**Back in September twenty-twenty-three, at a New Times event, Bill Gates was asked this question by the interviewer, David Gelles.**

 **“There’s a lot of people who are very enamoured with trees, we’ve got trees on this stage. Some people would even say that if you just planted enough trees, it could take care of the climate issue altogether”**

**“and that’s complete nonsense.”**

**“OK”**

**“I mean are we the science people or the idiots, I mean which one do we wanna be?”**

**Prickly bugger, isn’t he?**

**Strictly speaking, he’s not wrong though. On that SPECIFIC question – “if we just planted enough trees would we take care of climate change altogether?”, the answer is clearly no, as Gates quite rightly asserts.**

**The trouble is though, a glib, unquantified and somewhat irascible answer like that from such an influential figure risks deflecting the viewer from thinking about ANY kind of land use change solutions at all, with the emphasis instead placed firmly on so-called sustainable technologies, invented and built by human beings, many of which Mr Gates is heavily invested in.**

**The reason I’m moaning about this now instead of mentioning it eighteen months ago when Gates was interviewed, is that there’s some new research just been published reanalysing the effects of land use change, and deforestation in particular, on our climate. And that paper most definitely finds a very significant influence from those sectors. So much so in fact that it DIRECTLY challenges the accepted orthodoxy of the climate science establishment.**

**So, I thought we should probably have a little look at it.**

**Hello, and welcome to Just Have a Think**

**This latest research, led by Gerard Wedderburn-Bisshop, Lead Scientist at the World Preservation Foundation, asks a very simple question:**

**‘What human activities have caused present-day warming?’**

**Most of us would probably say it’s mainly the combustion of fossil fuels. And we would certainly be right to highlight the enormous impact that the burning of oil, gas and coal have had on our atmosphere. But we would be basing that assertion on the greenhouse gas accounting conventions set out by the Intergovernmental Panel on Climate Change, or IPCC, almost three decades ago. Back then, the ebbs and flows of land-based carbon were thought to be held in a self-balancing cycle that formed part of a more or less stable biosphere carbon pool. There also wasn’t much data quantifying the influence of tiny particles of pollution in the air that reflect the suns light back out into space – a phenomenon the scientists now refer to as aerosol cooling. And there also hadn’t been much research done on the way different emissions interact when they get up into the atmosphere either. So the agreed convention adopted by the world’s scientists and international lawyers that steered the IPCC outcomes was to focus on fossil fuel emissions; adopt a practice for land use known as ‘net land carbon accounting’; to more or less IGNORE the effects of aerosol cooling, and to make a completely arbitrary choice to compare all greenhouse gases to carbon dioxide over a one-hundred-year timescale.**

**So, let’s have a think about that ‘net land carbon accounting’ thing first of all then.**

**The IPCC has a category called Land Use/ Land Use Change and Forestry, or LULUCF which essentially says that on managed land the uptake of carbon by newly planted trees and crops can be set AGAINST the release of carbon from tree felling or forestry burning or any other land management practices that RELEASE carbon into the atmosphere. In number terms that means that while one hundred percent of emissions from fossil fuels are counted in the global emissions inventory, only ONE THIRD of the carbon released by land use is added in. The IPCC justification for that distinction is that fossil fuel carbon is ‘truly new carbon’ that should be regarded as additional to the biosphere carbon pool.**

**But the authors of this new paper argue that carbon emissions from the deforestation of well-established and in some cases ANCIENT forestry land should ALSO be regarded as ‘truly new carbon’. AND they point out that trees and plants and soil don’t care which carbon atoms they draw down from the atmosphere during new growth. They could just as well be using fossil fuel-generated carbon atoms as land use generated carbon atoms. So, arguably, to be consistent, carbon emissions from ALL sources should either be counted as net or gross.**

**For the purposes of this research, the GROSS emissions number was adopted.**

**Then there’s that aerosol cooling phenomenon that I mentioned. You’ll no doubt remember the lovely clear skies that some of our most polluted cities experienced during the COVID lockdowns. Those images really brought home just how badly people’s health was being affected by nasty particulates like sulphur dioxide coming from heavy industry and the exhaust pipes of millions of internal combustion engine vehicles.**

**According to UNICEF about eight million people die each year from air pollution and tens of millions more suffer from chronic pollution-related health conditions.**

**So huge efforts are now being made to reduce those airborne particulates by cleaning up fuels or using alternative energy sources. A good example is the twenty-twenty regulation by the International Maritime Organisation or IMO, mandating a dramatic reduction in the sulphur content of fuels used for freight shipping. These reductions in atmospheric particulates represent a huge step forward in terms of human health. But the reality is that those particulates were masking a lot of the warming caused by our greenhouse gas emissions.**

**Why? Well because they’re really good at reflecting sunlight back out into space. The better we get at eliminating them, the more the real effect of atmospheric warming becomes apparent. That ‘aerosol cooling’ effect is very poorly factored into existing IPPC accounting conventions, which is something this new research paper attempts to rectify.**

**Arguably the paper’s most significant departure from IPCC conventions though, is in the fundamental methodology used to assess how much warming we humans are causing.**

**I’ve talked about GWP, or Global Warming Potential several times in previous videos. It’s a way of comparing the warming effect of all known human caused greenhouse gases relative to carbon dioxide. So, CO2 has a GWP of 1 and all the other gases are calibrated accordingly. The IPCC uses the one-hundred-year timeline that I mentioned earlier. That’s already a bone of contention for many people though. According to the IPCC, methane is roughly 6:44 twenty-eight times more potent than CO2 over that one hundred-year timeline, but over the twelve to twenty or so years that it typically lingers in the atmosphere, it’s actually more like eighty-two times more potent.**

**Plus, different parts of our planet’s surface interact with these gases in different ways, depending on their geological make up and basically what they’re covered with, whether that’s a fully-fledged rainforest or an area of grassland or an ice-covered polar region, or one of our many densely populated cities. You get the idea.**

**This paper’s authors argue that using GWP to assess the relative planetary warming caused by various different sectors is therefore a deeply flawed metric.**

**They propose that a better measure for policymakers to adopt would be something called Effective Radiative Forcing, or ERF.**

**Essentially every part of our upper atmosphere receives energy from the sun at some point during our planet’s daily rotation. The science bods have calculated that number to be about thirteen hundred and sixty-one watts per square metre. Our planet absorbs some of that energy and reflects some of it back out into space. As long as the amount of outgoing energy is the same as the amount of incoming energy then our planet remains at a constant average temperature. But when we start blanketing ourselves with greenhouse gases, more of that energy is trapped in the atmosphere. Effective Radiative Forcing measures the extent of that warming. Right now, overall, our human activities have caused a positive ERF of roughly three watts per square metre That might not sound like much, but the surface area of our planet is roughly five hundred and ten million square KILOMETRES, so at 3 watts per square metre, that works out to be one-point-five three MILLION GIGAWATTS of additional energy constantly heating up our planet, which is like having a million nuclear power stations running at full tilt constantly adding warmth to our atmosphere. Or to borrow the analogy from our friends over at the Skeptical Science website, since nineteen ninety-eight our climate has accumulated the equivalent of more than three and a half BILLION Hiroshima bombs worth of heat.**

**Using Effective Radiative Forcing instead of Global Warming Potential numbers does away with any confusion or disagreement about relative potency of gases over arbitrary timelines. It is what it is, so to speak. No conversion necessary, just a measurable number.**

**So, how does all that stuff shake down into some useable comparative information then?**

**Well, here’s the chart that the paper’s authors provide us with, which you will notice uses Effective Radiative Forcing going up the Y-axis instead of GWP numbers.**

**Based on data for carbon emissions taken from the Global Carbon Budget, land use data taken from previous peer reviewed studies, and numbers for all the other greenhouse gases taken from the Potsdam Institute for climate research, the CMIP6 climate modelling project and the UN Food and Agriculture Organisation, PLUS FIRE data taken from the Global Fire Emissions database or GFED4, the researchers were able to start putting some colour into the picture.**

**Anything above the zero line represents warming and anything below that line represents cooling. So, let’s start with fossil fuels. Since seventeen fifty, a combination of carbon dioxide, methane, nitrous oxide, carbon black, and a few other volatile organic compounds have caused just over one-point-five watts per square metre of radiative forcing. BUT the polluting particulates like sulphur dioxide, nitrogen dioxide and organic carbon that come from the production, processing, transport and combustion of those fossil fuels have effectively resulted in more than one watt per square metre of COOLING.**

**Global industry also produces CO2 and methane, and it’s largely responsible for many of the other chemicals that can cause extremely strong atmospheric warming reactions. But it’s pollution particulates also have a cooling effect, almost cancelling out it’s warming emissions.**

**I should just stress here that this paper’s authors are not remotely suggesting we continue killing millions of people each year just to retain the benefit of having reflective pollution particulates in our atmosphere. That would be insane. But the effect is real, so it has to be accounted for.**

**Deforestation is overwhelmingly a cause of positive radiative forcing. Mitigated only very slightly by the higher reflectivity or albedo of the bare land that gets left behind in its wake.**

**Our human waste produces huge amounts of methane which contribute about zero-point-two watts per square metre of radiative forcing, and there are some other emission sources right at the far end here that broadly come out neutral.**

**So, what’s this big gap in the middle for then, I hear you ask. Well, it’s agriculture, isn’t?**

**Massive amounts of CO2, methane and nitrous oxide are generated by our human agricultural practice, the majority of which come from animal agriculture. Together, since seventeen fifty, they’ve resulted in almost one-point-eight watts per square metre of radiative forcing, barely compensated for by the relatively small cooling effects of organic carbon and increased albedo.**

**The paper’s authors then converted all that data into a set of pie charts to show the relative impact of each sector under various different measuring methods. The conventional chart uses Global Warming Potential figures over a one-hundred-year timeline, includes only very minimal data for the cooling effect of aerosols, and assumes the NET land use accounting numbers that we looked at earlier. This is the chart that most closely represents IPCC data provided to our policymakers today, and it clearly shows fossil fuels as the worst global warming culprit, at forty seven percent of the mix compared to only thirty-three percent for agriculture.**

**A second way to look at the numbers is to retain all the same IPCC assumptions but to assess each sector using the Effective Radiative Forcing, or ERF, method instead of the GWP method. Fossil fuels are still out front on this measure, but the gap to agriculture closes significantly.**

**OR alternatively you could RETAIN the GWP accounting methodology but apply GROSS emissions numbers for ALL sectors, INCLUDING agriculture. Now, that pushes agriculture ahead of fossil fuels as the largest warming sector at forty-three percent versus thirty-six percent.**

**And just to complete the slightly confusing juggling act with variables and parameters, let’s have a chart using ALL the conventional measuring methods, but with the real effects of aerosol cooling thrown in there as well. And we get a similar result.**

**But of course, the authors of this paper are proposing that we should be DOING AWAY with ALL the conventions currently used by the IPCC. In other words, they say we should use ERF instead of GWP, apply gross emissions accounting to every sector, AND include the cooling effects of aerosols.**

**When you apply ALL those things together, you get a DRAMATICALLY different outcome, with agriculture accounting for no less than SIXTY percent of all effective radiative forcing since seventeen fifty, and fossil fuels representing only eighteen percent.**

**Does that mean we can relax and not worry so much about a rapid transition away from coal, oil and gas towards renewable technologies like solar, wind and batteries?**

**No, of course it doesn’t. It means we need to accelerate that progress as aggressively as possible AND ALSO take a long hard look at the way we produce food, especially the industrial processing of livestock, and the way we strip out forestry land for other industrial processes like mining, logging and the production of biomass and biofuels.**

**I’ll leave you to draw your own conclusions though. I’ve left a link in the description section to the open-source research paper so you can scrutinise the numbers and methodology for yourself, and as always, I look forward to hearing your views, one way or the other, in the comments section below.**

**That’s it for this week though.**

**Thanks, as always to the amazing folks over at Patreon, who help me keep this channel’s content completely independent and free of ads and sponsorship messages. And an extra special thank you to the folks whose names are scrolling up the screen beside me here, all of whom celebrate an anniversary of Patreon support in May.**

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**And of course, you can also support the channel here on YouTube by hitting the like and subscribe buttons either down there or via that icon there.**

**Most important of all though, thanks very much for watching! Have a great week, and remember to just have a think.**

**See you next week.**