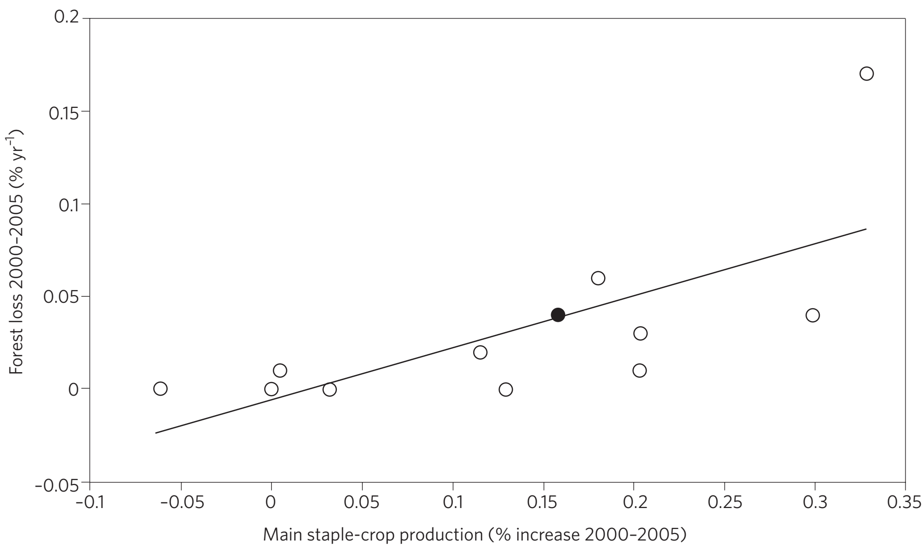

Figure 1 | Percentage forest loss[3] versus staple-crop production[9] in 12 sub-Saharan African countries. Open circles represent cassava as the main crop; closed circle represents yams as the main crop. Pearson's regression coefficient is significant: $r = 0.71$ ($p = 0.01$).

dominant drivers of deforestation[6,7]. Indeed, staple-crop production is strongly correlated with deforestation in the African countries assessed by DeFries *et al.*[3] (Fig. 1). This increased production is not correlated with yield increases over the same time period (Pearson's regression coefficient $r = 0.16$; $p < 0.66$), meaning that production increases result from agricultural expansion. In fact, agricultural yields have fallen or remained stagnant across sub-Saharan Africa since the 1960s (ref. 8).

Demand for biofuels and other cash crops, such as tea and coffee, may usher in a new export-driven mode of deforestation in Africa's future. But at present the rate of deforestation is slower in Africa than in other tropical regions, and interventions aimed at reducing it still need to focus on meeting local or regional needs, without foreclosing development and livelihood opportunities gained through the production of timber and non-timber products. Specifically, interventions should aim to reduce the demand for deforestation, while providing welfare benefits, for example by increasing agricultural yields on existing cultivated lands, and increasing household energy efficiency. Special consideration should be paid to urban demands from woodlands and forests, for example for charcoal and animal protein, as rural-to-urban migration rates are highest in Africa, and positively correlated with deforestation[3]. ❐

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Misrepresentation of the IPCC CO_2 emission scenarios

To the Editor — Fossil fuel CO_2 emissions have increased significantly. However, contrary to some statements in recent publications[1–3], current emissions are not higher than covered in the climate change scenarios used by the last two Intergovernmental Panel on Climate Change (IPCC) assessments[4,5]. And although emissions were recently near the top of the range that has been covered[6], the changes in atmospheric CO_2 concentration follow long-term average emissions rather than short-term variations.

The greenhouse gas emission scenarios used in recent IPCC assessments originated from the IPCC's Special Report on Emissions Scenarios (SRES)[7]. This provided a detailed overview of forty non-mitigation scenarios that were structured into six subgroups based on common storylines. As noted in the report, it is not appropriate to average across the scenarios within one subgroup, because such an average would mix different options for socioeconomic development and would therefore not be internally self-consistent. Moreover, subgroup averages do not reflect the full range of possible emissions pathways.

Instead, for each subgroup an 'illustrative marker scenario' was selected and reviewed in more detail for use in climate change simulations. These six illustrative scenarios have been used extensively by climate modelling groups and are the basis for most climate projections in the Third and Fourth IPCC Assessment Reports.

We therefore take issue with the comparison[8,9] of the estimated evolution of industrial CO_2 emissions since 1990 with subgroup averages of the SRES scenarios, rather than with the illustrative scenarios. These comparisons can be misleading over the next few decades because the upper boundary of the range covered by subgroup average emissions is significantly lower than the upper boundary of the range of illustrative scenarios. As a result, the comparisons with subgroup averages have led others[1–3,10]

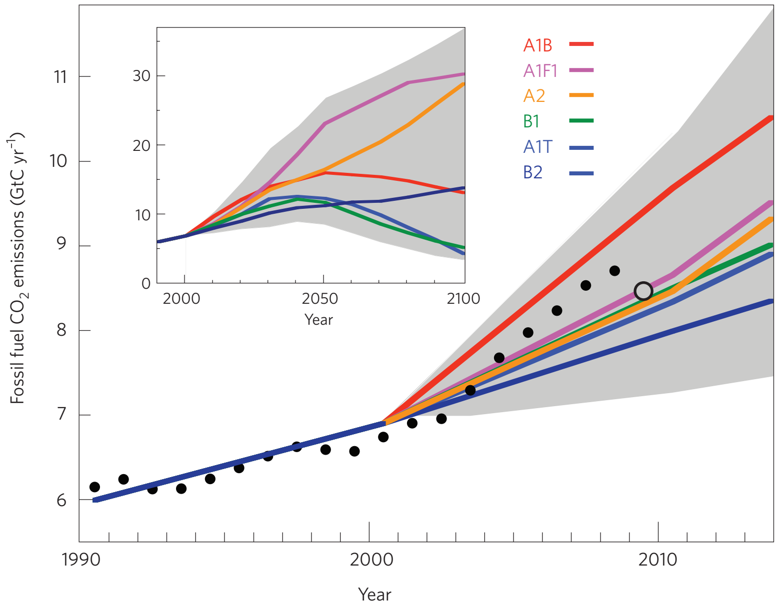

Figure 1 | Fossil fuel CO_2 emissions. The graph shows that estimates of annual industrial CO_2 emissions in gigatons of carbon per year (GtC yr^{-1}) for 1990–2008[13] (black circles) and for 2009[9] (open circle) fall within the range of all 40 SRES scenarios (grey shaded area) and of the six SRES illustrative marker scenarios (coloured lines). The inset in the upper left corner shows these scenarios to the year 2100.

to incorrectly conclude that current emissions are higher than the values used in climate change projections. This may be spreading into general reviews of climate change science[11,12], causing a growing inconsistency between the modelling work that has been done for the IPCC and its broader interpretation.

We would therefore like to emphasize two points for comparing estimates of recent fossil fuel CO_2 emissions[13] with the scenarios used in climate science. First, emissions have remained below the highest SRES illustrative marker scenario, although they have recently been larger than in the five others. For the first two decades of the twenty-first century, the highest emissions are in the illustrative scenario of the A1B subgroup, which was one of the three scenarios studied in detail by climate modelling groups for the last IPCC assessment[14].

Second, the emission scenarios are designed to cover long-term trends as a basis for considering corresponding changes in atmospheric CO_2 concentrations. Whereas there is a need to monitor whether actual emissions depart significantly from such trends, up to 2008 there was no evidence for such a departure[15]. Furthermore, the estimated cumulative emissions over the period 1990 to 2008, and the resulting changes in atmospheric CO_2 concentration, have remained very close to the midpoint of the range for the cumulative emissions covered by the six illustrative scenarios and given in the IPCC Third Assessment Report[4].

We urge scientists referring to the SRES scenarios to focus on the illustrative scenarios that have been widely used in cross-disciplinary research for both climate projections and impact studies. ❐

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