

## **The Wicked Problem of Biodiversity**

### **Targets or sustainability – that is the question.**

Martin Sharman<sup>1</sup>  
Brussels, August 2009

#### ***Wicked problems***

The climate is changing because humans are rapidly converting fossil carbon into atmospheric greenhouse gases. Why is biodiversity changing?

Reducing the concentration of greenhouse gases in the atmosphere would (perhaps) slow future change. This is true no matter how complex the mechanism by which buried carbon becomes atmospheric gas, or by which those gases drive climate change. The target almost sets itself – or it would if politics and economics did not complicate things. What target pops out at you from the radical anthropogenic transformation of biodiversity?

Stopping anthropogenic climate change will certainly be difficult. But we know what distinguishes the observed rate of change from the desired rate of change, and we know what actions would narrow the gap between what we see and what we'd like to see. In this respect, then, climate change is not a wicked problem – though in other respects it certainly is.

A wicked problem<sup>2</sup> is one that is poorly understood and resists clear definition.

A text-book example of a wicked problem is this: what must we do to stop the further loss of biodiversity? If we can answer that question, then we can begin to set sensible targets.

What is the cause of the loss of biodiversity? We can not point to a single driver like "humans are transforming fossil carbon into greenhouse gas". Instead it has many linked causes. They include profit-driven, growth-based economies, a growing human population with steeply increasing demands on the living world, ineffective institutions, poverty, accounting that externalises environmental costs, greed, war, protectionism, climate change, lack of political will, subsidies, corruption, inequitable access to the benefits of living resources, wilful ignorance, and a global trade regime fit for a different planet. All of these causes also help to change the composition of the atmosphere, but in every case, we can point to one cause: emission of greenhouse gases. In that tangle of causes, can you or anyone else say where, exactly, lies the cause of loss of the living fabric of our planet?

Well, OK, let's try something easier. Can you define a desirable status for biodiversity? One that I could step outside and measure, as I might measure, with appropriate instruments, the concentration of greenhouse gases in the atmosphere?

Perhaps the word "status" is unfair, since ecosystems are dynamic. But while it may be more accurate, it does not make the question any easier to answer – if you can't define a desirable status, how might you go about defining a desirable dynamic for biodiversity?

---

<sup>1</sup> [sharman@iname.com](mailto:sharman@iname.com)

The views expressed are purely those of the writer and may not in any circumstances be regarded as stating an official position of the European Commission.

<sup>2</sup> [http://www.uctc.net/mwebber/Rittel+Webber+Dilemmas+General Theory of Planning.pdf](http://www.uctc.net/mwebber/Rittel+Webber+Dilemmas+General+Theory+of+Planning.pdf) and you'll find many other interesting sources of information by entering "wicked problem" in Google.

These are quite clearly not idle questions. Nor is this: in what respect do the current status and trends and dynamics of biodiversity differ from what you'd like to see? That's easy to answer in general, vague, non-operational, hand-waving and superficial terms, but how would you set out your stall to heads of State and Government? Could you tell them what we must do to turn what you see into what you'd like to see? Can you write down an operational recipe for stopping biodiversity loss, equivalent to the 3-word "greatly reduce emissions" recipe for stopping the climate from changing?

Can you define a boundary for what you mean by biodiversity – or its loss? Is your own working definition of biodiversity (do you have one that really works?) shared by most other people – or even by anyone else on the planet?

Nobody can answer these questions in any useful way for one reason: biodiversity loss is a wicked problem. Take any problem, ask the equivalent questions, and if you get no useful answers to any of them, it's a wicked problem.

### ***Wicked characteristics, stopping rules and targets***

The problem of "biodiversity loss," like every other wicked problem, cannot be formulated once and for all. Our incapacity to do so is not a failure of imagination or competence – it is part of the nature of the problem. We can't even agree on what we mean by "biodiversity," because biodiversity is a boundary object<sup>3</sup>. The details of the problem of its loss, the constraints on possible solutions and the resources needed to solve the problem change in time and space and with scale. Problems overlap and change shape depending on your point of view. Most are horribly fractal. Solutions are typically local and depend on how the problem is perceived and framed – and every one of us has different frames for understanding the problem, because our world views differ. Some frames are mutually contradictory, and conflicts abound because one person's solution is another person's problem.

The nature of biodiversity loss also means that the problem will never be definitively solved – we cannot achieve the sustainability of a set of complex, dynamic and interdependent systems by switching off the autopilot and going to sleep. The problem is wicked because as the system changes (in ways that are often difficult to recognize), the contradictory requirements we have of the system are constant only in that they are permanently changing. The information we have about the system is incomplete and contradictory, and however well-meaning it may be, work done to solve one aspect of this wicked problem often generates other wicked problems.

One of the characteristics of a wicked problem is that it has no stopping rule. If you're fixing a puncture, you stop when the puncture is fixed. How do you know it's fixed? Because when you pump air into the tyre, it stays in. The solution, and the rule that tells you when the problem is solved, is inherent in the problem. Thus we will be able to tell if we manage to reduce the concentration of a given greenhouse gas to a given number of parts per billion, even if the larger problem of anthropogenic climate change itself has no obvious stopping rule. It is not going to be easy to tell when (or rather, if) the climate has stopped changing as a direct consequence of human activity. But one infinity can be larger than another (for example, many, many more numbers are multiples of 2 than are multiples of  $(2^{43112609})-1$ , but both sets are infinite<sup>4</sup>). It is going to be considerably more difficult to tell if biodiversity loss has slowed or stopped than if the climate has stopped changing. (If I were cynical, I might

---

<sup>3</sup> [http://www.edinburgh.ceh.ac.uk/biota/Archive\\_scaling/6710.htm](http://www.edinburgh.ceh.ac.uk/biota/Archive_scaling/6710.htm)

<sup>4</sup> At the time of writing,  $(2^{43112609})-1$  is the largest known prime number, so I thought I would honour it. But I could have chosen any number bigger than 2, and the point would be valid.

say that this aspect of the wicked biodiversity problem is irrelevant, because we are in fact doing nothing of much significance to stop biodiversity loss, and it isn't going to stop on its own.)

You don't need me to point out that "stopping rule" and "target" can be made congruent. The fact that wicked problems have no stopping rule is the reason for the assertion that no target will ever tell us whether we have stopped biodiversity loss. Furthermore, since we depend on the wellbeing of life on Earth, we cannot simply put the problem down and step away from it. If our species continues to drive down biodiversity, our species is not sustainable. There is no point at which we can sit back and say, "that's good enough," or "we've done our best." We cannot stop trying to halt biodiversity loss because we get too frustrated, or too cynical. If we do, the consequence is unavoidable: if nothing else stops us first, then the continued loss of biodiversity will eventually stop us.

### ***Tractable bits, targets and sustainability***

A target is, in some sense, a solution. "If we reach this target," we imply, "we will have solved this bit of the problem." If we accept that biodiversity loss is a wicked problem, then there are two ways to approach target setting.

Either we break tractable bits of the problem off from the main problem, and set targets that will tell us if we've solved those bits. This, in effect, is what the CBD tried to do when it established indicators of this and that<sup>5</sup>.

Or... but there is no or. You can't actually set targets for a wicked problem. You can only break off bits and set targets for them.

Breaking tractable bits off a wicked problem has an interesting result. The black heart of the problem remains just as big, and just as wicked. Knowing that farm birds have recovered to a given level, by some measure or other, tells us nothing at all about most of the other important dimensions of biodiversity.

Why is this? Why can't we find indicators and targets that tell us not just about themselves, but something about other bits of biodiversity? The main reason is the complexity of living organisms, their environment, and the multiplicity of the connections and relationships between them. Unlike our mathematical assurance when dealing with much of the (fiendishly complicated) chemistry and physics of the atmosphere, we can describe with confidence no more than a handful of the greatly more complicated and very much more obscure interactions in any habitat. We simply do not know how it all works. We don't even know the basics, such as whether ecosystems become more resilient or more fragile as they gain or lose complexity, or how the diversity of life in an ecosystem relates to the services it provides.

So is there any purpose in setting targets for biodiversity? To me the answer is far from clear. My gut feeling is that there are good reasons to set targets for certain dimensions of biodiversity, including targets related to the conservation status and trends of species, measures of connectivity and fragmentation of ecosystems and trends in their extent, the ecological footprint of individuals, companies and countries, the marine trophic index, and public awareness of the state of the planet. But I also suspect that we need to approach the problem in a less mechanistic, reductionist way if we really intend to solve it.

To my mind at least, setting targets for various dimensions of biodiversity suggests that these things can be achieved on their own, independent from and without reference to a wider context. The CBD website says, "Clear, long-term outcome-oriented targets... can help shape

---

<sup>5</sup> Convention on Biological Diversity indicators: <http://www.cbd.int/2010-target/framework/indicators.shtml>

expectations and create the conditions in which all actors... have the confidence to develop solutions to common problems." It doesn't say they encourage you to review and if necessary change your world view, values, beliefs, behaviours and the way you do business, which I think is what's needed.

If we're going to put a lot of effort into establishing a target, we must first ask ourselves some important questions. Before we begin work on defining the target itself, we surely need to know what real-world outcome we want to achieve by setting the target. Defining a desired outcome should help us to imagine useful targets<sup>6</sup>.

Since any outcome that uses the word "biodiversity" is an abstraction, let us suppose that the outcome we want is "a sustainable and mutually beneficial relationship between humans and the living world" by a date not too far in the future.

Let us not worry just yet about the meaning underlying this statement of outcome; it may become clearer as we ask, and try to answer, some of the other questions.

### ***Something about sustainability***

Well, actually, let's worry a bit about the meaning of that outcome.

What is that "mutually beneficial" qualifier doing there? To be honest, there are several potentially sustainable relationships. The state of being dead is about as sustainable a state as you, or I, or a planet can reach. The state of being impoverished, ill and miserable is also apparently fairly sustainable, given the evidence we sometimes zap past on TV – or if not sustainable, seems to be the permanent lot of a sizeable fraction of our species. Sustainable by being dead? There's little likelihood of us killing Gaia<sup>7</sup>, but she will sooner or later end her interesting experiment with humans. But wouldn't it be better for us, at least, if that "later" is in a million years or so, when we evolve into something else? What about "impoverished" as sustainable?

Earlier I asked whether you could pick a single cause for biodiversity loss. I have a partial non-operational answer that involves thermodynamics, homeostasis and sex. Photosynthesis decreases entropy. Human well-being is achieved in large part by increasing the entropy of other elements of the living world. Our global population has bloomed because we've found out all kinds of clever ways to reduce death rates but never worked out acceptable ways to keep fertility rates in step. We've reached the point where photosynthesis can no longer decrease the entropy of the planet's surface fast enough to balance the anthropogenic rate of increase in entropy. So biodiversity is lost to permit short-term human well-being.

If short-term human well-being is the problem, then to remove the problem, there are three elements that might change: short-term, human, or well-being. Of the three, I think we'd all prefer that it was the "short-term" that changed to "long-term." The issue needs no more than a moment's thought to see that "long-term" requires a mutually beneficial relationship. I think

---

<sup>6</sup> Understanding the desired outcome may also help to avoid the gruesome spectacle offered when worthy targets are met by the simple expedient of redefining things. As an example, to help private utility companies to achieve the (state-set!) target of 15% of their electricity from renewable sources by 2025, the Indiana legislature considered (in April this year) re-defining renewable energy sources to include clean coal and uranium.

<sup>7</sup> The Gaia theory proposes that organisms co-evolve with their material environment at the planetary surface in a tightly coupled process from which emerges self-regulation, within limits that allow for life, of temperature, oxidation, acidity, and other characteristics. Homeostasis is an emergent property of the system, but its set points are not guaranteed. The co-evolving system can transit into a new quasi-stable state, in which the values of these characteristics are collectively readjusted to a new set point, either when provoked by external events or when organisms evolve that substantially alter one or more characteristics of the system.

we need not stress the "mutually beneficial" bit any more, so from now on, I'll just assume that by sustainable we mean an agreeable world for people, where neither humankind's demands, nor the anthropogenic response of the planet, endanger each other.

So, let's look at "a sustainable relationship between humans and the living world".

Perhaps the first question should be, what is the geographic scale of the outcome? Can we achieve the associated target piecemeal, bit by bit, across the planet, or do we have to think about the planet as a whole? Can we imagine a world where human demands on most of the planet's biosphere could be sustained indefinitely, while in a few plague spots, biodiversity loss continued?

The ethics may be dubious, but the answer may conceivably be "yes"; at least, nations have forcefully asserted their right to deal with the biodiversity within their borders as they wish.

But is it really "yes"? If a plague spot can be functionally isolated from the rest of the system, then fine. But if the function of the whole requires that some bit of the planet must lose biodiversity, then I don't see how it works. Biodiversity declines in that plague spot until it flat-lines. No more can be lost there, but the function of the whole demands a rotten bit, and the plague must spread. Gradually, bit by necrotic bit, the planet dies. If this seems fanciful, think of the parlous state of the oceans.

But given the nature of biodiversity – especially its local geographical character and coherence – it is possible, and perhaps even in some respects sensible, to think of outcomes at national or even more local scales.

Perhaps we can achieve "a sustainable relationship between humans and the living world" one place at a time, but in practice it will certainly be more complex, since almost all our modern relationships between humans and the living world involve dependencies that extend well beyond any local boundaries. Even if we accept that we can set targets for smaller geographical regions than the whole planet, we must nevertheless ensure that those dependencies are accounted for in the formulation of the target.

Is it realistic to expect that we can achieve at least locally "a sustainable relationship between humans and the living world"? I think for most parts of Europe, at least, the answer to this is "possibly," though it would take a great deal of careful research to be sure. Currently about half of Europe's consumption is maintained by importing resources from other regions<sup>8</sup>, and using the atmosphere to dump greenhouse gases, but a combination of legislation and education might be able to bring consumption and waste back within limits. This would be difficult and opposition would be powerful, not least because European economies depend on growth, and it is not clear how they would survive a reduction in consumption followed by zero growth.

The market economy is not the only economy, but it is the one that grows by allocating resources optimally as a function of their relative scarcity, and that goes on growing and allocating resources irrespective of the size of the economy. The market economy is dangerous because it neglects a small detail: it operates on Earth. Growth can be sustained only while the sources and sinks of the planet have room for it. Growth depends on surplus.

---

<sup>8</sup> The EU, with 7.7% of the world's population and 3% of its land area, is responsible for between 15 and 20% of the global ecological footprint, and depends on the ecological production of third countries. This can only be sustained up to the point at which those other countries slide into ecological deficit and their populations become sufficiently impoverished, ill and miserable to make it uneconomical to continue to extract ecological resources.

Surplus land, surplus water, surplus energy, surplus natural resources. But there is no more surplus<sup>9</sup>. Zero growth seems to be an absolute requirement of sustainability.

My hoped-for outcome is wishful thinking, and nothing more, if we can do little or nothing to achieve it. Is it reasonable to think that we can in fact move toward the outcome? We would have to find ways to use renewable resources only at rates that nature can sustain, and to reduce the need for non-renewable energy to zero, or as close to zero as possible.

It is not only about energy, for if oil is the most spectacular example of heedless consumption, it is not the only non-renewable resource we rely upon. Increasingly effective ways of extracting non-renewable resources maintain or even increase their availability, and in some cases drive down their price<sup>10</sup>. Assuming business as usual, this trend will continue up to the moment at which a key irreplaceable resource runs out, or becomes so difficult to extract that it is in effect exhausted. Up to that point, most other non-renewable resources may continue to increase in apparent availability and get cheaper. The economy will collapse in a time of plenty, for want of one irreplaceable non-renewable resource.

Global production of gold, silver, lead, tungsten and zinc will soon fail to satisfy demand, but there seems to be no unambiguous way to predict whether the key limiting resource might be one of those metals, or tantalum, antimony, indium, beryllium, scandium, gallium, germanium, platinum, or perhaps some other obscure and alien-sounding element. For example, nuclear reactors need control rods, and control rods need indium, dysprosium, europium, and holmium. Some also need samarium. Hafnium and gadolinium are needed to make computer chips, while gallium and indium are used to make liquid-crystal computer monitors and terbium is used in optical computer memories and hard drives. Much of modern technology depends on rare elements. Despite what one infamous (and now dead) economist thought, there isn't an infinite supply of copper, and you can't make elements<sup>11</sup>.

When these non-renewables are gone, they're gone – and with them, mobile phones, computers, monitors, nuclear reactors, superconductors, wind turbines, gasoline, plasma televisions, hybrid car batteries and a host of other things we think are pretty neat – though probably not all at once. It's hard to imagine what happens to today's world if there are no more computers, but without almost any of these things our civilization may get wobbly<sup>12</sup>.

But let's close the parentheses and get back to the other nightmare.

In thinking about what we might do to achieve "a sustainable relationship between humans and the living world" I begin to get a sinking feeling. My hoped-for outcome reveals itself as a wicked problem. Part of the reason for this is that it shares many unfortunate characteristics with the wicked problem of biodiversity loss. Uncertain policy environments with many individual and organisational stakeholders are ideal breeding grounds for wicked problems, especially when the values, interests and goals of the stakeholders are complex, uncertain, unclear, ambiguous, heterogeneous and conflicting – and all the more so when the problem itself is composed of a complex set of elements that interact in non-linear ways. There is little or no linear causality in a wicked problem.

---

<sup>9</sup> Heinberg R. (2007) *Peak Everything: Waking Up to the Century of Declines* New Society Publishers ISBN 978-0865715981

<sup>10</sup> Simon J.L. (1995) *The State of Humanity: Steadily Improving* Cato Policy Report [http://www.cato.org/pubs/policy\\_report/pr-so-js.html](http://www.cato.org/pubs/policy_report/pr-so-js.html)

<sup>11</sup> Daly H. (2003) *Ultimate Confusion - The Economics of Julian Simon* The Social Contract Press 13 (3) [http://www.thesocialcontract.com/artman2/publish/tsc1303/article\\_1144.shtml](http://www.thesocialcontract.com/artman2/publish/tsc1303/article_1144.shtml)

<sup>12</sup> Since Chinese companies now own more than 90% of the global resources of rare earths, it's fair to assume that in the short term, most of these things will soon or are already in some sense "made in China".

### ***You can't solve a wicked problem except by solving it***

One inconvenient characteristic of a wicked problem is that it cannot be solved unless you try to solve it.

This statement is true of most problems, of course, but tame problems can be solved without going through the motions of implementing the solution. They can be solved on paper, or in your head.

Unfortunately you can't solve wicked problems in a model environment, because each wicked problem is unique, and in all its important details, it is unlike any other – and any model is necessarily not itself the wicked problem, and is therefore unlike it. In fact, any problem you can model is by that very fact a tame problem.

So to propose a solution for a wicked problem, we have to roll up our sleeves, get our hands dirty, and actually try to solve the problem. That costs a lot of time, effort, and money.

Even more unfortunately, we know beforehand that most solutions will engender unexpected and unwanted consequences, many of them wicked problems in their own right. And nowhere in the small print does the universe guarantee that any problem, far less a wicked one, has a solution at all. Furthermore, because wicked problems have no stopping rule, you never know if you've finally solved it.

So my answer to the question on whether it is reasonable to think that we can do much towards achieving the outcome is "we won't know until we try."

The good news is that we think we know how to achieve it, at least in broad terms. It's the ecosystem approach, which is based (whisper it!) on hippie teaching: there's no such thing as a free lunch, there is no "away," everything is connected to everything else, you cannot step into the same river twice, and you can never do just one thing. I'll come back to the ecosystem approach later.

If I were the ruler of this land, I would reintroduce some mediaeval ideas. For example, I'd punish company directors found guilty of planned obsolescence by making them spend a day in the stocks while customers throw obsolete items at them. Ducking stools would await those whose advertising encourages the perception of obsolescence (there goes the fashion industry) or over-eating, or the view that performance is a virtue when it comes to motor vehicles.

To be less frivolous, legislation and advertising alike should not encourage economic growth, but a frugal, responsible society that aims to reduce, reuse, repair and recycle.

Not gonna happen? No. Maybe not.

Why? There is a one-word answer: debt. Our economies are designed to generate profit for investors. If you invest money, you expect to benefit from it – you want your money back later, with interest. Your investment is a bet that your future worth will be bigger than it is today. Your money invested is a claim on future money. Look at this the other way round: to do business, companies, pension funds, building societies and governments borrow money and accrue debt. Debt is to the market economy what nutrition is to you and me; necessary. Interest is paid on loans, which means that our debt-dependent economies are based on the requirement that tomorrow's economy be bigger in real terms than it is today. The whole of society repays the debt, not just the institution that took it on, because costs (in higher real prices and hence more human labour) are passed on to the citizen. Thus irrespective of tomorrow's needs, just to pay today's debt, our successors must cover more land with houses,

buy more cars, pay more taxes and – most importantly – consume more resources than we do<sup>13</sup>.

This debt will be paid.

Well, not necessarily. There are three or perhaps four ways to get around this repayment. The first is if business, banks and governments default on their loans (say goodbye to jobs and investments). The second is if banks and governments print money (say goodbye to buying power and savings). The third is if an indentured future pays for our debt by going even further into debt itself, mortgaging an ever-ballooning future. But there is still only one pale blue dot<sup>14</sup>, so sooner or later, the buck stops and our wicked problem gains another sizeable wrinkle. If our children are to pay our debt, to do so they will need more resources than we already use today. How, I ask myself, is that going to be possible? The fourth way of getting around the payment is a bit radical, involving as it does the collapse of the whole house of cards.

I am no expert, and I see no way out of this. But it explains something important.

The loss of biodiversity is not just a wicked problem but, to borrow the phrase from the Lund Declaration, it is also a Grand Challenge – though the Lund Declaration lamentably failed to point that out. Perhaps the people who drafted the declaration, which blandly claims that science can help us to achieve sustainable growth<sup>15</sup>, decided that it is a matter of little importance that the living world is collapsing beneath our weight. Sustainable growth is, of course, perpetual motion by another name, and it is hard to maintain your belief in miraculous motion unless you can simultaneously ignore the fact that the machine is shaking itself to bits.

But if your options are otherwise limited to an entire economy defaulting on loans, universal hyperinflation, or economic collapse, sustainable growth looks like nirvana. And is, I can't help adding, every bit as easy to obtain.

Our leaders seem not to know how to think ahead in a context of swiftly-increasing complexity. Their jobs are not enviable; the challenges are developing far faster than the political process can follow. As a result, if they are planning at all, it is apparently for a war that took place rather a long time ago. Rapid exponential change makes such out-of-date planning inevitable and much of what underpins our societies seems to be changing exponentially. It's very hard to believe it can all go on like this for much longer. It seems that we are living on a cusp. What will befall us in the next twenty years is going to be unlike anything that has happened up to now. This wicked problem is, by definition, unlike any other. The only way to deal with it is to start dealing with it.

### ***Sustainability is forever: an attractive future***

If we are going to try to achieve "a sustainable relationship between humans and the living world," we need to know the current status of that relationship, or at least have a way to establish a baseline, and we need to discover criteria that can be used to assess whether we are moving towards sustainability. This brings us to question the definition of "sustainable" and the meaning of "relationship."

---

<sup>13</sup> <http://www.chrismartenson.com/crashcourse>

<sup>14</sup> Sagan C. (1994) *Pale Blue Dot: A Vision of the Human Future in Space* New York: Random House  
<http://www.youtube.com/watch?v=MnFMrNdj1yY>

<sup>15</sup> The conference was hosted by the Swedish Governmental Agency for Innovation Systems, which has the official task of supporting research to promote sustainable growth.

Our present use of the planet is not sustainable. Achieving "a sustainable relationship between humans and the living world" will require much more than stopping the loss. Whatever sustainable means, maintaining the current number of humans is not an option, and we cannot continue to extract services from the natural world at the rate we do today<sup>16</sup>. Stopping soil erosion is not enough; nor is stopping the fragmentation of habitats or the damming of rivers. Sustainability is not just a matter of making sure that the rate of use does not exceed the rate of replenishment. We have to take action to reverse many trends if we are to achieve a sustainable relationship with the living world. How, then, to establish a baseline, if all we really know is that today's relationships are not sustainable?

Incidentally, how do we reverse genetic erosion? By reversing the fragmentation and reproductive isolation of populations? No – that might help to reduce future erosion. But what we've lost, what we're losing every day, even every moment – how do you replace what is gone forever? How, I wonder, does one go about setting a target that is anything other than tangential, symbolic?

There are no good, by which I mean operational, definitions of sustainability. For an excellent reason; to attempt to define it operationally is to see clearly that it is a wicked problem. Sustainability is simply too complex an issue to allow for a snappy definition. To know what it is to be sustainable, we will have to do it. And the only way to do it is to hope we know where we're going, set off in that direction, and by dint of blood, sweat and tears, discover, but only several generations later, that we seem to be walking along the right road. Right road, perhaps, but we will never be able to relax because the biosphere is, like all living things, in flux, and has no fixed conformation. We will never know if we have achieved a sustainable relationship with the living world, because "sustainable" presumably means "for as long as there are humans," and for the rest of human history, we will never know what surprises tomorrow might bring.

We will nevertheless have a chance of being on the right road if each year the human death rate is no lower than the birth rate, if soils form no more slowly than the rate at which they erode, if species go extinct no more quickly than new ones evolve, if coral reefs form no more slowly than they die, and if waste, including greenhouse gases, is produced no faster than the local environment can assimilate. There are of course many other such indicators. There are therefore many measures against which we might set and assess the target. Since sustainability is forever (at least "forever" from a human perspective), many of the measures will require patience and long-term investments.

Which brings us to the nature of the relationship between humans and the living world. What is important here, I think, is not whether we should interpret our role as that of master, steward or gardener (or what leads us to think that we can successfully master, steward or garden the Earth before we understand it) but that we at least think about what we want from the living world. And not just what we want for ourselves, but for our children and their children – indeed I would suggest that we adopt the Great Law of the Iroquois and consider the benefit of the seventh future generation. And what better way to think about what we want from the living world than to set up mental pictures of the living world of the future, in which we would want to live? What picture of the future shows a global community in which we would like to live, and that can endure?

---

<sup>16</sup> Vogt W. (1948, reprinted 2007) *Road to Survival* Kessinger Publishing ISBN 978-0548385166

"What does a sustainable carbon-neutral society look like?" asks David Orr<sup>17</sup>. "It has ...local businesses ... local farms and better food ... local employment ...better poetry ...better schools ... fewer shopping malls ... less television and no more wars for oil or anything else."

If we were to agree on one or more attractive future worlds, it would then be possible to think about what our relationship would have to be with the living world in order to reach one or other of them.

### ***Responsibility for sustainability***

Who is the "we" that might try to achieve "a sustainable relationship between humans and the living world"? Who should agree that the "sustainable relationship" is a desired outcome, and who should be involved in setting the associated targets? Who are the people who will feel ownership of the outcome and the targets, and be given the responsibility for delivering sustainable relationships? Who will account for performance and to whom?

This, of course, is the key issue. It's key for any target, because unless someone feels responsible, you are unlikely to reach it. Brownian motion, or perhaps more appositely, drunkard's walks, are not the best way to reach targets. But for this issue – stopping biodiversity loss – ownership and accountability is the beating heart of the matter. The outcome "a sustainable relationship between humans and the living world" pivots on the word "humans". It implies individuals, companies and governments, but also *Homo sapiens* and the glorious human enterprise. Thus the stakeholder for this outcome is everyone on Earth, and probably every human institution, too. But most of the world's resources are consumed by a tiny fraction of the world's population. That tiny fraction could do most to establish sustainability, but has the least motivation to do so. Just as countries can for selfish reasons cheat on agreements to reduce greenhouse gas emissions, so individuals, companies, institutions and governments can behave selfishly when it comes to establishing sustainability.

But what do we expect? Most people have never heard of biodiversity or ecosystem services and don't know what either term means. Whatever they mean, most people probably don't think about them at all, far less about their loss. Of the small minority that has heard about biodiversity, almost all probably either equate it with species extinctions, thinking perhaps of pandas and passenger pigeons, or regard biodiversity loss as something affecting tropical forests or, possibly, coral reefs. Something beautiful, yes, but conceptually vague, geographically far away, and disconnected from everyday concerns. What percentage of people could identify any reason to be concerned about, far less any personal responsibility for biodiversity loss? I would guess that it is effectively zero. The same thing is doubtless true of the concept of sustainability – perhaps more people may have heard of it than of biodiversity, but nobody knows what it means.

"Biodiversity" was never a good word, because its meaning is obscure, but it is now also a failed policy; we did not reach the 2010 target. And what are the consequences of that failure? For many of us in the richer, service-economy nations of the world, the quality of life and freedom of personal choice is greater now than it has ever been. We have benefited greatly by the continued loss of biodiversity elsewhere on the planet. That steady draining-away of ecosystems has supplied our rapidly increasing needs for timber, food, cosmetics, medicine, and many other services.

The loss of biological capacity of the planet to support life is rapidly falling off political agendas everywhere. Nobody wants to chase a failed policy whose only observable

---

<sup>17</sup> Orr D.W. (2007) *Optimism and Hope in a Hotter Time* Conservation Biology Volume 21, No. 6 <http://www.davidworr.com/more.php?articleid=23>

consequence is the enrichment of the economy and the embarrassment of policy makers. The lesson here is, perhaps, that when setting targets we ought to think carefully about the political repercussions of not reaching them.

Governments are unlikely to do anything serious about biodiversity loss unless they are pushed into it by their citizens and advisors. Companies won't do anything unless it's profitable. And people won't do anything if they aren't even aware there's something to do.

And we're not telling them. Our wicked problem is compounded by good manners and Orwellian use of language. Good manners forbid us to speak of loss, of sacrifice, or of tasteless things like the distribution of wealth and political power within and between generations – and above all, let us never mention the entirely discredited idea of limits to growth. That's just so '70s. By correct use of language we see that there are never any problems, only challenges, which are really just opportunities waiting for us to seize and use to make money. An insoluble opportunity is an oxymoron, so any right-thinking person will clearly see that there is no such thing as an insoluble problem. Global change might look like a challenge, perhaps, but since the only problems we need to focus on are those that we can solve by making a profit, climate change and biodiversity change (never loss!) are opportunities to make money through technological break-throughs and green gadgets. The word "sustainable" must always be emasculated by coupling it with a succubus – "development" does nicely to render it harmless and divert attention from the issue. Oh, and you may once have been a citizen, but my dear, that is terribly old fashioned. Now you are a consumer, a customer, and your duty is to buy and spend and throw things away – only more, please, and faster.

On the one hand, then, ignorance and vested interests lead to a vacuum of ownership of the outcome or associated targets.

On the other hand, there's another tricky bit about "a sustainable relationship between humans and the living world." That is the size of the human population and the demands it places on the planet.

Most current demographic predictions suppose that the human population will not rise much above 9 billion, which is some 2.5 billion, or close to 30%, more than today's population. Humans currently sequester between  $\frac{1}{4}$  and  $\frac{1}{2}$  of all net terrestrial primary productivity and  $\frac{1}{2}$  of accessible fresh water. Human activities already fix as much nitrogen in terrestrial ecosystems as all other sources combined. It is hard to see how these proportions could be increased to keep step with the projected increase in human populations.

The question about the ownership of the outcome looks like a pair of wicked problems: how can each person take responsibility for the well-being of the whole world? Who is responsible for reducing the human population and its impact on the world? Unless we can answer them, is there any point at all in rabbiting on about sustainability?

## ***Overhaul***

What will to have to change if we are going to achieve "a sustainable relationship between humans and the living world"?

In our current paradigm, a small minority of humans benefit at the expense of the great majority, and of the environment. This leads to the bewildering, amazing spectacle of a species that is trying to strip everything worthwhile out of its planet as quickly as it can. Humans are busily converting prodigious volumes of carbon into greenhouse gases in a sustained, sweeping and hugely successful effort to reverse the natural creation of diverse and complex ecosystems that build soil, clean the air and water, and provide many other services.

The main deliverable of all this energy and toil is obscene wealth for some. Oh, and a raft of wicked problems. Most of us on the planet (but not, in general, the wealthy few) have to deal with one or other problem every hour of the day. The rest of us – living mostly in service economies – can ignore or deny them, or choose to remain in blissful ignorance about them.

Clearly, today's paradigm does not work. When we're done liquidating our planet, do we imagine we will slide the key under the mat and rush off to do something else?

What will have to change? Clearly, a new paradigm is needed, one that views our relationship with the entire Earth as a living system with a long-term future. Stopping biodiversity loss, or attaining a sustainable relationship between humans and the living world (which is the same thing), requires a root-and-branch overhaul of the way we do things. The ecosystem approach, or Gaia theory or something very much like it, will have to become the central tenet of the way we do things. In a sustainable world, personal autonomy is less valued than personal growth and community, while cooperation and conscious consumption replace the unethical and unacceptable mind-frames of competition and conspicuous consumption. The throw-away society must end; a sustainable society does not waste things. In this, the sustainable society could model itself on nature, where nutrient cycles and food webs result in very little waste. Resources are used efficiently, over and over again, and one organism's waste is another's raw material.

The global economy will have to reduce its demand for resources to the point where "renewable" means what it says and oil and coal reserves are not used as energy sources. This is a significant reduction, probably unachievable without a quick and permanent reduction in the human population and, simultaneously, a decrease in *per capita* demands on the living world. Economies will have to turn away from extraction and instead develop technology to minimize our ecological footprint and to sustain and improve the natural environment. Forestry and agriculture will have to adopt methods and technologies that do not depend on massive chemical input and transport over huge distances, while fishing will have to... what? I'm not sure. Can fisheries work out ways to remain within the regenerative capacity of the fish? If not, we may need a permanent moratorium on industrial fishing. Most significantly, and perhaps most difficult of all, our entire economic system and its underpinning monetary model will have to drop its dependency on growth and debt, and reorient on sustainability.

The bottom line is this: first, if there is a viable way forward at all, its watch-word is sustainability; second, before we can reach a sustainable society, huge obstacles lie in our way; and third, these obstacles are insurmountable if we do not try to deal with them. We will only reach whatever target we set if we put in a huge effort to change the way we do things, direct more resources towards understanding, and make significant investments in appropriate technology. At the same time we will have to thoroughly overhaul our organisations, and considerably improve the processes we use to grow and prepare food, clothes, and other material goods, and to transport them and us around the place.

No, for biodiversity loss, it's not just a matter of reducing the emission of greenhouse gases. This one is a wicked problem, and it will need, first, some serious thought about what it is to be a human on this planet, and then a serious attempt to live up to the name with which we flatter ourselves: *Homo sapiens*.

### ***Some final questions***

There is no realistic plan of actions towards "a sustainable relationship between humans and the living world." There isn't, but there could be, if politicians, businesses, scientists, industrialists, sages and a lot of other people set to work to create one. It would go like this:

use it up, wear it out, make it do, or do without. It would make it a criminal offence to use the word "consumer" and would re-instate the word "citizen." It would explain that sustainability is a life-long lesson in deportment. A successful step is a small triumph because the book is still balanced on your head. Happy complacency is the last emotion you feel before the book slides off.

But if there were such an action plan, would anyone take any notice? What would motivate them, and why? The plan must clearly show how every individual benefits, and hold up a vision of an agreeable future that we can attain if we act in certain ways.

What resources will be made available to help us into our new paradigm? Well, let's not get too ambitious. Just to stop biodiversity loss, then. If the past is any guide, not a lot. "We will spare no effort to free our men, women and children from the abject and dehumanizing conditions of extreme poverty, to which more than a billion of them are currently subjected." That's not about something obscure and remote like biodiversity – that's about in-your-face human suffering. The body that made that declaration in September 2000 was the United Nations. Almost a decade later, UN figures show that more than a billion – the same number – still suffer from extreme poverty, 1 in 8 people on the planet are malnourished, and around 1 in 12 experience severe and chronic water shortages. Sparing no effort, all right!

Another question we should always ask about targets is, "how much time do we have to reach it?" In this case, the question is a tricky one, because as we've seen, there's no target to reach, only a long road to walk along. "How soon do we have to start?" has an obvious answer, but unfortunately it involves a technology that we haven't yet mastered – time travel. "How soon do we have to be on the road?" has pretty much the same answer, if you believe Donella and Dennis Meadows and Jørgen Randers, who told us 16 years ago that we were already beyond the limits<sup>18</sup>. But however you look at it, we cannot buy time. Every day we continue with business as usual, the wicked problem becomes exponentially more knotted and complex, increasingly likely to prove intractable.

Can we reach our desired outcome of "a sustainable relationship between humans and the living world" within a reasonable budget? As these musings have shown, I don't think that there are any shortcuts, but there are options. We can either achieve an environmentally, economically, and socially sustainable relationship with the living world, or we can let a broken environment force a future upon us. Because "unsustainable" means "certainly will not go on like this."

Civilizations collapse when their wicked problems overwhelm them.

No previous civilization faced wicked problems anything like ours, of course, not least because ours are planet-wide, global affairs. Collapse is unlikely to be agreeable, and this time, for most humans, it will not be survivable. The simile I used concerning extreme poverty was not casual. The depth and impact of the planetary crisis depends on the distribution of wealth, not on wealth averaged across the planet. A large proportion of the human population is too impoverished to protect itself against ecological collapse. For them, the collapse will be cruel and widespread, but those of us living high on the hog in the post-industrial world will not be immune. No government, no business – nobody – knows how to operate in an environment in which natural resources and surplus energy are abruptly and simultaneously declining.

Given the steady growth in our demands on the planet, and the nature of exponential functions, zero population growth will happen soon, and – in historical timescales – suddenly. Zero

---

<sup>18</sup> Meadows D.H., Meadows D.L., & Randers J. (1992) *Beyond the Limits: Global Collapse or a Sustainable Future* Earthscan Ltd. ISBN 978-1853831317

human population growth is going to happen. Birth rates will one day be no greater than death rates. The question is whether death rates will greatly exceed birth rates, by how much, and for how long.

In the past, civilizations rarely died wholesale in an abrupt Armageddon, but became dysfunctional today a bit here, next year a bit there, in a slow death of a thousand cuts. Our civilization is the first global one, where gargantuan companies do business in every cranny of Earth. Yet we, too, may go out not with a bang but piecemeal. There's good reason to believe that an environment once relatively benign, but now broken under the strain of supporting our species, is already forcing a future on people in many places across the planet.

So the question of the size of budget needed to reach the outcome is no more an issue than is the question of how much it will cost to cut greenhouse gas emissions sufficiently to avoid runaway climate change. You either spend the money and make the effort, or experience what it is to exist on a planet in the throes of a simultaneous water dearth, energy desert, climate turnover, economic collapse, oh and by-the-by, a geologically significant extinction spasm.

### ***And here's what we must do...***

Almost everyone who read early drafts of this paper said something like, "well, that's all very depressing – and the worst thing is, you don't provide any solutions. People need solutions. Tell us what we should do!"

At which point I scratch my head, because I thought I answered that question throughout this paper. To propose a solution for a wicked problem, I said, we have to roll up our sleeves, get our hands dirty, and actually try to solve the problem. What makes you think I have the solution, when the essence of a wicked problem is that it has no "solution"?

At the risk of repeating myself, there are things we can do. Let's start by making sure we have the means to understand and take account of true costs, so that there are no longer any externalities. Let us be sure that our behaviour shows that we understand that this is a single planet on which it is not possible to throw things "away." That we understand that actions affecting one part of the Earth system affect other parts too; "biodiversity" is not a thing apart. That we understand that while we can learn by doing, every action will teach a different lesson. That we understand that nothing is as simple as it looks, and that complex systems sometimes react in unexpected ways.

Let's elect governments, and especially buy products from companies, that have committed to low ecological footprints and are ready to invest massively in a truly sustainable society. Let's only vote for parties whose leaders are never caught on camera looking cheerful, pleased with themselves or complacent, but only those who permanently look worried to death and who are rapidly going grey.

If we absolutely need targets, let them be ones that encourage movement along the road of sustainability. But better than targets, let us establish inspirational visions of an attainable future in which we would like to live, share those visions, and help each other to find ways to live that will cause that dream to come true.

Targets are intended to be reductionist, rational, value-free and quantitative. Evidence of movement towards a target is accumulated deliberately, through systematic, mechanistic experiment and measurement. The data are generated by specialists, who give the measurements legitimacy. Sometimes, but not always, the data are collected in a relatively short time over a wide area.

Understanding how to establish and sustain a balanced relationship between humans and the rest of the living world will certainly need that kind of knowledge. But because all of us must be involved in that relationship, much of the understanding will be generated by the people who use the resources – you, for instance, and me. The legitimacy will come from shared experience about what works in one particular place. It will also require a different kind of knowledge: holistic, partly intuitive, ethical and qualitative, accumulated over a long time by empirical observations and through learning by doing. And, of course, learning by inquiring. We need to demand the answers to questions like, "where did this meal come from?" "How much fossil fuel went into it?" and "What did it do to the soil?"<sup>19</sup>

Let us direct a whole lot more resources towards understanding and the capacity to understand. Not only do we need many more socio-ecologists out there doing anthro-geo-physiological fieldwork, but we also need philosophers and communicators and people who delight in studying and understanding complex, interacting, self-regulating, far-from-chemical-equilibrium, self-organising, ambiguous, borderless systems. Let us learn how to expect the unexpected.

And now I really am repeating myself.

What else can I say?

Well, perhaps there is one more thing to say, but now I sound discouraging even to my own ears. The evidence suggests that we – our institutions, our businesses, our leaders, our modes of thought, and certainly the way we live our lives – are not reacting, and probably not capable of reacting, nearly as fast as the planet's climate-biosphere complex is changing. If this is this case, then it is too late for our plague of humans to establish a relationship with the living world that is sustainable on this side of collapse.

But for our children's sake, we should try.

---

<sup>19</sup> Pollan M. (2006) *The omnivore's dilemma: a natural history of four meals* Penguin Press ISBN 978-1594200823