Global warming

Earth's plants are countering some of the effects of climate change

More photosynthesis means a slower rise in carbon dioxide levels—for now

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In 1972, on their way to the Moon, the crew of Apollo 17 snapped what would become one of the most famous photographs ever taken. The "Blue Marble" shows Earth as it looks from space: a blue sphere overlaid by large brown swatches of land, with wisps of white cloud floating above.

But times change, and modern pictures of Earth look different. A wash of greenery is spreading over the globe, from central Africa to Europe and South East Asia. One measurement found that between 1982 and 2009 about 18m square kilometres of new vegetation had sprouted on Earth's surface, an area roughly twice the size of the United States.

The growth in greenery is a consequence of climate change. As the planet heats up, places that were once too chilly for most plants to grow have become steadily more hospitable. That extra vegetation, in turn, exerts its own effects on the climate. According to a team led by Trevor Keenan of the Lawrence Berkeley National Laboratory, in California, who have just published their findings in *Nature Communications*, the plant growth caused by climate change may also be helping to slow it—at least for now.

In 2014 humans pumped about 35.7bn tonnes of carbon dioxide into the air. That figure has been climbing sharply since the middle of the 20th century, when only about 6bn tonnes a year were emitted. As a consequence, the concentration of CO_2 in the atmosphere has been rising too, from about 311 parts per million (ppm) in 1950 to just over 400 in 2015. Yet the rate at which it is rising seems to have slowed since the turn of the century. According to Dr Keenan, between 1959 and 1989 the rate at which CO_2 levels were growing rose from 0.75ppm per year to 1.86. Since 2002, though, it has barely budged. In other words, although humans are pumping out more CO_2 than ever, less of it than you might expect is lingering in the air.

Filling the atmosphere with CO_2 is a bit like filling a bath without a plug: the level will rise only if more water is coming out of the taps than is escaping down the drain. Climate scientists call the processes which remove CO_2 from the air "sinks". The oceans are one such sink. Photosynthesis by plants is another: carbon dioxide is converted, with the

help of water and light energy from the sun, into sugars, which are used to make more plant matter, locking the carbon away in wood and leaves. Towards the end of the 20th century around 50% of the CO_2 emitted by humans each year was removed from the atmosphere this way. Now that number seems closer to 60%. Earth's carbon sinks seem to have become more effective, but the precise details are still unclear.

Using a mix of ground and atmospheric observations, satellite measurements and computer modeling, Dr Keenan and his colleagues have concluded that faster-growing land plants are the chief reason. That makes sense: as CO_2 concentrations rise, photosynthesis speeds up. Studies conducted in greenhouses have found that plants can photosynthesize up to 40% faster when concentrations of CO_2 are between 475 and 600ppm.

For delegates at the latest round of UN climate talks, in Marrakech, that sounds like good news. But more vigorous photosynthesis is only slowing climate change. The effect is too small to reverse it. And it will not last, says Dr Keenan. Besides, there is more to growing plants than carbon dioxide. Take water: in a changing climate, wet bits of the world will probably become wetter while drier parts become drier. Extreme events—droughts and deluges—will intensify. Rainfall patterns may change, which could make some places less friendly to plants that now thrive there. And although plants benefit in the short term from extra CO_2, they suffer when temperatures get too high.

There will be more complicated effects, too. Much of the greening has occurred in cold spots. Yet while ice and snow reflect sunlight, vegetation soaks it up, so more greenery in the north will eventually lead to yet more warming. That, in turn, could release large quantities of methane—a potent but short-lived greenhouse gas—from thawing tundra. Elsewhere, higher temperatures could kill tropical forests. According to one estimate, for every degree of warming, tropical forests may release greenhouse gases equivalent to five years' worth of human emissions.

Indeed, some researchers think the effects of global greening may already be fizzling out. Every few years a climatic phenomenon called El Niño sees the tropical Pacific Ocean warm substantially, which tends to raise temperatures around the world. The most recent Niño, in 2015-16, was a whopper. Corinne Le Quéré, a climate researcher at the University of East Anglia in Britain says that means the world's plants may have, therefore, become a less potent carbon sink than they were in the period studied by Dr Keenan's team. Global greening, then, offers only a little breathing space. Kicking the fossil-fuel habit remains the only option.

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