

AN

ESSAY

CONTAINING

*PERSONAL REFLECTIONS*

*ON A WORLD OUT OF BALANCE*

**LUMBERJACKS IN EDEN**

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# LUMBERJACKS IN EDEN

## Preface

I am the steward of \$3 billion of savings and investments. I am charged with the duty of protecting that capital and making it grow and I must try to understand not just short-term issues but the 'over-the-horizon' factors that affect its security.

I see a world with two faces – one imbued with the happy cheer of a good party; the other grim and frightening.

The economic world, the world of humanity, is undergoing a huge boom as the industrial capitalist system spreads from Europe, North America and North East Asia to the rest of the world. But the physical world, the environment in which we make our lives, is in crisis, most clearly seen in huge losses of biodiversity and in climate change.

This essay is my attempt to puzzle out the conflict between these two worlds and their implications for the future. I have also found it impossible to resist the opportunity to proffer some solutions to the problems I see.

I have not provided footnotes to back up facts or assertions – this is not an academic work but the reflections of a participant in the drama. I do not have the academic and scientific qualifications that ideally would be applied to consideration of such important issues but I do have the responsibility of my position, a keen interest in history and, like you, a personal stake in its outcome.

## The world's biggest problem – us

Climate change is a big and urgent problem. But it is only one part of an even larger problem: humanity's attack on the 'Tree of Life' – the world's complex web of living matter – through our uncontrolled hunting, farming, fishing, forestry, polluting and habitat destruction over the last 60,000 years. Some markers of this destruction:

- megafauna extinctions of animals (such as the mammoth, giant ground sloth, sabre-tooth cat and the largest marsupial that ever lived, the diprotodont) from about 60,000 BC as modern homo sapiens moved out of his African home into Asia, Australia, Europe and the Americas
- extensive deforestation and desertification from about 10,000 BC as humans learned how to farm
- extinctions of many plants and animals (such as the moa and the dodo) on the islands of the world as humans occupied them
- large-scale industrialisation from about 1800 has caused the emission of waste and toxic chemicals, ozone depletion and increasing carbon dioxide levels (up by about 35%), leading to global warming and climate change
- 90% of the world's whales and large fish (such as tuna) have disappeared from the oceans since the 1900s as a result of industrial fishing and whaling
- firearms have allowed the extermination of many species of large animal. For example, African lion populations have fallen by 90% since 1980, with fewer than 25,000 remaining, and the Asian lion is almost extinct
- 10% to 30% of all mammal, bird and amphibian species are currently threatened with extinction, according to the United Nations-led Millennium Ecosystem Assessment reports. Much higher rates could occur under the most pessimistic forecasts

We are cutting down our world, like lumberjacks in Eden. And the consequence of that plundering will be a desert, if we do not exercise our rationality to control our Darwinian drives to consume and to reproduce as much as possible.

The most important task that this generation faces is the battle to cause humanity to act rationally to reduce our "take" of the planet's resources. It is a huge job and one that we have only just begun. But it is within our capacity and must be completed if we are to have a world that retains its beauty, diversity and capacity to support lives worth living.

From a short-term perspective the destruction of the Tree of Life is a moral question. But ultimately it becomes a practical question, a question of survival. The biota of this planet provide us with everything we need to live. The air we breathe, the food we eat, the water we drink, the materials we use to build our homes, clothes and medicines – all these are provided by this thin tissue of living matter, this Tree of Life.

If we do not return the world's environment to a balanced state then our civilisation will collapse, pressured by a collision between rising population and consumption and the environment's declining capacity to satisfy the demands placed on it. The environmental problem therefore is an existential crisis for our civilisation. If we stay on the present course our civilisation will collapse as our environment is destroyed.

But if we can halt the growth of population and consumption of non-renewable resources we have a chance to provide humanity with material and physical security and the opportunity to continue the development of our civilisation which at its glorious best allows a flowering of individual creativity, beauty and meaning. A species that can produce Piero della Francesca, Pieter Breughel, Shakespeare, Mozart, the Beatles and Stevie Wonder has a wonderful and exciting future and it would be an enormous tragedy to lose that future.

## Live fast, Die young

The world is limited. But we act as if it isn't.

We build our lives on the assumption that growth can continue forever, that human population and consumption can continue to increase at an accelerating pace – as they have for the last 10,000 years – without any painful consequence. That we can consume as much as we want with the heedlessness of teenagers on a binge.

In the wealthy, open societies and representative democracies, voters and politicians shy away from taking action that will cause pain to themselves or to powerful interest groups. We end up making token efforts without achieving substantive results that will benefit future generations.

More than half of the world's people live in societies without democracy, the rule of law or the free exchange of information. In those societies, the powerful plunder the earth, and their fellows, with impunity and without acknowledgement of the future.

In both cases humanity's behaviour is short-sighted. But in the developed world we know the consequences of our actions. We don't have the excuse of ignorance or powerlessness. Our inaction is, at root, the result of our greed, selfishness, sloth and lack of courage.

Humanity faces three paths:

1. The most likely is that we continue with 'business as usual'. In which case we will ultimately end up with a world dramatically reduced in its variety and quantity of life and where most people live at a Malthusian "ceiling of misery"; a world with no opportunity to fulfil its potential for creation, beauty and happiness and no margin of safety.
2. At worst, our plundering leads in the near future to catastrophic environmental decline (such as has happened repeatedly in the history of our planet and our species) that results in death and extinction, not just for many living things, but for our civilisation and most of humanity.
3. The best outcome we can hope for is a world in balance. Where humanity's share of the planet's resources is limited to an amount that allows our species a future at least as long as our past (about 140,000 years) and that maintains such biodiversity as has survived the extinctions humans have caused since we learned to make weapons, farm and travel on water.

A comforting belief that many people hold is that the world is a self-balancing mechanism. But that view is false. It is thought that the planet has experienced at least seven extinction events where large percentages of all living things have died. There are many theories of the causes of extinction events but the consequences are very clear in the fossil records. Restoration of biomass and particularly biodiversity after an extinction event takes millions of years.

<b>Extinction Event</b>	<b>Date</b>	<b>Possible Cause</b>	<b>Estimated % of species going extinct</b>
Cambrian/Ordovician	488 m BC	Volcanism?	50%
Ordovician/Silurian	444 m BC	Gamma ray burst?	50%
Devonian/Carboniferous	360 m BC	Meteor impact?	70%
Permian/Triassic	251 m BC	Warming/methane release	70% of land species, 90% of marine species
Triassic/Jurassic	200 m BC	Warming/methane release?	20% of marine species
Cretaceous	65 m BC	Meteor impact/volcanism	60% - 90%
Holocene	60,000 BC+	Homo sapiens	undecided

## A World with Limits

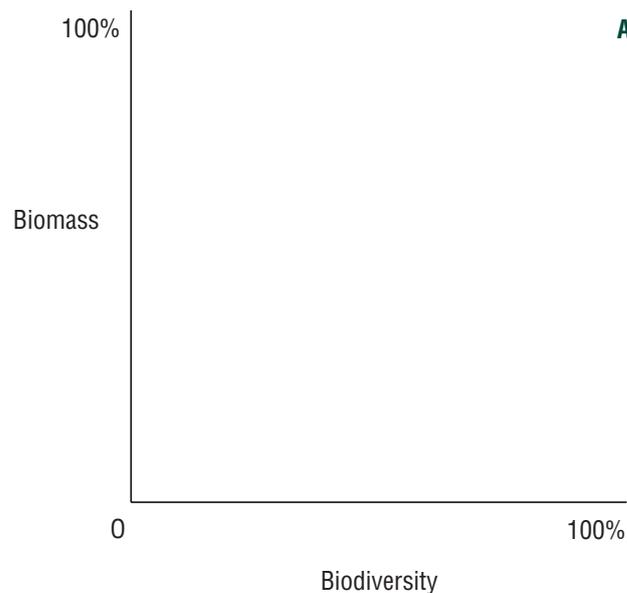
Life is a thin tissue below, on and above the world's 510 million square kilometre surface area. The combination of energy from the sun and chemical elements from the seas, earth and air of the planet can support only a finite amount of living matter (known as "biota").

Over four billion years life has evolved to fill up the capacity of our world, changing into different forms so as to exploit every environmental niche capable of supporting it.

This diversity has a miraculous beauty and variety; from the world's smallest bird, the Bee hummingbird of Cuba, weighing less than two grams; to the largest animal that has ever lived, the 200-ton Blue whale, which has a tongue that weighs as much as a small elephant; from dung beetles gamely wrestling with the production of zebra on the African plains, to the bacteria living on the surface of Pompeii worms at the edges of hydrothermal vents deep in the Pacific Ocean.

Life grew to have the maximum QUANTITY supportable by the earth's capacity and in order to do so had to evolve the maximum DIFFERENTIATION possible. The world, when it was in balance, had the maximum quantity of living matter (or "biomass") by having the maximum variety (or "biodiversity"). This idea is represented on the diagram below:

### A World in Balance



**A** = Balance = maximum quantity of life + maximum variety of life

The essence of the challenge faced by all living things today is that the advent of our species, homo sapiens, is reducing the quantity and variety of life. This is not only a tragic outcome but a profoundly dangerous one. With the world's biomass and biodiversity plummeting, it is not just the planet's biota but our civilisation that is in danger.

## The Darwinian Dynamic

Why is humanity driven to consume more and more? And why are we able to?

Simply, because homo sapiens has won the arms race that has been the central drama of our planet since life began. All living things need to reproduce and to get and keep resources. Our bias to consumption, conquest and growth is an expression of these ancient and deeply-embedded drives. Industrial capitalism is simply the most recently evolved competitive weapon in the Darwinian struggle for existence.

Life first originated when a molecule evolved the ability to copy itself. That replicator molecule is the ancestor of DNA and all living things. The essence of life is the drive to replicate. Living things that do not reproduce exist for only one generation. Living things that reproduce a lot may survive for many generations. And reproduction requires energy, which requires consumption. The more consumption, the more reproduction.

Since the dawn of life, all living things have been engaged in a struggle for resources with each other. This has manifested itself in a Darwinian arms race which requires all forms of life to invest in offensive and defensive systems so as to get and keep resources. The better the systems, the more resources are required to support them, and therefore the more consumption. And the more consumption, the better the offensive and defensive systems can be.

Reproduce. Consume. Attack. Consume. Defend. Consume.

After four billion years one species has won the Darwinian arms race. Through the development of the opposable thumb, colour vision, bipedalism, mental power, friendship, toolmaking, “distance” weapons (such as spears, nets, boomerangs, bows, and guns), fire, language, clothing, agriculture, writing, metal smelting, the rule of law, printing and the scientific method (among others) homo sapiens is now able to defend itself against; and attack, dominate, kill and consume (almost) all other forms of life.

Homo sapiens is a species that has acquired for itself the power to consume as much as it wants of the living matter of this planet. And as a result of the human victory in the Darwinian arms race, the world has lost its balance.

What does that mean?

In a system in balance no single species will have a large share of the resources of the planet.

In a world out of balance one species dominates and takes whatever it wants.

And because of the workings of the Darwinian dynamic – to consume and to reproduce as much as possible – the dominant species is driven to consume everything.

Which is where we are today as we sit at our teakwood tables and gulp down caviar and champagne, whale meat and sake.

## The History of Human Progress

Climate change is just one symptom of the burden that humanity is placing on the planet through its ever increasing population and consumption. As we convert more and more of the world’s land and seas to the human economy, the world’s biomass and biodiversity reduces. The story of human progress has its mirror image in the story of the reduction of biomass and biodiversity.

Homo sapiens probably first emerged as a distinct species about 130,000 to 140,000 years ago. Science posits the existence of “Mitochondrial Eve” at about that date; her DNA has been passed down from mothers to children and is now found in all living humans.

We in the twenty-first century have the same physical body as that species but not the same mind or spirit. From about 60,000 BC, humanity experienced a transformation of its mental capacities that expressed itself in complex linguistic skills, the capacity to create sculpture, art and music, religious sensibility and a problem-solving ability that allowed humanity to easily jump the environmental constraints of its evolutionary niche.

These developments allowed homo sapiens to spread from its tropical East African home to occupy the entire planet, displacing other predators and other hominid species such as homo neanderthalensis and homo floriensis (which possibly survived until as recently as 4000 years ago).

Knowledge about human population growth and economy in the Palaeolithic period is poor. However, estimates are that human population had increased from a few hundred individuals to about 3.5 million people occupying the Old World (Eurasia, Africa and Australia, with a land area of 94 million km<sup>2</sup>) by about 20,000 BC.

The occupation of the New World (North and South America, with a land area of 42 million km<sup>2</sup>) began from about 17,000 BC and was complete by 11,000 BC allowing an increase in population to about 5 million people. The world's land area is about 136 million km<sup>2</sup> (excluding Antarctica but including lots of other inhospitable places) so population density was about one person per 2700 hectares.

The development of agriculture and pastoralism from about 9000 BC added grains, pulses, dairy foods and more regular supplies of meat to the human diet and allowed population to increase by a factor of 50, to an estimated 270 million by about 1000 AD. Population density increased to about one person per 54 hectares.

The development of industrial capitalism can be traced to the Po Valley and Tuscany in northern Italy from about 1000 AD and allowed increased trade, the accumulation of capital and investments, increased specialisation of labour, faster technological, scientific and medical development, and better transport of food, food species and food production technologies. By 1800, world population had quadrupled to about 1 billion and population density had increased to about one person per 13.5 hectares.

## The Ceiling of Misery

In 1798 an English mathematician and clergyman Thomas Robert Malthus anonymously published a pamphlet entitled "*An Essay on the Principle of Population*". This seminal text on the limits to growth proposed the idea that human population had the capacity to increase at a faster rate than the capacity of the world to produce food to support it. Human population and consumption would expand until they were checked by a ceiling of misery of malnutrition, starvation, low rates of fertility, high rates of infant mortality, late marriage, emigration and conflict.

The Darwinian dynamic described earlier in this essay means that humans, like all living things, are driven to continually increase population and consumption. But in a limited world we ultimately reach a ceiling of misery.

Because we are the problem-solving ape we can find solutions to limits. Technology develops (stone tools, "distance" weapons, fire, clothing, pastoralism, agriculture, industrial capitalism, the "Green" revolution, genetic engineering) and allows increases in food production.

But these solutions only provide temporary respite from the pressure of the Darwinian dynamic. Whatever margin of safety provided by a buffer of food production capacity is ultimately eroded as population and consumption are driven to increase again.

In a finite world there will be an end point. And each step, each advance in technology, economic activity and food production, takes us closer to the end point, the ultimate ceiling of misery.

## The End Point

What (and when) is the end point?

A key limiting factor is simply the amount of physical space available on our planet. The world's population is currently 6.6 billion and population density is one person per two hectares of land. World population has grown at about 1% per annum since 1800. Over the past 35 years, global population growth has accelerated to 1.4% per annum, largely driven by increases in food production and improvements in public health that have lowered death rates in developing countries.

If population continues to grow at “only” 1% over the 93 years to 2100 it will increase to 16.7 billion and population density will increase to one person per 0.8 hectares.

The table below demonstrates the effect of a 1% annual population growth rate over the next one thousand years:

	Population (billions)	Hectares per person	Square metres per person
2007 AD	6.6	2.0	20,455
2100 AD	16.7	0.8	8108
2200 AD	45.0	0.3	2998
2500 AD	891.0	0.015	151
3000 AD	129,023.0	.00010	1

If we continue to grow population at 1% annually, by 2200 AD (less than 200 years from now) world population will be 45 billion. That number seems immensely large to me.

The figures at 2500 AD are interesting because at that point world population will have the same density as Singapore currently has, 6600 people per km<sup>2</sup>. So deeply embedded is the bias for growth that Singapore is hoping to increase its population by 50% even though today it must import almost all its food and 50% of its water (despite being in a high rainfall area).

If we continue to grow population at 1% annually, by 2500 AD the entire planet (assuming we don't colonise Antarctica) will have a population density equal to that of Singapore. Given the human capacity for problem solving, that is an entirely possible future – but it would not be very pleasant. Instead of living in an orderly Singapore many of us might live in a disorderly and desperate Gaza.

If we continue to grow population at 1% annually, by 3000 AD world population will be 129 trillion, and we will have 1 square metre of surface area each. No doubt we could all live in tower blocks hundreds of metres tall and eat laboratory-produced nutrition. But would it be a world worth living in?

There will be an end point to human population growth, either through arrival at the ultimate ceiling of misery presented by the constraints of the physical dimensions of this planet or through rational choice.

That end point will probably be reached in the next two or three hundred years. If population and consumption growth slow, it would be reached at a later date.

The point is that if we continue to operate according to the rules of the Darwinian dynamic (consume as much as possible, reproduce as much as possible), one day we will reach the ultimate ceiling of misery and thus the end point.

It is argued that as societies get richer population stops growing and we have indeed seen this phenomenon occur in countries like Italy and Japan. But the appetite for increased consumption never seems to stop.

## Our (increasingly heavy) Footprint

Another way to estimate the end point therefore is through the prism of economic activity. Humanity's take of the planet's resources is a function of both population and the rate of consumption. Mbuti hunter-gatherers living in the forests of eastern Congo have a much lighter impact on the world's biomass and biodiversity than people who live in the lap of the delights afforded by advanced industrial capitalism.

If we use gross domestic product as a proxy for human consumption and then compare it with the inhabited world's land area (136 million km<sup>2</sup>) we can come up with a very rough estimate of the heaviness of the human footprint on the world. This is an imperfect measure since services, which do not require much in the way of physical resources, make up a large part of GDP.

On the other hand, GDP does not measure environmental costs. A shrimp with a GDP value of \$1 may have come from an intensive farm in Thailand and have been flown to Italy to sit as a garnish on top of my bowl of soup. The world's mangrove forests have declined by 35% over the past 20 years, often to be replaced with intensive shrimp farms. Mangroves are important havens of biodiversity and spawning grounds for fish while intensive aquaculture can release significant volumes of wastes, fertilizers, pesticides, antibiotics and other pollutants. That \$1 price does not include any of those costs.

Since 1820 world GDP growth has been about 2.2% per annum. Last year world GDP growth was 5% with some countries such as China and Vietnam growing at more than 10%. Members of the industrial capitalist system are so conditioned to need economic growth that we (and particularly fund managers and politicians) become unhappy if economic growth falls much below 2% per annum. Let's use that number for the economic forecasts presented below while noting it is well below recent trends:

	<b>Production System</b>	<b>Estimated GDP (\$ billion)</b>	<b>Consumption per Km<sup>2</sup> (\$)</b>	<b>Notes</b>
10,000 BC	Hunter gatherer	1	7	1
1000 AD	Agriculture	116.8	865	2, 3
1820 AD	Early Industrial Capitalism	694.4	5143	2, 3
2000 AD	Advanced Industrial Capitalism	36,000	266,666	3, 4
2100 AD	"Turbo Capitalism"	260,807	1,931,906	3, 5
2200 AD	?	1,889,456	13,995,973	3, 5
2500 AD	?	718,436,488	5,321,751,770	3, 5
3000 AD	?	14,337,527,440,000	106,203,907,000,000	3, 5

*Notes: (1) For ease of comparison I have assumed world GDP was \$1 billion or \$200 per capita, probably a significant overestimate (2) Dr Angus Maddison, The World Economy – A Millennial Perspective, 2001, OECD (3) "1990 international dollars" as used by Maddison (4) Peter Hall estimate (5) assumes 2% per annum GDP growth*

If the world economy grows at 2% per annum for the next thousand years it will eventually reach the level of \$14.3 sextillion, or about 400 million times the size of today's economy!

Column 3 is interesting as it provides an index of the heaviness of our footprint. The footprint of the agricultural phase of humanity is estimated to be 117 times as heavy as that of the hunter-gatherer phase, composed of a population about 50 times as great, consuming resources at about 2.3 times the rate of hunter-gatherers. The result was widespread deforestation and desertification.

The footprint of our industrial capitalist phase is about 36,000 times as heavy as the hunter-gatherer phase. In crude terms this is the result of 1,200 times as many people consuming physical resources on average at 30 times the rate of hunter-gatherers. Of course there are many people consuming at a much higher rate than this in the industrial capitalist nations of the world.

Our footprint is likely to get much heavier in the short term as most of the world adopts the industrial capitalist system. Even Mbuti hunter-gatherers wish to eat chocolate and drive Mercedes Benz cars (the ones I met in Goma in the eastern Congo in April 1999 certainly did).

World population is forecast to increase to between 9.2 billion and 9.5 billion by 2050, an annual growth rate of about 0.8%, and a total increase of about 50%. This forecast (by the UN) assumes that the HIV pandemic significantly impacts population and it could be regarded as optimistic. Consider, for example, that according to India's 2001 Census 53.7% of its population (now over 1.1 billion) was under the age of 24. Many African and Islamic countries have similar age profiles.

If the world economy maintains an economic growth rate of 2% (well down on recent rates), global GDP will increase from \$36 trillion to about \$95 trillion by 2050, leading to an increase in per capita consumption of about 80%. This number indicates a footprint about 2.6 times as heavy as that of today, and at least 95,000 times as heavy as during our hunter-gatherer mode of existence.

Let me repeat that point. If we maintain our current trajectory of population and economic growth, by the end of my lifetime (and yours), the human footprint will be about two and a half times as heavy as it is today. Food production will need to be twice as high as today to support the 50% increase in population forecast as well as desired increases in standards of living.

## Where we are and where we are headed

Biodiversity loss since homo sapiens moved out of his African home about 60,000 years ago has been massive. For families ("genera") of animals above 40 kgs in size estimates of extinction rates are 73% for North America, 79% for South America, 93% for Australia, and 27% for Europe. To these losses could possibly be added two other species of human, homo Neanderthalensis and homo floriensis. No doubt there have been many other extinctions of smaller forms of life.

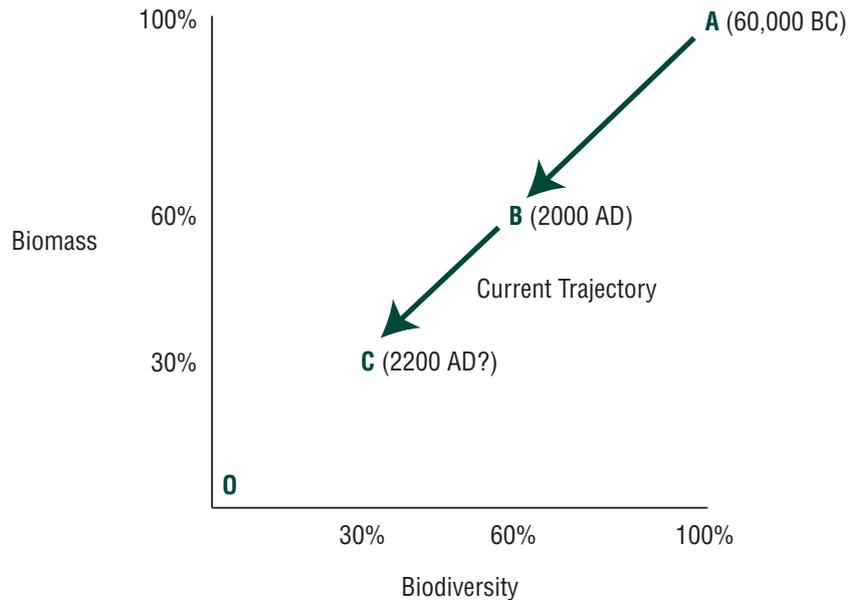
Biodiversity can be measured numerically but it should also be measured qualitatively – I do not feel that the loss of one species of lichen has the same significance as the loss of Neanderthal Man, Stellar's Sea Cow, the Atlantic Grey Whale, the Caspian tiger, the Giant Aye Aye or the Yangtze River dolphin.

On this subjective basis, I will pluck a number out of the air and suggest that the planet has lost 40% of its biodiversity as a result of homo sapiens' conquest of the planet.

Estimates of human utilisation of the biomass of the planet range up to 40%. Point B on the diagram following plots my estimate of where humanity and the world is today.

We are heading towards Point C on the diagram which represents an estimate of the end point. I think we will arrive at it between 2100 AD and 2200 AD.

## A World Out of Balance



**A** = Balance = Maximum Biomass + Maximum Biodiversity

**B** = Today = Significant loss of Biomass + Severe loss of Biodiversity

**C** = The End Point = Human economic activity expands to the Ceiling of Misery  
= Maximum Humanity + Minimum Biomass + Minimum Biodiversity

**O** = Dead Planet = No Biomass + No Biodiversity

Our current way of life and growth trajectory is going to create a world where all space possible is occupied by human economic activities and only those species useful to homo sapiens continue to exist. Biomass and biodiversity will reduce substantially and the world will teeter on the abyss of famine, disorder, ugliness and meaninglessness. We would be living at a Malthusian ceiling of misery where civilisation would cease and the physical world will be profoundly out of balance.

## Civilisational Collapse

With huge population growth occurring in the context of a disorderly world the risk of famine, pestilence, disruptive population movements and war is high. The survival of our civilisation and the lives of many members of our species are under threat. (I recommend Jared Diamond's *Collapse* as a superb survey of the history of civilisational collapse – see the attached reading list).

A particular pressure point we face is food supply. With human population forecast to increase from 6.6 billion today to 9.5 billion by 2050 and an increasing portion of humanity seeking a high protein diet, food demand is increasing at a time when supply may be about to fall as a result of:

- climate change
- desertification
- pollinator decline (wild bee populations have fallen by 90% in the United States in the last 50 years)
- depletion of groundwater reserves and falling water tables
- dependence on too narrow a range of food species and therefore vulnerability to pests and diseases

Famine has been an endemic tragedy since humans started to rely on weather-dependent agriculture for their food supplies. For the last forty years, apart from Ethiopia and the Sahel region, humanity has enjoyed a respite from famine, thanks to

the green revolution of the 1960s which substantially increased grain yields. However, famine is likely to return as population increases and as the factors outlined above come in to play.

The table below shows UN population forecasts to 2050:

(millions)	1900	2005	2050	Change 2005-2050
Africa	133	922	1997	+ 1075
Asia	946	3938	5265	+ 1327
Europe	408	731	664	- 67
North America	82	332	445	+ 113
Latin America	74	557	769	+ 212
Oceania	6	33	49	+16
TOTAL	1649	6513	9189	+2676

Much of the population growth is occurring in states that are food importers and that have poor government and infrastructure, in Africa, the Middle East and South Asia. A likely scenario is overpopulation and overconsumption in poor and disorderly countries leading to environmental degradation and collapse of food production.

The consequences of that would be massive famines and pressure for migration from populous, poor, malnourished and disorderly countries into wealthy and orderly states. Migration is already happening on a large scale and is likely to accelerate. The United Nations is forecasting a movement of 100 million people from lesser developed countries to more developed countries in the period to 2050 and I believe this is going to prove to be an underestimate.

The question is whether the “receiving” societies will be able to absorb the large numbers of people arriving. The cause of the collapse of the Western Roman Empire was the immigration of large numbers of refugees (from the Huns) who owed their allegiance to tribal leaders rather than the Roman state. Similarly many of the new immigrants will have allegiance to their own cultural and religious values.

The morality and value system of the western democracies will not allow them to rebuff the poor and starving millions who seek to immigrate into them. These new immigrants may be physically absorbed and culturally integrated but the problem of inadequate food supply will not be solved, it will just have been physically transported.

Increased competition for food and water, civilisational conflict and easy access to weapons of mass destruction threaten a catastrophic break from the relative order of the past few decades. Proliferation of nuclear weapons, biological weapons and advanced missile technology into the hands of non-democratic states and terrorist organisations mean that the entire world has become vulnerable to violence and existential threats.

Finally, pestilence hovers. Viruses, bacteria, fungal growths and insects have short lives and therefore much faster rates of evolution than humans. The widespread and unconstrained use of pesticides and antibiotics mean that strains of these actors are evolving that are resistant to human science. Humanity has been repeatedly visited by plagues and disease and it is not unimaginable that plagues like the Black Death which killed between a third and a half of the European population in the years after 1348 could be a feature of a hungry and disorderly humanity living in a world out of balance.

In 1968 Garrett Hardin, Professor of Biology at the University of California, wrote a brilliant and profound essay “*The Tragedy of The Commons*” (easily available at [www.garretthardinsociety.org](http://www.garretthardinsociety.org)). In his essay Hardin gives the following quotation by the British philosopher and mathematician Alfred Whitehead:

*“The essence of dramatic tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things... This inevitableness of destiny can only be illustrated in terms of human life by incidents which in fact involve unhappiness. For it is only by them that the futility of escape can be made evident in the drama.”*

This generation is riding a wave of massive proportions and power. A wave that has been building for the last 60,000 years and that will break in the near future. It sometimes does appear that it will be impossible to stop the wave from breaking and to avert the fate that some see lying before us.

But I, and we, nonetheless, will attempt to escape our fate, using the means to hand. Pathetic they seem. But they are all we have.

## Hope

Hope is a prerequisite to the solution of any problem. I prefer to hope, and believe, that like the many challenges faced by our species in the past, we can solve the problems presented by our Darwinian inheritance.

The first steps towards solving the problem are to stop denying that there is a problem and to stop thinking that we can postpone action. The time to act is now. Every delay will lead to irreversible losses of biodiversity and a further slip down the slope to the End Point.

The essence of the task is to break the power of the Darwinian dynamic. This can only happen through humanity exercising our rationality to control our deeply-embedded drives and our natural propensity to increase consumption.

Our civilisation has enormous resources of science, wealth and, most of all, the immense problem-solving capability of the human species. Therefore let us assume that it is not too late and that we have some time and the power to make adjustments to human behaviour and institutions that will give our species and the rest of Creation a future.

## Perspective

Humanity needs to gain a better perspective of time. We need to shift our view from the immediate future to a more distant future, from tomorrow and next year and the next generation to a perspective that includes the next millennium, the entire possible future of our species and on into geological time. In that way we can plan our management of the resources of the world in a responsible and unselfish manner.

We also need to understand our place in the world. We are not masters of all creation, for all time. We are one species, and one likely to be relatively short-lived if we do not adapt our behaviour. However, we are also a very special species, the problem-solving ape, that has been the victor (so far) in the four billion year struggle for mastery of this planet. Within each member of our species is a magnificent potential.

Such genius needs civilisation to flourish. The essence of our civilisation is that it allows individuals the opportunity to self-actualise by providing order, freedom and the satisfaction of material needs. Only by retreating from the ceiling of misery can we preserve our civilisation.

Does it matter if biomass and biodiversity are severely diminished? In the short term this is a moral and aesthetic issue. In the long run it is a practical issue. In my view, all life forms have a right to existence and each form of life is miraculous and beautiful, the product of billions of years of struggle, courage and survival despite the pressures of a precarious existence. Humanity has a moral obligation to preserve this beauty for future generations, to act mercifully to other living things, to walk humbly in this Eden.

## Objectives

Our objective in the management of the planet's resources should be to allow our species and all other species to fulfil their potential lifespan. Homo sapiens has existed for an estimated 140,000 years and it is reasonable to expect that we can continue in our current physical form for another 140,000 years.

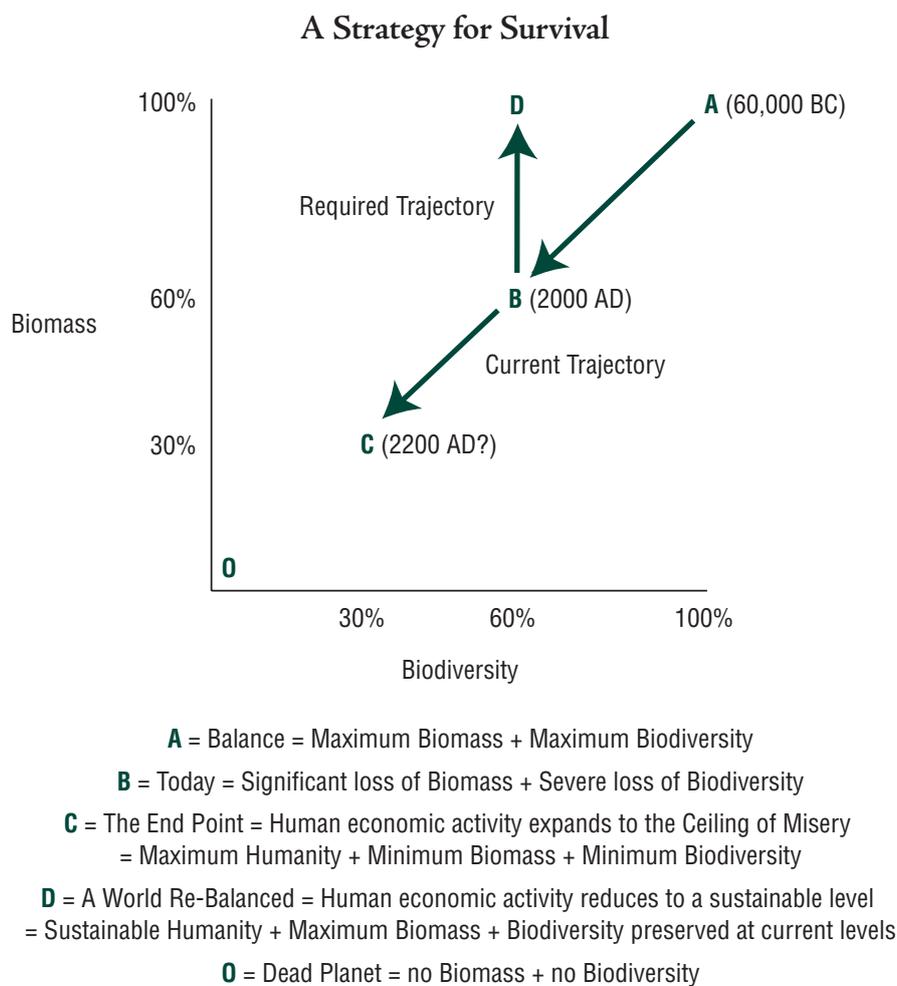
In order to survive 140,000 years, we need to dramatically reduce our “take” of the resources of the planet. We need to retreat from the ceiling of misery, allowing the biomass of other living things to increase, and thereby give our species a margin of safety and increased quality of life and the other species the opportunity to rebuild their own biodiversity.

I believe we have four objectives:

1. Preserve what biodiversity remains.
2. Increase biomass.
3. Prevent collapse of our civilization.
4. Build a system of human governance that will allow the creation of a world in balance.

## Strategy

We need to change our direction from heading towards point C on the diagram below to heading towards point D where human economic activity reduces to a sustainable level. We have lost huge amounts of biodiversity and it will take millions of years to rebuild it to its former richness. But we can preserve what remains.



The closer we move to Point D the greater our margin of safety and the more likely we will be able to maintain our civilisation.

## Time Frame

To stop the headlong rush to growth and Point C and shift towards Point D will be the work of generations. Simply to get population to stop growing and retreat to a sustainable level will take at least 250 years and enormous effort.

A feasible timeframe for bringing the world back into balance is 200 to 250 years. However, there will be many aspects of the programme such as climate change, biodiversity preservation and population control that require vigorous action in the immediate future.

## The Plan

So what must be done to bring the world back into balance? Below I set out very briefly some of the key elements of a programme for rebalancing the world that are developed in more detail later in this essay.

1. Switch consumption from environmentally damaging activities to low impact activities through the development of a system of Ecosystem Taxes and Credits (ETC).
2. Reverse population growth and reduce population.
3. Preserve biodiversity throughout the world but particularly in the biodiversity hotspots and the oceans. End whaling as an exemplary statement of seriousness of intent.
4. “Re-wild” the Earth by confining human occupation and economic exploitation of the planet to 50% of its inhabitable area and oceans.
5. Work to enable human creativity, diversity and self-actualisation to flourish by supporting literacy, education, womens’ rights, human rights, democracy and the rule of law.
6. Build an international coalition of states that will work to carry out this programme through international institutions.

This coalition could be called the Organisation for Environmental Co-operation and Balance (OECB). This is a conscious echo of the Organisation for Economic Co-operation and Development (OECD), that is comprised of 30 countries united by a belief in market economies and democracy. The OECB would be united by a belief in the need to take practical action to build a world in balance.

## Eco-System Taxes & Credits (ETC)

The key to maintaining biodiversity and increasing biomass is to reduce our “take” of the planet’s resources. This will require a reduction in population and a reduction in the consumption of physical resources and in particular biota.

The planetary economy can be divided into two parts – the human economy and the environment in which we live. The environment is a “Source” of the physical resources needed for the human economy; and is also a “Sink” for the wastes produced by the human economy. It provides essential services to the functioning of the human economy. It is not a bottomless pit.



As discussed above, the size of the human economy has grown massively relative to the size of the environment and is now clearly out of balance.

Some human activities require large inputs of physical resources and produce large amounts of waste with low levels of utility. Others require few resources, produce little waste but offer high levels of utility. We need to transition from the first type of activity to the second (see Appendix One).

I recently saw within the pages of *The Economist* an advertisement from an oil company proudly proclaiming its ability to produce ethanol fuel from farmland. Such “biofuels” are a classic example of the bad signals that our economy is getting about environmental costs. One acre of corn can produce about 375 gallons of ethanol which is enough to power a car for about 6700 miles. If that acre of land has been converted from rainforest it might have caused the loss of 500 tonnes of biomass and related biodiversity and led to the emission of 1000 tonnes of the greenhouse gas carbon dioxide (apologies for mixing Imperial and metric units of measure).

Fifty good books (see some suggestions in the reading list) might cost the same as the ethanol and might yield the same utility and enjoyment as driving a car for 6700 miles but they will have a much lower cost in terms of reduction in biomass and biodiversity. The table below shows the comparison:

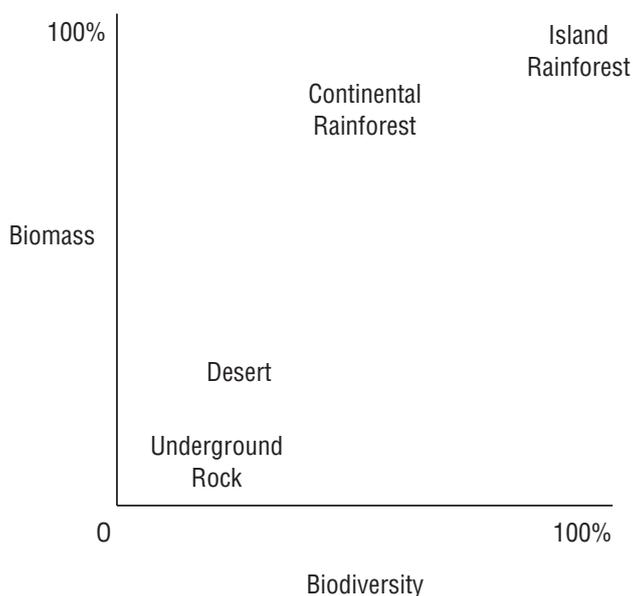
	Utility	\$ Cost	Source Costs	Sink Costs
50 good books	equal	\$875	25 kgs of wood	Negligible
Driving a car for 6700 miles	equal	\$875	1 acre of rainforest	1000 tonnes of CO2

We can assess the costs of goods and services within the human economy pretty accurately. We know the price of labour, financial capital and intellectual capital, and we work relentlessly to improve productivity and reduce costs.

We are, however, very ineffective at a) assessing source and sink costs and b) attaching those costs to goods and services. In order to build a balanced world we need to incorporate these costs into our economic system.

It should be possible to calculate source and sink costs by measuring impacts on biomass and biodiversity. Digging dead rock out of the ground has negligible impact on biomass and biodiversity, provided that there is no damage to the environment in extracting it or disposing of wastes. Converting one acre of island rainforest to a field producing grain for ethanol is hugely damaging in terms of biomass and biodiversity.

### Impacts on Biomass and Biodiversity



It is possible to construct a system of biodiversity credits and taxes for activities that promote or damage biodiversity and biomass. Destroying island rainforests would attract heavy taxes. Funding sanctuaries for endangered species would attract biodiversity credits. The market and economy would work efficiently to capture the credits and avoid the taxes.

Carbon taxes and credits are examples of ETCs. Given the scale and urgency of the threat presented by climate change, responsible societies should be working towards greenhouse gas neutrality within the next decade. This would be the first major test on a global scale of ETCs. They are effective as is demonstrated by the case of Sweden which imposed heavy carbon taxes in the early 1990s and reduced per capita carbon dioxide emissions to 6 tonnes as compared with Australia and the United States which have carbon emissions of about 20 tonnes per person.

The funds raised from ETCs would provide the financial fuel to fund other elements of the programme to bring the world into balance. They should start at a low rate and be focussed on only a few activities at first and then extended and increased as society sees their benefit.

The major difficulty with ETCs is that they will fall most heavily on the poorer members of our society. The environmental damage being visited on our planet is not the result of consumption by a few wealthy people but of consumption by our species as a whole. Cheap travel (whether by car or aeroplane) is an example of how mass luxury damages the environment. So when we have to adapt our behaviour it is not the few who have to change, but the many.

It will be very difficult to change our path. But it can be done if executed with sufficient leadership and skill. A classic example of society's leaders (for want of a better term) deciding policy in defiance of the popular will is the death penalty. In the United States popular support for the death penalty has averaged 65% for the years between 1936 and 2004, according to the Gallup polling organisation. Despite this, the penalty was suspended for periods in the 1960s and 1970s and only 15 states have executed more than 10 people since 1976 (40% of all executions have occurred in one state – guess which one). According to the United States Bureau of Justice Statistics 594,246 people were murdered or were the victims of “non-negligent manslaughter” in the period between 1976 and 2005 as compared with 1015 executions in the same period. The two thirds of America who take an Old Testament view of life have had remarkably little effect on the way the criminal justice system is managed.

The point is that once the leadership of our political, legal, financial, religious, academic, cultural and media systems decide on a course of action change can happen relatively quickly. The Montreal Protocol on ozone depletion is a case in point.

## **A Low Impact Economy**

Would society be prepared to make the changes and sacrifices necessary to switch from a high impact economy to a low impact economy?

Of course! Sooner or later we will have to adapt to a lower per capita “take” from the environment through population growth so it is much wiser to make the adaptation through conscious choice sooner and thereby preserve the beauty of the world and our margin of safety.

In fact, to use GDP per capita as a proxy for individual well-being is too narrow. In 1968 Robert F. Kennedy pointed out that GDP “counts air pollution and cigarette advertising...the destruction of our redwoods and the loss of our natural wonder in chaotic sprawl” and concluded that GDP “measures everything... except that which makes life worthwhile”.

Kennedy's statement is reflective of a more profound change that is happening in our mentalities. The cultural hegemony of the capitalist system is slowly giving way to a cultural hegemony based around the idea of sustainability. Much of the world is still in the grip of the idea that happiness can be derived from material goods. But some of the leaders of our civilisation are shifting to a new set of objectives and values.

The German philosopher Erich Fromm suggested that human happiness is fundamentally rooted in caring and loving relationships, creativity, and connection to our social group and the physical world.

Our drive to compete with each other through the consumption of material goods and other givers of status is really an echo of the more fundamental Darwinian struggle for existence. That (essential) competition can be resolved through much less destructive mechanisms such as adornment and costume, the creative arts and educational, athletic and other personal attainments. What is more impressive and interesting – a person with a big car or a person with a good mind? To be is better than to have.

In fact as our material consumption has increased our happiness has not. In the United Kingdom for example “life satisfaction” has not increased since 1973 despite substantial growth in per capita GDP. The price to be paid for economic progress is often “status anxiety”, long hours of work and atrophied personal relationships.

We can have rich and fulfilling lives where basic material needs are met and where we can fill our days with love and friendship, learning, creation and respectful relationship with the beauty of the world. That is the economy we need to shift to.

## Population Control

The quantity and type of economic activity and consumption is one factor in the heavy human footprint; population is the other. We need to reduce the human population to a level that allows a sustainable long-term future and work needs to be done to assess this ideal level.

It is possible to conceive of a reduction in population and to formulate policies that would allow it to happen. For example, to reduce population from the 9.5 billion it is projected to reach by 2050 to 4 billion (world population in 1975) would require a 0.4% annual decline in population for about two hundred years.

This sounds like a small rate of decline, but, given the existing momentum of population growth and the increases in lifespan (meaning decreases in the death rate) ardently sought by medicine, science and public policy, will require a significant reduction in the birth rate.

Assuming a sample of 1000 people, the current world average life expectancy of 67 years and a 1% population growth rate implies a death rate of about 15, and a birth rate of about 25.

- To get the population to decrease by 0.4%, to 996 people, requires the birth rate to decline from 25 to 10, a 60% decline
- To get the population to stabilise at 1000 requires a reduction in the birth rate from 25 to 15, a 40% decline

And if death rates continue to decrease, which is an important objective of our civilisation, birth rates will need to decrease at a higher rate than those set out above.

Those reductions in birth rates are huge and show how hard it is to reduce population in the absence of Malthusian factors such as late marriage, conflict, emigration, famine and disease. And proposing policies to reduce human population is dangerous, touching as it does in sensitivities related to religion, wealth distribution, power, national pride, individual rights and sex relations.

Some strategies that would need to be considered are:

- Increasing literacy and education, particularly of females, through mechanisms such as free school meals
- Making sex education, family planning, contraception and abortion freely available
- Increasing provision of medical services, particularly in poor countries

- ✦ For many poor people having children is a form of insurance so we should investigate ways of providing pensions more generally
- ✦ A substantial programme to educate the public about the crisis of excessive population and consumption
- ✦ An end to subsidies and other policies that reward population growth

Two more contentious and morally difficult strategies that humanity needs to consider and debate are:

- ✦ Voluntary euthanasia
- ✦ Providing financial and other incentives to women\* to defer having children, to have fewer children or not to have children at all

*\*This last idea has caused comment among readers, particularly on the point of why women should bear the responsibility for lowering the birth rate. Imagine two islands, Venus and Mars, each populated by ten men and ten women, all anxious to have children and flexible on the point of parentage. On Mars only one woman is fertile while nine are infertile. All ten men are fertile. On Venus the situation is reversed with only one man being fertile while all ten women are fertile. At the end of one year Mars is likely to have only one baby while Venus might have as many as ten babies. It is the number of fertile women in a population that is the key determinant of the birth rate not the number of fertile men. Therefore the logical focus of attention is female fecundity.*

Population cannot be limited by physical compulsion; that policy has been tried to disastrous effect in China and India. Rather society must use the carrot of economic benefits, education and better medical services to offset the costs of not having children.

And population control is not a policy to be limited to poor countries. In fact, reducing population in high consumption countries would be of greater benefit to the global environment.

Unpalatable as these ideas may be, the population crisis this world faces is so extreme and so dangerous, that a clear-eyed scrutiny and public debate of the costs, benefits and ramifications of such policies needs to be undertaken.

## Biodiversity

There is no level of biodiversity loss that is acceptable. Every creature is of infinite value in its potential, its beauty and wonder. And further, each loss of a species causes the ecosystem in which it lives to change and to become less balanced.

Biodiversity must be preserved in every ecosystem and environment but four important targets are set out below:

### a) Preserving Biodiversity in the Wealthy States

The easiest target for preserving biodiversity is in the territory of the wealthy states. These societies have the financial resources and the knowledge to preserve biodiversity and their actions will provide an example to the rest of the world as to what needs to be done and how it can be done.

#### i) Land

We should seek to restore the full range of biodiversity that existed prior to the industrial revolution by creating biodiversity action plans for all relevant species and creating extensive wildernesses which represent all ecosystems within their relevant jurisdictions. This would involve voluntary conversion by landowners of land into wilderness protection zones or outright purchase by states for conversion into protected zones.

#### ii) Sea

Exclusive Economic Zones (“EEZ”) are established by the United Nations Convention on the Law of the Sea and generally extend 370 kilometres from the coast. Within this zone states have sole exploitation rights over natural resources such as fish, hydrocarbons and minerals. Wealthy states with EEZ would manage them to preserve biodiversity and increase biomass through a system of licenced harvest zones and wildernesses. In the

harvest zones licences would be granted to catch limited volumes of seafood with the objective of increasing biomass and biodiversity. Ideally, licences would be granted only to local communities and individual fishermen so as to preserve the economic well-being of those communities rather than the profits of investors unconnected to the local environment.

Through the exemplary behaviour of the wealthy nations, other states would recognise that preserving biodiversity and building biomass are essential elements of a well-balanced society and hopefully would incorporate appropriate measures into their public policy.

## **b) Preserving Biodiversity in the Global Hotspots**

The most important target for preserving biodiversity are the 34 biodiversity “hotspots” as defined by Washington-based Conservation International. These are set out in Appendix Two. These hotspots cover only about 2.3% of the world’s surface area but are the only homes of over 50% of the world’s plant species and over 40% of all vertebrate species.

Most of the hotspots are tiny fractions of their previous size and are only tenuously clinging on to existence. Most of them are in poor or disorderly states where poverty and greed drive people to exploit nature for food, timber and other natural resources and to convert land from wilderness to agricultural land for production of cash crops such as bananas and palm oil.

Biodiversity must be preserved not just in the tropics but also in environments such as deserts and the arctic zones. These contain relatively few forms of life but those that do exist may have the most unique adaptations in order to survive extreme conditions.

Biodiversity cannot be preserved on a long-term basis outside the native ecosystem of each species. Zoos and wildlife parks can preserve individual animals but our long-term objective is not to preserve a few charismatic species but the entire complex web of life. Therefore it is essential to restore and preserve extensive well-policed protection zones which will allow species to thrive in interaction with the complex ecosystem within which they evolved.

In practice large areas of land need to become subject to wilderness protection schemes or purchased and converted into protected zones. The lands would be controlled by the state within which they exist and subject to restoration and strict protection, largely paid for by the international community.

An essential part of solving the biodiversity problem lies in the rich world interacting with the poorer states to fund biodiversity and to improve the order and prosperity of their societies.

The local people would need to benefit from the change from economic production to wilderness. They would need to receive stewardship payments for protecting the wilderness areas, access to much improved health and education services and employment opportunities in park protection, tourism and low impact economic activities.

The poor states receive negligible support from the rich world to support their biodiversity. For example, the United States Fisheries and Wildlife Service has a 2008 budget of \$9.988 million (NOT billion) for its total international grants programme. Similarly, the United Kingdom government’s main programme to support global biodiversity is the Darwin Initiative which has a budget of £7 million per annum. And Australia has provided a grand total of \$10 million over the past four years through its Regional Natural Heritage Program to projects in the South Pacific and South East Asia.

I stand aghast at these figures – they demonstrate a truly terrifying level of ignorance, indifference and stupidity among the people responsible for safeguarding and governing the planet.

## **c) Preserving Biodiversity in the Oceans**

The oceans are the reservoir of life, with enormous diversity and productive capacity. This is under grave threat as a result of climate change, pollution (particularly from plastic waste) and uncontrolled fishing and whaling.

The oceans are a commons. That is, they belong to no one and everyone is free to take whatever they wish. This legal fact combined with modern sonar technology which allows fishermen to easily locate fish and cetaceans has led to uncontrolled exploitation of the oceans. The result has been an estimated reduction of whales and large fish such as tuna of 90% - 95% as well as massive losses in other fish populations such as the Peruvian anchoveta, orange roughy and north west Atlantic cod. Removal of some of these species has caused massive changes to ecosystems and led to an effective desertification of some seas such as those off Nova Scotia. The oceans contain much less biomass than they could and therefore produce much less food on a sustainable basis than they could.

We can maintain the biodiversity of the oceans AND increase food production if we change the oceans from a commons into property.

In this proposal, a United Nations instrumentality would rent to public companies long-term, exclusive, tradable licenses to extract seafood from designated areas, subject to incentives and punishments to control catch limits to levels which increase biomass and biodiversity and ban destructive operating procedures, such as drift-netting, pair-trawling, and bottom-trawling.

For the companies, such licences would become valuable property, which would increase in value as biomass and biodiversity improve, but would have to be forfeited if they indulged in any cheating.

The licence fees would fund a system of surveillance and auditing and any bribery, corruption or cheating would be severely punished with fines and criminal sanctions.

At least 50% of the oceans, covering all types of ecosystem, would be wildernesses with no exploitation whatsoever. In these areas biomass would substantially increase and allow a repopulation of the harvestable areas.

#### d) Whaling

If we are serious about preserving biodiversity, we must stop whaling. Our relationship with whales is of the same character as our relationship with the rest of creation. If we are going to start treating the Tree of Life with love and respect, rather than as an insensate source of materials for humanity's consumption to be ruthlessly plundered until extinction, then we should start with whales.

Cetaceans (whales, dolphins and porpoises) are emblematic of the value of the non-human world. Often highly endangered, they are miraculous, in their ability to live in harsh environments through intelligence, social structure and stupendous physical attributes, and in their mystery and beauty, shaped by millions of years of evolutionary competition. They are often at the top of the food chain and support the health and balance of their ecosystems.

The needless slaughter of these highly intelligent, beautiful and endangered creatures is horrifying and disgusting and it must be stopped both as an evil in itself and as a signifier of man's relationship to the planet. Their existence tells humanity that this is indeed a beautiful and miraculous world and their survival is necessary to ensure a world in balance.

The International Herald Tribune of 10 July 2007 carried the following story:

*"At the end of May a 50-ton bowhead whale was killed by Alaskan Eskimos as part of their traditional subsistence whale hunt. Upon cutting into the whale, the Eskimos made a startling discovery: embedded in one of its bones was the tip of a 19th century bomb lance."*

The lance dated from between 1885 to 1895 making the whale between 115 and 130 years old. Some scientists believe that bowhead whales may be the longest-living animals (until they meet Eskimos with modern gun-launched harpoons).

The story filled me with enormous sadness. The whale had survived for over 115 years, blamelessly going about its life in the harsh conditions of the Arctic, with a bomb lance stabbed into its skeleton and had finally been killed for non-essential reasons. Bowheads were originally hunted for their bone and baleen, which were used in corsets. More recently, Eskimos have been allowed to hunt them in the context of the importance of whaling in their traditional culture. But

the whales are hunted in non-traditional ways using powered boats, guns and propelled harpoons with explosive rounds rather than kayaks and lances. How important in the killers' motivation is the cultural role and how important is the excitement of hunting and killing a big animal and then having a party as it is butchered?

Where is man's compassion for his fellow creature? Where is his sense of proportion and humility before the wonder of life? Only 9000 bowhead whales survive and clearly they are endangered.

Whaling is an abomination and, must be ended as humanity moves to a higher level of civilisation. Governments and citizens can and should put pressure on whaling states through action in international organisations and through consumer boycotts.

## “Rewilding” the Earth

We need to “flip” our concept of our place in the world from one in which humanity occupies all possible space and takes as much as it wants, to one in which humanity restricts its consumption, occupies a limited amount of space and allows the other living things of this planet to occupy the remainder.

In a rewilded planet, humans would only take a small percentage of the biomass of what we could take from the seas and only occupy small amounts of land with the rest given over to nature and a full range of ecosystems. We would retreat from large areas of the planet and return it to wilderness. Of course we could visit the wilderness but we would not extract biomass from it or permanently occupy it. And we would need to stringently protect it from encroachment.

There is a free market in land and governments have enormous resources. If each state were to try to turn 50% of its surface area into wilderness over a period of 200 years it would need to purchase 0.25% of its surface area each year and convert it to wilderness. That seems an achievable target.

In the early years of such a programme, efforts would be focussed on building wildernesses in a full range of habitats and in particular on biodiversity hotspots within the state in question.

It would be possible to set up a system of offsets where some states that are unable to rewild parts of their territory or have already reached their target could provide financial assistance to other states to help conserve and build wilderness, particularly in global biodiversity hotspots such as Madagascar, Indonesia, Brazil and certain island states.

One of the benefits of rewilding the earth will be an increased rate of carbon capture, helping to slow climate change. Plants take up carbon dioxide, convert the carbon to tissue and release oxygen. Ultimately some of the carbon is released back into the atmosphere; but during the growth or rewilding phase the balance is to the benefit of carbon capture.

## Implementation of the Plan

The global system of power relationships in human civilisation is the product of thousands of years of contact, communication, competition and conflict. It is imperfect but it is what we have to work with. The elements of the system are:

- thousands of cultural, linguistic, ethnic, religious, economic and civilizational groupings
- about 190 sovereign jurisdictions (commonly known as “countries”)
- international agreements and protocols such as the Montreal Protocol (on ozone depletion), the Kyoto Protocol (on climate change), the International Whaling Commission and the World Trade Agreement
- international organisations with varying degrees of executive power such as the United Nations and the World Bank

These building blocks interact to form the complex and often ineffective system that resolves conflict, provides peace and material security and seeks to solve the problems of the world. The most effective elements of the system are the

sovereign states. Until the Second World War, the states put most of their effort into competition over territory, resources, and survival. The devastating effects of the war taught many states the wisdom of putting aside their weapons and working for common ends through international organisations such as the United Nations and the European Community.

The accelerating growth of human population and consumption since 1945 and the pressures that this is putting on the planet through civilisational conflict, proliferation of weapons of mass destruction, mass movements of people, climate change and loss of biodiversity and biomass means that in future the countries of the world have to work much more closely together than they have in the past to solve our problems.

The world's architecture of power is based on national states but our problems are global. Therefore the mechanisms we must use to solve our problems are the international agreements, protocols and organisations such as the International Whaling Commission and the Convention on International Trade in Endangered Species (CITES).

The problem is that many of agreements are observed in a piecemeal and wavering fashion and many international institutions and sovereign states are corrupt and ineffectual. Hundreds of billions of dollars have been given in foreign aid since 1945 but the world still has huge problems with the environment in severe decline and billions of people living in grinding poverty and disorder.

## A New Deal

The dilemma we face is that the wealthy societies need to give much more if we are to achieve the strategic objectives of restoring balance to the planet. But it is hard to keep giving when so much giving in the past has been wasted or stolen.

New ways need to be found to transfer wealth from developed to developing countries. In the past such transfers have usually been through the governments of the poor countries and in this process much of the aid tends to be skimmed off by the leadership and ends up in banks abroad. Getting assistance direct to the people who need it is a big challenge.

More has to be given but it has to be spent effectively and this can only happen through much higher levels of scrutiny, auditing of progress towards agreed objectives and governance.

We need a New Deal which involves much better governance and accountability, closer cooperation between the elements of the human system, and a much greater commitment of resources, respect and, yes, love to each other and to the other living things of this world.

The central institution of this New Deal would be a coalition of sovereign states that would work together directly and through international institutions to carry out the plan to build a balanced world, the Organization for Environmental Cooperation & Balance (the OECB).

As well as the programme set out above, the members of the OECB would commit to:

1. Donate 1% of their GDP to carrying out the plan (with an intent to increasing the proportion in future).
2. Be exemplary in the management of biodiversity within their borders, through the successful implementation of biodiversity action plans and the creation of extensive wildernesses which would allow the preservation of all native species across all environmental niches.
3. Use international institutions such as the International Whaling Commission as well as governments and non-government organisations to implement the plan.
4. Work to improve the functioning of international conventions and agreements on biodiversity and other matters affecting the programme through continuing pressure to end corruption and cheating by full disclosure and proper auditing. Encouragement would take the form of generous financial, educational, intellectual and moral support of complying states and minimal support of non-compliant states.

5. Work to improve the functioning of other sovereign states through encouragement and support of democracy, human rights, the rule of law and freedom of information.
6. Carbon neutrality by 2015.

Candidates for membership of the OECB would be most European countries apart from Belarus (not a democracy) and Russia, Denmark and Norway (which support whaling), all Anglo-Saxon countries (although the United States should be encouraged to end their aboriginal whaling), South Africa, Israel, Turkey, Iraq, Mexico, Costa Rica, Chile, Uruguay, Argentina, Brazil, India, Taiwan, the Philippines and Indonesia.

## **Australia's role as an exemplary environmental citizen**

Australia has a special role to play in the struggle to create a balanced world. It is a society small enough and intimate enough to undertake the political process that is required to effect the necessary changes. Thanks to 25 years of good government and a resources boom. we have a strong balance sheet with effectively no sovereign debt and a vast pool of pensions savings. We are also somewhat insulated from the conflicts and pressures that more centrally located societies are subject to and we enjoy a high ratio of land to population.

Australia could give practical effect to the policies I have been discussing above:

1. Research a system to estimate and capture ETCs and attach them to goods and activities throughout the economy. This would start with a narrow range of goods and activities and be at a low rate and then be extended as their effectiveness is proven. A good starting point would be the forestry, paper, packaging and plastics industries as well as carbon taxes.
2. Establish a comprehensive programme to understand, preserve and build the biodiversity and biomass of Australia's territory, on land, sea and the Australian Antarctic Territory.
3. Convert agricultural, forestry and pastoral lands to protected wildernesses with a target of 50% of Australia's land area covering all types of ecosystems. This conversion process would be by negotiated purchase or through agreement with existing landholders to implement management protocols and could occur over an extended period (say 100 years, but hopefully sooner).
4. Convert the seas within our EEZ into property managed through a licencing system as set out above with conservative catch quotas and the objective of building biodiversity and biomass. 50% of the EEZ would be protected wilderness.
5. Maintain our policy of staunch opposition to whaling and overfishing of the oceans. Do not supply, allow docking or any other support of ships involved in whaling or overfishing.
6. Increase foreign aid to at least 1% of GDP to assist complying jurisdictions with programmes to improve literacy, education, economic and governmental stability, population control, biodiversity and biomass.
7. Support educational exchange programmes focussed on environmental science and governance, particularly with our Asian and Pacific friends and neighbours.
8. Maintain a policy of a balanced fiscal budget. In the future there will be fewer resources and more people so to run budget deficits now is foolish and immoral.
9. Continue to be a good world citizen by supporting a system of civilisational stability and progress so as to foster biodiversity and biomass.

## Action

Last year I was lucky enough to attend an intimate breakfast meeting with Al Gore in Sydney. He ended his speech with a quotation from the mountaineer W.H. Murray:

*“When we make a commitment towards something then Providence moves also.”*

The following passage occurs near the beginning of Murray’s *The Scottish Himalayan Expedition* (1951):

“..but when I said that nothing had been done I erred in one important matter. We had definitely committed ourselves and were halfway out of our ruts. We had put down our passage money – booked a sailing to Bombay. This may sound too simple, but is great in consequence.

“Until one is committed, there is hesitancy, the chance to draw back, always ineffectiveness. Concerning all acts of initiative (and creation), there is one elementary truth the ignorance of which kills countless ideas and splendid plans: that the moment one definitely commits oneself, then providence moves too. A whole stream of events issues from the decision, raising in one’s favour all manner of unforeseen incidents, meetings and material assistance, which no man could have dreamt would have come his way. I learned a deep respect for one of Goethe’s couplets:

*Whatever you can do or dream you can, begin it.*

*Boldness has genius, power and magic in it!”*

I now commit myself to work to bring about a balanced world.

1. With the standing given to me by my position as founder and Chairman of Hunter Hall I will personally engage with the task of persuading political and institutional leaders to change our laws and practices so as to create a balanced world. In particular, I will work to support endangered species, stop whaling, and encourage the governments of wealthy nations to increase the aid they give to poor nations to support civilisation and biodiversity.
2. Hunter Hall has already donated over A\$4 million to charitable causes. We will continue to work diligently to deliver excellent returns to investors and thereby increase our funds, profits and resources for charitable donations. Hunter Hall is donating a substantial portion of the management and performance fees it earns from the Global Deep Green Trust to charitable causes. I can see a time when our charitable giving may be many millions of dollars a year. This giving is likely to become more focussed in future as we develop relationships with the most effective conservation groups.
3. The Global Deep Green Trust will not invest in any country supporting or engaged in commercial whaling. In practice this means a number of major economies including Japan, Russia, South Korea, China, Denmark and Norway as well as a host of micro-states, bribed to vote in favour of whaling at the annual meeting of the International Whaling Commission.

It is indeed difficult to make this decision as some of the world’s most highly advanced and economically prospective states support whaling. However, we believe there is plenty of opportunity in other jurisdictions and certainly enough to enable the fund to achieve its return objectives.

We hope that our stance on whaling leads to a change of view on this subject similar to the change of view that occurred among Western financial institutions with apartheid. One of the reasons why apartheid ended was because the South African people became fed up with being anathematised and isolated from the rest of the world. Similarly we hope to convince the financial community and our society to shun investment in jurisdictions that support whaling.

By ending whaling humanity will be signalling a respect for the rest of creation and a commitment to sharing the earth more fairly.

4. The Global Deep Green Trust will invest in the new sustainable economy. If we are successful in doing so we may encourage a further shift by our society from high-impact to low-impact economic activities and thus towards a balanced world.

One day humanity will have to stop growing its population and consumption of non-renewable resources. It can be forced to stop growing by the constraints of our environment. Or we can choose to stop growing by using our rationality to recognise that an end point is inevitable.

If we choose to end unsustainable growth soon enough; and if we are effective in ending unsustainable growth, we will be able to preserve a large measure of the beauty and diversity of our planet. If we do not, we will lose that diversity and the margin of safety it gives.

But stopping unsustainable growth does not mean stopping development or the adventure and joy of life. We can find our satisfactions and our consolations in the things that really matter: our creativity, our friendships and loves and the beauty of the world we live in.

It is time to grow up, curb our appetites and build a sustainable world. A world in balance.

A handwritten signature in black ink, appearing to read 'Peter Hall'. The letters are stylized and connected, with a large 'P' and 'H'.

Peter Hall

October 2007

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I must thank my dear friends Laura Smith, for her constant support, advice and encouragement, and Dr Lucy North for her meticulous editing and polishing. I would also like to thank Dr Terri Roth, Dr Edward Luttwak, Dr Ruth Smith, Leonard Hall, Andy Hall, Mark Forstmann, Angela Howard and Kate Rae for their invaluable comments and my colleague Catriona Alford for her help with Appendix Two.

Finally, I would like to thank my school friend Martin Markus for allowing me to use the words “Lumberjacks in Eden” that were first set down in a poem he wrote when he was 16 or 17 and that have stayed with me through the years.

## About the Writer

Peter Hall is the founder and Chairman of Hunter Hall Investment Management, one of Australia’s oldest and largest ethical investment companies. In November 2007 Hunter Hall launched its first positively screened ethical fund, the Global Deep Green Trust.

## Further Reading

The books and essays detailed below have informed my thinking and are given in the order of date of publication. All are excellent.

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Lester R. Brown, *Outgrowing the Earth: The Food Security Challenge in an Age of Falling Water Tables and Rising Temperatures*, W.W. Norton 2005.

Tim Flannery, *The Weather Makers*, Penguin 2006.

James Lovelock, *The Revenge of Gaia*, Penguin 2007.

## Appendix One: Choose your Environmental Impact

### Activities with low environmental impact

Gardening

Making and eating nice food and wine

Making and listening to music

Talking

Flirting

Having sex (with contraceptives)

Having intense conversations

Making love

Staying in bed all day

Having two or fewer children

Playing with children and cats and dogs

Learning

Making and looking at art

Making and watching films, plays and operas

Reading and writing books

Reading and writing poetry

Walking in the woods

Hanging out with friends and family

Sailing

Exercising

Dancing

Travelling by foot, bicycle, horse or camel

Living in houses built from wood grown in a sustainable way

Living in the inner city

Going to bed at sunset and waking at dawn

### Activities with high environmental impact

Driving around in cars

Taking motorbikes and four wheel drives into the woods and giving them a good thrashing

Flying

Skydiving

Helicoptering

Hunting and killing wild animals

Eating tuna, caviar and whale

Moving over water in motor cruisers

Having three or more children

Living in concrete, metal or brick houses

Living in the suburbs

Staying up after sunset (with the lights on)

## Appendix Two: The Biodiversity Hotspots

In a world where conservation budgets are insufficient given the number of species threatened with extinction, identifying conservation priorities is crucial. British ecologist Norman Myers defined the biodiversity hotspot concept in 1988 to address the dilemma that conservationists face: what areas are the most immediately important for conserving biodiversity?

The biodiversity hotspots hold especially high numbers of endemic species, yet their combined area of remaining habitat covers only 2.3 percent of the Earth's land surface. Each hotspot faces extreme threats and has already lost at least 70 percent of its original natural vegetation. Over 50 percent of the world's plant species and 42 percent of all terrestrial vertebrate species are endemic to the 34 biodiversity hotspots.

To qualify as a hotspot, a region must meet two strict criteria:

- 1) It must contain at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and
- 2) It has to have lost at least 70 percent of its original habitat.

Hotspots provide us with the real measure of the conservation challenge. Unless we succeed in conserving this small fraction of the planet's land area, we will lose more than half of our natural heritage.

Hotspot	Jurisdiction	Examples of Vulnerable/Endangered Species	Endemic Plant Species (must be > 1500 to qualify as Hotspot)	Endemic Plant Species as a Percentage of World Total	Habitat Intact	% of Original Habitat Protected* I-IV Areas)**	% of Original Habitat protected (IUCN Categories)**
1 Atlantic Forest	Brazil, Paraguay, Argentina, Uruguay	Woolly spider monkeys, New World monkeys e.g. Black-faced Lion Tamarins, Golden-rumped Lion Tamarins, & Golden-bellied Capuchin, Purple-winged Ground-dove	20,000	3%	8%	4%	2%
2 California Floristic Province	United States of America	Giant Kangaroo Rat, Island Grey Fox, Desert Slender Salamander, California Condor, Nelson's Antelope Squirrel	3,488	1%	25%	37%	10%
3 Cape Floristic Region	South Africa	Black rhinoceros, Geometric tortoise, Cape sugar-bird, Mountain Zebra, Lion, African Elephant.	9,000	2%	20%	14%	13%
4 Caribbean Islands	The Bahamas, the Lesser Antilles, and the Greater Antilles (Puerto Rico, Jamaica, Cuba, and Hispaniola). Politically, the Caribbean (West Indies) comprises 12 independent nations and several French, British, U.S. and Dutch jurisdictions.	Giant shrews, Cuban crocodile, Puerto Rican parrot, Hawksbill & Leatherback Sea Turtle, Ivory-billed woodpecker, Tiny bee hummingbird (world's smallest bird)	13,000	2%	10%	13%	7%
5 Caucasus	Georgia, Armenia, Azerbaijan, Russian Federation, Turkey, Iran.	Caspian monk seal, Caucasian turs (mountain-dwelling goat antelope), Mediterranean horseshoe bat & Mehely's horseshoe bat, Caucasian viper.	6,400	1%	27%	8%	7%
6 Cerrado	Brazil	Giant anteater, Brazilian Three-banded Armadillo, Jaguar, Maned wolf, Giant otter.	10,000	2%	22%	6%	1%

Hotspot	Jurisdiction	Examples of Vulnerable/ Endangered Species	Endemic Plant Species (must be > 1500 to qualify as Hotspot)	Endemic Plant Species as a Percentage of World Total	Habitat Intact	% of Original Habitat Protected* I-IV Areas)**	% of Original Habitat protected (IUCN Categories)**	
7	Chilean Winter Rainfall – Valdivian Forests	Chile, Argentina	Rare Andean cat, Juan Fernández fur seal, Mountain Vizcacha, Chinchilla, Andean condor, Darwin's Fox.	3,892	1%	30%	13%	11%
8	Coastal Forests of Eastern Africa	Somalia, Kenya, Tanzania, Mozambique	Tana River red colobus monkey, Tana River mangabey, & Zanzibar red colobus monkey. Black rhinoceros, Savannah elephants, Golden-rumped elephant shrew, Pemba flying fox, Horseshoe bat.	4,000	1%	10%	18%	4%
9	East Melanesian Islands	Papua New Guinea, Solomon Islands, Vanuatu.	Solomons sea-eagle, Flower-faced bat, Monkey-faced bat, Sea Turtle varieties.	8,000	1%	30%	6%	0%
10	Eastern Afromontane	Kenya, Tanzania, Malawi, Zimbabwe, Mozambique, Rwanda, Burundi, Uganda, Tanzania, Democratic Republic of Congo, Ethiopia, Eritrea, Djibouti, Sudan, Saudi Arabia, Yemen.	Mountain gorilla, Chimpanzee, African Old World monkeys, African elephant, Mountain dwarf galago (small night monkeys), Walia ibex (wild mountain goat), Mountain Nyala (antelope), Jackson's Mongoose.	7,598	1%	10%	15%	6%
11	Guinean Forests of West Africa	Guinea, Sierra Leone, Liberia, Cote d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Sao Tome and Principe.	Pygmy hippopotamus, Jentinka's duiker (Sub-saharan African antelope), Western chimpanzees.	9,000	1%	15%	17%	3%
12	Himalaya	Pakistan, Nepal, China, Bhutan, India.	Sloth bears, Gaurs, Snow leopard, Tigers, Gangetic dolphin, Golden langur (Old World Monkey variety), Elephants, Rhinoceros.	10,000	1%	25%	15%	11%
13	Horn of Africa	Somalia, Djibouti, Ethiopia, Eritrea, Kenya, Yemen, Oman, Sudan.	Gazelle, Antelope, (Beira, Dibatag, Speke's gazelle), Cheetah, Lion, Grevy's Zebra, Black Rhinoceros, African Elephant, Green & Sea Turtle, Somali wild ass, Sacred baboon.	5,000	1%	5%	9%	3%
14	Indo - Burma	Bangladesh, India, Myanmar, China, Lao People's Democratic Republic, Cambodia, Vietnam, Thailand, Malaysia.	Javan, Sumatran & Indian Rhinoceros, Bumblebee & Vesper Bat, Annamese pond turtle, Tiger, Asian lion, Red Panda, Asiatic Elephant, Water buffalo, Old World monkeys (including Tonkin Snub-nosed Monkey & Grey-shanked douc monkeys), Leaf deer, Vu Quang ox, Box turtles, Burmese star tortoise, Siamese crocodile.	13,500	2%	5%	10%	6%
15	Irano - Anatolian	Turkey, Georgia, Azerbaijan, Armenia, Iraq, Iran, Turkmenistan.	Asiatic cheetah, Caspian tiger (probably extinct), Asiatic wild ass, Viper, Vesper bat.	6,000	1%	15%	6%	3%
16	Japan	Japan	Stellar Sea Lion, Iriomote cat, Snow monkeys, Asiatic Black Bear, Bonin Flying Fox, Okinawa black-breasted leaf-turtle, Okinawa woodpecker.	5,600	1%	20%	17%	6%
17	Madagascar and the Indian Ocean Islands	Madagascar, Seychelles (including Aldabra), the Comoros, Mauritius (including Rodrigues), and the French overseas departments of Reunion, Mayotte and the Iles Esparses around Madagascar.	5 families of lemur (primate variety) unique to the area, Flying fox, Fossa (resembles cross between cat & dog), Seychelles Frogs, Aldabra giant tortoise.	13,000	4%	10%	3%	2%

Hotspot	Jurisdiction	Examples of Vulnerable/Endangered Species	Endemic Plant Species (must be > 1500 to qualify as Hotspot)	Endemic Plant Species as a Percentage of World Total	Habitat Intact	% of Original Habitat Protected* I-IV Areas**	% of Original Habitat protected (IUCN Categories)**
18 Madrean Pine – Oak Woodlands	United States of America, Mexico	Flat-headed Myotis (vesper bat), Omilteme Cottontail rabbit, Mexican Prairie Dog, Pocket gopher, Volcano rabbit	5,300	1%	20%	6%	2%
19 Maputaland – Pondoland – Albany	Mozambique, South Africa, Swaziland.	Black Rhinoceros, White rhinoceros, Cheetah, Black-footed Cat, Lion, Mountain Zebra, African Elephant, Samango monkey, African Wild Dog, Giant Golden Mole.	8,100	1%	24%	8%	7%
20 Mediterranean Basin	Morocco, Portugal, Spain, France, Italy, the Balkan states, Greece, Turkey, Syria, Lebanon, Israel, Jordan, Egypt, Libya, Tunisia, Algeria, around 5000 islands around the Mediterranean Sea, Macaronesian Islands of the Canaries, Madeira, the Selvages (Selvagens), the Azores, and Cape Verde.	Mediterranean monk-seal, Barbary macaque, Barbary deer, Iberian lynx, Barbary Lion, Barbary Leopard, Atlas Bear, European Mink.	22,500	4%	5%	4%	1%
21 Mesoamerica	Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Mexico, Panama.	Painted Leopard, Howler monkeys, Black-handed spider monkey, Central American Squirrel Monkey, Pocket gopher, Giant Anteater.	17,000	1%	20%	13%	6%
22 Mountains of Central Asia	Kazakhstan, AsiaKyrgyzstan, Tajikistan, Uzbekistan, China, Afghanistan, Turkmenistan.	Snow leopard, Saiga antelope, Argali wild sheep, Asiatic Black Bear, Afghan Tortoise.	5,500	1%	20%	7%	7%
23 Mountains of Southwest China	China	Giant panda, Red panda, Snow leopard, Golden monkey, Black snub-nosed monkey, Asiatic Elephant, Asiatic Golden Cat, Chinese Desert Cat, Asiatic Black Bear.	12,000	1%	8%	5%	2%
24 New Caledonia	France	Ornate Flying Fox, Loyalty Bent-winged Bat, New Caledonian Lorikeet, New Caledonian Owlet-nightjar.	3,270	1%	27%	22%	3%
25 New Zealand	New Zealand	Kiwi, Penguin, Blue Duck, New Zealand Sea Lion, New Zealand Lesser Short-tailed bat, Long-tailed wattled bat. None of its mammals, amphibians, or reptiles is found anywhere else in the world. Interestingly, both endemic land mammals are species of bats.	2,300	1%	22%	28%	22%
26 Philippines	Philippines	Dwarf water buffalo, Phillipine crocodile, Phillipine Forest turtle, Visayan & Phillipine warty pigs, Calamianes hog-deer, Visayan spotted deer, Golden-capped fruit bat (world's largest bat), Negros naked-backed fruit bat, Visayan wrinkled hornbill, Phillipine eagle, Panther flying frog.	9,253	2%	7%	11%	6%
27 Polynesia – Micronesia	Islands of Micronesia and Polynesia, plus Fiji. This includes at least 4,500 islands, representing 11 countries, eight territories, and one U.S. state (Hawaii).	Hawaiian monk seal, Fijian monkey-faced bat, various Flying Fox, Fiji Crested Iguana, Sea Turtle.	5,330	1%	21%	5%	4%

Hotspot	Jurisdiction	Examples of Vulnerable/ Endangered Species	Endemic Plant Species (must be > 1500 to qualify as Hotspot)	Endemic Plant Species as a Percentage of World Total	Habitat Intact	% of Original Habitat Protected*	% of Original Habitat protected (IUCN Categories)**
28 Southwest Australia	Australia	Numbat, honey possum, quokka (small, furry wallaby), Gilbert's potoroo, western swamp turtle.	5,571	1%	30%	11%	11%
29 Succulent Karoo	South Africa, Namibia	Black Rhinoceros, African elephant, Gemsbok (African antelope), Mountain zebra, Lion, Black-footed cat, African Penguin, Golden mole, riverine rabbit, Unique species of lizards, tortoises and scorpions.	6,356	1%	29%	3%	2%
30 Sundaland	Thailand, Malaysia, Singapore, Brunei Darussalam, Indonesia. The Nicobar Islands, which are (under Indian jurisdiction), are also included.	Orangutan (Bornean & Sumatran), Javan rhinoceros & Sumatran rhinoceros, Asiatic Elephant, Tiger, Bay Cat, Proboscis monkey, Grizzled Leaf Monkey, Silvery Gibbon, Saw-jawed turtle, Malaysia Giant Turtle, Siamese Crocodile.	25,000	5%	7%	12%	5%
31 Tropical Andes	Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile, Argentina.	Brown Spider Monkey, Giant Armadillo, Yellow-tailed Woolly monkey, Opossum, Spectacled bear, Andean cat, Giant Otter, Magdalena River Turtle.	30,000	5%	25%	16%	8%
32 Tumbes – Choco-Mangdalena	Panamma, Colombia, Ecuador, Peru.	Spider monkey, Bare-faced tamarins, Galápagos Islands fur seal.	11,000	1%	24%	13%	7%
33 Wallacea	Indonesia, Democratic Republic of Timor Leste (East Timor).	Komodo dragon (World's largest lizard), Siau Scops Owl, Babirusas ("pig-deer"), Dwarf buffaloes, Macaques (Old World Monkey variety), Tarsiers, McCord's Snakeneck Turtle.	10,000	1%	15%	7%	6%
34 Western Ghats and Sri Lanka	India, Sri Lanka.	Asian elephants, Indian tigers, Lion-tailed & Tonque macaque (Old World monkey variety), Purple-faced Leaf Monkey, Sea Turtle, Malabar civet.	5,916	1%	23%	14%	11%
<b>AVERAGE</b>			<b>9,761</b>	<b>1%</b>	<b>18%</b>	<b>12%</b>	<b>6%</b>

\*Source: World Database on Protected Areas - Percentages are higher due to the fact that many existing protected areas are protected in little more than name. E.g. areas which have official designation as parks or reserves but lack funding, capacity, and enforcement. Or areas where mismanagement compromises the conservation of biodiversity.

\*\*Source: International Union for the Conservation of Nature and Natural Resources (IUCN) is an international organization dedicated to natural resource conservation – Protected areas in IUCN categories I-IV afford higher levels of protection. The management objectives of these categories imply constraints on human occupation or resource use.

Source: Conservation International (<http://web.biodiversityhotspots.org>)



