

Speech by Sir Matt Ridley  
Opening of the Academic Year 2017/18  
Science as the basis for optimism

Thank you, Louise, very much for that kind introduction, and President Fresco, Rector Mols [sic], and other distinguished guests, may I just say what an enormous pleasure and honour it is to speak at this incredibly distinguished university, which combines applied and fundamental research in the most appropriate and fascinating way.

Now, I'm going to give you some reasons for environmental optimism of the kind that Louise was just mentioning. This is not because I'm going to say that the world is alright, let alone perfect; quite the reverse. I'm going to say that compared with what it could be, there are enormous improvements we could make. And I'm not going to say that we're on the way to making all of these – there are a lot of things wrong with the world, even as we speak. But I am going to say that there are reasons to think that, with the appliance of science, we have every reason to give people hope about leaving the world in a much better place for our children and grandchildren than we found it. And that is really the gist of what I think that one can argue.

Let me begin with human welfare. If you ask people this question, and this is a question put to people by the late, great Hans Rosling, who many of you will have seen speeches by, who sadly died last year. "In the last twenty years, the proportion of the world living in extreme poverty has almost halved, almost doubled, or stayed the same?" When this poll was taken, the answers given to that question were that only five percent of people thought that it had almost halved, sixty-five percent thought the proportion of poverty had almost doubled, and the rest were in-between. And that's wrong, because the right answer is that the number the proportion of the world living in extreme poverty has almost halved in the last twenty years. So, a lot of people get the wrong answer. But Rosling realised that it's worse than that, because if you wrote these three answers on three different bananas and threw them into a cage full of monkeys and asked them which banana to pick up first, without knowing the question, they would get the right answer thirty-three percent of the time, not five percent of the time. They would do six times as well as people. So what is this telling us? It's telling us that, when it comes to what's going on in the world, sometimes we're worse than ignorant; we're actively wrong. We know things to be true which are not true. Or, as Daniel Boorstin put it, "The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge."

In the last in my lifetime, the proportion of the world living in extreme poverty has plummeted from two-thirds to less than ten percent. Now, obviously this is extreme poverty and there is still an awful lot of poverty above this level; we're not don't yet with solving this problem, no one suggesting that, but it is the most remarkable transformation, which has never happened in the history of humanity before – that most people are no longer extremely poor. And accompanying this, there has been a spectacular decline in child mortality in every continent, the greatest measure of misery anybody can think of, which is really one of the greatest achievements in human welfare. And not only that, but people are becoming more equal in the world. We hear all the time about increasing inequality, but globally, this simply isn't true. In the 1970s there was a great valley between the rich world and the poor world, between the first world and the third world. Today, there is a great mountain where that was instead. And although continents like Africa have lagged behind in this process, nonetheless, people in poor countries have been getting rich faster than people in rich countries and that is generally tending towards make the world more equal.

Now, I'm very influenced by the fact that, as a student in the 1970s, I heard a lot of pessimism about the future and it got me down, frankly. I began to think that there wasn't much future for my planet and my life, because I heard about how the population explosion was going to be unstoppable, global famine was inevitable, crop yields were gonna [sic] fall, the cancer epidemic caused by pesticides was going to shorten human lifespan, the desert was advancing at two miles a year, rainforests were disappearing, acid rain was going to destroy forests, oil spills would get worse, oil and gas were going to run out, but so would copper, zinc, chrome, and many other natural resources, the Great Lakes were dying, dozens of birds and mammal species would go extinct every year, and a new ice age was on the way. And it culminated, of course, in the idea that civilisation would come to a thundering stop on the 31<sup>st</sup> of December 1999 because our computers couldn't cope with the date change.

So when I grew up and found that quite a lot of these were badly exaggerated, if not downright wrong, it made me a bit of a passionate believer in the idea of going around and telling people, "It isn't quite as bad as you think, there's quite a lot of good things going on." And I think it's very important to give that message, particularly to young people, because, actually, it's knowing that there is hope that motivates people to achieve things, much more than giving them a council of despair.

So, let me talk a little bit about some of the things that, as I say, were the environmental scares of my youth. Pollution was going to get worse. In fact, this is the UK air pollution – not as good as it should be, and a lot worse than it would be if we hadn't gone for diesel cars in a big way, but nonetheless, dramatic improvements over the last few decades in pretty well all measures of air pollution. The decline of oil spills worldwide, down by some ninety percent since the 1970s, because of double-hulled tankers and GPS steering and other and regulations and all these kind of things. Remarkable improvements in one of the worst forms of environmental local damage that happened when I was young.

What about population and food? Because the big one was that we were gonna [sic] run out of ways to feed a growing population. World population has peaked sorry world population growth has peaked. It has fallen from two point one percent in the 1960s to about one percent today. That's to say it's going up slower and slower and the absolute number of people added to world population each year is actually has been going down for twenty years. That is not to say that the population is not still increasing; it is and it's likely to get to ten billion before it stabilises. But nonetheless, the end of the population boom is in sight. Population will not double in this century whereas it quadrupled in the 21<sup>st</sup> century. And at the same time, despite this increase in the number of people on the planet, the amount of food available per head has gone up on every continent, again Africa lagging behind a bit, but still improving steadily throughout this period.

But, more important, I think, the footprint of farming has been shrinking. This is to say the amount of land that you need to produce a given quantity of food, averaged over all crops – this is a calculation by Jesse Ausubel and colleagues at Rockefeller University – is down by sixty eight percent since the 1960s. And that means that we can feed more people from a smaller area of land and we can actually look forward to the prospect of feeding ten billion people from a smaller farming acreage than we feed seven billion from today. If these trends continue we will be able to release an area of land the size of India from the plough and the cow by the year 2050. One of the things that's contributed – the main thing that's contributed to this, of course – is mechanisation and fertilisers and pesticides and those sort of things, but let it not be forgotten that biotechnology has made a significant contribution to this. On this chart you can see the dotted lines are crops that have not been genetically modified and the solid lines are crops that have been genetically modified. And sugar beet is the exception that proves the rule, because it's [sic] only recently been genetically modified and so it's catching up with the others.

So this point, sustainable intensification, which is one that Louise brings out in her fantastic book, "Hamburgers in Paradise," is such an important idea; that if we can get better at growing crops on the land we do use, then we won't need to use so much of the planet. And the logical end point is to bring farming indoors with LED lighting of this kind, this is in I think Japan, but I know it's happening here in the Netherlands as well, and I know that it's being studied here at Wageningen University. I don't think all farming is gonna [sic] go indoors. It's probably a niche thing for lettuces and herbs and so on for quite a long time yet. But nonetheless, the idea that you could bring farming closer to the consumer, use less pesticide – no pesticides at all, because you're essentially growing in a sterile environment – use less water, less fuel, and use a much smaller footprint of land is an exciting prospect. And what it does is it reduce releases land for nature again, and this is the Oostvaardersplassen, which I know is a controversial project here in the Netherlands, but is just a little example of the kinds of rewilding experiments that are happening around the world with land essentially released from agriculture.

What about forests, though? Are we not losing our forests at a terrifying rate? Well, actually, of course in the developing world we are still deforesting and there is still horrible pressure on tropical forests in particular. A lot of it coming from the need for indigenous...from indigenous people for firewood for burning as well as from corporate interests for other reasons. But, in the world as a whole, the deforestation project has just about ceased. According to the FAO the net annual rate of forest loss is now point naught eight percent, which is pretty well zero. So, the world has stopped losing forests. It's still losing forests in poor countries, but it's gaining forests in rich countries, which is a, you know, not the way round that we'd like it, but it is a start, and this is an example of something called the Environmental Kuznets Curve, which argues that, as countries get richer, they tend to damage their environment until there comes a point when they get rich enough to start reversing the damage. And the evidence suggests that the inflection point is around for forests is around four and a half thousand dollars per capita GDP. And countries like Bangladesh, for example, are now reforesting and are above that level of GDP.

What about resources, though? Are we not gonna [sic] run out of minerals and metals? I don't think so. We run out of renewable resources all the time when we overdo them, like for example whales, we ran out of whales. But non-renewable resources, it's very unlikely we will hit the limits. By now, according to a book that was very influential when I was young, we should have run out of aluminium, copper, gold, lead, mercury, molybdenum, natural gas, oil, silver, tung, tungsten, and zinc. In fact, our production of these metals has gone up and up and the price of them, more importantly, has gone down. And there was a very important wager in the 1980s between an ecologist and economist, Paul Simon and Julian Ehrlich, about this point. Simon challenged Ehrlich to say, "Look, I think the price of metals is gonna [sic] go down over the next ten years." And Ehrlich said "No, because they're running out they're gonna [sic] go up." Ehrlich was allowed to choose the five metals that made up the wager. Nonetheless, he still lost and he had to write Julian Simon [sic] a cheque for five hundred and seventy dollars.

But are we not running out of water? Well, again, the amount of water on the planet isn't changing. We are mining it problematically in many places and there is an awful problem of access to clean water supplies and sufficient water supplies in many parts of the world. But about ninety percent of water use in the world is used in agriculture and in there, we are incredibly wasteful, largely because we don't price it properly and so we don't give people an incentive to be better conservationists. And where that is happening, in countries like Cyprus and Israel, you are seeing 95 percent reductions in the amount of water used in irrigation by shifting to hydroponic and drip irrigation systems. So the technology for living more frugally with water is there, it's simply a matter of applying it. And even the United States, per capita water use has now been falling for several decades.

Wildlife. My favourite topic, I'm a keen naturalist and I love travelling the world looking for wildlife. We're losing a lot of wildlife, no doubt about it. We are seeing extinction of species, but we're losing biodiversity of other kinds as well. Nonetheless, there are reasons for optimism, because take, for example, the situation with the wolf. Wolves have been seen here in the Netherlands. Wolves are increasing all around the world – they're increasing in North America, they're increasing in Eurasia. Lions are decreasing. Tigers are roughly holding their own. There was a slight increase in tiger numbers in the last few years. What explains this pattern? Well, I think it's very simple. Wolves live in rich countries, lions live in poor countries, and tigers live in middle income countries. And this pattern is actually seen with a lot of wildlife. We're seeing wildlife return to -in many rich countries. Things like beavers and seagulls here in the Netherlands. Whereas we're still losing wildlife pretty dramatically in the poorest countries.

And, as for species, this is the total extinctions of mammals and birds over the last five hundred years, roughly – peaking in the 19<sup>th</sup> century, with another severe peak particularly for mammals in the 1960s. So, yes, a huge problem, and yes, a catastrophe for these species. And remember we wiped an awful lot out a long time before that at the end of the Ice Age with the Pleistocene megafauna extinctions. But not actually as great as was predicted. Here are some of the predictions that were made when I was young about species loss. Dillon Ripley, a famous conservationist in the 60s said that seventy five to eighty percent of all species would be gone by 1995. Pollan and Earle [sic] said 50 percent by 2005 – rather more modest a prediction. And Thomas Lovejoy said 15 to 20 percent by 2000. Whereas the true figure is that we've only lost 1.3 percent of mammal species and 1.4 percent of birds, the vast majority of which are island species; we've lost many fewer continental species, as it happens. Now, that's still a problem and one we must learn to deal with, but it is important to set it in the context of the predictions that were made.

Now, interestingly, particularly with respect to birds, the cause of extinctions is largely invasive species. That is the problem on islands, where it's rats and cats and avian malaria and things like that, that are wiping out island species...much more than other causes. Other causes are important, too, but it's important to focus to remember where the problems are, and in this case invasive species are a key part of the problem. I was in Hawaii recently and I was lucky enough to see this bird, the ewe, but you can only see it in very high elevations on volcanoes now. Why? Because that's above the level where the mosquitoes get to and mosquitoes carry avian malaria, to which these all these Hawaiian honeycreepers are particularly vulnerable. Now, I think that's a soluble problem: get rid of the mosquitoes. But you say, "well, hang on, mosquitoes are natural, too," not in Hawaii they're not; there are no native mosquitoes in Hawaii, and certainly the avian malaria parasite is not native to Hawaii. So you would actually be returning it to something like a natural state if you could get rid of the mosquitoes. But can you really get rid of mosquitoes in Hawaii? Well, this is where genetic engineering technologies come in. The genetic engineering to suppress populations of mosquitoes is a fantastic new technology that has proved immensely successful in Brazil in fighting dengue-carrying and Zika-carrying mosquitoes and carries the prospect that we could use this tool, this genetic tool, this piece of science, in a wonderful conservation purpose and see the honeycreepers not only safe, but back in their natural habitat.

Last year I was lucky enough to go to the island of South Georgia in the South Atlantic in the sub-Antarctic area, where I saw a cornucopia of wildlife, absolutely bursting with wonderful species. But I wasn't looking at a pristine paradise; I was looking at a restored masterpiece. The fur seals were virtually extinct a hundred years ago. The elephant seals were extremely rare. The penguin colonies were down to a few hundred. Now there are hundreds of thousands in each colony. The wandering albatross were there still and are not particularly more numerous today, but are now thriving again after a period when they were devastated by the fishing industry. So, what's happened here is an example of the fact that, because we no longer want to kill the fur seals to make hats, and the elephant seals to make oil, and the penguins to throw them in the furnaces of steam ships, which is what was happening, we can actually take the pressure off a lot of Arctic

and Antarctic wildlife and we are seeing these species come back. Most remarkably of all on Antarctica, sorry, on South Georgia, they have got rid of the rat entirely, last year they finally eradicated the rat from the entire island with a technology developed in New Zealand and that has brought some of the petrels back onto the mainland island again, where they're thriving. So, conservation can benefit from science.

I thought to myself a few years ago, "We're probably increasing the speciation rate even as we're decrease - as we're increasing the extinction rate, because of the way we move species around the planet and introduce them to new habitats." But I thought that was a slow process. And then earlier this year I read a book by Chris Thomas of York University called "Inheritors of the Earth" in which he argues that, no, this is a much faster process than you think and that there are all sorts of new, incipient species on this planet as a result of us moving creatures around. The apple maggot fly has evolved quite distinct now from its ancestral fly to live on apples in North America and is starting to look very different from its ancestral species. The Italian sparrow came about after a hybridisation between the Spanish sparrow and house sparrow and is now a distinct species, and so on. So, if we all went extinct, if all human beings disappeared, it's a fair bet that the end result would be that, yes, we've extinguished a lot of species, but actually we resulted in the creation of a lot of species, too. Most habitats now have greater biodiversity in them because of introductions by man – which is not always good, because some of these invasive species are dangerous, but it is nonetheless true that increasing biodiversity is possible.

The logical endpoint of this one is to bring back extinct species. Impossible, you think. I would have said so too ten years ago – I probably do still say so. It probably will never be possible, but it's just beginning to look, because of CRISPR and Casper [sic] Cas9, because of the ability to read genomes of extinct species, and because of primordial germ cell transfer and technologies like that, it's possible to start having a conversation about whether or not we might be in a position, in twenty or thirty years' time, to recreate the passenger pigeon or the great auk, the only breeding bird species in Europe to have gone extinct in five hundred years.

What about the climate change debate, because this is where I've been criticised for being too optimistic? And let me state very clearly that I am someone who thinks that global warming is real, is happening, and is at least partly, possibly largely, man-made, and that, in that sense, the physics is undeniable and the trend is clear. But it is happening slower than forecast. In 1990 we were told to expect by the Intergovernmental Panel on Climate Change point three of a degree per decade. We've had barely half of that, whichever method of measuring it you use, and this is a graph just showing the difference between the models and the actual observations. And the effects of climate change are not showing up as bad as we had feared by now. When I first started writing about it, when I was very alarmed about it, in the late 1980s, we were expecting it to make things like storms worse. Global weather-related disaster losses as a proportion of GDP have actually gone down in the last few decades. The number of deaths from storms, floods and...I think I missed a slide there...no...the number of deaths from storms, floods, and droughts, have actually dramatically decreased in recent decades – not because weathers [sic] got less dangerous, but because we have better transport, better communication, and better infrastructure to adapt to these problems. And actually, if you look at cyclones like the devastating one that has just recently hit...hit Texas, the accumulated energy of cyclones, that is to say the frequency and the ferocity of cyclones, has shown a lot of variation, but it is not showing an upward trend.

The percentage of the world in drought, in moderate or severe drought, has actually shown a slight decline over the last thirty years, and this is consistent with the fact that rainfall has shown a slight increase. So, the way I see the climate change debate is that at the moment it's very polarised. You either say it's real or it's not real, or you say it's dangerous and not or not dangerous. And that it is assumed that you if you say it's real you must assume it's dangerous and if you say it's not real then you must assume that it's not dangerous. But, actually it's perfectly possible to think that it's real and not very dangerous and this is what I call "lukewarmism," other people have called this "lukewarmism".

Which brings me on to the subject of energy and the energy footprint of mankind and its effects on the planet. As I say, the Intergovernmental Panel on Climate Change doesn't actually give a specific prediction for how much warming we're gonna [sic] get. It gives a range of possible outcomes using four different scenarios. And the pink one is a really dangerous one in which the world definitely gets far too hot at the end of the century and the blue one is a harmless one in which it's not a problem...and the other two are in-between. When you hear dire predictions, they're always based on that pink scenario, but what is that scenario, the RCP eight point five scenario? This is its assumption about global energy use in the 21<sup>st</sup> century. It assumes that we will be burning ten times as much coal as we are today and we will depend on coal for fifty percent of our energy sources. Now, I have a financial interest in coal, because I come from the northeast of England, which I declare frequently. But I don't think that's gonna [sic] happen. I think that's extremely unlikely; I think it's much more likely that gas will displace coal than that coal will displace gas. So my point is that there are some fairly unrealistic assumptions behind that scenario that have to be challenged from time to time.

And meanwhile, the dash for renewable energy feels to me like a mistake, in some respects, because of the land hunger of renewable energy, because they need so much greater footprints of land. Nuclear energy has a very small footprint in terms of hectares per gigawatt; gas, somewhat larger; solar photovoltaic, quite a bit bigger. Wind is huge and if you rely on wood as most of the European economy did for many centuries, then you need a gigantic hectareage [sic] per gig per gigawatt. You simply couldn't fuel a modern economy like a European economy from wood. To put it in perspective, if you wanted to supply today's world electricity demand – not the rest of energy, not transport or anything else – simply from wind, you would require a wind farm the size of North America, including Canada. That's really not gonna [sic] be feasible and this isn't based on some inefficient version of wind; this is the basic physics of the low density of wind energy. Meanwhile, we're doing things in the name of climate policy that I think are mistakes, like, for example, the biofuels programme – ethanol and biodiesel – which is essentially turning food into fuel, displacing extremely little oil use in the process, but driving up the price of food, which is increasing malnutrition and is in a sense in that sense a mistake.

Meanwhile, a billion people live without electricity and many people without access to gas in the developing world, and cook over wood with dire consequences for their health – it kills about three million people a year, cooking over wood stoves. And this is something that we could do something about, because if you take the island of the island with Haiti and the Dominican Republic on it, you can see the border between these two countries terribly clearly, because Haiti is deforested dramatically, because it relies on charcoal on wood for almost all of its cooking and domestic needs, whereas the Dominican Republic actually subsidises propane as a cooking fuel, so that people will not go out into the forest and cut down the trees.

Final reason for ecological environmental optimism is the discovery in recent years of how much global greening is going on. It's well known that if you increase the CO<sub>2</sub> in the air, that plants grow faster, that's why commercial greenhouse growers here in the Netherlands use CO<sub>2</sub>-enhanced atmospheres in their greenhouses. But what has not been well known until recently was whether this was having an effect on the global scale. And we now know, because of detailed publication of data based on satellite data, that the global area of leaves on the planet is increasing, and has increased by some fourteen percent over the last thirty years. And this is happening in all ecosystems throughout the world, most notably in arid ecosystems like the Sahel region of Africa. The effect is enormous, as Zaichun Zhu, the lead author on the paper that was published last year, put it, "The greening over the past thirty three years reported in this study is equivalent to adding a green continent about two times the size of main of the mainland United States and has the ability to fundamentally change the cycling of water and carbon in the system." Now this beneficial effect may run out of room eventually, we don't know, it's not impossible. But it is nonetheless a much larger effect from CO<sub>2</sub> than anything we can pick up on the climate side so far, and seventy percent of the cause of that greening is CO<sub>2</sub> enhancement. And the effect is to improve the water use efficiency of plants all around the world – this is a more recent study showing that.

So, in summary, I boldly predict – and I might well be wrong – that as long as we use science in the way that is being at this wonderful university, we can have cleaner air and water, abundant mineral resources, less land farmed, more and larger nature reserves, increased forests, greater local biodiversity, more species, and a greener planet in the year 2100. Thank you very much.