Our place in nature: past, present and future

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1. Past and present

1.1 The human situation

We are biological beings – products of nature and totally dependent on the processes of life, within us and around us, for our very existence.

Life processes underpin, permeate and make possible our whole social system and everything that happens within it. Keeping them healthy must, in the long run, be our first priority, because everything else depends on them.

The dominant culture of our time has lost sight of this reality – with grave consequences for humankind and for the planet.

The population explosion and the massive intensification of resource and energy use and waste production by the human species are causing using serious damage to the ecosystems on which we depend.

The biosphere as a system capable of supporting civilisation will not tolerate this onslaught indefinitely. If present trends in human activity continue, the ecological collapse of society is inevitable.

There are many other highly undesirable features of human society worldwide today. First and foremost is the existence of weapons of mass destruction which could so easily bring about an end to civilisation. Others include the gross disparities in human conditions of life, widespread poverty affecting hundreds of millions of people, and the ongoing armed conflicts and acts of terrorism which cause so much unnecessary bloodshed and suffering in human populations across the globe.

There is a critical need for sweeping changes. We must move towards a new kind of society that is based on understanding and respecting the processes of life, and which satisfies the health needs of all sections of the human population as well as those of the ecosystems of the biosphere. In this booklet a society with these characteristics is called a ***biosensitive society***.

1.2 Biological background [1]

An evolutionary perspective

Our planet is about 4.6 billion years old. The Sun provides it with a constant supply of energy – in the

1. For a more detailed account see our book *People and Nature: The Big Picture*

Some dates

Years ago	Developments
4,000 million	The earliest forms of living organisms, single-celled bacteria, were in existence
2800 million	Micro-organisms capable of photosynthesis were in existence. This resulted in the release of oxygen into the atmosphere. Some of this oxygen became converted to ozone, which formed a layer in the stratosphere where it acted as a filter, protecting the Earth's surface from life-damaging ultraviolet radiation from the sun
600-700 million	Multicellular organisms came into being in the oceans
400 million	The colonisation of land by plants and animals began
250 million	The most severe of the mass extinctions in the history of life (more than 90% of all species wiped out)
160 million	The emergence of the first flowering plants
65 million	A mass extinction bringing an end to many forms of life, including all the dinosaurs and flying reptiles
60-1 million	Great diversification among birds, mammals and flowering plants
1 million	*Homo erectus* in existence

form of rays of visible light and ultraviolet and infrared radiation.

Interdependencies in the living world

Our existence, and that of all other animals, is entirely dependent on the growth of green plants – because plants, through photosynthesis, manufacture the complex energy-containing organic molecules on which life depends.

An essential characteristic of life on Earth is the cycling of the nutrients that are taken up from the environment, built into the tissues of living organisms, and then eventually released again to become available for incorporation into new life. These nutrient cycles are essential for the sustainability of life.

The organic content of soil is essential for maintaining soil fertility. It consists of decomposing plant and animal matter as well as a profusion of different kinds of living organisms.

There are thought to be some 7 to 15 million different species of living organisms on Earth today. About half of them may be extinct by 2075 as a consequence of human activities.

Humans in nature

At the time that the dinosaurs disappeared, about 65 million years ago, there existed on Earth a small group of shrew-like, tree dwelling primates. Among them were the ancestors of humankind.

By 6 million years ago some much larger primates had come down from the trees, and were walking with an upright posture.

By 180 000 years ago people with the physical characteristics of modern humans, and classified as *Homo sapiens*, were in existence in Africa.

By 60 000 years ago *Homo sapiens* had reached Australia.

About 45 000 years ago *Homo sapiens* displaced another human species, *Homo neanderthalensis*, in Europe.

As *Homo sapiens* spread across the globe some divergence took place in the genetic characteristics of populations, resulting in observable physical differences between people living in different parts of the world.

An extremely important feature of the evolution of *Homo sapiens* was the development of the human

capacity for culture, and consequently the gradual emergence of human culture itself.[1]

The most essential aspect of this capacity for culture is the ability to invent symbolic language and to use it for exchanging information and ideas, and so to create, accumulate and share knowledge, beliefs and assumptions.

The ability to invent new technologies and to pass on this technical knowledge from one individual to another and from generation to generation is also often regarded as an aspect of culture.

Human culture emerged as a new kind of force in nature, and it has had far-reaching consequences not only for humankind but also for the rest of the living world. All the major threats to humankind today, including global climate change and the stock pile of nuclear weapons, are the consequence of the human capacity for culture

From very early times one of the outcomes of the capacity for culture was the emergence of religion, involving belief in supernatural spirits and gods (or a god).

Religion became a universal feature of human societies, although there has been enormous variation in the details of the different belief systems. In present society some people do not accept any religion.

Differences in religious beliefs have been, and still are, a major cause of violent conflict between human groups.

The history of Homo sapiens falls into four distinct ecological phases

Phase 1 The hunter-gatherer phase

The human species emerged as a species biologically adapted to the conditions of life of hunter-gatherers, and the hunter-gatherer phase was by far the longest of the four ecological phases.

Ecologically the most important culturally-inspired activities in this phase were the deliberate use of fire and the manufacture and use of tools and weapons.

As in the case of all other animal species living in their natural habitats, most of the time most members of hunter-gatherer bands are likely to have been in a state of good health. Indeed, they had to be in order to survive and successfully reproduce under the demanding conditions, which included such hazards as serious injury acquired during hunting with the likelihood of life-threatening bacterial infection setting in – and, in most parts of the world, risk of attack by predators.

However, because of the relatively low population density people would not have suffered from such respiratory and enteric virus infections as colds, influenza, gastric 'flu, measles, small pox and German measles. Nor are they likely to have suffered from bacterial diseases like cholera, typhoid, shigellosis or tuberculosis.

Phase 2 The early farming phase

Homo sapiens had probably been in existence for at least 180 000 years before some people started farming 10 000 to 12 000 years ago. This development marked a turning point in cultural evolution. It was a precondition for all the spectacular developments in human history since that time.

Phase 3 The early urban phase

This phase began around 9000 years ago when fairly large clusters of people, sometimes consisting of several thousand individuals, began to aggregate together in townships. Many of these people played no part in the gathering or production of food.

Although the new conditions offered protection from most of the hazards of the hunter-gatherer lifestyle, malnutrition and infectious disease became much more important as causes of ill health and death.

Phase 4 The high consumption phase

This phase was ushered in by the so-called industrial revolution, which began a little over 200 years ago. It has been associated with profound changes in the ecological relationships between human populations and the rest of the biosphere. The following developments have been especially significant:

1. The word *culture* is used here to mean the abstract products of the capacity for culture, such as learned language itself and the accumulated knowledge, assumptions, beliefs and values of a human population

- the introduction of machines that use extrasomatic energy, mainly from fossil fuels, for performing various kinds of work[1]
- the discoveries and applications of electricity and radioactivity
- the spectacular growth of the chemical industry
- the invention and manufacture of weapons of mass destruction.

Phase 4 has seen a marked increase in human life expectancy, especially in the developed world – due mainly to improved hygiene and nutrition, but also to immunisation and the use of antibiotics.

The global population increased from about 1 billion in 1800 to 2 billion in the 1930s; and it is now approaching 7 billion.

People in cities today live under conditions very different from those to which the human species is biologically adapted through evolution. Many of the forms of ill health in modern society are a consequence of this fact. There have been too few generations exposed to life in cities for there to have emerged a new breed of humans better adapted to urban living. We are essentially the same animal as our hunter-gatherer ancestors of, say, 15 000 years ago.

The recent massive growth of the human population, as well as the explosive increase in intensity of techno-industrial activities, are resulting in progressive ecological disturbance across the whole planet. The high consumption phase of human existence is ecologically unsustainable and will soon come to an end.

1.3 Human culture as a force in nature

The most distinctive biological attribute of our species is the human capacity for culture. This characteristic was of major biological advantage in the evolutionary environment of the species, and in more recent times it has resulted in an amazing increase in the number of humans on Earth.

Apart from its practical advantages, culture adds richness to human experience. It did so in the days of our hunter-gatherer ancestors – as in story telling, musical traditions, dancing and other forms of artistic expression. It does so today in so many ways. Culture makes a huge contribution to the sheer enjoyment of life.

But there is another side to the picture. The consequences of our capacity for culture are not all good. Culture has also been responsible for an immense amount of human suffering.[2]

An important feature of cultural evolution is the fact that cultures have often come to embrace not only factual information of good practical value, but also ideas and assumptions that are sheer nonsense, leading to behaviours which are equally nonsensical.

Sometimes these cultural delusions have resulted in activities that have caused a great deal of unnecessary human distress, or damage to ecosystems, or both. We refer to culturally inspired activities with these characteristics as *cultural maladaptations*. There are countless examples of this in human history. And today all the main threats to human wellbeing and survival are consequences of cultural maladaptations.

Among the undesirable consequences of our aptitude for culture is the fact that culture has separated us, mentally, from the rest of the biosphere. Instead of feeling part of nature, humans tend to see themselves as separate from – even in some way superior to – the rest of the living world. This mindset effectively blocks social reform aimed at achieving ecological sustainability.

1.4 Ultimate biological limits

Through their capacity for culture, humans have long been consciously manipulating the processes of life to their advantage – or to their perceived advantage. Up to a point, nature permits these culturally-inspired manipulations. Indeed it allows considerable scope for people to enrich their lives through culture.

However, there are limits to the degree to which nature can be manipulated; and these limits are determined by the simple rule that the essential

1. Extrasomatic energy is energy which is used outside the human body, as distinct from the somatic energy which is consumed in food and which flows through the body.

2. For farther discussion on human culture as a new kind of force in the biosphere see S. Boyden. 2004. *The biology of civilisation: understanding human culture as a force in nature*. UNSW Press. Sydney.

underlying processes on which life depends must not be violated.

For example, we can modify our diet up to a point to our advantage – as in the practice of the culinary art. But if we omit essential nutrients like ascorbic acid, or if we add certain toxic chemical agents, we will fall ill and eventually die.

And we can modify our natural sleeping patterns up to a point. But if we are deprived of sleep for too long we cease to function biologically.

Similarly with the natural environment – the essential ecological processes on which all life depends must be kept intact. We can practice farming to our advantage. But if we seriously disrupt the natural nutrient cycles, or if we interfere with soil biology so that bacteria and other organisms can no longer play their crucial role in these cycles, then bioproductivity will cease. Or if we discharge into the environment chemical pollutants that interfere, directly or indirectly, with essential life processes – then the life support system will ultimately collapse.

So, if we overstep the mark by interfering with the underlying processes that make life possible, then we are in big trouble. There are many instances when this has happened in the past.

Today our society is transgressing these biological limits on an unprecedented scale. And we are indeed in big trouble.

1.5 The changing scale of human impacts

The dominant culture of modern society is leading to a range of activities that threaten the future of civilisation.

An essential difference between these modern causes for concern and maladaptive practices in the past lies in the huge scale of the various destructive, or potentially destructive, activities and their impacts.

There are two sets of changes underlying the major ecological difficulties facing humankind today.

1. The massive increase in the human population. There are now about 1000 times as many people on Earth as there were when our ancestors first started farming, putting enormous pressures on the food-producing ecosystems of the biosphere. Nearly 6000 million of the present 6800 million people now in existence were added in the past couple of hundred years, and the UN forecasts that another 3000 million will be added by 2050.
2. The explosive intensification, especially in the developed countries, of resource and energy use and technological waste production associated with consumerism and economic growth.

In addition to these ecological issues, the manufacture of weapons of mass destruction constitutes another horrendous threat to our future. According to recent estimates, there are around 26 000 nuclear warheads in existence. It would not take many of these to bring an end to civilisation as we know it.

The elimination of nuclear weapons is an essential precondition for the long term survival of civilisation.

Here our focus is on the ecological predicament.

The energy emergency

Most human populations in the world today have become dependent on fossil fuels, especially oil, for their normal functioning. This technoaddiction is dangerous for humanity because the combustion of fossil fuels results in the release of the greenhouse gas carbon dioxide, and this is leading to a progressive increase in temperatures across the planet.

At present rates of consumption, global supplies of oil are likely to be exhausted within a few decades. The sooner the better from the standpoint of climate change. But because of society's present dependence on this fuel, its increasing scarcity is likely to lead to serious economic and social problems, including disruption of supplies of food and water. It could also result in escalating armed conflict across the world as nations strive to satisfy their oil needs.

Coal is used widely across the globe for electricity generation. It is not yet in short supply, but is a major source of greenhouse gas emissions.

The ecological impact of humankind

Figures for energy use are the best single indicator of the overall impact of the human species on the ecosystems of the planet:

- Humankind as a whole is now using about 12 000 times as much energy per day as was the case when farming began 10 000 years ago. (90% of this increase has occurred in the lifetimes of some us alive today).
- Humans are discharging into the environment about 12 000 times as much of the greenhouse gas, carbon dioxide (CO_2) as they were 10 000 years ago – as well as vast quantities of other pollutants
- If all populations around the world had the same pattern of energy use as the developed countries, the increase in energy use and CO_2 emissions since farming began would be around 60 000 fold.
- The use of energy per person in Australia is at present about twice what it was around 35 years ago, about 3 times what it was 50 years ago. It is still increasing at the rate of about 1.6% per year (doubling in less than 50 years).There is no evidence that Australians are any happier than they were in 1956 or 1976.

1.6 Causes of ecological unsustainability

The important ecological issues confronting our society today are the following:

The enhanced greenhouse effect – Climate change due to increasing concentrations of greenhouse gases, especially carbon dioxide, in the atmosphere is currently the most critical ecological issue at the global level. Global warming is already underway, and it is asserted that fossil fuel use must be reduced by 90% in the coming decade or two to avoid catastrophe.

Increases in the concentration of CO_2 in the atmosphere have occurred several times in the history of life on Earth due to natural causes. The current increase is notably different in the following ways:

1. A single species of animal, *Homo sapiens*, is responsible for the current change in CO_2 concentrations in the atmosphere
2. The change is taking place very much more quickly than in the past
3. Humans were not around on the previous occasions to experience the far-ranging ecological consequences.

Thinning of the ozone layer — Human activities over recent decades have released large quantities of chlorofluorocarbons (CFCs), methyl bromide and halons into the atmosphere. These gases, together with waste products of high flying aircraft, have been causing the progressive destruction of the ozone layer in the upper atmosphere. Because this layer acts as a filter shielding the surface of the Earth from ultraviolet radiation from the Sun, the thinning of this layer is resulting in an increase in the intensity of UV radiation reaching the ground. This is of concern because of the damaging effect of UV radiation on living organisms, including humans

As a result of international agreements, there has been a major reduction in the release of CFCs and related compounds, and it is now hoped that the ozone layer will be back to normal by around 2065, although there is still much uncertainty about this.

Persistent organic pollutants (POPs) – Persistent organic pollutants are synthetic compounds used as pesticides and in various technological processes. They are being released into the environment in large quantities.

POPs accumulate in the tissues of living organisms and are believed to be responsible for widespread and increasing infertility in wild animals, and probably also in humans. They are also suspected of contributing to the increase in breast cancer in women and to reduced sperm counts in men.

Soil erosion – Soil loss resulting from wind or water erosion is a major ecological problem in many parts of the world today, especially in Australia. It is largely the consequence of land being denuded of a protective cover of native vegetation as a result of over-stocking with cattle or sheep or the widespread use of the plough in areas with shallow topsoil.

Soil salinity – Salt is a natural component of soils and water, but certain human activities have increased the salinity of soils in many areas. There are two main forms of human-induced salinity in rural parts of Australia: dryland salinity and irrigation salinity. Salinisation of soils leads to serious reduction of agricultural productivity.

Disruption of natural nutrient cycles – In natural ecosystems there is continual recycling of nutrients required for the processes of life, and the continued growth of plants is dependent on this cycling process. Humans interfere with these cycles by extracting nutrients from farmland in food, and eventually disposing of them elsewhere as waste in landfill or sewage in the sea. At present, this problem is largely overcome by replacing the extracted nutrients with artificial fertilisers, like phosphorus and nitrogen from other sources; but there are serious doubts about the long-term sustainability of these practices.

Bioimpoverishment of soils – Failure to protect the biological content of soils is interfering seriously with soil fertility in some regions

Loss of biodiversity – The present rate of extinction of living organisms is exceptionally high, due to human activities. Some scientists believe that about a quarter of existing species will be extinct by around 2025, perhaps half by 2075. It is predicted that if current trends continue in the oceans there will be virtually nothing left to fish by the middle of the century.

Water supply – The ecological sustainability of any community is dependent on an adequate and reliable supply of clean water. The rate of use of water in many Australian cities and townships is unnecessarily high, and serious water shortages are likely in the future. It is clear that more effective measures must be introduced to reduce the rate of consumption.

Ecosystem health needs

In light of our knowledge of the effects of various human activities on ecosystem health at the present time, we can put together a list of *ecosystem health needs*, as follows:

The atmosphere

- The absence of polluting gases or particles in the atmosphere which significantly change the climate (e.g. CO_2 produced through the combustion of fossil fuels and resulting in increases in atmospheric concentrations of the gas above the natural level)
- The absence of polluting gases or particles in the atmosphere which interfere with living processes (e.g. particulate hydrocarbons from combustion of diesel fuel, sulphur oxides)
- The absence of substances in the atmosphere (e.g. CFCs) that result in destruction of the ozone layer in the stratosphere that protects living organisms from the ultraviolet radiation from the sun

The oceans and waterways

- The absence of chemical compounds in oceans, lakes, rivers and streams in concentrations harmful to living organisms (e.g. persistent organic pollutants – POPs)
- The protection of biodiversity in the oceans

Terrestrial ecosystems

- The absence of chemical compounds in the soil that can interfere with the normal processes of life (e.g. persistent organic pollutants, heavy metals)
- A rate of soil loss no greater than the rate of soil formation (i.e. no soil erosion)
- Maintenance of the biological integrity of soil (i.e. maintaining a rich content of organic matter)
- Intact nutrient cycles in agricultural ecosystems over long periods of time (requiring return of nutrients to farmland)
- The maintenance of biodiversity in all regional ecosystems

Radiation

- The absence of levels of ionising radiation that can interfere with the normal processes of life and photosynthesis.

1.7 Urgency

Clearly, there are limits to the amount of damage that humankind can do to the ecosystems of the biosphere before they cease to be able to support civilisation. The crucial question is: How far are we from reaching these limits?

Opinions differ on the answer to this question. A middle view is that of the Union of Concerned Scientists (UCS) who have stated that:

'No more than one or a few decades remain before the chance to avert the threats that we now

confront will be lost and the prospects for humanity immeasurably diminished'.

An important report known as the Millennium Ecosystem Assessment (MA) was published in March 2005. It was called for by United Nations Secretary-General Kofi Annan in the year 2000. It involved the work of 1360 experts around the world.

The following excerpts from the statement from the Board governing the MA process summarise some of its conclusions:

'At the heart of this assessment is a stark warning. Human activity is putting such a strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.

'Protecting and improving our future well-being requires wiser and less destructive use of natural assets.

'We must learn to recognise the true value of nature – both in an economic sense and in the richness it provides to our lives in ways much more difficult to put numbers on.

'Above all, protection of these assets can no longer be seen as an optional extra to be considered once more pressing concerns such as wealth creation or national security have been dealt with.

'This assessment shows that healthy ecosystems are central to the aspirations of humankind.

'… this is not a counsel of despair. The natural balance sheet we bequeath to future generations depends on choices made at every level and in every corner of the planet.'

The urgency of the current challenge is emphasised by Lester Brown in his recent book, '*PLAN B 3.0: mobilizing to save civilization*', in which he describes the causes for global concern and the essential changes that will be necessary to avoid ecological collapse of civilisation. He writes:

'There are many things we do not know about the future. But one thing we do know is that business as usual will not continue for much longer. Massive change is inevitable. Will the change come because we move quickly to restructure the economy or because we fail to act and civilization begins unravel?

Saving civilization will take a massive mobilization, and at wartime speed.'

1.8 Some critical perspectives

Introduction

Understanding the nature of the ecological predicament facing humankind today requires full appreciation of the time perspectives and also of the scale and acceleration of human impacts on the natural world. For some people such appreciation is assisted by the use of analogies. The following comments on perspectives therefore include some analogies which are in ***bold italics.***

The history of life on Earth

Life has been in existence on the planet for around 4,000 million years. Until around 800 million years ago, bacteria were the most complex form of life on Earth.

The following table summarises some developments in the history of life on Earth since the

Development	**Years ago**	***Time ago (metaphorical)***
First multi-cellular organisms	800 million	***24 hours***
Life invades the land	400 million	***12 hours***
Dinosaurs at peak – first mammals	200 million	***6 hours***
End of the dinosaurs	65 million	***2 hours***
Upright walking primates (Lucy)	4 million	***7 minutes***
First *Homo* species (*H. habilis*)	1.8 million	***3 minutes***
First *Homo sapiens*	200 000	***20 seconds***

emergence of multicellular organisms around 800 million years ago. In the right hand column, we are supposing that *800 million years ago was 24 hours ago, and the other times have been appropriately adjusted to this hypothetical time scale.*

The human population

Life expectancy in many developed countries today is 70 to 80 years, which is about twice what it was a couple of hundred years ago when the mortality rates were exceptionally high, mainly due to infectious disease and malnutrition.

Over the period from 10 000 years ago to the year 1800, the human population increased by about 1000 million (average of around 100 000 per year).

During the past 200 years it has increased by a further 5000 million (average of around 20 million per year – i.e. 200 times faster)

There are now about a 1000 times as many people to be fed as there were before farming began around 450 generations ago. *The difference is equivalent to inviting a friend to dinner and having 20 busloads of people turn up.*

The biological history of Homo sapiens

Picture yourself on the stage of a large theatre with room for an audience of 2000 (100 rows with 20 in each row). In your mind's eye place your mother in the seat at one end of the front row, and then her mother next to her and so on, until you have filled the place with 2000 generations of mothers and daughters.

The great majority of your maternal ancestors in the theatre would have known nothing of agriculture or of the urban way of life. Only the women in the front twenty or so rows would have been alive since the time when people first started farming. And only those in the front six or seven rows would have lived after the earliest cites came into existence, although few of them are likely to have actually lived in cities.

Increasing intensity of human impact

During the past few generations there has been an extraordinary intensification of resource and energy use and waste production by humankind. Figures for energy use are a reasonable general indicator of the intensity of the impact of our species on the ecosystems of the planet. The human species is now using about 12 000 times as much energy per day as was the case when farming first started.

The difference between the impact on the biosphere of humankind at the time when farming began and the present day is thus equivalent to the difference in weight between a small apple and a tonne of bricks.

About 10% of this increase is due to the fact that there are about 1000 times as many people alive today as there were just before the first introduction of farming. The rest of the increase is due to the relatively recent introduction of technologies depending on the use of extrasomatic energy (mainly provided by fossil fuels).

Humankind is now appropriating 40 per cent or more of the plant material produced by photosynthesis globally.

We hear a great deal these days about the threat of human-induced climate change. This is an extremely serious problem. But it is just one symptom of an overall ecological overload resulting from:

- the population explosion
- the extraordinarily extravagant consumption of energy and materials in the developed world
- lack of cultural sensitivity to the needs of the life processes that underpin our existence.

The following analogy illustrates the accelerating increase in intensity of human impact on the natural environment – from the beginning of farming to the year 2000AD.

Let us suppose that:

- *The beginning of farming was 12 hours ago (rather than 12,000 years)*
- *At that time humankind jumped into a vehicle it had invented (representing technology)*
- *The speed of this vehicle is proportional to the total amount of energy used each day by humankind. This vehicle set off at a speed of 1 km per hour (i.e. 12,000 years, or 12 hours ago)*
- *The vehicle's speed thus reflects the rate of energy use by humankind at different times — this being a reasonable indicator of the*

overall magnitude of the impact of our species on the natural environment.

The results of this exercise are as follows:

- *12 hours ago, then, the vehicle was travelling at 1 km/hr*
- *4 hours ago it had picked up speed and was travelling at 25 km/hr*
- *1 hour ago it was going at 85 km/hr*
- *15 minutes ago – at 100 km/hr*
- *6 minutes ago at 820 km/hr*
- *3 minutes ago – 2500 km/hr*
- *It is now travelling at around 12 000 km/hr*

Visibility is not good and we, the passengers, don't have a clear view of where we are going - although there are some among us who have made a study of the environment and who are warning that we are heading for a precipice. They are calling out to us to slam on the brakes and change direction. But there are many others, especially those in charge, who are hell-bent on making the vehicle go faster and faster.

One does not have to be an ecologist to appreciate that this accelerating increase in the intensity of human activity in the biosphere cannot go on indefinitely.

Energy use in Australia

The *per capita* rate of use of energy today in the developed countries is 30 to 40 times what it was during most of human history.

Energy use *per capita* in Australia (GJ per year):

1940: 75 GJ per person per year

1960: 114 GJ per person per year

1990: 228 GJ per person per year

1998: 280 GJ per person per year

2005: 310 GJ per person per year

At the present rate of increase, *per capita* energy use in Australia will increase by another 50 per cent in about 21 years.

The use of extrasomatic energy in Australia in the year 2003 to 2004 was distributed as follows (per cent):

Transport	35.3
Manufacturing	32.1
Residential	11.8
Mining	8.9
Commercial	6.6
Agriculture	2.7
Construction	0.8
Other	1.8

Transport and manufacturing are thus by far the biggest users, accounting together for nearly 70 per cent of our total energy end use consumption, and it is in these sectors that most change is necessary. The residential sector accounts for nearly 12 per cent. Therefore if everybody in our society reduced energy use in their home to zero, the total energy use would be reduced by only about 12 per cent.

The Australian Government has recently announced that, to reduce greenhouse gas emissions, incandescent light bulbs are to be phased out – to be replaced by the more energy-efficient fluorescent light bulbs. If all Australian homes made this change overnight, total national energy use (and carbon dioxide emissions) would drop by about 0.35 per cent.

This does not mean that we should not bother to take steps at the household level. It simply means that big changes must be made in all sectors of society.

Weapons of mass destruction

The growth in the killing potential of bombs during the 20th century can be illustrated by the following analogy. *If we imagine the explosive power of the biggest bombs in World War I to be represented by a pea, then the most powerful weapons (other than the atomic bombs used at Hiroshima and Nagasaki) used in the Second World War would equal the size of a large plum. The Hiroshima bomb would be equivalent to a sphere of about 0.5 metre across, and the most powerful bombs now ready for use would have a diameter of 5 metres.*

Disparities

The present cultural system allows extreme disparities in the conditions of life and the well-being of different human groups – both within and between nations. While this situation has been commonplace since the days of the first cities, it was not a feature of hunter-gatherer bands or of

early farming societies. Globally, hundreds of millions of people live in abject poverty.

Globally, the ratio of the income of people in the top 20 per cent bracket to the income of those in the bottom 20 per cent was 60:1 in 1996. In 1997 it was 74:1. The wealthiest Mexican citizen has an income equivalent to the combined incomes of the 17 million poorest Mexicans.

At present the richest 2 per cent of adults own more than half of global household wealth.

In Australia economic inequality has grown during the past decade. In 2007 the richest 20 per cent of households own 63 percent of all net wealth. The bottom 20 per cent own 0.2 per cent.

1.9 Cultural delusions today

The cultural maladaptations of the present era involving ecologically unsustainable activities are a direct reflection of the worldview, assumptions and priorities of the dominant cultures of our time.

Especially important is the ideology of *ever-moreism* – which is, the crazy cultural delusion that social well-being necessarily requires an ever-increasing consumption of material goods, and consequently ever-increasing use of resources and energy and discharge of wastes.

This cultural assumption is reflected both in governmental policies in the affluent countries aimed at forever increasing the material standard of living for all the population, and in the economic system which is geared to increasing industrial production and consumer spending.

Linked with ever-moreism is the implicit faith in the market as a panacea for all the problems facing humankind today.

Although mutely accepted by most people and certainly by the major political parties, ever-moreism is ecologically insane, and it is leading us into big trouble.

If one day our civilisation does achieve a state of ecological sustainability, people will look back on ever-moreism as having been as ill-conceived and wrong as we now view slavery and military imperialism, which only a few generations ago were widely accepted as normal and entirely appropriate.

2. A biosensitive future

2.1 A new ecological phase of human existence

If our civilisation is to avoid ecological collapse there will need to be big changes in the scale and nature of human activities on Earth.

Unlike the previous major ecological transitions in human history – the deliberate use of fire, the introduction of farming, the formation of cities and the industrial revolution – this next transition will have to be deliberately planned.

We must look forward to, and design, a new kind of society that is very much more sensitive to the health needs of the processes of life – within us and around us – on which we are totally dependent. That is, it must be a *biosensitive society.*

At a very basic level, the prevailing conditions in the new biosensitive society must:

- Satisfy the biologically determined health needs (physical and psychosocial) of all sections of the human population. This will require elimination of the gross disparities which at present exist in the health of different sections of the human population.
- Be consistent with the health of the natural environment. This means that human activities and lifestyles:
    - must be consistent with major reductions in energy use and material consumption in the affluent countries
    - must not, directly or indirectly, cause significant climate change, land degradation, chemical pollution of the environment or loss of biodiversity.

A biosensitive society will be in tune with nature – in tune with our own biology and in tune with the living world around us.

This will mean big changes right across the board. A biosensitive society will be characterised by biosensitive lifestyles, governments, technologies, farms, transport systems, urban design and a biosensitive economic system.

In a biosensitive society top priority will be given in governmental and corporate decision-making to the health and well-being of both people and the natural environment.

The achievement of a biosensitive society will require reversing the current spiralling growth of resource and energy use and consumerism.

It will also mean moving towards a smaller human population.

All responses to global warming must be based on the principles of biosensitivity .

In a biosensitive society local communities will be much more self-sufficient than they are at present, in terms of material and psychosocial needs and job opportunities – reducing the necessity for long distance travel, long distance transportation of goods, and rewarding in terms of quality of life. Hamlets within villages within townships within cities.

The new biosensitive society will have the potential not only to bring about a much-improved relationship between human populations and the natural environment, but also to provide a better quality of life for all peoples.

A biosensitive society will mean healthier people and a healthier and safer planet.

Unfortunately the worldview and assumptions of the dominant cultures that determine patterns of human activity across the world today are incompatible with any transition to an ecologically sustainable, healthy and equitable society. They are simply not attuned to ecological realities.

Major changes in the cultural system are therefore a precondition for the achievement of this new biosensitive society.

2.2 A biosensitive society: some essential biophysical characteristics

A biosensitive society will have the following essential characteristics:

Human conditions of life

- Healthy conditions of life for all sections of the human population and no gross social disparities in health and well-being
- Much less emphasis on consumerism as a source of pleasure
- Much greater emphasis on psychosocial influences on health (e.g. creative activity, sense of purpose, making music, the experience of conviviality)

- Human population at a level that does not exert harmful pressures on the planet's ecosystems (1000 million globally?)

Industry and transportation

- Minimal use of fossil fuels
- Increased use of clean energy sources[1]
- Recycling of all material resources
- No release of CFCs, POPs or other harmful chemical compounds in quantities that interfere, directly or indirectly, with the health of humans or ecosystems
- No release of radioactive substances of a kind, and in quantities, that interfere with the health of humans or ecosystems
- The non-existence of weapons of mass destruction

Carbon sequestration

- Massive efforts to reduce the concentration of carbon dioxide in the atmosphere to the preindustrial level – for example through widespread forestation and possible geoengineering procedures

Primary production and land use

- Farming, forestry and mining practices protecting soils from degradation.
- Farming practices encouraging bio-enrichment of soil.
- Progressive rehabilitation of areas degraded in earlier periods
- Forestation on a massive scale
- Nutrients in organic wastes returned to the soil
- A much higher proportion of food for human consumption produced locally (including in urban areas)

Biodiversity and the natural environment

- Large areas of natural wilderness preserved to maintain biodiversity
- Widespread establishment of wildlife corridors
- Biodiversity protected in agricultural systems and human settlements.
- Fisheries organised in a sustainable fashion

2.3 Biosensitive lifestyles

Lifestyles in a biosensitive society of the future must have two fundamental characteristics: They must promote human health and they must be consistent with the health of the natural environment.

(1) Lifestyles must promote human health

The lifestyles of individuals must satisfy human health needs. It is suggested that the following items are especially important:[2]

Physical health needs

- Clean air (not contaminated with tobacco smoke, hydrocarbons, sulphur oxides, lead etc.)
- A natural diet (e.g. a diverse range of foods of plant origin and some cooked lean meat; absence of noxious contaminants or additives, calorie intake neither less than nor in excess of metabolic requirements)
- Clean water (free of contamination with chemicals or pathogenic microbes)
- Absence of harmful levels of electromagnetic radiation
- Minimal contact with microbial or metazoan parasites and pathogens
- Adequate protection from extremes of weather
- Noise levels within the natural range
- A pattern of physical activity that involves short periods of vigorous muscular work and longer periods of medium (and varied) muscular activity.

Psychosocial health needs

- An emotional support network that provides a framework for care-giving and care-receiving behaviour, and for the exchange of information on matters of mutual interest and concern

1. There are those who advocate replacing fossil fuels with nuclear power. It is indeed a sad situation if we have recently become so addicted to high levels of energy use of extrasomatic energy that we are forced to replace one polluting source of energy with another – and with one that undoubtedly holds extremely high risks for humankind.

2. The theory underlying this list of human health needs is explained in the paper *Health and civilisation* on www.biosensitivefutures.org

- The experience of conviviality
- Opportunities and incentives for creative behaviour
- Variety in daily experience
- An environment and lifestyle conducive to a sense of personal involvement, purpose, belonging, responsibility, challenge, comradeship and love
- An environment and lifestyle which do not promote a sense of alienation, anomie, deprivation, boredom, loneliness, or chronic fear or frustration.

These health needs must be satisfied in all sections of society, and in all socio-economic and ethnic groups.

There is ample evidence that humans can lead rich, enjoyable and healthy lives with vastly less per capita consumption of non-renewable resources and energy than is the case today.

(2) Lifestyles must promote the health of the natural environment

The health needs of the human population must be satisfied in ways that are consistent with maintaining the health of the ecosystems of the biosphere.

This means that lifestyles must not involve activities that, directly or indirectly, cause significant chemical pollution of the environment, land degradation or loss of biodiversity

Especially important trends in lifestyles will include:

- Putting much more emphasis on sources of enjoyment that are not environmentally costly (such as making music, dancing, art, theatre, reading, sport, athletics, convivial social interaction, gardening and growing food)
- Putting much less emphasis on forms of enjoyment that are environmentally costly (such as consumerism and energy-costly travel)
- Increasing active involvement in local activities – including, for example, food production, tree planting, protection of biodiversity, caring for neighbours and arranging car pools
- Greatly reducing the use of devices powered by polluting fuels, including electricity from power stations powered by fossil fuels
- Greatly reducing the acquisition of manufactured goods
- Selecting goods and services with a low environmental impact
- Improving the energy efficiency of homes and making use of clean energy sources.

2.4 A biosensitive economy

The essential changes in human activities that will be necessary for the achievement of a biosensitive society will not be possible without big changes in the way society is organised.

At present our societal arrangements (e.g. the economic system, the institutional structure of society, the structure of the work force, government regulations) are all geared to continual economic growth involving an ever-increasing rate of consumption of material goods and energy.

In particular, the survival of civilisation will require an economic system which differs from that which we have today in the following ways:

- It will not result in a continuously increasing rate of use of material resources and energy or continuously increasing rate of discharge of pollutants into the environment
- It will be equally sensitive to:
  (a) the health needs of the ecosystems of the biosphere
  (b) the health needs of the human population
- It will result in the satisfaction of human health and well-being needs at much lower rates of energy and resource use than those typical of affluent societies today
- It will lead to progressive reduction of existing disparities in health and well-being across the human population
- It will be based on economic theory that embraces, at its core, understanding of the processes of life that underpin our existence and of the biologically determined limits to human activities on Earth.

2.5 A biosensitive culture

The worldview and assumptions of the dominant culture of our society today are incompatible with the notion of a biosensitive society. This culture

effectively blocks any significant move in this direction.

The argument that we have heard in Australia that we must not reduce greenhouse gas emissions because it would be bad for the economy is an indication of this serious cultural weakness.

Widespread biounderstanding[1] across the community would lead naturally to a biosensitive dominant culture with a worldview characterised by:

- Appreciation of the reality that we humans are part of the living world and entirely dependent on the processes of life in and around us for our very existence
- A deep sense of respect for the processes of life that brought us into being and on which we are totally dependent for our health and survival
- Appreciation of the absolute necessity, as well as the desirability, of living in tune with nature – as individuals and at the level of society as a whole.

A biosensitive culture would result in top priority being given in all decision-making to the health and well-being of living systems, including all sections of the human population and the ecosystems of which we are a part. This is what matters most. The economic system and all other aspects of societal arrangements must be treated as subservient to this fundamental imperative.

2.6 The role of concerned citizens

An effective transition to a biosensitive society will require decisive action by governments.

But this does not mean that individuals and community groups have no role in the transitional process.

On the contrary, members of the public who appreciate the absolute necessity for big changes in society, and who are enthusiastic about the opportunities that the situation presents for improving social conditions in general, have a crucial part to play in the whole process. Without their efforts governments will not act, and the changes will not take place.

The specific contributions of concerned and interested individuals will depend on their previous experience, particular talents and personal enthusiasms.

The following four kinds of activities are important – with special emphasis on the first.

1. Learning and informing

Concerned individuals can:

- Take steps to improve their own understanding of the processes of life, the human place in the living world and the major ecological and health issues of the present day
- Communicate what they have learned to others. In so doing they can play a very significant role in promoting widespread appreciation across the community of the urgent need for social change.

2. Political pressure

Concerned individuals can put pressure on government to introduce policies of reform aimed at bringing about a transition to a biosensitive society. They can do this through the electoral process, joining political pressure groups, lobbying and writing letters to politicians and the press.

3. Personal action

Concerned individuals can contribute to the transition by setting an example in their personal behaviour. They might do this, for example, by putting more emphasis in their own lives on low-consumption sources of enjoyment, by making no unnecessary purchases of material goods, by choosing environmentally friendly products, by avoiding unnecessary travel by energy-costly means, by increasing the energy-efficiency of their homes, by making direct use of renewable energy sources and by growing some of their own food.

4. Community involvement

Concerned individuals can participate in the activities of NGOs committed to the ideal of a biosensitive society. They can also promote more communication and co-operation in their own neighbourhoods

1. Biounderstanding is defined as a good understanding of the story of life on Earth, of the living world around us, of human biology and of the human place in nature.

2.7 The role of governments

Lifestyle changes by individuals and family groups, necessary and worthwhile as they are, will not alone be sufficient to overcome the current ecological threats to humankind. The transition to a biosensitive society will not come about without strong and decisive action on the part of governments.

Enlightened government action is an absolutely essential condition for the transition to a sustainable and biosensitive society. But such government action is highly improbable unless and until there is overwhelming support for such action from an informed and concerned electorate.

It is high time that we all became engaged in active discussion and debate about the actions that governments should take in order to bring about the necessary transformation in our society.

Here is a contribution to this process:

It is suggested that governments should:

- Introduce new policies to ensure that a high level of employment is not dependent on increasing use of material resources and energy and production of greenhouse gases. This would include:
  - Developing strategies for providing alternative work for the members of the work force affected in cases where certain occupations are inconsistent with the goal of ecological health and sustainability
  - Taking steps to bring about a greater degree of sharing of the nation's work load, by reducing the hours of full time work in all occupational groups (rather than attempting to create unnecessary new jobs, and so increasing the intensity of resource and energy use and waste production). This may require a slight drop, perhaps a few per cent, in the income of some of those at present employed
- Introduce procedures to ensure that all policy options are assessed in terms of the health needs of all sections of community and of the living systems of the natural environment
- Introduce incentives and regulations to ensure that the activities in the business sector and the stock market are always in the best interests of all sections of the human population and of the natural environment
- Introduce regulations and other incentives to encourage:
  - the use of clean sources of energy
  - waste-free packaging practices
  - the recycling of material resources
  - the recycling of nutrients in agricultural ecosystems
  - water conservation
  - the protection of biodiversity
- Introduce effective measures to reduce the wide disparities in conditions of life and material wealth that at present exist between different sections of the human population
- Introduce active measures designed to:
  - ensure a systematic, integrative approach in government departments and agencies to counter the current compartmentalisation
  - overcome the disinclination of decision-makers and politicians to give serious attention to long-term planning
- Take incremental steps to encourage the self-reliance of local communities with respect, for example, to food production, nutrient recycling, biodiversity protection, soil protection and water conservation
- Introduce methods for assessing societal progress that take full account both of the health and quality of life of all sections of the population and of the integrity of the natural environment.

Perhaps the day will come when governments, in seeking re-election, will boast of their success in improving social equity and the health of the human population at the same time as reducing industrial production, the rate of extraction of non-renewable resources and the release of pollutants.

2.8 A biosensitive future — Summary

The survival of civilisation and the future well-being of humankind will depend on big changes in human activities across the world.

We must move rapidly towards a new kind of society that is based on understanding and respecting the processes of life, and which satisfies the health needs of all sections of the human population as well as those of the ecosystems of the biosphere – that is, a biosensitive society**.**

In a biosensitive society our lifestyles and our society will be in tune with the processes of life – in tune, that is, with our own biology and in tune with the living world around us. They will be protective of the essential processes of life on which our existence depends.

The great challenge is to work out ways of improving human well-being at the same time as reducing material consumption and waste production and reducing human pressures on the ecosystems of our planet.

The most critical difference between a biosensitive society and the society we live in today will lie in the assumptions, worldview and priorities of the dominant culture. In the biosensitive society this culture will embrace, at its heart, a basic understanding of the story of life on Earth and the human place in nature and a profound respect for the processes of life – with the result that the health and integrity of living systems will be given top priority in policy formulation and decision-making at all levels of society.

Biosensitivity will be what matters most.

Biosensitive Futures

The Biosensitive Futures Program is a project of the Nature and Society Forum (NSF), which is a non-profit, non-partisan, non-governmental organisation concerned with the future well-being of humankind and the natural environment.

This program is based on our appreciation that the future well-being of humankind will require big changes in our social systems and lifestyles. This is because our society today is not ecologically sustainable – and if a society is not ecologically sustainable it cannot, in the long term, be sustainable in any other way. There are also other highly unsatisfactory features of current society requiring social change, such as the major disparities in health and conditions of life across different socio-economic groups and the existence of thermonuclear weapons of mass destruction.

NSF therefore embraces the notion of a future *biosensitive society – that is,* a society that is in tune with and sensitive to the processes of life and that satisfies the health needs of all sections of the human population and of the ecosystems of the natural environment.

However, we believe that there will be no significant move towards biosensitivity until there comes about a basic understanding, right across the community, of the processes of life, the human place in nature and the important ecological and health issues of the present day. We call this *biounderstanding*.

The Biosensitive Futures website therefore aims:

(1) to promote biounderstanding (which leads to appreciation of the urgent need for a transition to a biosensitive society)

(2) to promote the concept of biosensitivity as the best hope for the future and to describe the essential characteristics of a biosensitive society (what biosensitivity means in practice)

(3) to foster discussion and debate on the social changes necessary – locally, regionally and nationally – to achieve the transition to a biosensitive society

(4) to provide a framework for community action groups concerned with ecological and health issues to report on their activities and so benefit from each other's experience

(5) to publicise the outcomes of this program as widely as possible and to encourage action aimed at the achievement of biosensitivity.