

**Transcript of Johan Rockström’s talk on Radio National’s Science Show, September–October 2020, about the state of the planet and what we need to do.**



**A brilliant talk: If you only listen to one talk about climate change, this should be it.**

**Johan Rockström** is a distinguished and awarded global environmental scientist and a diligent debater of climate issues. He has been appointed “The most powerful environmental person” in Sweden twice. Radio National’s Science Show hosted Rockström’s excellent talk over several episodes. In the program Johan Rockström says there’s a climate emergency. Rockström is a professor of Global Environmental Science and the director of the Potsdam Institute for Climate Impact Research in Germany – one of the most well reputed climate research institutes in the world.

Each **episode heading below is a link** to the [Science Show](#) website. Another way to find and listen to the series of course is via the [ABC’s Listen app](#).

## Contents

<b>EPIISODE 1: Window closing for action to stabilise the Earth’s climate</b> .....	3
<b>EPIISODE 2: Stressed planet sending clear warning signs</b> .....	5
<b>EPIISODE 3: Urgent action required to steer clear of climate tipping points</b> .....	7
<b>EPIISODE 4: The Amazon regulates the planet’s climate and we’re burning it</b> .....	10
<b>EPIISODE 5: Fixing the climate emergency is today’s Apollo mission</b> .....	13
<b>EPIISODE 6: Sustainable healthy food boosts health and planet</b> .....	15
<b>EPIISODE 7: Ten steps for best chance of climate stability</b> .....	18
<b>EPIISODE 8: Fixing the climate emergency must start now</b> .....	21

## **EPISODE 1: Window closing for action to stabilise the Earth's climate**

Robyn Williams: This is Science Show number 2,293. When I began the program, exactly 45 years ago this week, our first show included a plea from Lord Ritchie Calder to do something useful to tackle climate change. He had been worried about it since 1963, and there we were in 1975.

Well, now in 2020, Craig Reucassel and friends have shown what you and I can do at home, but what about the international scene? Here's the first of a series of short talks we will run in the next few weeks, after which today we'll go to LA, Melbourne, Perth and South Georgia.

Speaker: This is the English version of the Swedish radio show Vinter i P1 with Johan Rockström. The program is a very well-known radio show in Sweden where a person is given the freedom to talk about whatever they want and play whatever music they like.

Johan Rockström: Dear friends, welcome to 2020, the year of truth, the moment of truth for our future on Earth, the year when the rapid rising curves of global environmental changes, our damage to the planet, must start bending downwards to give us a chance of having a stable planet to live on.

This might sound alarmist, but it is only laying out the facts. This is the place to which all of the misguided roads of the last 50 years have taken us. Don't misunderstand me, we've made phenomenal progress where we are producing more food and human well-being than ever before. But these things have happened entirely at the expense of our planet. Our planet has been forgiving for the past 150 years of industrial development and globalisation, but it has now hit the ceiling which she can tolerate, and she did this already some 30 years ago.

Throughout this period, the science has been clear, and the knowledge is there for those who want to know. But political ineptitude, economic short-sightedness, systematic manipulation by powerful stakeholders, and the media's inability to deal with loud, marginal and false climate change denial has resulted in a negative cocktail that has slowed down action on climate change. And now we are where we are; a political failure. We have lost 30 years since the United Nations Intergovernmental Panel on Climate Change, the IPCC, submitted its first report. We've lost ten years since the failure of the climate summit in Copenhagen, when the problem was finally to be solved. And now it's five years since we signed the Paris Accord in 2015.

Despite all the good intentions and the upscaling of renewable energy, global emissions of greenhouse gases continue to rise by 1% to 2% per year. We are burning more oil, coal and natural gas than ever before, just when we promised we would stop. This is only one side of the coin. Behind a stable climate, there is a resilient and strong biosphere; living nature in the oceans and on land. But our animals, plants, forests, soils, ice sheets and seas are following the same, potentially disastrous trends.

The fact is that the planet is in a state of emergency. What we do this year and the following one to two years will probably affect the living conditions of all future generations. It is about the future of our children, mine and yours, and their children. And don't forget, we live in a world with 7.7 billion inhabitants, all with the same right to a decent life. The world's population will grow to around 10 billion people in just 30 years. We have close to 1 billion people living in absolute poverty, poverty that we have agreed to eradicate by 2030. We have a world economy of almost US\$90 trillion per year, forecast to more than double over

the coming 30 years. It is this rapidly growing world that we must keep within Earth's safe operating space.

To stop global warming, all countries in the world need to reduce their emissions by approximately 6% to 7% per year. If we delay, emission reductions need to be even faster and that is simply not possible. 6% to 7% per year is already incredibly fast. It is a pace of revolution.

And politically, unfortunately, the picture looks anything but rosy. Trump has withdrawn from the Paris Accord and he did so with the most destructive and dishonest message one can imagine: The world's richest country cannot afford to implement the Paris Accord, to ensure that Americans can continue their current levels of consumption.

When Saudi Arabia listed its state oil company Aramco on the stock exchange market, it immediately became the world's highest valued company. It is clear that the market is betting on the Paris Accord failing.

This is our current situation. The moment of truth is now. Are we serious about this or are we not? It's time to rise up. Five years ago when we met in Paris, I was still optimistic. The window was still open and the planet wasn't exhibiting too many causes for catastrophic concern. Now things are different. Today, I'm genuinely worried. I don't know if we're going to make it. I will in this program make a public confession, rub scientific salt in the wound, declare war, call for revolution and provide a ten-point agenda on what I believe needs to be done in the world in the next ten years.

My name is Johan Rockström. I'm a professor in Earth System Sciences and the director of the Potsdam Institute for Climate Impact Research in Germany.

Boris Johnson took the stage at the United Nations headquarters in New York during the heads of state climate summit in September 2019, and with his disarmingly boyish and highly calculated style gave his full support to declaring a state of planetary emergency. His punchline was typical for Boris Johnson: 'There are more UN bureaucrats in the world than there are Indian tigers on Earth. There are more heads of state than there are humpback whales. At this pace of destruction of our planet, we have reached a state of planetary emergency.'

Before him, Frans Timmermans, executive vice president of the European Commission and responsible for the European Green New Deal, had said that he too, along with another eight heads of state, supported the declaration of a state of planetary emergency.

To declare a state of planetary emergency is no small thing. When you think about it, if it ever has to happen, it can only occur once during our existence on Earth. So the big scientific question is: Are we facing catastrophic risks, which would justify declaring a state of planetary emergency?

19 years ago, in 2001, when the third IPCC report was released, the assessment was that big catastrophic risks, such as permanently losing Greenland or Western Antarctica, might perhaps occur at 5°–6°C of global warming. In other words, it was virtually unthinkable. In 2018, two IPCC reports later, and after the IPCC's 1.5°C report, we know better. The risk of catastrophic warming has crept down to between 2°–3°C. This is the new risk landscape we're faced with. Go above 2°C and we are at risk of permanently damaging our chances on

Earth. At the moment we are on track to reach between 3°–4°C of warming in just 80 years, when your children have their own adult children.

Today we have more scientific evidence than ever before. Just since the 1970s we have managed to wipe out 60% of populations of vertebrate animals on Earth, which has also resulted in the loss of species, such as the West African black rhino, the Asian river dolphin and the Tasmanian tiger. Today over 60% of mammals in the world are livestock; cows and pigs. Only 4% are wild animals in nature.

We have polluted our environments with such large volumes of microplastics, nitrogen phosphorous and other chemicals, that the very foundation of our prosperity—natural ecosystems—are showing alarming cracks. The devastating moral implications of our behaviour is made painfully clear when we look at images of dead whales with their bellies crammed full of our plastic waste.

But the risk landscape in itself is not sufficient to declare something as drastic as a state of planetary emergency. Time is also running out. The window to avoid major catastrophes is still open. But only barely. During the next decade, global emissions must be cut by half and we must halt the loss of species on Earth. That's the reason. That's the basic justification for declaring a state of planetary emergency.

The idea is not to create panic, or scare people into taking action. We have done this because you have a right to know, and because there is still time. The window to a manageable planet is still open.

## **EPISODE 2: Stressed planet sending clear warning signs**

Robyn Williams: We begin as we did last week with the head of a renowned institute in Germany, led by a Swede. After Craig Reucassel showed us the cheeky way to deal with climate at home, and The Great Acceleration last Tuesday on ABC television brilliantly told the energy story, Johan Rockström talks now about our global future and its terrible urgency.

Johan Rockström: My assessment is that the world at large understands that we are facing a global climate crisis.

In Madrid at the Climate COP 25 meeting, an official plenary session was organised on the need to understand that we are facing a climate emergency. Science, youth, policy, finance and indigenous communities all made a joint case for a state of climate emergency. Check out this session. It is quite a landmark in the 25 years of COP meetings. It is the plenary from 11th of December 2019 at 9 o'clock in the morning. It ended with the large stage being occupied by young people from Fridays for Future, pleading with the adult powers in the room to act according to the emergency that science now shows we are facing.

But alas, despite a constructive shake-up in Madrid, the world is so far not capable of solving the planetary crisis. It is not so much due to the lack of understanding, or even efforts being made, it's the lack of willingness to do what is necessary to continue defending marginal change and the inability to step outside of our conventional frameworks that lock in the economy, trade, politics and power structures.

With a state of planetary emergency, as with other emergencies, solutions that were previously considered impossible may become possible. Suddenly, introducing a global price on carbon may no longer be only in the realm of wishful thinking.

And who knows? We might suddenly be able to have a serious discussion on stopping all funding for coal power and all finance flows for fossil fuel infrastructure already during this year of truth. Why not when we meet in Glasgow for COP 26? And perhaps we can now finally talk about setting a global moratorium of destroying the remaining natural ecosystems on Earth, our insurance towards irreversible changes, thanks to their carbon sinks and their ability to circulate nutrients and water. A good point when world leaders can do this is when they meet in China later this year, at the United Nations Convention for Biodiversity in Kunming.

And honestly, we have quite some evidence of impressive action during other states of emergency. I mean, just take 9/11, Brexit and the global financial crisis in 2008. These are different types of emergencies that have mobilised political power in a way that, bizarrely, we've never seen directed to save our planet. I mean, when did you last see a European Union, or any finance minister, shuttling back and forth, in this case to Brussels, to save the planet?

It is now high time to change this. Over 1,000 municipalities and regions in the world have declared a state of climate emergency. Five countries—the United Kingdom, Portugal, Canada, Argentina and France—have done the same.

The aim is not to create panic. It is to mobilise those in power in the world to act. This year, we want a proposal of declaring a state of planetary emergency on the agenda in the United Nations General Assembly. It remains to be seen if we will succeed.

In August 2019, a memorial ceremony was held for Okjökull glacier in Iceland. It has melted and shrunk so rapidly that it has lost its status as a glacier; 'dead ice' according to the glaciologists. The first official victim of global warming. This is occurring at 1.1°C, the warmest temperature on Earth since we left the last ice age 12,000 years ago.

I'm really sad to say we can now publicly announce the list of the first planetary victims of global warming. It is a largely unexpected list and the victims have fallen at a faster rate than we scientists had anticipated.

Victim number one: The Arctic summer ice. The rate at which the ice sheet has shrunk, and in particular that the ice now consists mostly of young first-year ice so that in principle all the old multi-year ice is gone, means that the trend cannot be reversed. In 30 years, the Arctic will be an open sea in summer, which will impact the jet stream and cause extreme weather such as drought and heat waves in the countries in the northern hemisphere from Canada and the US to Scandinavia and Russia.

Victim number two: Several glaciers in Western Antarctica may already have crossed the tipping point, which means that they are inevitably sliding out into the ocean. This would add another two metres of global sea level rise. For a long time we thought that the Arctic was the more sensitive of the poles. It now appears that big brother Antarctica is probably the more fragile of the two.

Victim number three: Our tropical coral reefs. This is a huge drama. 50% (yes you heard correctly), half of the world's biggest marine ecosystem, the Great Barrier Reef in Australia, has already been lost. Coral reefs cannot cope with the heat. They are extremely important nurseries and spawning grounds for fish and a source of livelihood for over 200 million people.

Many systems that can tip over from a good to a bad state have begun to show signs of shifting. The northern polar jet stream is one such system. The abrupt changes in weather from heat waves to extreme cold and drought in North America and Europe have one thing in common: Changes in how the jet stream is behaving. This jet stream is a narrow band of strong winds that circulates from west to east around the Earth in the northern hemisphere, around 10 kilometres up in the atmosphere.

Meanders, big curves in this jet stream generate gigantic planetary waves called Rossby waves, which control high and low pressure systems, weather fronts and how warm and cold air masses move or remain stationary over northern latitudes. Where the jet stream is and how it changes has a direct impact on our weather.

During the extreme years of 2003, 2010, 2018 and 2019 the jet stream exhibited some strange behaviour. It slowed down and very deep Rossby waves were generated. In 2018, these waves ended up in a quasi-resonance, which formed an unusually stationary seven-leaf clover-shaped pattern of weather over the entire northern hemisphere. These planetary waves resulted in high pressure and low pressure areas being locked, amplifying the extremely hot weather.

In 2010, the jet stream showed a similar behaviour, which resulted in wildfires and drought in Russia. At the same time there were floods in Pakistan, where they got all the low pressure systems that never came to Russia. Drought and heat waves in one place, torrential rain and cold in another place.

The circulation of heat in the Atlantic is also shifting. We're now seeing a first sign that the ocean circulation of heat in the northern Atlantic is slowing down, which includes the Gulf Stream. An estimate is that it has slowed down by 15%, which is cooling down parts of the northern Atlantic Ocean south of Greenland, which in turn is reinforcing extreme weather events, for example affecting impacts in Scandinavia.

The Amazon rainforest may be approaching a tipping point, which would irreversibly transform this richest land-based ecosystem on Earth into a savanna. Peatlands are emitting more and more methane and carbon dioxide now that the permafrost is thawing rapidly in the Arctic and on the Siberian tundra. And methane gas is leaking out of the East Siberian sea as it gets warmer and warmer.

Aren't these red flags enough? Isn't Mother Earth being clear enough with her warning signs? I mean, certainly there is scientific uncertainty around all of these potentially catastrophic tipping points, but the total evidence base is overwhelming. And as a summary, in an article in *Nature*, which we published in November 2019, we show that nine of the 15 known major planetary systems that can tip over have now begun to move.

Dear friends, the Arctic summer ice, the glaciers of West Antarctica, the tropical coral reefs are now already etched into the gravediggers' death lists. Let us avoid making that list any longer.

Robyn Williams: Yes, Johan Rockström, a professor and director at the Potsdam Institute for Climate Impact Research in Germany. And thanks to Radio Sweden.

### **EPISODE 3: Urgent action required to steer clear of climate tipping points**

Robyn Williams: Now we continue our series of talks from Sweden with Johan Rockström on climate impact and the special nature of the Pleistocene.

Johan Rockström: Recently I sat with some research colleagues at the Potsdam Institute for Climate Impact Research and looked at a brand new Science article, in which our climate model for the first time had recreated the climate on Earth over the last 3 million years, which covers the entire geological Pleistocene epoch.

The Pleistocene is so important as it constitutes a point of reference for life on Earth. Because although, sure, our planet has existed for 4.5 billion years, it's only during the last 3 million years that Earth has looked, at least roughly, in the way as we know it.

The continents were roughly where they are today. The north and south poles were covered with ice. The atmosphere had a similar chemical composition to what we have today. Planet Earth, our Earth, has only existed for 3 million years. All comparisons further back in time are quite meaningless. And the manuscript I hold in my hand is not just reaching my brain, it's also striking straight into my heart.

A deep humility settles in when I look at the graph showing the variations in mean global temperature on Earth over the past 3 million years. It shows that we have never, throughout the whole Pleistocene, exceeded 2°C global warming compared to our pre-industrial average temperature of approximately 14°C. Never. This means that Earth, despite all the stresses and natural shocks from fluctuations in solar radiation, volcanic eruptions, asteroid impacts and earthquakes, has regulated itself within an incredibly narrow range. Minus 4°C; we're in deep ice age. Plus 2°C; we're in a warm, interglacial period. Lasting 3 million years. It's absolutely incredible. Especially since we know why. It's Earth's ability to self-regulate. The ability of the oceans to absorb and store heat. The ability the ice sheets to reflect solar radiation. The ability of the forests to absorb carbon dioxide. Nature's ability to be a safe and store greenhouse gases. The planet is a biophysical self-playing piano, whose music sheet stays naturally within the minus 4, plus 2 scale.

If that is not cause for humility, then I do not know what humility is. And a deep concern. In 150 years, in the geological blink of an eye, we risk now tearing this planetary symphony to shreds. Let that sink in. The global average temperature is now changing 170 times faster than over the last 7,000 years, and it's doing so in the wrong direction - upwards - when the current orbital forcing, meaning our distance to the Sun and the current low level of solar activity, means that the temperature should in fact be slowing down. You don't have to be a physicist to understand that we have a problem.

Climate sceptics like to argue that historically the climate has fluctuated so much, so why shouldn't it be fluctuating now? Obviously it fluctuates. But we are now racing towards plus 3° to plus 4°C warming. Sceptics like to bring up the Little Ice Age, the time when Swedish king Carl X Gustav marched his army across the deep frozen Great Belt and the Little Belt in 1658 to beat the Danes. Or that the Vikings grew grapes in Greenland during the medieval warm period. Yes, of course, this is true. But it all occurred within the natural boundaries of minus 4°C and plus 2°C. It's here, within this sweet spot, that we must remain for our own sakes and our future.

In August 2018, at the peak of that year's drought and fires in Sweden and Europe, we published a scientific paper where we tried to establish whether we are at risk of pushing the entire planet away from its current state of equilibrium - the Holocene epoch - where we have been since the last Ice Age.

This is fundamental. Our planet Earth can be in three different states. It can be in a deep ice age, as it was 20,000 years ago, with large ice caps extending over the northern and southern hemisphere, with over two kilometres of ice above our heads here in Sweden and ice extending as far south as Berlin.

This is an equilibrium state as it is not only lower solar radiation that keeps Earth in an ice age. It is also the feedbacks caused by ice. As the ice sheets grow, Earth gets whiter, which means that more and more incoming heat from the Sun is reflected back to space. More ice means it gets colder, which means even more ice and suddenly you have a self-reinforcing mechanism. This is what makes an ice age an equilibrium. Earth remains there not only because of the external forces from the Sun, but also thanks to these inbuilt biophysical processes, in this case the colour of ice.

Earth can also be in an interglacial, an intermediate state, which is what we have today. We will still have permanent ice sheets at the poles and we have glaciers on land and a biosphere with forests, grasslands and lakes, roughly Earth as we know it. It is these two equilibrium states, and only these two states, that the planet has been in over the last 3 million years, that is during the entire Pleistocene.

But then there is a third state, when Earth tips over from self-cooling feedback loops to self-heating feedback loops, which leads to an inevitable journey to becoming a hot tropical planet that is 4°, 5°, 6°, potentially 7°, 8°C warmer than today, where in principle all the ice has gone and the surface of the ocean is more than 50 metres higher than it is today, and where the conditions for life is fundamentally different all over the entire planet.

This is what we call Hot House Earth. Or Heisszeit, 'hot time' in German, where the article, when we published it, drew so much attention during this burning heat wave in the summer of 2018 that 'Heisszeit' was chosen as the word of the year in Germany. In this research, we tried for the first time to identify the global mean temperature at which we are in danger of tipping over from our current state, the Holocene interglacial, and embarking on a journey that would inevitably take us to Heisszeit.

Our conclusion is that we cannot exclude that the planetary threshold, the tipping point where we kick off unstoppable processes of self-amplified warming, is at 2°C. Bear in mind, we are today at 1.1°C. Bear in mind, we're moving fast along a path that reaches 1.5°C in potentially only 20-30 years and 2°C in 40-50 years.

This is one, I would argue, of the biggest scientific challenges of all; to test whether we are right. Can the planet cope with, or can it not cope with, higher temperatures than 2°C? But my conclusion, based on the knowledge we have today, is that the planetary threshold to avoid triggering Heisszeit is most likely at 2°C.

Of course, it's not so that Earth will fall off a cliff at 2°C. The risk is rather that we would then pass the threshold where the shift towards Heisszeit would become unstoppable. In other words, we face an urgency at the timeframe, whether we push the 'on' button or not. Triggering unstoppable warming is within the next few decades, meaning essentially now.

If we press the 'on' button and kick off the great planetary machinery with feedback loops causing self-warming, then the full impacts may play out over 300, 400, 500 years before we reach a new equilibrium state; hot house. A planet with over 10-metre sea level rise,

temperatures and extreme droughts, floods and heat waves making large parts of Earth uninhabitable. A planet we do not want. A planet that cannot support us humans.

This requires from us that we understand two different time horizons. The short-term time of commitment. When do we push the 'on' button? But then also the long-term time horizon, when we have the full impact hitting on people. These are different. But ethically I would argue only the trigger moment counts. We cannot leave a damaged planet beyond repair to future generations.

So, to summarise, the decisive moment when we press or don't press the 'on' button lies within the next 10 to 20 years, with consequences for all future generations. A moral bomb. Our Heisszeit article concluded that 2°C is our ultimate planetary threshold that we need to stay away from. This article actually came out six months before our climate modelling showed that we've never exceeded 2°C throughout the whole Pleistocene, the last 3 million years.

And already in 2009, our planetary boundary science showed that 1.5°C is a boundary we should not transgress, because then we enter a danger zone of uncertainty. So perhaps you do understand my feeling of deep concern and humility in the face of our latest scientific findings, which really only says one thing; tipping points are real, and if they're crossed they lead to unstoppable changes, which requires a new relationship between us and our planet and that we realise that we are facing a new ethics. What we do today will determine the future on Earth for all our children and their children.

Robyn Williams: Johan Rockström, head of the Potsdam Institute for Climate Impact Research in Germany, with that talk, care of Radio Sweden. More from him next week.

#### **EPISODE 4: The Amazon regulates the planet's climate and we're burning it**

Johan Rockström: Tipping points are just a scare tactic, according to not only climate sceptics, but even some level-headed opinion leaders and industry leaders. I wish that was the case, that there were no unstoppable changes leading to self-amplified global warming. But I can assure you that our current state of knowledge shows something different. Today, we have so much proof, proof which is being strengthened for every day that passes, most recently summed up in an article that we wrote in the journal Nature at the end of November. In that article we show not only that nine of the known 15 systems on Earth that control the planet's stability have begun to shift already, we also show that there's evidence that they are interconnected, and can fall like dominoes.

Today we have evidence of three domino-like connections. The first one is that rapidly melting sea ice in the Arctic is speeding up thawing of permafrost, which makes the jet stream meander, which in turn leads to more droughts and forest fires, which in turn causes even faster heating when the forests emit carbon dioxide. The second domino is when melting of Greenland is slowing down the heat circulation in the North Atlantic, which in turn is reinforcing droughts in the Amazonian rainforest, drying out and resulting in fires and huge emissions of greenhouse gases when the forest irreversibly moves towards a savanna state.

The third domino risk is when ice sheets in the Arctic and Greenland show evidence of being connected via the oceans to Antarctica. When the Arctic melts, the exchange of heat in the ocean from the southern to the northern hemisphere will slow down, and this means that the ocean around Antarctica gets gradually warmer, which will result in huge glaciers being

lubricated by hot surface waters and thereby gliding faster into the ocean with an ultimate risk of not just one- to two-metre sea level rise, but over ten metres.

And strange as it may seem, it is one of the climate change sceptics' own arguments that proves that we are right. Sceptics love to keep telling you, quite rightly, that Earth is not stable, that climate has varied enormously throughout Earth's history, and this has happened despite relatively small changes in solar radiation. A-ha! This is proof that the climate can change very quickly even without any influence for the Sun and thereby, the reasoning goes, without human impact.

But this is exactly the point that should make us particularly concerned. Yes exactly, large fluctuations in Earth's climate have occurred because even small changes in solar activity (and we today play the role of the Sun, by the way, when we burn fossil fuels), these small changes can cause big systems like the oceans, forests, ice caps to tip over thresholds and accelerate change. It has happened before. It can of course happen again.

And right now the temperature on Earth is rising faster than ever before in over 3 million years, despite small changes in solar radiation. The reason is our greenhouse gas emissions. Under these circumstances, being so certain that Earth can't tip over thresholds abruptly and self-reinforce change in a big way, knowing that she's done that so many times before does not feel very reassuring.

The Amazon rainforest is burning. Over 40,000 fires, mainly in Brazil and Bolivia, where government politics, from the far right the extreme left, has unleashed chaos in the rainforest. The situation is very serious. All ecosystems on Earth are special. But the Amazon is really special.

30% of the world's land-based species of plants, animals and insects live in the Amazonian rainforest. One-tenth of Earth's land-based biomass is found here. In an infinite number of rivers and streams, one-fifth of the world's flowing freshwater winds its way through dense rainforest. And I remember as a child living in Brazil how incredible it was that not only were there trees with trunks as thick as lorries, but Tarzans swinging between tree vines were not just a cartoon fantasy, they were very real.

The rainforest is home to approximately one million indigenous people, but immediately affects the life of many, many more, through water supply, weather and economic development, in Latin America, and in countries well beyond. This is because the Amazon is one of the major ecosystems on Earth that regulates the state and health of the entire planet. It's not just that 30% to 40% of the rain that falls on the rainforest is generated by the forest itself, or that the evapotranspiration generated from the rainforest creates the rain that provides drinking water for cities like São Paulo, as part of a regional weather system that is connected to rainfall systems in both America and Africa.

Destroy the rainforest and we destroy part of what keeps our Earth stable. This makes the Amazon rainforest everyone's business. It is one of our global commons, like the atmosphere, Antarctica, the ozone layer and outer space. Our entry point in any discussion about the Amazon rainforest is always based on the notion that the rainforest is a national concern for the nine countries whose borders cut through this ecosystem.

But what if you were to turn this around? What right has Brazilian President Bolsonaro to undermine a part of the economic basis of American, German or Chinese industry and

agriculture? Because if the Amazon rainforest is destroyed, it would contribute to an abrupt pulse of carbon dioxide emissions into the atmosphere, which would accelerate global warming, which in turn would impact all of us. The collapse of the Amazon rainforest water cycle could create geopolitical instability and decline of economic growth in Latin American countries, which could in turn impact refugee streams and export industries in Sweden, the European Union and beyond. Is that a risk worth taking? Is that an acceptable risk?

Thirty years ago, we could perhaps ignore the fact that the world's major ecosystems, like the Amazon rainforest, like the temperate forests and the world's peatlands, were global commons that we need to protect together. Earth was so biologically intact, and thereby resilient, and our carbon footprint was so limited that Earth could absorb national mismanagement without putting living conditions for all of us at risk. Not anymore.

Think about the following. We are at 1.1°C of global warming. We must not exceed 1.5°C and certainly not go above 2°C. We are on track to take us to 3° or 4°C of warming. If we are going to have any chance, global emissions must start to decline this year and then be cut by half by 2030, then cut by half again 2040, and then reach zero by 2050. This is what we call the carbon law; cut emissions by half every decade and you follow science.

But this will only work if the planet does not surprise us. That is, all ecosystems and all the ice sheets and all the storage of energy and conveyor belt heat in the oceans must remain intact. If we were to lose the Amazon rainforest, it could potentially add another 1°C of warming by itself. If we were to lose all of the Earth's temperate peatlands, this could potentially lead to another 1°C warming.

You know, nature is not just our friend. She is strong, but she's not invincible. And she holds our future on Earth in her hands. But sure, a natural question you may be asking at this point is whether there really is a risk that we could destroy the whole Amazon rainforest.

In September last year, in a small meeting room packed with politicians, researchers and journalists at the United Nations headquarters in New York during the UN climate summit, I sat next to Brazil's leading climate scientist Carlos Nobre and the world-famous ecologist Tom Lovejoy. Carlos Nobre began with the following words: 'The Amazon rainforest is very, very close to a tipping point.'

This was deeply disturbing. Carlos, a close colleague whom I have huge respect for, is a cautious academic general. If he has come to this conclusion, this situation must indeed be serious.

Some years ago, Carlos Nobre and Tom Lovejoy published a study which specifically pointed out that the Amazon rainforest could be more susceptible to the risk of tipping over from rainforest to savanna when deforestation and global warming interact and accelerate through wildfires, droughts and extreme events. They pointed out that when global warming and forest fires create additional shocks to the forest, it may only be able to cope with 20% to 25% deforestation, compared to the 40% or so that many researchers thought previously due to global warming. The estimates are that the Amazon today has reached 17% of deforestation. We are, I would argue, coming uncomfortably close to 20%.

And that's when French president Emmanuel Macron pounces on President Bolsonaro. I would argue Macron is right. Bolsonaro does not have the right to exploit the Amazon rainforest in a way that threatens to destabilise the entire system. It is not just a Brazilian

concern. It's a matter that concerns us all. In the same way that the Moon controls the tides on Earth, the Amazon rainforest controls the flow of water and the climate on Earth. It is a vital organ for a healthy planet.

This is the situation we've reached today.

Robyn Williams: Professor Johan Rockström is director of the Potsdam Institute for Climate Impact Research in Germany. More from him next week.

### **EPISODE 5: Fixing the climate emergency is today's Apollo mission**

Robyn Williams: Next in this Science Show where we've heard from Johan Rockström in a short series of talks each week, he now asks whether space research itself can help us tackle massive challenges like climate. An example of the tragedy of the commons?

Johan Rockström: We have come to the point where all the global commons that determine Earth's stability, from the Amazon rainforest to our temperate forest and the peatlands around the world, must be kept intact. This is the most important insurance we can have for the safety of future generations.

John F Kennedy: We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard. Because that goal will serve to organise and measure the best of our energies and skills. Because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one we intend to win, and the others too.

Johan Rockström: Few events in modern history have inspired me so much as the Apollo 11 landing on the Moon 50 years ago. I've often wondered why it is that I can listen over and over again to President John F Kennedy's famous speech where he stated: 'We choose to go to the Moon.'

Perhaps it's because it was such a large-scale concerted effort involving science, politics, the public sector and industry, and that this effort, along with a large dose of resilience and creativity, made the impossible possible, in just ten years. The key was that they all had a common goal.

The Apollo program of our time is to give Earth a soft landing after 50 years of escalating mismanagement. Apollo 11 landed 50 years ago, just at the take-off point of the great acceleration of our unsustainable pressures on the planet. Just like the Apollo program, we now have only ten years to do the seemingly impossible, to transition the whole world to a new logic; modern prosperity and equity within planetary boundaries.

Just like with the Moon landing, we don't know how we're going to succeed. But we know that the verdict, whether we succeed or fail, lies in our hands, not in the limitations of physics. Our moonshot is to cut by half global emission of greenhouse gases in ten years. During these ten years we must also have come a long way in transitioning food production in the world from problem number one to solution number one.

During these ten years we must also halt deforestation of natural forest ecosystems, and halt the loss of biodiversity, and break the current trend of all material use from our linear exploit-and-throw-away paradigm to a circular economic development, based on recycling and reuse in closed loops. This is our collective global agenda in order to stabilise our planet and our future.

The ten-year Tellus program is a necessity to have a chance of achieving the United Nations global sustainable development goals. Economic growth, jobs, health and good food for everyone in the world must be secured by 2030, in ten years' time.

Because a healthy planet is a prerequisite to achieve and because we are racing towards big risks and running out of time, we have truly, at this moment of truth, got ourselves our very own Moon landing. In ten years, between 2020 and 2030, we need to turn the trends around entirely for Anthropos on Tellus.

Recently we published an article that presented the six transformations that will allow us to succeed. These are:

- Fix education and gender equality.
- Healthcare for all.
- A transition to fossil fuel-free energy for all.
- Sustainable and healthy food in the world.
- Modern and sustainable cities.
- Digital technology for sustainable development.

The most important insight here are not the details and the fact that we have technologies that can deliver. It is to understand that we're talking about global transformations, major reforms and big structural changes. We have left behind the era when small incremental changes are sufficient, such as having a bit of environmental labelling here, or sustainable reporting there. I mean, don't get me wrong, this is not bad, but it's very far from sufficient. No, we must now go all-in and transition all sectors of the world economy to a sustainable logic within planetary boundaries.

Did you know that the US invested 2.5% of its GDP in the Apollo program at the peak of its implementation? 400,000 people worked full-time with the Moon landing. The President put his heart and soul into the program. If all the countries in the world put 2.5% of their GDP into saving our planet, then we would have US\$2,000 billion to invest. Just delivering on the SDGs is assessed to require US\$100 billion. I think we can fix it if we just decide to.

Neil Armstrong: That's one small step for (a) man, one giant leap for mankind.

Johan Rockström: We are living in turbulent times, where populism, geopolitical power games, economic egoism and a deepening divide between the haves and the have-nots are interacting with and being reinforced by the digital highways that crisscross the whole globe. The result is xenophobia, social instability, conflict and global warming.

The short-sighted reaction by world leaders are to build new physical or mental walls to keep the rest of the world at arm's length. As if we could isolate ourselves from our shared climate and biosphere. Just when we need more than ever to trust each other and work more closely together than ever before to manage our entire planet, we are at an all-time low in terms of the will to act collectively. The United Nations is at its weakest point when it needs to be at its strongest.

Sometimes it feels like this trend is inevitable, and hopeless, that we are rapidly, abruptly even, sliding down into an era of populism, distrust and viral spread of lies, where the divide between people just gets wider and wider. And we tend to get bogged down in debating and complaining about this negative trend and blasting against the dark forces behind it, about

how digital technology is being used to manipulate democratic elections in the US and UK, how dark digital forces are being used to spread uncertainty about global warming and environmental destruction, how we are hurtling towards in Orwellian world dominated by Big Brother, in which lies are tearing the truth to shreds.

We have to reverse this disquieting trend. We have to make the digital revolution we're undergoing work for democracy, fairness and sustainability, not against them. I think we have been and still are far too naive. We believe that truth and the forces of good will eventually win in the end, that reason and basic human values will ultimately prevail. Unfortunately, this is not going to be enough. We are in the midst of a global power war, with considerable evil forces at work, deliberately continuing to manipulate and do everything they can to keep us in a dark status quo. Forces like the coal and oil industries and big financial interests are resolutely trying to slow down the transition to a sustainable, fossil fuel-free world.

I say slow down because the transition hasn't just begun, it is inevitable. We are leaving the fossil fuel era behind us. The question is not whether we will become fossil fuel-free, it is whether this will happen fast enough. But now the forces for good must rise and carpet-bomb the world with truth, solutions and particularly demonstrate the benefits to all people of a transition to a sustainable world. We need an exponential crusade for our future on Earth.

And there are white knights out there. We have the solutions. We have the proof that they are better and more attractive in terms of profitability, equity, the economy and quality of life. We actually hold all the joker cards, and yet the game is not going so well. This only goes to show the power of the forces resisting change.

It is really important to remember that just as things can go wrong very fast, they can go right very fast. Look at Greta Thunberg and the whole Fridays for Future movement, which has gone from one 16-year-old girl outside of the Swedish parliament to a global movement in less than a year. An exponential movement, perhaps even a global social tipping point, that cannot be stopped.

And I'm not surprised. Statistics show that 60% to 70% of people worldwide are concerned about global warming and want us to solve the problem. We also know that young people are the most concerned of all. In fact, I've often wondered why young people in the world have not risen up earlier against this immense injustice, that we adults allow ourselves to simply shovel over all the damage to our planet to them.

But better late than never. This is why, though, I'm totally convinced that we've only seen the beginning.

Robyn Williams: Professor Johan Rockström runs the Potsdam Institute for Climate Impact Research in Germany. And my thanks to Swedish Radio. More next week.

### **EPISODE 6: Sustainable healthy food boosts health and planet**

Johan Rockström: In 2019, three independent studies using different methods arrived at the same finding, that approximately 11 million people per year die prematurely from eating unhealthy food, caused by malnutrition, obesity, diabetes, cardiovascular diseases and cancer. This makes food the single biggest killer in the world, shortening the lives of more people than those who die of AIDS, malaria and tobacco combined.

But as if this was not serious enough, did you also know that the way we produce food in the world today is the single biggest threat to the stability of our planet? Nearly a quarter of the world's emissions of greenhouse gases come from agriculture. Food production consumes 70% of all the water we tap from rivers, lakes and groundwater.

What is the main reason why we are in the midst of the sixth mass extinction of species on Earth? It's food. What is the single biggest cause for deforestation and the degradation of natural ecosystems? Food.

We have transformed 50% of the land area on Earth to different forms of agriculture, from crops to grazing. The overuse of fertilizers and manure in modern agriculture has catastrophic effects, causing nutrification in groundwater, lakes and coastal zones. And agriculture is one of the major causes behind rising risks of antibiotic resistance, and of the growing concentrations of life-threatening chemicals in our environment due to herbicides and insecticides.

Put simply, if we fix our food, we can fix people and planet. If we carry on as we are doing today, it will end badly for both. What is so incredibly exciting is that we know how to transform global agriculture from the planet's number one threat, to the number one hero.

We need a transition to healthy and sustainable diets, and the solutions are found in sustainable agriculture, which draws on technological solutions and practices from ecological as well as conventional cultivation methods. We are talking about digital precision agriculture, which can avoid all forms of nitrogen and phosphorus leaching, no-till farming, we're talking about diverse crop rotation, managing farming at landscape-scale, and establishing a sustainable balance between crop production and livestock. A recent study showed that nearly 30% of farmers worldwide are practicing various forms of sustainable agriculture.

Because the solutions exist, the road to success is relatively straightforward: abolish all the subsidies, introduce penalties, like taxation, on everything that is unsustainable and pay instead for sustainable solutions. This is a big step forward, but it is when we combine health and sustainability that we can achieve something really exciting.

This is what we tried to explore in the EAT-Lancet Commission on Food, Planet and Health, which we published last year. The EAT-Lancet report summarises the latest health science, which shows that a flexitarian diet that mixes animal and plant-based protein with a much higher proportion of fruit, vegetables, nuts and vegetable oils than we generally eat today, and which cuts down on red meat and starchy food, means that we can live healthier and longer lives.

Many people have strong views on the planetary health diet presented in the EAT-Lancet report. Often the people with the strongest views are those who clearly have never read the report, because if they had done so, they would have seen that we do absolutely not propose a diet that completely eliminates meat. It actually contains five meals each week that contain animal protein: one with red meat, two with chicken and two with fish.

How radical is that? Well, it depends where you're coming from. In principle this is a typical Mediterranean diet, shown empirically to be one of the healthiest diets in the world. It's a return, roughly, to the dietary intake of animal protein that we had in a country like Sweden in the mid-1960s. Not such a bad period for health in Swedish history, as far as I'm aware. But

the really exciting thing is the following: if you eat a planetary health diet, you not only prolong your own life, you also contribute to saving the planet.

If we continue to eat as we do today, we will fail to stay below 2°C global warming and we will fail to achieve the United Nations Agenda 2030 goals—a double whammy. So, it is possible, and we all benefit from it if we move to sustainable healthy food. Not bad.

Barack Obama: Fourteen of the 15 warmest years on record have occurred since the year 2000, and 2015 is on pace to be the warmest year of all. No nation, large or small, wealthy or poor, is immune to what this means.

Tony Blair: Essentially, it's about trying to unite the scientists and the experts with the political leaders and decision-makers.

Ban Ki-Moon: More than 150 world leaders have come to Paris. I urge you to choose the path of compromise and, if necessary, flexibility. Bold climate action is in the national interest of every single country represented at this conference.

Emmanuel Macron: Let us face it, there is no planet B.

Barack Obama: The question now is whether we will have the courage to act before it's too late. And how we answer will have a profound impact on the world that we leave behind, not just to you but to your children and to your grandchildren.

Emmanuel Macron: ....ones of guarding our Earth.

Johan Rockström: Of course they mean what they say, for the moment, but not deep down. What you've just heard were a few political statements among thousands of statements. Climate and the environment continue to be perceived as single-sector issues that have to compete with all the other political areas, such as employment, health, integration and economy.

This is despite the fact that sustainability is a decisive factor for all the other sectors to be successful. As I see it, this is the very core of our problem today. We're not putting the planet at the centre of everything we do. We sideline it as if it's something that we can choose to deal with when we feel the economic inclination to do so.

Does this sound a bit harsh perhaps? I mean, climate is very high up on the agenda today, isn't it? I mean, even higher than ever before. Well, that's true, of course. It is so important that climate has finally climbed up on the political agenda.

The President of the European Commission, Ursula von der Leyen, has promised a fossil fuel-free European Union by 2050. The Green New Deal sets out to reduce emissions at least by 50% by 2030. The European Investment Bank has decided to stop all funding for fossil fuel projects. We now have seven countries that have passed laws with a binding target of zero emissions by 2050. And the oil industry is taking the climate issue seriously. Shell is inviting researchers in a rapid succession to give it strategic advice.

Renewable energy is beginning to account for over 30% of the energy supply in many countries, and in April 2019, for the first time in history, more electricity was produced from renewable energy than from coal in the US. Solar and wind energy are the cheapest form of energy in two-thirds of the countries in the world. According to Bloomberg, solar and wind energy will produce half of the world's energy needs in 30 years' time.

The rate of increase is exponential. From a few percent a few years ago, to double digits in just a few years. All of this is incredibly good. But it is still overshadowed by the negative trends, by the fact that over 400 coal-fired power plants are still being built worldwide. Yes, you heard right. Our analysis actually shows that if all the coal infrastructure is built and runs its full life, we will use up the entire remaining global carbon budget that can allow us to avoid exceeding 1.5°C of global warming.

Then we have Russia's gas pipelines through the Baltic. Then we have new oil exploration in the Arctic. We have continued expansion of fracking of natural gas in the US. All of this is being allowed to continue, while we are waving the climate flag, more intensively now of course than ever before, but still.

No, the problem is not that the climate issue is not high up on the political agenda. The problem is that it's not at the top. Our problem is that the planet does not provide the frame for all the political areas in society.

Just like the economy, the climate and nature ought to constitute a planetary limit in all sectors and political areas. And in addition to rub extra salt into the wound, we are seeing a deplorable political trend in the world today. How climate change deniers are desperately trying to deepen the ideological divide in addressing the global climate crisis.

How young people's movements and civil society are accused of being driven only by emotion and of spreading panic. What does climate and biodiversity have in common with populism and nationalism? Nothing. And yet the Republicans in the US, the Sweden Democrats in Sweden and the AfD in Germany make the actions on climate into an issue of ideology.

Why is climate change always placed along a left to right spectrum?

Robyn Williams: Professor Johan Rockström in Sweden, thinking bigger. More next week.

### **EPISODE 7: Ten steps for best chance of climate stability**

Robyn Williams: Politics. Has it ever been uglier? And why, as Professor Johan Rockström in Sweden asks, is clean energy seen as left-wing, and coal seen as right? Are the workers now the deplorables, materialists all, and scientists just elites? 'Elite', by the way, is today an insult. Johan Rockström:

Johan Rockström: What does climate and biodiversity have in common with populism and nationalism? Nothing. And yet the Republicans in the US, the Sweden Democrats in Sweden, and the AfD in Germany makes the actions on climate into an issue of ideology. Why is climate change always placed along a left to right spectrum?

The Gilet Jaunes in France have nothing to do with the climate. Their protest is about social injustice. When Trump tries to marginalise the climate issue as a concern of an urban left-leaning ideological elite, it is a blatant lie, a desperate attempt to create ideological battle lines that don't exist, and he does so with the sole purpose of undermining the truth, of sabotaging the science.

We climate researchers stand up to this every day. It is interesting that these accusations of making the climate crisis into political ideology, or anxiety-provoking panic, only come from sceptics. It's as if they are desperately seeking another last card to play after having lost all

the others. Because global sustainability is about just one thing; truth. It's about data, data and more data, observations in the real world and biophysical analysis.

It is hardly strange that people get concerned when so many analyses backed up by empirical evidence show that we only have 10 years left to reduce global emissions by 50% to have a 66% chance of keeping the global temperatures below 2°C. Emotions, ideology? Nonsense! Rising up against this risk is a rational act.

Today, climate and environmental issues continue to be dealt with based on the premise: 'What do you believe in?' When it is really about: 'What facts are you acting on?' If based on truth, meaning the latest observations and science, the world's political leaders are forced to act on the basis of what? That's right, a planetary emergency, to put the stability of the planet as the objective, above all else that we do.

What is the conclusion? That today's politicians have understood that we have a problem, and that the climate is important, but they haven't understood that we're talking about a global transformation of the entire economy, and that it has to happen now. They haven't understood that it is an emergency, a 10-year Apollo program for the planet.

We have no political leadership for a sustainable planet. President Macron could have taken up the baton after President Obama. But it was sabotaged by the Gilet Jaunes. Just when we need one, or in fact several, Nelson Mandelas, Martin Luther Kings or John F Kennedys, the stage is populated by the likes of Trump, Bolsonaro, Putin, Modi and Xi. Not a great line-up. This places even greater responsibility on Europe and the vanguard regions like the Nordic countries.

Every day, Albert Einstein looks down at me from a poster I have on the wall in my office. Next to it is one of his deepest and hardest quotations, and I'm convinced that he is right: 'The world will not be destroyed by those who do evil, but by those who watch without doing anything.'

I see 10 steps that must now be taken over the next 10 years.

**Step 1.** Put an end in 2020 to all investments in new fossil fuel infrastructure. This applies to all projects from Adani's coal mine in Australia, to Preem's refinery plans in Lysekil, Sweden. Once and for all, we must finally embark on the beginning of the end of the fossil fuel era on Earth.

**Step 2.** Withdraw all subsidies to fossil energy use. According to IMF, the International Monetary Fund, governments around the world are still paying US\$500 billion per year in direct subsidies to the fossil fuel industry. On top of this, there are tax exemptions, such as for diesel use in Swedish agriculture.

**Step 3.** Introduce a price on carbon for all sectors in all markets in all countries and regions. Did you know that 90% of the world's emissions of carbon dioxide, which are destroying our climate, are still emitted entirely free of charge? The price must be at least €50 per tonne of carbon dioxide and it must be applied in all sectors, from food and transport to heating. No exemptions.

To succeed, the countries that do introduce a price on carbon must also introduce import duties on carbon that penalise all imports from products and countries that are not paying their part of the price of destroying the climate. In this way, we will rapidly move to an indirect

global price on carbon, as we create a global market for carbon pricing. The European Union should lead the way.

**Step 4.** The only region in the world showing any leadership on climate, even though it is fragile, is the European Union. Now it's time to give full support and a chance for Frans Timmermans, executive vice president, and Ursula von der Leyen, president of the European Commission, in their efforts of introducing a new climate legislation and achieving a 55% reduction in emissions by 2030, a new emissions trading scheme, and tough penalties for member states that fail to meet the targets.

Simply put, make the green new deal a reality, 'rebooting Europe', as Ursula von der Leyen has stated. Europe as the single largest economic region in the world, has a huge responsibility for historic emissions and now should lead the way in showing the world that it's possible to transition into an equitable, competitive, nation building of modern states for the future, and that this can function as a role model for all economies across the world.

**Step 5.** Kickstart the big food transition to sustainable healthy food, the first task being a global moratorium on not allowing any more expansion of agriculture into virgin lands. We have to preserve all the remaining natural ecosystems, from rainforests to peatlands.

**Step 6.** Safeguard carbon sinks, watercourses and the remaining biodiversity in all remaining natural ecosystems. We need an apex target for biodiversity, just as we have an apex target for climate, to reach the 1.5°C limit.

Start by setting aside 30% of the oceans and 30% of ecosystems on land up to 2030 as protected global commons for the stability of the planet. But the long-term target must be crystal clear: zero loss of species, zero depletion of natural ecosystems. We have come to the end of the road of our exploit-consume-pollute-throw-away philosophy, and now is the time to think really about science-based targets, also for biodiversity.

**Step 7.** Lock the global financial sector within planetary boundaries. Control all financial flows to ensure that they do not contribute to deepen the climate crisis and degrade natural capital on Earth. This applies at all levels, from mandatory rules for national pension funds, easily done in parliamentary decisions, to no new funding for fossil fuel infrastructure, for the World Bank, the International Monetary Fund, China's Belt and Road initiative, the G7 and the G20.

**Step 8.** Introduce new economic development principles. I'm not so naive to believe in a new economic paradigm in just 10 years' time, or that we could suddenly solve the problems by stopping all economic growth. But we can't wait for major systemic changes. Pragmatism must prevail.

So, two things apply: One, correct market failures by penalising everything that is harmful with taxes and charges. And, two, use regulations and policies to generate circular economic behaviours, such as reuse of all plastics or, as in Sweden, the requirement that 95% of everything in your car must be recycled.

**Step 9.** All countries must pass climate legislation, making a transition to a fossil fuel-free economy mandatory within 30 years.

**Step 10.** Make Save Tellus into what it is, the most exciting, attractive and inclusive Apollo project in the world. We need to make the Earth safe in 10 years' time. We need to turn around the logic of the world. We can, we must and we will win if we do so.

Our new narrative for success must start penetrating at a deep level, reaching every nook and cranny worldwide, planetary sustainability as an Apollo program for success, modernity, justice and health.

These are 10 steps that are not particularly controversial, that we can implement if we have the will to do so, 10 steps that can secure a good future for all generations on Earth.

Robyn Williams: Beyoncé on The Science Show? As chosen by Johan Rockström, director of the Potsdam Institute for Climate Impact Research in Germany, with an alternative budget, a global one. His final talk next week. As for President Xi, China has announced quite recently it will reduce net emissions of CO<sub>2</sub> to zero by 2060.

### **EPISODE 8: Fixing the climate emergency must start now**

Robyn Williams: And still thinking about youth and the future, a final comment from Johan Rockström, whose series of talks have featured on The Science Show. He's director of the Potsdam Institute for Climate Impact Research in Germany. This time he's meeting the young leaders, like Greta from Sweden.

Johan Rockström: It's March 2019, and Greta Thunberg and Luisa Neubauer, the leader of the Fridays for Future in Germany, contact me to ask whether, after the demonstrations in Berlin on 15th March, which is the first time the Friday demonstrations have gone global, they can come to the Potsdam Institute for Climate Impact Research to meet us climate scientists.

I agree of course, and the demonstrations are followed by a three-hour academic seminar where these sharp teenagers ask our scientists some really tough questions about everything from the jet stream to the sliding of the glaciers in Antarctica. I'm really heartened by this conversation. It occurs to me that it would never happen with our politicians. For example, that a head of government would call us and ask whether they could come by after an important meeting or initiative and fill up their knowledge base with the latest science.

I quickly erase this naive thought and return to the conversation, which has now dived deep down into the oceans and the heat exchange from oceans to the atmosphere between Ricarda Winkelmann, one of our most successful young researchers, and Greta.

And then two weeks later, it actually happens. German Chancellor Angela Merkel calls, well her personal assistant of course, and asks if Chancellor Merkel can visit the Institute to discuss, yes, climate science. She doesn't want to shoot the breeze, something serious is happening. And it started back in 2015, when 400,000 people marched through New York in the People's Climate March. It was amazing. Never before had so many people turned out in support of climate action.

But this was nothing compared to the global Fridays for Future demonstrations on 20th and 27th September, 2019. There were over 4 million young people and people of all ages out on the streets and cities across the entire world, perhaps the single biggest demonstration in human history.

I'm just about to go on stage and talk to the 300,000 people or so gathered in Berlin, when the news arrives that Chancellor Merkel has just released the decision, her government's agreement on a climate package, a political compromise that was a disappointment.

Basically, just as I'm getting up on stage, I'm told that Chancellor Merkel is proposing a price on carbon of €10 per tonne of carbon dioxide. At first, I think I must have misheard. Even the European Union's Emission Trading Scheme, the ETS, has a price of €27, which is far too low. We have constantly explained that research shows that a minimum price must be €30, but preferably €50, and should then rise rapidly to the Swedish level of €100 per tonne of carbon dioxide.

I go on stage. News of Chancellor Merkel's announcement has already circulated among the demonstrators and can be heard in their increasingly agitated chanting. It is undoubtedly a political own-goal for the German government to throw such a provocative grenade among the demonstrators on the day of what may be the biggest single demonstrations in German history.

Needless to say, I have to crumple up my prepared speech and conclude my frustration over our political leaders, is that they still are not able to act in line with science, with the only excuse I can think of for Chancellor Merkel's provocative €10 initiative, suggesting that she might have left out a zero.

However, the reality of course is that this only confirms that the young people are right. We are responsible. We the adults of this generation.

Greta Thunberg: You are failing us. But the young people are starting to understand your betrayal. The eyes of all future generations are upon you. And if you choose to fail us, I say we will never forgive you.

Johan Rockström: As I hope I've been able to show in this program, our responsibility is right now, that we have reached the moment of truth, the year 2020. We adults bear a heavy burden of responsibility. In 50 years, we have changed the conditions for life on Earth, as they have prevailed for 10,000 years. What happens in the next 50 years will determine the conditions for life for the human race over the next 10,000 years. We're standing on a knife's edge. The future will be decided now.

I'm the first to admit, with my hand on my heart, I admit my guilt. I have lived through this 50-year period in which we have accelerated towards catastrophic risks, and I hope to live through a significant part of the coming decades, in which we transform our world.

I and my generation are guilty and currently hold the positions of power in society. It is up to us to solve the problem. It's as simple as that. Yes, it is as simple as that, because we have the solutions and we now have enough evidence that a sustainable future is the way to success. We know that the window to a manageable future on Earth is still open. But only just.

I'm often asked how I can handle being confronted daily by all the research about the threats to our planet. The threats are overwhelming at times, but are to a significant extent balanced out by all the positive signals. And I get positive news pretty much every day. Most recently from Jochen Zeitz, former CEO of Puma, who has introduced sustainability principles throughout the company. He is on the board of directors of Harley Davidson. He told me in

confidence earlier last year that the company would now take the big leap in autumn 2019: Harley goes electric.

I almost fell off my chair. Harley Davidson, the very epitome of loud motorcycles, oil and combustion engines, is launching electric motorcycles. Is this possible? And why? Well, Jochen Zeitz told me, simply because they realise that demand from the next generation will be fossil fuel free. It's about their survival, and if Harley can do it, so can the world.

Speaker: This was the English version of the Swedish radio show Winter on P1 with Johan Rockström. The producer was John Swartling and the sound engineer was Emilia Martin.

Robyn Williams: And our thanks to Radio Sweden and Johan Rockström of the Potsdam Institute for Climate Impact Research.