tion if it had occurred under cool temperate Pliocene conditions.

A second argument for stability comes from sea cores. J. P. Kennett (University of California, Santa Barbara) claimed that there is no sign in them of the change that would have accompanied the collapse of the East Antarctic ice sheet. Oxygen isotope ratios, strontium isotope ratios, the pattern of biogenic sediment and ice-rafted debris distribution all show little change through the Pliocene and point to no more than limited fluctuations of the East Antarctic ice sheet.

A third argument for stability is glaciological. Ice sheets in dry, cold, polar environments are restricted by a shortage of snow rather than by warm temperatures. In such environments, an increase in temperature of a few degrees is accompanied by more snowfall and an expansion rather than a decrease in the size of the ice sheet. P. Huybrechts (Free University of Brussels) used glaciological modelling to show that an increase of around 20–25 °C would be necessary to remove the ice sheet from the interior of East Antarctica. Furthermore, warming by up to 5 °C would lead to an increase in ice volume as a result of the increased snowfall that would accompany warming in a polar desert climate. The implication is that the ice sheet could not have disappeared during the modest warming of the Pliocene; rather, it is likely to have been bigger than it is today.

At present, it is difficult to reconcile the contrasting views about the stability or instability of the East Antarctic ice sheet. The impasse will be solved by careful scrutiny of the assumptions underlying the alternative hypotheses. Barrett *et al.*[1] remove one important uncertainty, that of the age of the diatoms. But there remains the problem of whether the diatoms are the same age as the terrestrial vegetation and glacial deposit in which they lie, and whether they were emplaced by ice. If not, then the Sirius Group deposits could be very old indeed and could reflect the onset of Antarctic glaciation in the early Cenozoic, about 40 million years ago. □

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Flowering inferno

TALK of pollution, and the instant thought is of smog over Los Angeles, or of floods of industrial effluent. But it is becoming increasingly apparent that ordinary agricultural practices are also villains in the piece. A third of anthropogenic carbon dioxide and carbon monoxide comes from biomass burning, participants concluded at a conference held two years ago. Although that leaves two-thirds coming from burning of fossil fuel, it was clear that there is a big gap in our picture of the factors that could cause global climate change, and the decision was to rectify matters.

On page 812 of this issue, D. R. Cahoon and colleagues use military satellite images to find the patterns of grassland burning in the African savanna belts: grassland burning consumes three times as much biomass as does the much better known rainforest destruction, and two-thirds of all savanna is in Africa (10 million square kilometres). The grassland is burnt back regularly to make way for new shoots, as otherwise the land would quickly become unusable for grazing.

The main determining factor in the extent of burning is season — fires are most prevalent in dry conditions. At this time of year, large tracts of coastal southern Africa, from Namibia round to Tanzania, are aflame, but by January the destruction will have moved north and then inland to the sub-Saharan savannas of North Africa.

As a second prong of the new work, over 180 scientists from 13 nations converged on South Africa in September to study at first hand the atmospheric and chemical effects of fires started deliberately in Kruger National Park. The SAFARI (Southern African Fire–Atmosphere Research Initiative) burnings, two destroying a little more than 3,000 square kilometres each and four smaller ones, were timed to start as the US National Oceanographic and Atmospheric Administration's NOAA9 satellite was flying overhead. At the same time, a pair of helicopters took coordinated measurements of the firet temperature and the chemistry of the air immediately above the blaze; a Cessna sampled the air tens of kilometres downwind and a DC3 took further samples hundreds of kilometres downwind (as far as the Atlantic coast). But most workers were involved in ground-level observations. Not only was the amount of visible biomass before and after the fires measured, but even the effect of microbial biomass in the soil, a significant source of nitrogen oxides, was determined.

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Joel S. Levine, NASA Langley Research Center

Savanna ablaze in Kruger National Park, South Africa, during the SAFARI experiment.

Of particular concern — greenhouse gases notwithstanding — is the role of the products of biomass burning in producing ozone in the troposphere: although ozone is beneficial in the stratosphere, shielding us from solar ultraviolet radiation, down here in the troposphere it is both a poison and another greenhouse gas. The conference two years ago determined that 38 per cent of tropospheric ozone is generated through biomass burning, and satellite mapping has revealed large plumes of ozone extending over the South Atlantic.

The masses of data collected will take months to digest — the participants in SAFARI will gather at the end of next May to pull all the threads together. But the hope is that a giant piece in the global environmental debate will then be put into place. R. P.