Oxford Three Faiths Encounter

God, Creation and Us: From Theology to Action Conference Transcription

BIODIVERSITY AND CLIMATE CHANGE

OXFORD THREE FAITHS CONFERENCE FRIDAY MARCH 25th 2022

Planetary Boundaries

Dr Martin Hodson

This morning we're going to look at planetary boundaries and sustainable development. We do quite a lot of talks on this area. Years ago, I was asked by Tearfund the Christian development agency to put together a fifteen-minute presentation on all the world's environmental problems. I started with a picture of the world and I decided I would bring in all the problems I could think of. I'm fairly generalist and so I ended up working on all kinds of areas. Some of these issues will be familiar to you, some of them less familiar but there was a pretty substantial list. Of all that list I think only two we have any control over. One: acid rain, back in the 1970s and 1980s that was a big topic. Why don't we hear about it now? It's because governments actually took prompt action to deal with the problem. The main problem was sulphur dioxide pollution from the burning of coal and what they did was they put scrubbers into the flu gas to remove the sulphur dioxide and that decreased it a lot. It's still a big problem in China and India but it's much less in Europe and North America than it was. And then the ozone hole, ozone depletion another issue that came up and which you don't hear very much about now and again it was because the government took international action to deal with the problem. We had these gases CFCs which were going into the upper atmosphere breaking down the ozone layer and of course that then allows in ultraviolet light which could have been a serious problem. Governments banned the production of CFCs. It's not that they've disappeared and they're still out there and in some parts of the world where fridges are thrown away they're still getting released but it's not as serious a problem as it was. And it looks like the hole isn't getting bigger and if anything it's getting a little bit smaller.

Oxford Three Faiths Encounter

God, Creation and Us: From Theology to Action
Conference Transcription

So that was my kind of list. But I'm not the only person to put together that kind of list. Jared Diamond, the American biologist-anthropologist once said 'There are a dozen things any one of which could do us in and we've got to get them all right.' And Diamond is absolutely correct because we could for instance solve climate change and forget about say soil degradation and our civilisation and our society would still collapse because we wouldn't have any food. Although climate change is a massive and huge problem it's not the only one we've got, there are a lot of other ones. And Diamond's most famous book was actually called *Collapse*. In it he looked at what had caused previous civilisations and societies to collapse and very often there was an environmental component to that collapse. And then he started to think well what could actually cause our civilisation and society to collapse? And if you looked at Diamond's list, you'll see there was quite a considerable overlap with mine. In some cases he's bulked things together and in some cases, he's sort of split them apart there is a lot of similarity and I guess you would expect that; two scientists coming up with lists of environmental problems. But, the sort of list that most people use nowadays, scientists, and it's gone quite a bit into the public domain is something called Planetary Boundaries. It first came out in 2009 with Johan Rockstrom et al. in the Stockholm Resilience Centre and they thought up the Planetary Boundaries concept. It was then updated by Will Steffen in 2015. For more on Planetary Boundaries and the latest diagram go HERE.

My suspicion is that they will be working on a further update because you'll see there are some issues which we now know more about. What they were trying to do was to find a 'safe operating space for humanity' and so what they did was they looked at all the environmental issues and then they tried to assess how we were doing on each of these issues. Were we within safety limits? Were we getting close to the safety limits? Were we way over the safety limits? Did we actually have enough data to say anything about it? And in 2015 they isolated four problems that they thought were significant. One was what was called biogeochemical flows which is basically the nitrogen and phosphorus cycles. The second is land system change. Third is biosphere integrity which is mainly biodiversity loss, and the forth is climate change. So those were the four issues they thought of as the most significant. We're going to look at the first three of those, and then spend a little more time on climate change.

Nitrogen: you hardly ever hear about nitrogen being a problem on the news. Well there are two main problems one is that when these vehicles are driving along out there unless they're electric vehicles, they're not just burning the fossil fuel, the carbon, they're burning the nitrogen. And the nitrogen then produces nitrogen oxides which then go up into the atmosphere and react with water to produce nitric acid and then come down as acid rain. The same with biomass burning – burning of forests, etc. – you're also getting nitrogen oxides produced. This rain falls anywhere but when you're talking about a lot of natural environments you want to keep the nutrient levels low you don't want them going up. In a lot of nature reserves the rare plants prefer low nutrient status and if you get high nutrient status you going to end up with a lot of grasses growing very quickly and that will shade out all of your rare plants. The second problem is to do with agriculture and particularly to do with inorganic nitrogen fertilisers. They're a good thing, they increase the growth of plants, and they estimate that without nitrogen fertilisers we wouldn't have two billion people on the planet. So out of our eight billion two billion are only here because of nitrogen fertilisers. But a lot of the nitrogen that you apply to soil doesn't actually get taken up by the plant and it gets washed out into lakes, streams, and rivers and then out eventually into the sea. Then it does that it's what called eutrophication, which means it stimulates the growth of algae and then the algae die. When the die they rot and take the oxygen out of the water and you get anoxic zones in the oceans, which means fish and things can't live there so you get these massive dead areas. Areas around the Baltic Sea, Latvia, Lithuania, Estonia, Sweden are really trying very hard to deal with this problem. But of course, in a lot of other parts of the world where they are much poorer they can't deal with the problem very easily. So, places like China and India, have these big dead areas of ocean. That's something you don't hear about this often but it's a huge problem.

Land System Change. The second problem is land system change. Essentially you have two things with land system change: you have changes from natural habitat like the Amazon rainforest to agricultural habitats. So what they're doing there is chopping down the rainforest and growing things like soybeans or ranching cattle. The second issue is much more familiar to us in the south of England at the

moment, which is changing from agricultural habitats to urban. We're doing an awful lot of building and one of my personal worries is that we are building on a lot of our best quality agricultural land, when we are facing potential food security problems in this country. We only grow about half of the food we eat in this country and the rest is imported. When we've got a war going on in the Ukraine, you get the drift. It's not good to build on a lot of our agricultural land. That is a problem which we have to think about.

Biodiversity Loss. There are a whole lot of really disastrous reports about biodiversity loss. One is the WWF report from 2020 and they do something called the Living Planet Index from 1970-2016. The population sizes of vertebrates declined by 68% since 1970. That's a phenomenal decline. Looking at the weight (mass) there are three categories of animals: wild animals; our domesticated animals; and humans. Ten thousand years before the Christian era BCE the mass was nearly all wild animals. There would have been a few of us humans around at the time and of course we hadn't domesticated any animals then. But then you can see how things change, you wouldn't be surprised that the human population has doubled in my lifetime but look at the weight of domesticated animals shows a phenomenal increase and of course the wild animals are decreasing very markedly indeed. I think this graph in itself is a good reason for decreasing one's meat consumption. Wild mammals are 4 % of the global mammal biomass, humans are 34%, cattle 25% of the biomass. Why have we had biodiversity loss why has it been so big? Several reasons. One through hunting and collection (like the dodo) and overfishing. Whale populations are getting better now but many species were under threat. Indirect loss through habitat destruction like the cutting down tropical rainforests is now actually the number one problem for biodiversity loss. Competition with invasive species like the grey squirrel which was introduced from North America is a major problem. The native red squirrel can only be found on little islands and refuges. Then pollution from plastic, oil, nitrogen etc. Global climate change may be a problem in the future. Up to now, most animals and plants have adapted. They've moved range from South to North in the Northern Hemisphere or up mountains to cooler climates. There have been few extinctions due to climate change yet, but we could end up with a huge biodiversity loss in the future. A paper in January 2022 quantified the 'novel entities' which includes plastic and chemicals and it is way over the safety limit. Sir David Attenborough

highlighted plastic in the oceans as being a serious problem. The total mass of plastics now exceeds the total mass of all living mammals. They are found everywhere from the summit of Mount Everest right to the deepest oceans. And there's been a fifty fold production of chemicals since 1950 and it's expected to triple by 2015. You wonder how anything is going to live.

Climate Change. Carbon dioxide emissions are not the only cause but are the biggest in terms of anthropogenic climate change. The burning of fossil fuels includes coal, oil and gas. Since The Industrial Revolution carbon dioxide emissions have gone up and there was a step change around 1950. Since then there have been little kinks due to global economic downturns (when you don't produce as much emissions) but in general terms it's up and up and up. Since 1990 up until 2020 things have started to level off a little bit and the reason is that the rich countries places like the UK and the US have started to cut our emissions whereas places like India and China have increased their emissions. So we're levelling off. 2020 was the biggest year ever for cutting emissions it was 5% down as a result of the pandemic. The sad news is that 2021 was straight back up again, not as high as 2019 but we need to be cutting emissions rapidly.

There are three things that can happen to the emissions of carbon dioxide: they can be absorbed by plants through photosynthesis; they can be absorbed by the oceans (and that in itself causes ocean acidification); and they can accumulate in the atmosphere. It turns out round about half of the emissions through the burning of fossil fuels accumulate in the atmosphere. The pre-industrial concentration of carbon dioxide was around 280 parts per million. By the time we get to 1960 we've gone up to 315 parts per million then we go up around 2-3 parts per million a year. It's now (2022) 418 parts per million. If you know about the greenhouse effect you would expect the temperature to rise and it's risen by about 1.1 centigrade since the Industrial Revolution. That doesn't sound a lot, but it is a lot over such a short period of time. It's very fast, and it's the speed that's the problem. The ten hottest years on record are all of since 2010. Global ocean heat content has markedly increased and 90% plus of the heat from global warming goes into the oceans. We, being very land centric, tend to look at statistics for land and for the air but what's happening in the oceans is very important. The amount of heat in the oceans is going steadily upwards. We're getting heat at the bottom of the

oceans. Now why is this important? The reasons: hot water expands so it's part of the reason for sea level rise, the other being melting of ice caps and glaciers; hot water doesn't hold a lot of oxygen so bad news for corals and organisms living in oceans; hot water drives our weather systems. The more hot water we've got the more energy in the weather systems and the more trouble you're likely to have. Storms and hurricanes are increasing in intensity at least partly down to climate change. I'll give you an example from 2020, one of the warmest years on record. In Atlantic hurricane and storm seasons, you will know that they start labelling storms with A-Z. In 2020 they ran out of letters started on the Greek alphabet. We got quite a long way into the Greek alphabet as there were a massive number of storms in 2020. Moreover, a category five hurricane hit Nicaragua on 16th November 2020. The temperature of the ocean should have been cooling off by then but it was still hot enough to drive this really strong hurricane. This is really bad news.

You'll have heard a lot about COP 26 at Glasgow. Before the COP meeting all the world's governments were invited to submit their nationally determined contributions which is basically how much carbon emissions they were going to cut and the UN came come up with one global estimate. The Paris agreement said we should be aiming at a 1.5 degree C limit. At present we're releasing around 55 gigatons per annum. To get to 1.5 degree C we need to be releasing 25 gigatons by 2030. This is not likely to happen. To get to 2.0 degree C we need to get 35 gigatons. We are nowhere near the 2 or 1.5 degree C targets. We're on target for 2.8 degree C or higher, which would be disastrous.

Where are the best places to live at a time of climate change? New Zealand is one of the best places and the UK is too, you'll be pleased to hear. How do they calculate this? Two things: one is what your natural climate is like, so if yours is moderate like ours it is good, whereas if you're in Sub-Saharan Africa it is already hot and dry. Secondly how rich you are: in rich countries you can buy air conditioning and put in lots of barriers to defend against sea level rising. If you're poor you can't do any of that. And you add up those two factors and you can see where you're at. It's really bad news for us all because a lot of people aren't going to be staying still, and they will be migrating because of climate change. And so that is a real concern for the future.