



Figure 1 | No net change. Li *et al.*¹ report that China's relative contribution to global radiative forcing — a measure of how strongly different factors affect climate change — has remained constant over the past three decades (broken blue line). The total net effect has several contributors. Carbon dioxide emissions from fossil-fuel combustion have increased, as have black-carbon emissions, both of which lead to climate warming (positive radiative forcing). Land-use change can also contribute to warming, but the effects of this have declined. Conversely, sulfate emissions that cool climate have increased, and the negative radiative forcing associated with this has offset that from warming factors. Plotted lines are approximate.

is because Chinese sulfate emissions soared at the same time that Europe and the United States instigated controls that slashed their sulfate emissions. It has long been known that some air pollutants cool the climate²; what is remarkable in the present study is that the concurrent changes in different emissions have led to a stable overall contribution of China to global radiative forcing (Fig. 1).

Air pollution is a serious environmental issue in China, where 1.3 million people die each year because of exposure to poor-quality air outdoors³. Reductions in the emissions of air pollutants are urgently required to improve air quality, but this will also affect Earth's climate. Li *et al.* find that the current composition of Chinese air pollution causes almost no net radiative forcing — the cooling effects of sulfate aerosols balance the warming impacts of black-carbon emissions.

This means that it will be difficult to achieve rapid reductions in near-term global warming through the control of Chinese air pollutants overall — a focus on greenhouse-gas emissions in particular will be required. It also means that carefully managed mitigation of air pollution that focuses on reducing both black-carbon and sulfate emissions might have a minimal impact on climate, because their effects seem to counteract each other. Controlling the combustion of solid fuels for cooking and heating in the home is important in this context, because domestic solid fuel accounts for 40% of Chinese black-carbon emissions⁴ and causes half a million deaths annually through poor outdoor air quality^{3,4}.

Li and co-workers went on to explore China's contributions to emissions of CO₂ and methane from pre-industrial times (1750) to the present day. They find that China's relative contribution to radiative forcing from these greenhouse gases has remained remarkably constant over this much longer period as well. The extensive conversion of China's natural forests to agricultural land resulted in substantial CO₂ emissions in the early part of this period. The rate of deforestation has declined in recent decades, but this has been counteracted by increasing fossil-fuel emissions. China is now planting forests on a larger scale than anywhere else on the planet. These plantations sequester CO₂ from the atmosphere, so that Chinese forests are now a net sink of this gas.

Mitigating climate change and air quality without unintended consequences will require an understanding of many complex interactions. Current models, including the one used by Li *et al.*, do not cover many of these complexities. In particular, the authors' study does not consider the formation of secondary organic aerosols — which might dominate in the haze over China⁵ — from gaseous pollutants. Detailed monitoring of Chinese air pollution is urgently needed to inform the development of effective mitigation policies⁶.

Air pollutants also interact in complex ways with ecosystems: land-use change alters air quality⁷, and deposition of pollution can alter forest growth and carbon sequestration⁸. But these effects are not included in many models. Recent work⁹ has shown that fast-growing forest plantations in Europe store less biomass



50 Years Ago

The winds of change are sometimes almost indistinguishable from placid summer breezes. The decision of the British Government that British money must now be decimal ... would bring some benefit, not disaster ... There will be those who claim that the duodecimal system is better because twelve has several integral factors, though it is at least as sensible to argue that the base of all arithmetic should be a prime number in order that people should not be encouraged to manipulate vulgar fractions ... More distantly, other feats of rationalization may now be attempted. Why not, for example, decimalize the day? ... A decimalized day should be a much more practical proposition. From midnight to midnight would be a million new seconds. One per cent of a day, or 10⁴ new seconds, would be a convenient sub-unit roughly equal to a quarter of what is now an hour. Astronomers and airline travellers alike would welcome — in due course — that further proof that decimals are not merely reasonable but inevitable.

From *Nature* 19 March 1966

100 Years Ago

Scientific men in their most august society are banded together "for the improvement of natural knowledge." They are by implication a body of students working in the temple of Nature for truth's sake alone, heedless of the world and its rewards. What they garner is their gift to the world: they fill another page in the Revelation that brings men nearer to the angels. Let a man wander into the world with his science as wares to sell for money profit, and he has passed from true brotherhood. Surely this idea, perhaps rather fancifully stated, is at the bottom of much of our exclusiveness.

From *Nature* 16 March 1916