Tom Oliver

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Tom has published more than 100 scientific papers in world-leading interdisciplinary journals and won two first-place prizes for essays communicating science to a broader audience. He won the Marsh Award for Entomology in 2014 for outstanding contributions to Entomology. He currently lives in Oxfordshire, UK. His first book The Self Delusion was published in January 2020.

Tom has advised the UK government through secondments with Defra (designing a 'systems research programme') and the Government Office for Science. He currently sits on the Food Standards Authority science council and expert college for the Office for Environmental Protection. He has advised the European Commission through membership of the EEA scientific committee and bespoke presentations.

Laurent Dingli. — Laurent Dingli. — Dr Tom Oliver, you are a Professor in Applied Ecology and Associate Pro-Vice Chancellor for Research (Environment) at the University of Reading. You are a prominent systems thinker, advising both the UK government and the European Commission. You are a regularly interviewed in broadcast media and your first book ***The Self Delusion: The Surprising Science of Our Connection to Each Other and the Natural World*** received critical acclaim. And you are currently writing a new book, THE NATURE DELUSION which takes the ideas to the next level, showing how our relationship with wild nature holds the key to regenerating both human nature and the natural world. And of course, we will focus on this book

I'm convinced that you are writing a landmark book. Let's start with part one, chapter one entitled 'Tipping points and vicious cycles' — Planetary Dynamics are complex, with feedbacks between social and environmental systems.'

In this chapter, you're taking stock of the situation of the multiple threats and what impact these threats have on human culture and nature. Can you tell us a bit more about this?

Tom Oliver. — I think we obviously read about the environmental crisis every day. It's hard to open a newspaper without seeing another story of the symptom of our cumulative human impacts on the world. The environmental crisis is a polycrisis as its different impacts, — from habitat degradation to pollution, climate change —, interact in their effects. When you take a system's lens you start to see the risks of tipping points, rapid changes in the biophysical characteristics of the earth system. We know from research that ecosystems can shift from a forested to a desertification state. We know that we have tipping points in the climate system. We see them in past records, where we can observe abrupt changes in climate dynamics, and thus understand that we could be faced with risks such as melting ice caps, which reduce the reflection of solar radiation, or the dieback of large tropical forests like the Amazon being susceptible to drought.

With a more systemic perspective, we're beginning to realise that social systems also interact with ecological systems and that feedback processes occur. The idea that we can be trapped in vicious circles where feedback processes worsen a negative state is perhaps less recognised in the way these feedbacks link social and ecological systems. We are perhaps most familiar with this kind of vicious circle in social systems, such as poverty traps or the cycle of alcoholism and depression: the more depressed you are, the more likely you are to drink alcohol, and the more likely you are to drink alcohol, the more depressed you are. Actually, these vicious cycles can operate linking social and ecological aspects and that's what the start of the book is describing. Environmental degradation, such as through worsening climate change, drought and pollution leads to social repercussions.

For example, society is moving towards a survivalist mindset, where barriers are being broken down, and this can be seen in nation states, where countries are trying to cope on their own. We see increase in protectionism; we see enforcing borders, this idea that cooperation is a kind of luxury that in the face of crisis we need to forego. Clearly, this is an inadequate approach to tackling a global environmental and social crisis that doesn't respect national borders (i.e. the effects of biodiversity loss, air pollution, ocean acidification, climate change and so on, are all transboundary issues). And, these vicious cycles go right down to levels of individual behavior. For example, in the face of scarcity, people become ultimately more selfish in looking after themselves and their small group. Similarly, nations become more coherent but increase xenophobia and aggression towards other nations. That's the risk that we face, that we enter these vicious cycles and, arguably, we're in some of these cycles already.

This first part of the book is essentially helping to zoom out and see the planet from that broader perspective, that we are just this single planet floating in space and actually these processes of environmental change and social change are linked, taking a more dynamic perspective on those processes.

L. D. — You have this sentence I like very much: ‘As wild nature around us is destroyed, we lose our sense of place, experience less awe and wonder, and even our self-identity is subtly changed, making us more selfish and xenophobic.’ And you also write: ‘as the natural world is degraded, we ourselves become transformed.’

In chapter two called ‘Nasty and Brutish — the loss of nature can make us more aggressive and warlike’, you’re giving the example of the Kibale National Park where chimpanzees are fighting together because of scarce resources.

T. O. — We know that other species, particularly other primates, compete for resources and that this competition leads to violence. By examining bone fragments, we know that, from the outset, the history of humanity has been marked by violent conflict. But it has also been a history of close cooperation. Be that as it may, it is undeniable that we form tribes and that we fight. Today, in the context of current global shortages, we can anticipate this fundamental trait, this propensity for aggression. The economic globalisation in which we live has probably allowed some delay in our aggression because when resources run short in one country we can find them elsewhere but as populations increase, as per capita resource use increases and as the economy has become fully globalised in the sense of those supply chains, we're running out of world essentially and we're seeing resources become scarcer. And even if these shortages sometimes turn out to be less serious than expected due to the discovery of new deposits (for example, oil, rare earth metals) and through recycling, if demand remains too high in relation to supply we then get conflicts over who has access to these resources.

Consider the transition to electric cars as an example, the EU block of countries expected to increase their demand for lithium by 60 times by 2050; that's a huge amount of resource that we have to secure and it's increasing. That demand is also sought by other countries trying to electrify their transport systems. So, we see the supplies being disrupted.

Arctic — Credit: Sarah Nic/Pixabay

Climate-change — Credit: Jody Dell Davis/Pixabay

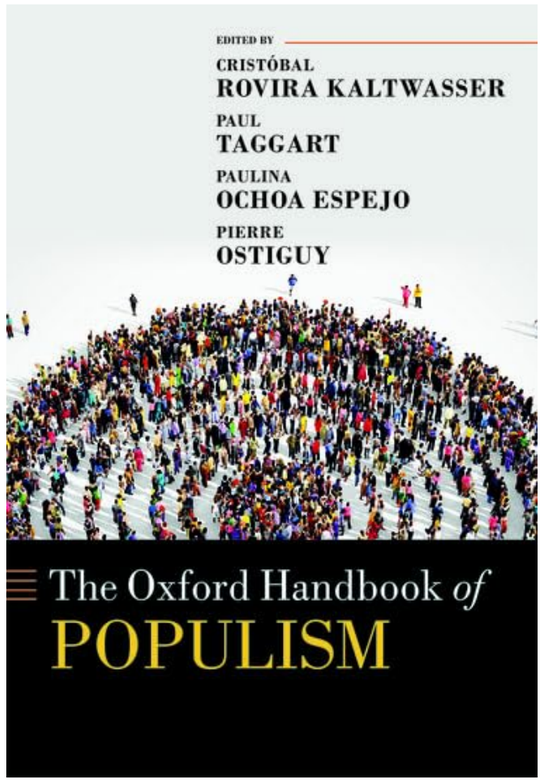
Geopolitical conflicts can also be a source of supply chain disruption where countries weaponize scarce resources and we see that already happening in Ukraine-Russia conflict for example and over wheat supply. When you look at the historical record there are huge amounts of examples where there are water-related conflicts. Under one study, there are a record of over 920 water-related conflicts and 800 of those have occurred since 1970. You could say that we're reporting them more but there's no doubt that we're seeing these increased water shortages with water scarcity already affecting 40% of the global population. As a matter of fact, a quarter of the world's population faces serious shortages for at least one month a year. Of course, this will get worse with climate warming and drought and using up our aquifers. So, we can definitely see on the horizon this potential for significant water related conflicts. Just one example.

Food security as well is another issue of course potentially leading to conflict. There are signs that drought and food price shocks had an influence in shaping geopolitical changes such as the Arab Spring. Of course, it's harder to predict the ultimate impacts of food insecurity. There have been some famous examples. Thomas Malthus predicted that there wouldn't be enough food for people and there would be massive shortages. He turned out to be wrong because we innovated and through the intensification of food production through the agricultural revolution we pushed back the limit of finite resources. But just because Malthus was wrong and predictions can be wrong doesn't mean that there are no limits, and we see that food insecurity is already causing huge disruption

So I think we have a pretty worrying picture of contested resources here, and the big question is how are humans managing these impacts? There are two types of competition known from ecology: ***scramble competition*** and ***contest competition.*** Scramble competition is like cows in a field in an overgrazed meadow; they all eat the resource and gradually, they may all become impacted. Actually, with a small resource loss, that can be okay; they’re all just a little bit impacted. But under significant resource depletion, all the cows would suffer. Contest competition is more brutal — it is kind of winner takes all — and can actually lead to more resilient species because you always have some kind of winner, even though there's huge inequality and ethical implications of the losers starving.

Humans have tended to have followed contest competition but it's not hard to imagine the huge ethical implications of this type of competition, on a global, national or even individual level. We have time to head this off. We have time to think about it, but all the trends, our traditions, our history of conflict, point to this serious shortage of resources. You could talk about cooperation under diversity. Humans do show great kindness in the face of diversity. For example, during extreme weather events like Hurricane Katrina or the Typhoon Haiyan in the Philippines, we see people coming together and cooperating. So, humans also have the potential for cooperation in the face of adversity too. Now, those two things are not completely contradictory and you can resolve them by understanding the tribal nature of humans. In the face of adversity what we do is we bind together in tighter groups and within those groups we look after each other and we can be incredibly cooperative if you're part of the ingroup but equally become more aggressive and more xenophobic to those in the out group. So, I guess the big question is how our group identity changes in the face of this planetary crisis.

I think the mechanism by which we see these geopolitical conflicts intensify is often linked to these changes in group identity and an increase in xenophobia and aggression, and this may be due to the scarcity of resources. We know that this is an evolutionary mechanism that allows tribes to cope with adversity. We even find that tribes are more likely to elect right-wing authoritarian leaders, strongman-type leaders, who literally have more masculine and strong traits, which could be adaptive if you're in a tribe that's fighting with another tribe over resources and your leader is more likely to help you through that. Of course, in a globalised world, with the complex issues we face, you could argue - and the evidence shows - that this kind of very right-wing mentality is actually worse at dealing with wicked environmental problems. Highly right-wing leaders like to think in black and white rather than being able to deal with the ambiguity and complexity of an issue. So, there are clear and precise signals that, faced with a shortage of resources, xenophobia is on the rise and our reactive responses in terms of governance choices may hinder rather than help.

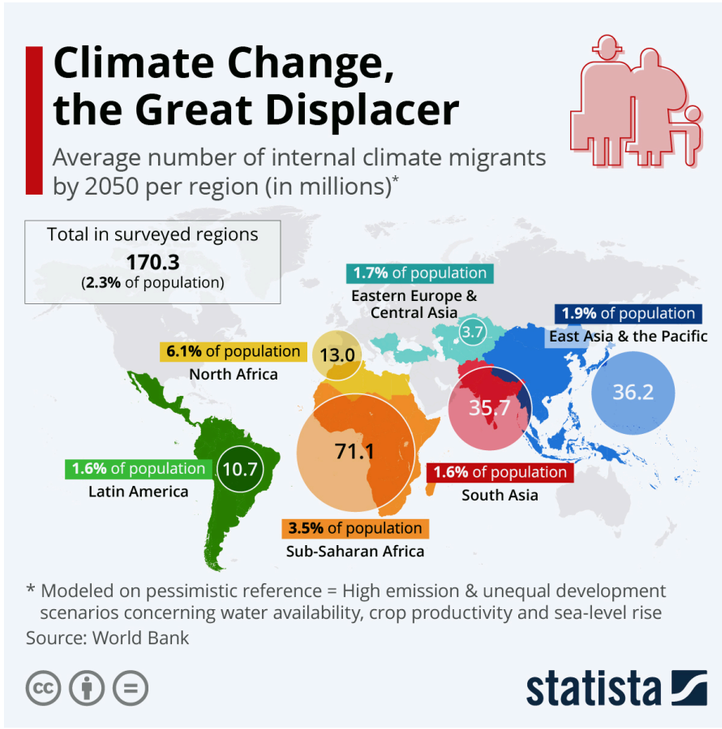


This kind of increased nationalism and group identity at the national level may have advantages in terms of coherence within society and reduced internal civil unrest, but it can also lead to an inability to deal with international problems related to climate change, ocean acidification, biodiversity loss, air pollution, zoonotic diseases, just to name some examples. There is a serious the risk that an increased focus on the national level will lead to a neglect of international cooperation, and we see this perhaps in Trump's approach to withdrawing from the IPCC and cutting funding to the World Health Organisation, etc.

One of the worries is that nationalism seems to be exacerbated by migration and of course people moving across borders is growing. Already 3.6% of the global population are migrants moving from the country that they're born but that figure is likely to increase dramatically in current years. One forecast shows that the climatic envelope that humans have lived in for the last 6,000 years will shift and so vast areas of equatorial belt will become essentially uninhabitable unless we have the sufficient technology to live in those climates that we've never really lived in before. And the authors of this paper are predicting between one and three billion people to be outside of that envelope. Of course, the most likely response of any species to those climate shifts is migration– movement to track the climate envelope.

I live in the UK and arguably the whole of Brexit was exacerbated by unhealthy focus on migration.

In fact, we're talking about a small number of migrants - and their numbers haven't increased radically in recent years - many contribute to the economy and most are legal, but the way the media have focused on this issue has exacerbated xenophobia. There is this tendency for humans to have this ingroup identity in the face of crisis and the crisis can be real or it can also be perceived. The problem with our modern-day technologies like social media is that those perceived crises can also be exacerbated and we can get certain elements or populist leaders who create that sense of fear that you mentioned. Some headlines from UK papers from around 2015, which was just before the Brexit vote: ‘the Swarm on our streets’ — that's the Daily Mail —, 40% surge in ethnic numbers. And the Daily Express: ‘migrant invasion out of control, migrants to swarm Britain.’ This terminology uses dehumanizing statements. We actually had a reporter saying: “make no mistake, these migrants are like cockroaches some of our towns are festering sores plagued by swarms of migrants and asylum seekers shelling out benefits like Monopoly money” . The headline of the article was “Rescue boats — I'd use gunships to stop migrants”. Historically, dehumanizing people and talking about the most cockroaches was also what happened in previous genocides.



This evolved tendency in humans to form groups in the face of diversity can be maladaptive in the face of globalized problems, but also can be exacerbated by certain technologies like social media and also in some of the technologies we might use to control our borders like lethal autonomous weapons which are weapon systems that essentially don't need a human to operate them. These weapons already exist for example in the Korean demilitarized zone. So, you have machine guns that have computer vision and there's a big sign that say please don't approach this border, you will be shot at. But people are desperate. If they don't have food or water, they will move and yet the host country can argue that, well, it wasn't our fault, we did put the signs there. So, that's a real risk I think that these borders are becoming even harder and technology has the potential to worsen this impact of xenophobia. I don’t want to paint too negative a picture because I think there are approaches to expand our ingroup and think of other humans as part of one family and even other species as part of connected entity of life. Albert Einstein said our task must be to free ourselves from this prison by widening our circles of compassion to embrace all living creatures and the whole of nature in its beauty. So, there are ways that we can think about how we do this and overcoming xenophobia.

Governments have an important role to play because they can make the problem worse. For example, the British government has been extremely hostile to immigration, which has backfired in terms of the economy and civil unrest. But governments could facilitate debates in local councils, in community halls. In a sense, it's very easy to press emotional buttons and say, ‘Yes, we want to keep our old traditional cultures, we don't want new cultures, we don't want people taking advantage of us’. It's very easy to press these buttons of fear and scarcity about resources and come to the following conclusion: let's build walls and keep people out. But we need to break this down a little and encourage people to ask themselves what it means to leave their country because the climate is too hot and they can no longer grow food there, particularly because there isn't enough water. Ultimately, climate change has been caused by the emissions produced by many rich countries. I think most people would question the responsibility that our countries have to improve conditions for these migrants. We haven't set up such debates and it's a real problem. It's something we really need to do something about.

L. D. — Let's talk about part two "Sticking plaster fixes and perverse 'solutions'". I love in particular the title of chapter five: 'Monetizing love — getting rich doesn't help, it just means we destroy nature quicker.' You say in particular: 'another piece of wishful economic thinking is the strategy backed by major conservation organisations such as The Nature Conservancy to put a monetary value on nature'. This is a very important and interesting point because regarding the advantages and limits of actions and projects aimed at integrating nature into our economic systems particularly through compensation schemes and so-called net gains we often get the impression that we are still trying to adapt nature to our dominant economic models which have shown their limits and often their failure. Can you tell us more about the limits of the technological fixes, economic fixes and so-called miracle solutions we think we have and about the importance of having a more holistic approach to these matters?

T. O. — Yes, there is a new approach to conservation that involves trying to quantify the value of nature and there are definite limits to this. In reality, it is very difficult to understand the function of the estimated eight million species (there are actually many more if we include fungi, bacteria, etc.). The benefits of these species are intangible and, as one sociologist, William Bruce Cameron, put it: 'Not everything that can be counted counts and not everything that counts can be counted'. Implementing systems that quantify and monetise the value of nature is an illusion.

In my book, I give the example of a commercial port in Durban in South Africa, where it was estimated that the economic value provided by jobs was greater than the value of biodiversity in terms of monetary benefits, in a way that is questionable to say the least, insofar as many essential parameters, such as the supporting services provided by biodiversity, the way in which nature regulates our nutrient cycles, the cultural 'services', the educational and even spiritual values of nature, which are very difficult to quantify, were not taken into account. We often see programmes that try to adopt this economic approach to nature and whole reports that look at the economics of biodiversity and say that we should treat nature as an asset. Of course, it is possible to take into account what some people call 'ecosystem services', which is very transactional language. For example, a company looking to purify water could organise a small auction to find out which landowners would like to change the way they manage their land in order to purify the water and reduce the cost of chemical water treatment. I don't deny that these closed market approaches can have advantages. But I think there is cause for concern when these nature markets become much more open. For example, LIFE, the EU's funding instrument for the environment and climate action, which should be used to restore wetlands, plant trees, etc., was used for a project called 'Nature-Trade', the explicit aim of which was to create a kind of 'eBay for ecosystem services'. The danger is that protecting nature becomes a transactional relationship and we do less out of a sense of responsibility. We don't take care of our family on the basis of a transactional relationship, we do it out of love, a sense of shared identity, care and responsibility. This instrumental language of treating nature as property and even writing contracts for landowners risks crowding out other social norms. We must protect nature because it is the right thing to do from a moral and social point of view.

'We have a very casual attitude to ecocide where we think we can destroy biodiversity in one place and simply put it back somewhere else.'

I'm not saying that the economic approach is completely wrong but I think it has to go hand in hand with recognizing the important role of pro-environmental values, in underpinning nature. As an example, you couldn't run a society full of psychopaths with just the right rules and regulations and economic incentives; you have to have this bedrock of pro-social values which essentially makes civilisation work and the danger in our modern, neo-liberal market economy is we have forgotten that bedrock of pro-environmental values which allow us to actually protect the environment and restore it effectively. We have a very casual attitude to ecocide where we think we can destroy biodiversity in one place and simply put it back somewhere else. This comes back to this idea of net gain schemes, biodiversity net gain, where you quantify number of habitat units or some aspects of biodiversity that you've lost in one place from a development and then you recreate it elsewhere. I've looked into some of these schemes in the UK and how they're actually operating. The problem is that they're very subjective in the way you quantify what is lost and what you're going to put back elsewhere.

Aerial view of the container port, Durban, South Africa — Credit: Media Club/Wikipedia

The moment we have a system where developers pay a consultant to quantify that biodiversity, the habitat units, the consultant is incentivized to essentially give the right answer to the developer who is employing them and paying them. So, it's hugely problematic and there are a number of subjective questions.

We had an example of a woodland that the developers proposed to put about 50 houses on, quite a small amount, on an area of secondary woodland and they argued that they would create a 20% net gain from this development. They would have destroyed the secondary woodland and there was another woodland elsewhere that, according to them, was in a poor condition and they were going to improve to a moderate condition. But actually, they were going to allow the other woodland to just get older which it would have done anyway. Some of the questions about the woodland that was being lost under the development are very subjective things like is rhododendron present, yes or no? Rhododendron is an invasive plant in countries like the UK but obviously to ask 'is it present?' is very subjective. It could be one small plant or it could be a large stand of rhododendron and you could answer that question either way. Actually, there were four very subjective questions. The algorithm could be completed by someone who wasn't being employed by the developer, changing the response to just one question and you would get a 40% net loss. So, this is the danger of these net gain schemes. It can be a tool that could massively accelerate biodiversity loss. The key is how well it's regulated and monitored? Are these developers actually restoring biodiversity? If you look at our track record of how we monitor and enforce regulation on the environment in the UK in particular: our air quality enforcement has been poor, our water quality enforcement has been terrible. We don't have a great track record of monitoring and enforcing environmental regulation. So, that's to me is a worry of a purely economic approach which doesn't really think about the social sciences of how we value nature.

L. D. — Regarding, 'planetary escapism', you give the eloquent example of Elon Musk wanting to colonize another planet instead of taking more care of ours. Can you tell us more about that?

T. O. — Yes, it is quite close to the idea that economic fixes will solve the planetary environmental crisis and I think there's also a fallacy that technological fixes will be our savior.

The Andasol Solar Power Station near Guadix, Spain — Credit: Kallerna/Wikipedia

That said, this is not to deny that there's an important role of technology in restoring the environment but I think the danger comes when we have an idealistic belief in tech-fixes and that can sometimes encourage us to focus in the wrong direction and ignore other aspects. To give you a small example, we are facing a pollinator crisis; bees are in decline and some people think that pollinator robots will be able to pollinate our fruit and vegetable crops with those little drones that fly around greenhouses. These robots do in fact exist and are constantly being perfected, but they will never be a solution for pollinating the hundreds of thousands of wild plants we have. So, if we focus only on the technological fix, which is these pollinating drones, we will ignore our efforts to restore wild pollinators. There is a huge number of unanticipated side effects of technological fixes that often with our one-track thinking, our kind of linear mindset of 'here's a problem, here's a solution', we don't necessarily think in a systems-type way in terms of what burdens are being shifted elsewhere, what's the unanticipated effects. If you just take robotic pollinators, how do they power themselves? Well, they'll need batteries. So, how do we power those batteries? People argue well, they could be renewable; they could use the sun. These batteries are probably going to be toxic if they land in the environment, are eaten by birds and imagine the number of resources needed to pollinate the trillions of flowers on the planet, the number of batteries needed. So, there's an adverse, unanticipated outcome in terms of pollution and waste and resource use that comes from this belief in this technofix of robotic pollinators. Of course, if you take a step back you could say well, we've got these little machines that grow on sunlight; they are self-assembled and they pollinate plants; they're called bees; they're called wild bees! We can just protect those!

So, there's a real danger of unanticipated side effects and we see that in geoengineering solutions where people say well, let's put mirrors in space, let's whiten the clouds by flying planes and putting aerosols out which would create more reflection of the sun's rays. Obviously, for philanthropist billionaires who want to be heroes of the planet you can see these big silver bullet ideas are exactly what they would like to do, but there is huge risk of using the whole planet as a guinea pig and we know that many of these technologies would have side effects. Changing the weather in one part of the world, from putting up mirrors in space would no doubt disrupt monsoons; it would change crop seasonal patterns; it would lead to food insecurity impacts; it would potentially lead to warfare as a consequence.

Some like Elon Musk suggest we're degrading the environment on this planet but we can just colonise Mars. The actual cost of taking Humanity to another planet and terraforming it in the time frame that we have is clearly, on closer inspection, not feasible. And even arriving at another planet that's more habitable than Mars at the moment is not feasible. It would take thousands of years to get a spaceship there and, under current plans, that spaceship would be no bigger than a paper weight. So, trying to think about how to transport civilization, how to colonise another habitable planet is clearly naïve. That's an example where this mindset that we can justify a technological fix is very problematic. We need to recognize a role for technology but we need to certainly balance that with a kind of understanding of the unanticipated effects of technologies; many technologies create further problems that we then use technologies to fix and we become like a dog chasing its own tail. And this is not to say that we should not use technology but we need a greater wisdom in understanding how we harness technology.

L. D. — Regarding the authoritarian way to rule and to face the threats, you say: 'trying to impose environmental sustainability will not work, even though many governments still fail to recognise this with their top-down implementation plans for net zero climate policies as growing civil unrest is showing', and, in a recent webinar, you give for instance the example of the yellow vest protest in France, a couple of years ago, showing that it's really ineffective to try to impose the reform without involving the population. Can you say a bit more about this?

L. D. — Yes absolutely. This is such a live issue; there's an urgency to get emissions down. As we all know, many countries aren't meeting the targets that they've promised to meet even the 1.5 degrees target for global climate warming and so there's a real urgency to make emissions cuts, but they have to be done in a way which brings people along; this is really a people problem and many governments use a much more top-down approach. Most recently, we see the farmer protests in Europe with tractors in the streets of cities, with civil unrest and fires. Many factions will mobilize against the imposition of sustainability regulation and can be quite effective in pushing back. In this case, it led to the European Commission backtracking on regulations around pesticide use and the amounts of land that farms must devote to nature. So, we get an ineffective implementation of what are arguably pro-environmental and progressive ideas about reducing emissions and making our planet more habitable, because the way it's done in a top-down kind of command and control approach is very problematic.

I did a secondment with DEFRA, the UK Department for Environment Food and Rural Affairs and this was just when the ***Net Zero legislation*** been put in place. The first thing they wanted to do was build a model to understand land use in the UK and the emissions that we have from our different aspects of land use and how much of the land would need to change in terms of converting from intensive agriculture to forests or biofuel. Actually, it turns out an area the size of Wales would need to change in land cover and incidentally, it is actually in Wales where we have a lot of upland agriculture, sheep farming, which is not very economically productive. Any policies promoting afforestation of Welsh Upland areas imposed in a very top-down way would likely result in huge push back. Families have been farming these upland areas for generations over time and you can imagine Westminster, where the UK government is based, imposing these land use changes is clearly going to backfire.

John Deere 6320 tractor at Saint-Etienne-de-Fontbellon, France, during the farmers' demonstrations in January 2024. — Credit: Kakoula10/Wikipedia

But there are other ways to do this. If you started with the people first, then talked about having for example more representative democracy where we have citizen's assemblies in local towns looking how we're going to deal with a climate crisis and in a more bottom-up way, we generate these possible solutions. We can look into the evidence of what's more effective, what's not, but in a much more democratic way. We generate a plan for Net Zero together and we think about who the losers of that plan are and the ideas of a just transition are hugely important here. Those assemblies might have come up with the same solution such as: this sheep farming in the hills of Wales is hugely inefficient, we want to think about now adding more trees to those landscapes. You can have the same solution, but the chance of it working through one route which is very much top-down imposition– command and control– versus a much more bottom up co-development of solution, you can see that one is much more likely to be effective. With Net Zero, these are such big changes in the way we live, the way we work, the way we travel, that we have to really bring people along. I think that's a lesson that governments are rapidly having to learn with Net Zero in the UK, with the yellow-vest protests around fuel price rises in France, with the farmer protests about more green regulations on farms all over Europe. I think governments rapidly have to become a bit more genuinely democratic in how we think about implementing these changes so they can really bring people along.

L. D. — You wrote in Part 3, Chapter 9, entitled 'Locked-in' that "Balancing reductionist approaches with more holistic understanding becomes particularly important when dealing with complex 'wicked' problems, such as issues like obesity, the mental health crisis, pandemics, climate change, soil health and biodiversity loss. Despite these being the critical urgent issues of our time, 'systems-thinking' is not something we generally learn well in schools, universities and workplaces. These institutions instead create intelligent people that sometimes work together in a way that produces stupid outcomes." I love this sentence and the example of the yellow-vest protest in France is a very good example of this.

Your clear-sightedness about the seriousness of the threats we face in no way means that you are pessimistic, quite the contrary. In fact, your approach is positive. You indicate what you think is the way forward to achieve effective change and deal effectively with these huge threats. The usual objection is that changing mentalities takes a lot of time and that we don't have any. How do you respond to this objection?

T. O. — I like the saying: 'this is an emergency, we need to slow down', because, if you try to solve a problem by running off in the wrong direction, you're equally not going to be very effective. Actually, thinking a bit more carefully about what are the root causes of this planetary environmental crisis and where do we really need to make the changes leads us to this idea that we need to go right down to the level of how we think and who we feel we are in relation to others and the natural world. So, we need to go to that level of deep inner transformation as it were, to think in particular of the impact of excessive individualism in society where people are looking out for themselves or just their close family at the expense of other people and expense of Nature. This sense of individualism or even narcissism taken to the extreme is hugely damaging. How do we challenge our current world views? How do we challenge this idea that we are these isolated individuals, separate from each other and separate from nature, which is not supported at all by science from a huge range of disciplines now, from cell biology, evolutionary biology, neuroscience, cognitive psychology, etc. I believe we need to move away from the view that humans are exceptional and separate from the rest of the web of life, by really decentering the human and seeing ourselves as part of this more than human world.

It's easy for people to come back and say well, actually, it's fine to change individuals but isn't it about how our societies are run, our institutions, our economies, our justice systems, how do we change all those? But those are made up of our worldviews, past and present, and to really change those institutions, we need to change people and how people think and what people feel is their role in the world. Of course, institutions constrain how we think and how we feel, there's no doubt about that. Equally, individuals and their worldviews combine to form cultures which shape our institutions.

There's no simple solution. Here, it's a kind of 'chicken and egg' situation. There are feedback processes between the social and the individual worldview, but there's a definite place we can intervene at the level of how we think, and this can cascade up because the way we talk, the way we act, the way we influence other people, we see these cascades of social change happening and we see these changes in the way institutions can be run. For example, how can we run corporations, not just with a very highly market driven neoliberal mindset where we're trying to make profit for the shareholders? We can think about the values that permeate an institution and if we make those values pro-social and pro-environmental, those corporations would operate in a very different way than simply a company that's forced to do some natural capital accounting and tweak some of its supply chains. A values-driven corporation can completely transform the way it operates. These are the types of approach in terms of thinking about the role of of attitudes and values in tackling the environmental crisis. Actually, what's promising is a lot of science policy organisations from the IPCC to the United Nations Environment Program (UNEP), to the European Environment Agency are now voicing this in their reports and recognising that we need to go beyond technological, economic fixes, that we need to look at changes in culture, changing the paradigm by which we view ourselves and the rest of the world, and there's an explosion of science as well in the mechanisms by which we can create those inner changes. So, I think it's an exciting time in terms of how we can refocus how we tackle the environmental crisis.

L. D. — Yes, absolutely; it's important to finish this interview with this very positive note because I think we all need it and, very interestingly, you say that it's not that we are disconnected, it is that we don't know that we are connected; we have forgotten that we are.

T. O. — Some religions or spiritual traditions have been saying this kind of thing for a very long time. There is a deeper level here, when we get down to this idea of inner change, where we start to see the interface between science and spirituality. What I would like to see more of is this evidence-based approach to spirituality, rather than just a religion saying well, we're all one, we're all connected to Nature. As I wrote in my first book, The Self Delusion, the science can actually show us that this is factually correct in terms of our microbiome, the fact that our bodies are full of bacteria– a roughly equal number of bacteria in our bodies as human cells, how our social networks work– where every word that we hear, even every pheromone, are transforming our minds all the time, that our minds are porous and that we're influencing each other constantly. So, the science is really evidencing what many of these traditions have been saying. Regarding how we transform our world views, we can also use science-based practices to think about how we measure that change. We're trying now to harness some of this evidence so that we can bring it to the table, understanding both the risks and the opportunities of these different approaches, how effective they could be, how they could be combined to really challenge our existing worldviews of individualism and anthropocentrism, really challenge them and open up opportunities for a different way of thinking about ourselves, and acting which could be I hope more transformative for how we address the environmental crisis.

Yellow-vests protesters (gilets-jaunes) during the climate march in Paris, 16 March 2019