfera. La presa di coscienza sempre più vasta di questa necessità vitale, e dei rischi cui sono esposte le generazioni future, è un primo passo per il miglioramento delle nostre attuali capacità di escogitare e mettere in atto appropriate misure di sopravvivenza. Per ora, sagacia ed ingegnosità umane, se riferite alla tutela dell'interesse collettivo, sono inferiori a quelle delle altre specie, poiché l'umanità non è unita e i vari leaders politici, perennemente occupati nel sopraffarsi a vicenda, ben poco si curano dei pressanti allarmi lanciati dalla comunità scientifica internazionale.

[6] Cfr. "Protocollo di Kyoto" http://www2.minambiente.it/Sito/settori_azione/pia/docs/protocollo_kyoto_it.PDF

Thoughts on Climatic Change and Human Extinction

J.L. Cloudsley-Thompson

Introduction

The world is experiencing its sixth major biological extinction. Similar events have occurred at the end of the Ordovician Period (*c* 440 mya), Devonian (*c* 350 mya), Permian (*c* 250 mya), Triassic (*c* 250 mya) and the Cretaceous (*c* 70 mya) when the dinosaurs – apart from birds – finally disappeared. Numerous hypotheses have been proposed to account for each of these – some gradualist, others catastrophic, many a combination of both (Benton, 2003; Cloudsley-Thompson, 2005). The current extinction differs from all others in that it has been engendered by the activities of a single species of animal (*Homo sapiens*) and is taking place with catastrophic abruptness (Boulter, 2002; Erlich & Erlich, 1970). Mankind first began tampering with the environment some 10,000 years ago, and the rate has accelerated rapidly since the Industrial Revolution (Wilson, 2002). Human beings have already not only drastically reduced the diversity of plants and animals throughout the planet (Diamond, 1997; Erlich & Erlich, 1970; Kaufman & Mallory, 1986; Wilson 2002; Ziswiler, 1967) but, in the long run, will I believe almost certainly be responsible for their own extinction.

My reasons for this conclusion are outlined below.

Quaternary Extinctions

The sixth major biological extinction now taking place began at or near the end of the Pleistocene, and the question as to whether this is the result of a natural major climate change or of human activities is still widely discussed (Martin & Klein, 1984). Either way, *H. sapiens* seems to have played a major part in it. The large mammals and birds of Australia and New Guinea became extinct *ca* 40,000 years ago. In contrast, most of the big mammals of Africa and Eurasia have survived until modern times because they coevolved with proto-humans for hundred of thousands or even millions of years. As Diamond (1997) wrote, 'They thereby enjoyed ample time to evolve a fear of humans, as our ancestors' initially poor hunting skills slowly improved'. Alaska was not colonised across the Bering Straits from Siberia until about 14,000 years ago.

Shortly afterwards, a North-South ice-free corridor opened in the Canadian ice sheet. America's rich and varied fauna of large mammals was thereupon wiped out by the flint-headed

spears of the so-called Clovis peoples who reached Patagonia, 8,000 miles South of USA, in less than 1,000 years.

When ecosystems collapse, whatever the cause, the first animals to disappear are large species such as elephants and rhinos, and large predators at the top of the pyramid of numbers (Elton, 1927), including lions and tigers, cheetahs and leopards, pumas or cougars, jaguars, and bears. Ziswilwer (1965) published a graph which shows a close correlation between the increase in the human population over the past 300 years and the number of mammalian and bird forms eliminated during the same period. He also pointed out that uncurbed increase can lead to the ultimate destruction of an animal species. For example, all the carnivores – pumas, coyotes and wolves – on the Kaibab Plateau in Northern Arizona were slaughtered to provide the mule-deer there with complete protection. Consequently, the deer population increased to such an extent that the plants upon which they browsed were damaged almost beyond recovery. From a few thousand in 1906 the mule-deer reached nearly 100,000 in 1925; but only 15 years later the population was well-nigh as low again as it had been before the predators were exterminated. Is there a lesson here for *H. sapiens*?

Limits to Population Growth

During the years before and after WW II, ecologists paid considerable attention to the factors that limit populations when the asymptotes of their sigmoid or logistic population growth curves have been reached. These factors include food shortage, environmental 'conditioning', and the various consequences of density – including increased predation and parasitism (Allee *et al*., 1949). More recently, the subject has been reviewed in considerable detail by Ricklefs (1990) among others. Numerous examples appear in the literature of the application of logistic curves to the human populations of demographic units such as countries, cities, states and even of the whole world. In 1936, Pearl & Gould fitted a logistic curve to known census data for the world from the 17th Century to 1931-32. They calculated a lower asymptote of about 445,500,000 in 1650 and an asymptote of some 2.65 billion individuals by the end of the 21st century. The fit between points and curve was, however, only moderate. In the event, the world population reached about 2.5 billion in 1950 and numbers some 6.5 billion today (McDougall, 2006). Like it or not, there will be no possibility of feeding the growing billions of the future without genetic engineering of food crops. Selection for suitable mutations and gene combinations would take far too long!

When population increases culminate, not in levelling off but in a precipitous decline in numbers, as in the case of the Kaibab mule-deer, the growth curves are referred to as being J-

shaped rather than S-shaped. Mathematicians are still calculating and re-calculating the future asymptote for the human population of the world, assuming that the curve will be S-shaped. If it turns out to be J-shaped, however, the future for mankind will be unenviable, to say the least (Cloudsley-Thompson, 1998). A classic example of a J-shaped curve is afforded by the population of Easter Island, famous for its 30 tonne stone statues. First inhabited by a few Polynesian people about 400 AD who, over the centuries, cut down their trees, Easter Island had a population of over 10,000 by the end of the 18th century. Then the population collapsed leaving little more than 100 individuals living in abject poverty (Diamond, 2005). 'World population is expected to reach 9.1 billion by 2050, adding another 2.5 billion people to an already environmentally stressed planet' (McDougall, 2006).

The only possible solution to the problem of overpopulation lies in universal family planning and birth control. This is notoriously difficult to achieve, as experiences in India and China have shown: despite laws and restrictions, the current rate of population growth in China is reported to be still some 9 per cent per annum (see Diamond, 2005). Moreover, the estimation that an asymptote will have been reached by 2050 is based on the fact that reproductive rates decline when living standards improve. There is little evidence, however, to suggest that the well-nourished societies of the First World are prepared to share their vast wealth with those of the Third World.

Food chains are almost invariably based upon plant life, and usually contain from three to five major links.

As the food chain is ascended, predators become progressively larger and their numbers decrease. Furthermore, there is usually an optimum size for a predator in relation to that of its prey and an optimum, too, for the herbivorous species that form the prey. An animal must be large enough to migrate from one feeding ground to another. On the other hand, a greater number of small creatures can exploit a limited area much more thoroughly than can a smaller number of larger individuals. Man is the *only* animal capable of dealing with food materials of all sizes from grain to cattle, and to this he owes much of his success. Ziswiler (1965) concluded that Man 'will not be successful in maintaining a purely artificial balance with nothing but cultivated plants and domesticated animals …… the continued existence of many natural biocoenoses is necessary …' and Jablonski (1986) emphasised that 'the very species that provide a rich harvest of medicines, foods, fuels, raw materials, and even climatic regulation are being driven into extinction, forever beyond our reach'. To make matters worse, human beings are disturbingly wasteful. London alone produces 17m tonnes of waste each year. Much

is taken for granted in the developed world, and consumed without thought as to its real cost in terms of the exploitation or depletion of human, animal and global resources. This subject has been addressed effectively by North (1986).

Global Warming

Global warming, accompanied by depletion of the ozone layer, is currently the greatest threat to the biosphere. Carbon dioxide levels are at their highest for 400,000 years. Before the Industrial Revolution, atmospheric CO2 was 270-280 ppm. The figure is now about 380 ppm! Correlated with this and almost certainly caused by it, is the *El Niño* Southern Oscillation (ENSO) during which the surface waters of the tropical oceans are alternately cooled – *El Niño* phase and warmed – *La Niña* phase (Ricklefs 1990; Wilson, 2002). During *El Niño* phases there are storms and heavy rain in arid countries like Peru and California, while desert conditions prevail in places such as Queensland, Australia and South East Asia that are not normally arid (Cloudsley- Thompson, 1998; Diamond, 2005). The cost of *El Niño* events to natural environments already damaged by human activities can be absolutely devastating. For instance, it is now generally accepted that *El Niño* was responsible for the disappearance of the advanced Moche civilisation of South America. Not only will the melting of the Polar ice caps engender the demise of many Arctic and Antarctic plants and animals, but the rising sea level will undoubtedly cause widespread flooding, slowly drowning the world's largest cities such as New York, London and Amsterdam. In addition, it will reduce the amount of land available for agriculture. Furthermore, if the flow of the Gulf Stream were to be halted by fresh water from the melting North Polar ice cap, the British Isles and much of northern Europe might well experience a return of the Ice Ages – somewhat surprisingly as a direct result of global warming (Boulter, 2002). Moreover rising sea-water temperatures could well release methane clathrate from the oceans, greatly increasing the amounts of yet another important 'greenhouse' gas in the atmosphere. Global warming is certainly responsible for more frequent lightning strikes causing even more forest fires than before. Finally, at the present rate of logging, coupled with more frequent ENSO effects, it is calculated that the Amazon rainforest will have disappeared by the end of the present century. As this rainforest is a major force in reducing atmospheric CO2 , global warming will increase even more rapidly than before. The stable period of benign warmth experienced over the past 10,000 years (inferred from ice cores) is quite exceptional. Should human beings not have caused global warming, it must be the consequence of natural causes not yet properly understood (Cairns, 1997; Polunin

& Burnett, 1993). If, as seems more probable, they have and are still causing it, there is little if any time left for us to mend our ways.

Horsemen of the Apocalypse

Only a few years ago, fears were being expressed that the world might well be threatened with a 'nuclear winter' following the exchange of intercontinental ballistic missiles with multiple re-entry atomic warheads. With the end of the 'cold war', however, this threat has receded[7]. It is not surprising, nevertheless, that the first predictions of imminent global warming – due to the excessive emission of 'greenhouse' gases – which appeared soon after the 'nuclear winter' scare – were received by many with a degree of scepticism. It is not really my intention to discuss the effects of climatic change, however distressing they may be for mankind, but to consider the extent to which they could portend the extinction of the human species.

Four or five decades ago, food shortage – engendered by inappropriate land use, waste, pollution and a rapidly increasing human population – appeared to be the environmental factor most threatening to human survival (Cloudsley-Thompson, 1965).

Although still a vast and growing problem, desertification, exhaustion of soil nutrients and the destruction of forest on a global scale are today seldom in the forefront of media hyperbole.

Nor, for that matter, is water shortage – although it looms behind the political agenda of all Middle Eastern nations. In many desert countries, such as Libya and Tunisia, underground 'fossil water' sometimes dating from Pleistocene times, is being exploited with extravagant wastefulness.

Although both war and famine will no doubt limit the asymptote of a logistic human population curve, neither of these by itself seems likely to result in its becoming J-shaped – although the population certainly cannot continue to increase for much longer at its present rate. Thirty years ago, Dawkins (1976) pointed out that the population of Latin America was around 300 million people, and already many of them were under-nourished. If, however, the population were to continue to increase at the present rate, it would take less than 500 years from then for standing room to be filled up. In 1,000 years people would be standing more than a million deep on each other's shoulders and by 2,000 years the mountain of humanity, travelling outwards at the speed of light, would have reached the edge of the present universe.

[7] **N.d.R**. – Sembra purtroppo che tale pericolo sia invece aumentato, per diverse ragioni (cfr. *"Biosfera: la minaccia delle armi nucleari"*, in questo sito).

Long before this, of course, the population explosion would have been checked by war, famine or disease. The 20th Century saw a great deal of mass starvation and was by far the bloodiest in history, yet the population increased more quickly than ever before. Even if these factors alone could eventually impose a ceiling on the asymptote – possibly delayed by universal birth control if achievable – it seems to me rather more likely that the curve will become J-shaped. This could well be caused by a combination of disease, coupled with the effects of global warming which will undoubtedly reduce the area of land available for agriculture, and also have adverse effects on productivity – both terrestrial and in the seas. The only hope of achieving an S-shaped logistic curve, as already mentioned, lies in stabilising the population and then gradually reducing it, with regular reviews to take into account any advances in green technology and other factors that affect sustainability (McDougall, 2005). For this to take place, women world wide must be accorded equality with men and religious views of all denominations need to be reconciled.

Paul and Anne Erlich (1970) pointed out that, if numbers were to be reduced sufficiently, the small groups of survivors would undoubtedly face genetic problems since each would contain only a small part of mankind's total genetic variability. They would suffer further loss through inbreeding, making them even less able to adapt to a degraded environment. So it would not be necessary for every man, woman and child to die at roughly the same time. The extinction of *Homo sapiens* would be inevitable after a sufficient decline in population had taken place. Several examples of this phenomenon are known among bird populations, where extinction is much more common on small than in large islands.

Thirty years ago, I wrote that mankind's first and last ecodisaster may already have begun in the form of a steady decline in the standard of living nearly everywhere, coupled with massive pollution and widespread malnutrition in the underdeveloped countries of the world. This will persist unless and until the world population eventually becomes adjusted to sustainable environmental resources (Cloudsley-Thompson, 1977).

Disease

The effects of disease are greatly enhanced by the fact that they are density dependent. You cannot have an epidemic of malaria or sleeping-sickness, for example, if the human population is not sufficiently dense for the pathogen – *Plasmodium* or *Trypanosoma* – to be transmitted efficiently between one vertebrate host and another by the insect vectors, *Anopheles* and *Glossina* respectively. At the same time, the situation is complicated by the fact that the quality of life is initially usually higher where people live together in larger numbers. And

when populations are dense in towns and cities, the environment is often unsuited to the invertebrate hosts, as in the case of *Trypanosoma*. Moreover, when the standard of living is higher, people can afford to buy mosquito netting and, if they are infected, they are taken to hospitals from which mosquitoes can be excluded.

It is difficult for a biologist to conceive anything more threatening to the survival of a mammalian species than for its members to be crowded into densely packed groups throughout the world, as human beings are, and then for pathogens to be continuously introduced from one group to another by means of rapid air transport. Fortunately, many of the major epidemic killing diseases of today and yesterday, such as plague, malaria, smallpox, tuberculosis, cholera and dysentery, are controllable thanks to our understanding of the modes of their transmission (Busvine, 1976; Cheng, 1986; Cloudsley-Thompson, 1976). The organisms responsible are Monera, and Protista. Viruses, prions, etc (Cloudsley-Thompson, 1998) present a much greater problem, mainly because they reproduce and mutate so rapidly.

With the benefit of hindsight, one could say that AIDS might well have been foreseen. The females of most higher animal species, and certainly most tetrapods, tend not to be promiscuous. From an evolutionary standpoint, this behaviour has been accorded a number of functions, not least that it inhibits the transfer of parasites from one host to another. Following the sexual liberation afforded to mankind by the development of the contraceptive 'pill', and the ability to cure previously incurable venereal diseases using antibiotics, there has been a marked change in sexual behaviour since the 1960s. Promiscuity of various kinds has increased greatly. In many parts of Africa and elsewhere, promiscuity has always been rife, it is now accompanied by the spread of HIV, until recently a death sentence almost everywhere. Nevertheless, some poverty-stricken women in sub-Saharan Africa not receiving antiviral therapy are protected by HLA-B genes which they pass onto their children. An effective vaccine for HIV has not yet been produced, largely because its variants or 'escape mutants' constantly arise and thus do not evolve protective immune responses (Melton, 2006). The existence of a menstrual rather than a seasonal reproductive cycle in Man naturally adds to and accelerates the problems caused by venereal diseases. The lethal myxomatosis virus became benign to rabbits surprisingly quickly through the co-evolution of viral and rabbit populations (Ricklefs, 1990). The same could well be taking place in the case of HIV, although the latter is more complex because it attacks the defences of the host. The deadliest plague in history was the pandemic of 'Spanish flu' which swept the world in 1918-19, claiming over 40 mil-

lion human lives – more than three times the number of people who were killed during the Great War (table1).

Table 1

1889 Russian flu 1 million deaths

1918 Spanish flu 40-50 million deaths

1957 Asian flu 2 million deaths

1968 Hong Kong flu 1 million deaths.

Avian influenza, which threatens the world today, is caused by a different strain of virus than that responsible for the Hong Kong epidemic. Migrating wildfowl are not immune to its effect and several species of mammals are also susceptible. This or some more lethal virus could – in combination with the effects of global warming – conceivably be responsible for the extinction of mankind.

Conclusion

However much the human population of the world may be reduced by food shortage, war, environmental degradation (accelerated by over-exploitation of mineral resources, water and energy), there seems to be little doubt that the final coup de grace will be administered by viral infection. Indeed, as long ago as 1982 I suggested that 'Man will not become extinct until he has lost the ability to reproduce and maintain himself; that is, until social co-operation or intellect - or both - have been destroyed'. It is believed that the entire human population of the world is descended from a single extended family group. The same evolutionary process almost certainly could not take place a second time for the genetic reasons outlined above. If human activity were curtailed to the level of intelligence found in other animals, Man would again become subject to the natural forces from which he has escaped through the exercise of his brain-power. His subhuman but still big-headed descendants would then be vulnerable, in the manner of every other species of animal, to any deleterious environmental changes that occurred faster than evolutionary adaptation could take place to counter them. Twenty-five years later, I think much the same. The only question is, *when* will human extinction take place? EO Wilson (2002) was to some extent optimistic that the human population explosion could be countered. The same year, Michael Boulton (2002) reached a very different conclusion. In a series of articles published by *The Times* of London during 1972, John Maddox (Editor of *Nature*), Wilfred Beckerman, Kenneth Mellanby and others, criticised the 'false prophets of calamity', the ecologists whose arguments, they said, were flawed by ignoring the successes of technology. Thirty years on, it seems even more likely that these same ecologists were correct in their assessments.

'Just as HG Wells foresaw the destruction of invaders from outer space by infection from the tiniest terrestrial organisms to which they had no immunity, so too might Man eventually be defeated by viral DNA molecules that insidiously destroyed his mental capacity to devise methods of combating them' (Cloudsley-Thompson, 1982). Alternatively, the agent of extermination might be a virus that mutates so rapidly that countermeasures cannot be taken in time. Either way, it seems probable that a virus of some kind will be responsible for the extinction of *H. sapiens*, and this might be sooner than we think!

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