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The rise and fall of *Homo sapiens sapiens*

BY C. TUDGE

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Human beings have broken the ecological ‘law’ that says that big, predatory animals are rare. Two crucial innovations in particular have enabled us to alter the planet to suit ourselves and thus permit unparalleled expansion: speech (which implies instant transmission of an open-ended range of conscious thoughts) and agriculture (which causes the world to produce more human food than unaided nature would do).

However, natural selection has not equipped us with a long-term sense of self-preservation. Our population cannot continue to expand at its present rate for much longer, and the examples of many other species suggests that expansion can end in catastrophic collapse.

Survival beyond the next century in a tolerable state seems most unlikely unless all religions and economies begin to take account of the facts of biology. This, if it occurred, would be a step in cultural evolution that would compare in import with the birth of agriculture.

I am going to address three issues. First, is there reason to suppose that human beings might be in danger of extinction; and in particular, will they be swept up in the present wave of mass extinction that they themselves have perpetrated, and which Jared Diamond (this symposium) has described? Second, if we don’t become extinct, what is liable to happen to us, and to other living things? And third, will the mass extinction that now is going on provide the kind of kick that might promote our own evolution – rather than our extinction – and if so, what form would that evolution take?

I shall address these issues by playing devil’s advocate, the method of discussion invented by the Catholic Church in the late sixteenth century, in which an appointed critic attacks ideas that are popularly held (and indeed are of a kind that people *want* to believe in) to see if they are true. The point is not to destroy the ideas, but to see what they’re made of; to ensure that what survives the attack is robust. It’s the method of science, in fact.

Issue one: are we ourselves in danger of extinction?

The possibility of human extinction has certainly been suggested of late, on several grounds, including nuclear winter, epidemic (such as AIDS), and – the matter that concerns us here – because of our own destruction of the planet. In particular, it has been suggested that we are sowing the seeds of our own destruction by destroying so many other species; that we need a planet that is in ecological ‘balance’; and that that balance depends upon the multitude of other species, perhaps between 10 and 30 million, that the Earth is thought to contain.

If that argument were true, it would be very powerful from a conservationist point of view. I take it to be self-evident that human beings are important; even being exaggeratedly detached, we can hardly deny that our species is an interesting biological experiment, and it would be a pity if it were snuffed out before its time. But I take it also to be self-evident that ours is not the only important species; that other creatures have a ‘right’ to occupy this planet, and that we at times have to bow to their needs, even at cost to ourselves. Those self-evident

truths are the basis of 'Green' philosophy. But most people, I think, take only the first of those premises to be self-evident. Most people, if pressed, would probably maintain in a way that is not incompatible with much of the apparent teaching of the Bible, that other animals and plants were 'put on Earth' for our convenience, and that although we shouldn't be cruel to them, we may dispose of them at our will. In other words, the moral philosophy of the Greens is not exclusively anthropocentric, whereas that of most of humanity is.

If you are in a minority, of whatever kind, then it pays as far as possible to demonstrate that your philosophy is compatible, and preferably congruent, with that of the majority. Thus it is that Greens have been anxious to show, these past few years, that a moral philosophy that is not entirely anthropocentric is coincident in its effects with one that is exclusively anthropocentric. Specifically, to bring the discussion down to earth, they have tried to show that human beings benefit from the variousness of other creatures.

Well, do we? The answer, after we've run the gauntlet of devil's advocacy, is 'up to a point'; which is Evelyn Waugh's euphemism for 'not really'.

The arguments that affect to show that a wealth of other species is good for us are of two kinds, specific and general. Specifically, it's pointed out, for example, that new drugs might be found in the roots of plants as yet unexamined, or in the glands of tree frogs; or that the wild relatives of present-day crops – or even, in these days of genetic engineering, the non-relatives of crops – contain genes that may confer resistance to disease; or that people could derive income from wild animals, by attracting tourists, for example, or by allowing limited hunting of animals such as the black rhinoceros.

All these arguments are true. The examples abound, or at least make an impressive list. But none of them is critical. The human species is not dying for lack of drugs, and if you should say, 'what about AIDS?' we might answer 'does anyone believe that the best strategy for seeking an AIDS therapy is to search among the glands of tree-frogs? Wild ground nuts from South America recently supplied breeders at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India with genes that protected the domestic crop against rust (Gibbons 1985). Very valuable, but not critical; and if it came to a toss-up between saving wilderness for its possible complement of genes, and planting that same wilderness with crops of known value, it would be perverse (if the extra food were really needed) to opt for the wild species. Some Africans do make money from elephants, but if oil is discovered beneath the reserves, what price the wildlife? Besides, we might argue that saving particular species may itself help to perpetrate mass extinction. True, the coat-tail effect is well known; a reserve designed to harbour some particularly charismatic species will also contain a huge number of hangers-on, just as some of the tiger reserves in India also provide homes for jungle cats. But this can work the other way. The bontebok of South Africa, a rare subspecies of the blesbok, very properly has its own small national park. It is good for the bontebok, but the park was established on land that once was fynbos, with its fabulous assemblage of species based upon proteas and ericas. But the fynbos has been banished locally, because bontebok prefer grass.

The more general argument in favour of natural variety is that human beings in some way depend upon the natural food webs that almost invariably are highly complex and rich in species. For example, it is commonly argued – in essence – that if tropical forest is removed or decimated so that the number of species is reduced, then what remains degenerates into desert, which is of no use to anyone. But this argument simply isn't true. A greatly simplified forest, dominated by commercial species of *Eucalyptus*, dipterocarp or *Aralcaria*, stands up just as well,

and as far as we know for just as long, as pristine tropical forest that contains hundreds of species of tree. True, if you replace tropical forest with grassland and then overgraze it, the grass is liable to degenerate. But it's not the loss of species that counts, it is the change of habit; that and a level of husbandry that probably isn't properly matched to the demands of the tropics.

Mangroves seem to provide a cast-iron example of natural variety leading intricately but nonetheless inexorably to human benefit. Mangroves contain several species of trees which, in Queensland at least, according to studies by Tom Smith at the Australian Institute of Marine Science (T. Smith, personal communication), in turn depend oddly enough upon unprepossessing crabs to spread their propagules; there are algae in there, and detritus, and a host of insect larvae and Protozoa; all providing food and shelter, eventually, for the larvae of fish that grow into the kind that people love to eat. Take the mangrove away – or indeed, take individual elements away, such as the crabs – and the edible fish disappear as well.

There can be no argument with this. Yet a conscientious devil's advocate would point out that the fish that are nurtured in mangroves are for the most part eaten by rich people who are over-fed to start with; and indeed might point out that fish as a whole, including the apparently vital tilapias of Africa and the enormous yields of cod and the like from high latitudes, contribute a remarkably small proportion of the total protein and energy intake of human beings, and that most of what is consumed is indeed consumed by people who don't need it. An average monetarist – nothing so grand as a devil's advocate, which is a sacred office – could point out that most of the luxury species that Queenslanders or Floridians love to eat can perfectly well be farmed (salmon, turbot, catfish, abalone, giant clams, oysters, and numerous prawns are among the animals that take well to life in a pond or a cage); and if they are farmed they can be fed on ground beef, raised in Illinois. The mangroves can then be given over to hotels, as in Miami; and the tourists will pay to visit the fish farms, which can easily be turned into theme parks, and generate far more wealth, with far more human comfort, than miles of pristine and singularly inhospitable mangrove.

Indeed, when you think about it, it is obvious that the people-need-natural-variety argument is false, on two grounds. The first is that cultivated systems, whether of intensive grain or for fish, are always more productive than wild systems because they absorb a much higher level of nutrient, and process it much more efficiently into human food. Most wild plants hate being over-nourished; and indeed, fertilizer escaping from arable farms, even in small amounts, is in many places the greatest single threat to the marvellous natural variety of the Australian bush. But because they prefer infertile conditions, the output of wild plants is bound to be relatively meagre. Indeed, cultivated systems often out-produce wild systems by 100-fold or more. But cultivated systems are inevitably simplified. They should not, of course, be monocultures, but there is no deep ecology in that; it's just a matter of sensible husbandry. But few cultivated systems contain more than a dozen or so species; orders of magnitude fewer than the wild environment.

Secondly, the argument that humans need the variety of other species is, when you think about it, a theological one. It would be likely to be true only if the Lord had indeed created the world for our express benefit. If we reject that notion, as Green thinkers do on moral grounds and as post-Darwinian scientists are bound to do, then we must concede that other species are for the most part totally detached from any consideration of human welfare, and that the loss of most of them would do us no demonstrable harm, while the loss of several –

including many of the genus *Anopheles* – would be a definite plus. The loss of the Large Copper butterfly from the English Fens has done the British people no material harm at all, and unless the Fens had been drained they could not have become one of the world's most intensive foci of arable farming. Most societies through most of history have persecuted the wolf, and it is impossible to show that the demise of dozens of subspecies, and one or two full species, of wolf-like animals, has had the slightest adverse effect on human material wellbeing. I wish it were not so. I wish we could demonstrate that people need Large Coppers and wolves. But we cannot.

Thus my first conclusion in this diabolically adversarial role is that the elimination of all but a tiny minority of our fellow creatures does not affect the material wellbeing of humans one iota; and indeed, that if human beings really want to take over the world, then they are obliged to tidy most other living creatures away. This is what the European colonialists set out to do when they first encountered the fauna of Africa, and it is what all farmers have done, assiduously and deliberately, since the neolithic revolution began around 10000 years ago. In fact, if we were to appoint a committee to make a short list of creatures that truly contributed to human wellbeing, then I doubt if it would contain more than 10000 species; one tenth of one per cent of the number conservatively estimated now to be on Earth. And that list would include the black rhino for millionaires to hunt, and the Lady Amherst pheasant for ordinary people to look at. There has never been such a mass extinction; but if human beings care only about their material wellbeing and a little sport, they would not need to worry about it at all.

Indeed the only concern that human beings need have about their fellow creatures, a competent devil's advocate would point out, is whether there are enough. Never mind the species, what's the biomass? Provided we can produce enough cellulose, then in an age of biotechnology we can feed ourselves. And here there are two questions that are linked but are none the less separate, and should be treated separately. First, there is the matter of human numbers; can the world as it now is, or as we may contrive to make it, support all the people there are liable to be in the next few decades and centuries? Secondly, are we by our activities reducing the capacity of the world to provide biomass, and is this putative reduction irredeemable? The two issues of course compound each other, but they are separate issues nonetheless.

Human numbers are, of course, staggering. There is an ecological law – a simple extrapolation of bedrock physics – which says that large, predatory animals are rare. We break that law: we are large and have a penchant for predation, yet our population now stands at five billion; and of all feasible demographic projections the one that comes nearest to consensus says that this will double to around 10 billion by the middle of the 21st century, that it will remain at such a figure for several centuries, and that it will then begin to decline, in theory to some figure that our distant descendants feel is appropriate. Nuclear war or some form of super-AIDS could of course make nonsense of such figures. But these figures do represent the ground state.

If the fabric of the Earth stayed as it is throughout that time, and if we add a little more science (as we will), and organize the world a bit better, reducing some of the awful inequities between north and south, for example, then there is no doubt that the world could accommodate such numbers without difficulty. Britain's farming is as intensive as any in the world, but agricultural scientists agree that with present technologies, and without claiming more land, output could easily be increased by at least 25%. Along with most western

countries, we give the greater proportion of our home-grown cereal and pulses to livestock. So if we farmed competently and ate less meat we could probably feed around 200 million people in Britain alone. Much of the rest of the world is incapable of such intensive output, but on the other hand, most of the rest makes a far worse job of realizing whatever potential it has, than we do here. If the world really pulled its socks up and if some of us were less greedy, then even with present techniques we could probably feed not 10 but 20 billion people fairly comfortably.

This, however, is where we run into the second consideration; whether the world can *continue* to be as productive as it is now. The issues are not simple. It isn't true to argue, for example, as some Green philosophers like to, that intensive food production inevitably and invariably leads to soil degradation. There are fields at Rothamsted, in Hertfordshire, that have produced cereal every year for 140 years, without added manure, and they are in better heart now than at the beginning. Though the straw and grain have been harvested, organic matter has been maintained by the rotting roots. You cannot treat heath in this way, but any soil can go on being productive, and indeed improve in agricultural terms, provided you stay within its limits; and the limits of some soils are very high indeed.

On the other hand, we cannot ignore the general argument of Paul Ehrlich, of Stanford (Ehrlich & Ehrlich 1987), that much of present-day food production depends not upon sustaining soil but on mining it; that in many soils, if not most, there is a steady loss of 'heart', and indeed of the soil itself, as it washes or blows into the sea; that there is a net increase of undesirables, such as soil salinity, which can be very hard to correct; that some useful commodities such as fossil fuels are being destroyed forever, while others, such as phosphorus and many metals, are being spread around the planet and will become increasingly difficult to harvest. Overall, there is a degradation of the planet's fabric. To a large extent this could be arrested, or circumvented: soil salination can be reversed, as is happening in places in Australia; the loss of fossil fuels need not matter, as there is enough energy in surplus straw to run a tractor and fix nitrogen. But it is clear that the technologies to correct the ill effects of over-farming are not being applied fast enough, and won't be in the foreseeable future.

It is obvious, then, that human numbers would have had to stop increasing at some point; and Professor Ansley Coale at Princeton has pointed out that our population would have reached 17 trillion (10^{18}) within 700 years if the rate of increase of the 1960s had been maintained (Coale 1974, 1987). It is clear, too, that the numbers will level out sooner than optimists might have hoped, as the planet's capacity to produce is undermined. Exactly where the cut-off will be, and when we will reach it, is not clear. What does seem to me extremely likely is that the monetarist argument that the human species will back away from disaster for economic reasons – that as production becomes difficult so demand will reduce – is simply nonsense. Human beings are just as capable as any other species of breeding their way into trouble; and in fact they are more so because of the principle of momentum, which says that in a species with a generation time as long as ours the effects of overbreeding at any one time are not felt until 30 years later, by which time the fabric of the planet could have changed dramatically for the worse (Coale 1974, 1987).

The general point, then, is that we cannot say that disaster for the human species and for the planet as a whole is inevitable; the tragedy of Ethiopia in the 1980s will not necessarily be rehearsed on a global scale. But as Paul Ehrlich has pointed out, it is simply feeble-minded to dismiss out of hand the possibility that at some time in the next few hundred years – in a very short time, indeed – human numbers will exceed the capacity of the world to provide support

(Ehrlich 1987). What happens at that point really is anybody's guess. Mathematicians versed in the intricacies of chaos are perhaps best qualified to comment.

In fact, the likely fate of the human species over the next few hundred years might profitably be modelled mathematically, as has been done for nuclear winter. Every known factor that might influence our material wellbeing, and every known interaction, would be fed into a computer, to see what turns up. In practice the models would be far more complicated than those for nuclear winter, partly because there are more material factors to feed in, but partly because there are other dimensions to take into account. The nuclear-winter models are purely physical; they attempt to assess what will happen *after* the bombs have fallen, and after human beings have done their worst. If we modelled the fate of the human species and our fellow creatures, we would also have to take into account future *intentions*: what kind of a world do we, and our immediate descendants, want to create; and also human fallibility: to what extent are we capable of achieving the end results we find desirable?

The physical factors to be fed into the human future model are complicated, as I have already said, but they are to some extent quantifiable. But it is a sad fact, a reflection on the discipline of sociology, that to my knowledge we have no information at all on the second set of factors we would need to feed in: information on human intention. We don't know what kind of a world human beings want. We may guess in a general way that people nowadays are saddened by the poaching of rhinoceroses, and wish it didn't happen; but it is doubtful if many people know that there are two distinct races of white rhino, for instance, or indeed that there's any difference between the African species and the Asian. And when the Javan tiger was officially declared extinct only a few years ago, the matter hardly featured in national newspapers, though it did feature – significantly – on children's television. It is doubtful if anyone cares, in any positive way, about the reduction in species in tropical forest; secondary forest, or even a plantation, tastefully laid out, looks much the same as a natural wood to the untrained eye. Indeed I suspect that when politicians – Margaret Thatcher, Neil Kinnock, George Bush – use the word 'environment', as now is mandatory in all campaigns, that all they have in mind is generalized green-ness, a golf-course and a bit of Repton-style landscaping, or even a Disney-style theme park with, to quote the blurb of Disney-World, 'clownish baboons and madcap macaws'. It's one thing to get politicians ostensibly on the side of environment, but it's another thing again to determine what actually goes on inside their heads. But what does go on inside their heads, and those of the electorate, matters; and we just don't know what kind of a world people think is desirable.

However, the point of nuclear winter models is not that they unequivocally predict the future, as a soothsayer would do, but that they show a range of possibilities. More specifically, they differentiate the possible from the impossible, and the likely from the less likely. In fact, present nuclear-winter models show that nuclear war is likely to have some effect on climate, and that this could be disastrous if, for example, it led to midsummer frosts in the north, and delayed monsoons in the south. Extreme scenarios – a new mini-Ice Age, as in the seventeenth century, or the total elimination of the human species – are shown to be on the cards, but very much at the extreme tips of the probability curve.

And if we made a model of future human possibilities, feeding in intention (if we knew it) and putting an arbitrary figure on fallibility, we too would finish up with a curve, or rather a three-dimensional curve, of possibilities. And I suspect – this being pure guess work, but I hope reasonably sensible guess work – that among the many scenarios on that curve would be the following six:

1. *Superabundance*. High human population; many other species; lush vegetation.
2. *Most people's ideal (the 'populist' scenario)*. High human population; small, select variety of other species; abundant vegetation.
3. *Fall-back position: the 'Crete' scenario*. Low but stable human population; small but select variety of other species; scenery devastated but acceptable, as in modern Crete.
4. *Failure*. Low human population, but unstable; small variety of other species, with many 'desirable' types already gone, and extinctions continuing; scenery devastated and continuing to degrade. Human extinction conceivable, though extremely unlikely.
5. *Green and pleasant*. Low, stable human population arrived at by voluntary means; high variety of other species, lush vegetation.
6. *Green and unpleasant*. The same as (5), but arrived at by coercion.

I should like to comment briefly on these points. I think we can say that (1) is extremely difficult and perhaps impossible to achieve. The growth of the human population is eliminating other species, and it is hard to see how that trend could immediately stop. Scenario (2) is the kind alluded to above; and probably what politicians have in mind, insofar as they have anything in mind, when they start pushing environmentalism. The select band of species envisaged in (2) would be the 10000 that competent biologists might identify.

Scenario (3) represents the likely fall-back position if (2) fails. The proposal is that the world as a whole might come to resemble present-day Crete. Crete is stunningly beautiful. But it is, ecologically speaking, a mess. The Minoans finished off the devastation that the farmers of the neolithic began. In a hundred years time the hillsides of Malaysia might look like those of Crete, and we may draw comfort – cold comfort – from the fact that they will be beautiful; bare rock, after the soil is gone, shining in the sun; not so much like Crete, perhaps, as Utah. Clearly, if we treat all the world as the Minoans treated Crete, then we will perforce have a much smaller population than now (and Crete's population is only half what it was in its heyday) but life for those that are left could be highly agreeable, even though their lifestyle was arrived at by insouciance.

On the other hand if things go very badly wrong – in the way that Paul Ehrlich suggests is easily to be envisaged – then we would finish up with scenario (4). Human extinction seems unlikely even in this, the worst conceivable scenario, because even though extinction is very difficult to predict (Jablonsky, this symposium) we can make commonsense observations. And a species like ours that is numerous, ubiquitous, heterogeneous and individually adaptable, and yet shares a common gene pool so that different surviving bands can swap genes, must be a very strong candidate for survival. But if we reach the stage of (4), then we will never be the same again. As Paul Ehrlich has pointed out, recovery in a devastated world, with easily obtainable raw materials already gone, will not be possible; or at least it's very difficult to see how.

The Green scenario is (5). It has been described both by Paul Ehrlich and by Michael Soule (Ehrlich 1987; Soule 1987). Paul Ehrlich envisages a final human population of around one to two billion, while Michael Soule puts the figure much lower, at about 100 million, the likely world population at around the time of Christ; a time, as he points out, of flowering genius. Both Ehrlich and Soule are humanitarians, and envisage such low populations being achieved by voluntary means. The means need not be draconian; if married couples averaged two children, as people in rich countries generally seem happy to do, then the population would inexorably drop, given that some people will elect not to have children at all, and some will die before they have children. The only problem is that a non-draconian policy would take hundreds of years to bring about a significant decline in population, and would not prevent the

rise that is imminent. Conservation thus would become a matter of tiding as many creatures as possible over the centuries of human populousness: a period that Michael Soule has called the ‘demographic winter’. Ehrlich and Soule both argue that the diminution of human numbers is compensated by the increased quality of life of the people that are on Earth, and by the probable increased longevity of the human species as a whole; for (5) is almost undoubtedly the ‘safest’ of the scenarios here envisaged.

I agree with Soule and Ehrlich that (5) is the most desirable of the envisagable scenarios; and so, I suspect, do most people reading this paper. But although it’s not known what people at large think, I’m sure that many people would not agree that (5) is good. Some feel that to contemplate reduction in human numbers is *ipso facto* inhumane, and others feel it’s a kind of blasphemy. On a more secular level, people seeking public office in South Florida at this instant, in Everglades country, are arguing the case for growth and more growth; to quote from a political advertisement on Florida television in 1988, ‘growth leads to greater consumer choice’: Taco Bell as well as Kentucky Fried. Many people would argue, in short, that (2) is the most desirable scenario, one that has lots of people, albeit living dangerously; and that (3), which is probably more likely than (4), is not too bad as a fall-back. Crete is beautiful, after all; and so, for that matter, is Utah.

The burden of this paper, though, is that if we want (5) to come about – and this is the only realistic scenario that allows for a reasonable proportion of our fellow species to survive – then we have to persuade vast numbers of other people that this is worth aiming for. We cannot, however, simply rely on the materialist arguments that say that we should preserve our fellow creatures because they are of direct benefit to us, for three reasons. The first, as I suggested earlier, is that these arguments are, for the most part, simply untrue. The human species could survive just as well if 99.9% of our fellow creatures went extinct, provided only that we retained the appropriate 0.1% that we need. Secondly, if those who believe that our fellow creatures are important go down the monetarist road, and allow themselves to agree that other species are important only insofar as they bring material benefit, then they will have no arguments with which to resist the inevitable takeover of the national parks when the problems of tropical agriculture are finally solved, and none to resist the inexorable transformation of nature reserves into theme parks.

Thirdly, by couching their defence of our fellow creatures purely in materialist terms, conservationists and scientists – often the same people, of course – are simply failing to express what it is that they feel about nature; and if they fail to express what they feel, then they can hardly be surprised if they fail to make the impact they want. David Jablonsky said that he regarded fossils ‘with love and respect’ (Jablonsky, this symposium). Absolutely. That’s exactly it. Another word, equally appropriate, would be ‘reverence’. Such an attitude to nature is, I am sure, what motivates most creative scientists; not a desire to control nature, as Karl Marx supposed, or as Margaret Thatcher supposes. But scientists very rarely, except among themselves, express that reverence.

Because they are generally afraid to admit in public to anything so irrational, so ‘unscientific’, as an emotional response to nature, scientists reinforce the image that the public has of them: that they are cold, hyper-rational and therefore sinister individuals. Thus the scientists, who care deeply about nature, and who are best equipped to save what is left of it, have largely abandoned what British politicians now call the ‘moral high ground’ to people who lack the kind of reverence for nature that impels scientists to spend their lives studying

it. In recent years, scientists have instead allowed themselves to be swept up in the monetarist fervour, and give the impression that they agree that the point of science, and indeed the point of nature, is materialist. Scientists must learn to argue their case in aesthetic terms – and indeed in religious terms. Religion doesn't have to be a lot of theological and mystical airy-fairiness. In essence, as J. B. S. Haldane averred, it is simply 'an attitude to the Universe' (Haldane 1985); and the proper attitude is that of respect. The point of saving the mangroves is not that they provide us with fish to eat, and that fish are big business, but that fish are good; and so are the skimmers, and herons, and dolphins, that feed upon them in the wild.

The final twist, is that if such a philosophy as this prevailed (a philosophy that may be called Green), and if indeed the human species as a whole, or as a majority, was persuaded that the Green scenario was worth aiming for – that human beings should reduce their numbers, largely in the interests of other species – then this would truly be an evolutionary shift. Human evolution is not a matter of genes these days, and hasn't been for some thousands of years; it's a matter of what goes on inside people's heads. We could argue that what goes on in people's heads has a physical basis, even though the proximate cause is not genetic; after all, the brain is a plastic organ, and takes different forms, depending on the stimuli and indeed on the attitudes to which it is exposed when young.

Since the Neolithic revolution, the transition from hunter-gathering into farming, which began 10000 years ago, human beings have been weaned, and have weaned their children, on the notion that it was the destiny of humans, and indeed the God-given right of humans, simply to take over the world. Ever since then, that's what we've been doing. I think that the Book of Genesis can properly be read as a folk memory of the transition from late Palaeolithic hunter-gathering – when life in the Middle East must have been very good indeed – into the traumas of Early Neolithic farming, which, though hard, eventually prevailed. All the myths and the Godly admonitions of the first four chapters make perfect sense when viewed in that light. 'In the sweat of the face shalt thou eat bread' is what God said to Adam as He banished him from the easy pickings of the Garden of Eden, the hunting-gatheric Arcadia, and condemned him to a life of agriculture; and we've been sweating, very successfully, ever since. 'Be fruitful and multiply' said God to the sons of Noah, who survived the flood; and we have followed that injunction to the letter. But it is time to acknowledge that the Neolithic party is over.

Green philosophers have argued in recent years that we need to create a post-industrial society, but that is nonsense; future generations will need industry, and besides, to blame all present ills on industry is a serious mis-reading of history. Romantics have argued of late that we need a post-scientific society, which is an even grosser nonsense. Leaving aside the philistinism of such a sentiment, we can be sure that our chances of survival will be greatly compromised, and the death of our fellow creatures guaranteed, unless we practice science of a very high degree.

But we do need a post-Neolithic society, which in its attitudes, in its moral philosophy, in its religion, in its politics and economics and in its way of working would be quite different from all that we have been developing for the past 10000 years. What exactly those attitudes should be, and how they should be expressed; what form the politics and economics should take; those, I suggest, are the most interesting questions now facing the human species.

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