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# Climate Models Don't Give Us The Full Story

## Modelos del Clima nos han Dado la Historia Incompleta

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In the debate about global warming we forget at our peril the role of ecosystems in giving us a climate we can live with. Life co-evolving with our planet over thousands of millions of years has created an environment apt for millions upon millions of species, from bacteria to the massive whale or towering redwood trees. In its totality and working together through complex, even endogenous, symbiotic relationships, life gives us a relatively stable climate, modifying the amount of heat stored at the Earth's surface, regulating the clouds that bring rain to the continents, and changing the colour of the Earth so that it differentially absorbs energy from the Sun or on the contrary, reflects it back into space.

The warming effect of a darker colour can therefore thwart our efforts to reduce the impact of anthropogenic increases in the atmospheric concentrations of greenhouse gases. One consequence of global warming is that the boreal forest is spreading, absorbing CO<sub>2</sub> in its growth, and, in principle, helping to cool the planet. However, fir trees, by dint of their pyramidal shape, shed snow from their branches, so exposing dark green needles to the first rays of the Spring sunshine. The overall effect of that spurt in growth is, therefore, to warm the planet rather than cool it.

Gaia is always in the process of becoming, step by step modifying conditions at the Earth's surface, and, as James Lovelock has so vividly described, bringing about temperature regulation as an emergent property of the intertwined system of life and its local environment. How inadequate, therefore, the great majority of climate models, which on account of the difficulty of putting precise numbers to life's role in generating climate, take the easy way out and leave life out of the equation. Yes, in our obsession with greenhouse gas emissions — ironically, as a result of burning fossilised life — we have not just omitted life's current role in forming climate, but we have crudely deemed that disrupting and tearing up ecosystems, with our chainsaws, bulldozers and monoculture agro-industry, will have minimal impact on a process that surely is governed and powered by the Sun. How absurd, say the climate change cynics, to imagine that life, as no more than a puny veneer on the Earth's surface, would be able to alter and regulate climate. Yet a better scientific understanding of the power of that veneer of life to alter everything — plate tectonics, the gas content of the atmosphere, the prevention of life-harming ultraviolet from getting through to the Earth's surface, even that this planet is a watery one — combined with recent research showing that the

current spate of global warming couldn't possibly be caused by the Sun — has put the ball firmly back in the court of human responsibility for global warming and climate change.

We are now playing with technologies to reduce our emissions of greenhouse gases — surely a laudable aim. We will dump carbon dioxide from power stations in spent oil wells; we will install thousands upon thousands of wind machines, some on hill tops, some out at sea; we will cover roofs with photovoltaics that capture sunlight and convert it to electricity; we will construct tidal turbines and wave machines; and not least, in our scramble for energy, we will build nuclear power stations to generate electricity, some of it to make hydrogen which we can then use in fuel cells. The list goes on, with more and more elaborate and high tech ways to prevent that CO<sub>2</sub> from floating dangerously into the atmosphere. Even the idea of rocketing up a reflective shield to send the Sun's rays harmlessly out to Space, has been mooted yet again in the United States. Just the sort of thing that technomaniacs love. At all costs, we must keep the global system running, so that we don't have to alter one jot our consumer aspirations.

Surely Nature is there for our use, to be managed and put in order, so that we can banish selfish, competitive life that eats away at our profits by attacking our crops. Let technology do the work, just as President Bush has said. And, in the mad helter skelter to make money out of climate change, through carbon dealing and giving multinational agribusiness full reign, he has belatedly realised that his 'head in the sand' policies have left the United States out of the loop. And how virtuous the project of transforming chaotic nature into a production line for 'green' biofuels, which, as they are consumed, get replaced by new growth of the same energy crop, with all the emissions being reabsorbed conveniently back into the system? In other words, by managing life we are managing the planet.

What hubris! The very production of biofuels, from a suite of different crops that ranges from maize, canola (rapeseed oil), sugar cane, soya and not least African palm, will probably prove the last straw for our belea-

guered planet. We are now in the hands of massive agro-industrial enterprises that gobble up land as fast as they can, while sowing it with genetically modified crops and pouring on poisons to wipe out any living opposition to their scheme of absolute domination. And, of course, governments are complicit in the process, for there's money to be made — bags of it.

Fuelled by cheap petroleum we have destroyed a staggering proportion of the world's tropical forests in the 50 years since the end of World War 2, with an average 20,000 square kilometres a year going up in smoke. Indonesia alone has destroyed the majority of its biodiverse-rich forests to make way for plantations of African Palm, as has Malaysia and Paraguay. Colombia too, is getting in on the act. Meanwhile Brazil is adding sugar cane to soya as an Amazonian crop, with the plan to sow 30,000 hectares alongside the BR-317 road in Acre. Overall, we are talking of tens of millions of hectares of forests destroyed to make way for the 'green' fuels of the future.

How many tens of thousands of farmers and their families have had their lands wrenched from them and have lost their livelihoods and means of support. How many have been murdered for resisting the corrupt practices of governments, assisted by an illegal militia or even by the army? How many of those who have stayed to work the plantations have found their health ruined because of the massive use of agrotoxins? How many forests have been eliminated from the face of the Earth so that we can run our cars on 'green' fuels? And what has happened to soils, rivers and indeed climate as a result of planting crops that are tailor-made to respond to agrochemicals?

In fact, the idea that 'biofuels' are 'green', benign fuels is for the most part the biggest deceit ever. The use of maize in the United States for the production of ethanol requires an investment of energy that is 70 per cent more than can be gained by putting the stuff in the fuel tank of our car. The release of greenhouse gases from the destruction of tropical rainforest, some 200 tonnes of carbon per hectare, would take generations upon generations of Africa Palm — which gives

30 times more energy per hectare than US maize — to make up, if ever. And how on Earth can we justify that the 10 per cent of biofuel substitution for petroleum products in Europe and 20 per cent in the USA by 2020 will consume one sixth of the world's cropland, or the land mass of an India?

We have forgotten the role of ecosystems and the incalculable services that they provide, and not least their role in giving us a liveable climate. How unbelievably selfish and stupid we are to permit the dismantling of the world's great tropical forests, whether in South America, Africa or Southeast Asia. The Amazon basin is now being invaded, as never before, by the agro-multinationals, with their suite of chemicals. And the more we rape and pillage, the more we discover the extraordinary role that tropical forests play in determining climate.

Nowhere on Earth can be more important than the mighty, luxuriant rainforests of the Amazon Basin. Convection ever upwards of the air mass over the Amazon Basin, fuelled by the condensation of water vapour which the forest has pumped into the atmosphere, sucks in the mighty trade winds that traverse the ocean between Africa and South America. And while those winds are passing over the tropical Atlantic, they pick up volumes and volumes of water, just enough to keep moist the rainforests over a stretch of more than 4000 kilometres and to form the grand rivers, such as Madeira, Napo, Putumayo and Caqueta in the Cordilleras of the Andes — rivers that in coming together form the largest single transport of fresh water in the world.

If it were not for the evapotranspiration from the trees, forests further to the west of the air circulation system would never receive sufficient rain to enable them to survive. Indeed, the same drop of water from the ocean may therefore get recycled six or more times as the air mass passes over the rainforest towards the Andes. The rainforests of the Amazon also react magically to the penetrating sunshine of their summer by increasing their foliage to benefit from enhanced photosynthesis. But, more foliage also translates into more transpiration, by which water is drawn up from the roots and passes out of the stomata in the leaves in

the form of water vapour. Clouds begin to form and convection upwards again takes place, drawing in humid air over the equatorial line. Rain now falls and the forest receives its essential watering. Consequently by intensifying the rate of evapotranspiration, the rainforests of the Amazon are effectively managing their local climate.

Some 20,000 million tonnes of water are evaporated and transpired every day over the 5 million square kilometres of the Legal Amazon of Brazil, an amount that exceeds the 17,000 million tonne flush of water each day into the Atlantic Ocean via the Amazon River. To put that into another perspective, the energy required to bring about that evapotranspiration is equivalent to the summed output of Itaipu, the largest hydroelectric dam in the world, for a period of 135 years. Such a powerful process, involving the transfer via water vapour of 40 times more energy than currently used by all humans on the planet, has consequences for climate all over the globe.

The forest, as a gigantic, irreplaceable water pump, is therefore an essential part of the Hadley mass air circulation system. And it is that system which takes the latent energy inherent in water vapour out and away from the Amazon Basin to the higher latitudes, to the more temperate parts of the planet. Argentina, thousands of miles away from the Amazon Basin gets no less than half of its rain, courtesy of the rainforest, a fact that few, if any of the Argentinian landowners — increasingly engaged in producing soya for agrofuels — are aware of.

The unavoidable conclusion is that, unless the world acts swiftly to prevent further deforestation in the Amazon, we could find the impact of global warming far worse than anticipated in the IPCC's latest, 2007, fourth assessment report. The deforestation now taking place over the Amazon Basin is an act of global genocide, for as the forest is cut back so its ability to recycle essential rain becomes more and more threatened, until the entire system collapses. With that collapse the atmosphere will be filled with the greenhouse gases from the destruction and decay of the vegetation and we will have lost for ever an essential energy pump and deliverer of water over most of the South Ameri-

can continent. The boost to global warming will make irrelevant our efforts, through the Kyoto Protocol, to reduce carbon dioxide concentrations in the atmosphere.

It should be of no surprise that our weather, and no less climate, are being profoundly affected by what we are doing to the Amazon. In blaming greenhouse

gases emitted from our factories, transportation systems, electricity production, agriculture and our non-sustainable consumer life-style as a cause of climate change, we are neglecting at our peril the role that life plays. The destruction of ecosystems for agrofuel production is not the solution: it has become the problem. Trying to match agrofuel production with our current and projected use of the fossil fuels will be the death of us all.