Open evidence. In Broxa Forest on the North York Moors, G. W. Dimbleby established a set of plots where natural regeneration was allowed to occur. Young birch here surrounds an opening dominated by heather — like some of the later stages of prehistoric openings inferred from pollen analysis. (Photograph courtesy of I. G. Simmons.)

ments, Simmons and Innes[1] analysed 70 samples in this way, taking them through an episode in which the pollen of *Triticum* (wheat) occurs for the first time. Their temporal resolution is such that each sample is reckoned to comprise just six years' pollen rain, so the event recorded took about 400 years.

Before disturbance occurred, the forest consisted of deciduous trees (oak, alder, hazel and elm), with some birch and willow. These latter two trees, together with a range of herbs, show that the forest had some open (presumably natural) clearings. A more persistent and marked clearance is then shown by an abrupt fall in first alder and then oak pollen, and a general increase in indicators of open, disturbed conditions. Most marked among these indicators is *Melampyrum* (cow-wheat), which is a semi-parasitic plant often associated with clearings, trampled areas and sometimes burnt habitats. These conditions continue for some time (about 20 mm of peat depth, which is equivalent to about 120 years) before the first appearance of wheat pollen grains. With the appearance of cereal crops, the weed flora changes; plantain (*Plantago laceolata*), mugwort (*Artemisia* sp.) and various species indicative of disturbed soil become more frequent. Evidently, the land management has changed at this stage and new management objectives have been adopted.

The authors regard the initial clearance and the maintenance of open conditions as a means of habitat management for the promotion of hunting activities. Red deer, a major prey species of Mesolithic cultures and a common animal in upland forests, was undoubtedly encouraged by the creation and maintenance of open, regenerating areas of forest. Hunting must also have been facilitated by the clearance of glades within the forest. So we can imagine a population of hunters managing clearings by felling and fire for more than a century before the arrival in the region of the agricultural idea, together with the wheat grains that were ultimately to revolutionize the way of life of the people of the area. Simmons and Innes claim that "cereal growing was slipped into a patch of land which had hitherto been used for another purpose". Perhaps that former usage had even proved an effective preparatory stage for cereal cultivation, with fire and increased animal dung input enriching the constantly disturbed soils.

What is also apparent is that cereal growing was abandoned at the site after another fifty years or so, possibly as a result of soil exhaustion, or poor crop productivity at this altitude, or the sheer effort involved in protecting crops from the deer that the clearing had originally encouraged. Whatever the reason for the abandonment of the agricultural experiment, it is clear that, far from being a Neolithic revolution, early cereal growing in this part of Yorkshire was not only an afterthought, but was also a bit of a flop. □

Peter D. Moore is in the Division of Life Sciences, King's College London, Campden Hill Road, London W8 7AH, UK.

1. Simmons, I. G. & Innes, J. B. *J. Archaeol. Sci.* **23**, 613–618 (1996).
2. Iversen, J. *Danm. Geol. Unders.* Ser. IV **3**, 1–23 (1949).
3. Edwards, K. J. & Hirons, K. R. *J. Archaeol. Sci.* **11**, 71–80 (1984).
4. Edwards, K. J. & McIntosh, C. J. *Pollen Spores* **30**, 179–188 (1988).
5. Chambers, F. M. in *Climate Change and Human Impact on the Landscape* (ed. Chambers, F. M.) 247–259 (Chapman & Hall, London, 1993).
6. Turner, J., Innes, J. B. & Simmons, I. G. *New Phytol.* **123**, 599–647 (1993).

DAEDALUS

Clearing the air

MOST domestic smoke alarms have a feeble radioactive source, the alpha-emitter ^{241}Am. The alpha particles ionize the air in the device, permitting a weak current to flow between two electrodes. The light ions carrying this current are readily captured by smoke grains or other fine particles in the air. Once stuck firmly onto large, heavy smoke grains, the ions travel much more slowly. The current falls, and an amplifier sounds the alarm.

Particles suspended in the air bring all sorts of trouble. Exhaust fumes cause grime and pollution; pollen, asbestos fibres, airborne viruses and bacteria spread ill health; and these days cigarette smoke is the most resented of them all. Can smoke-alarm technology, asks Daedalus, be adapted to remove them?

The principle seems simple enough. A suitable beam of alpha radiation should rapidly put a charge on every particle in the local air. Two large plates with a few thousand volts across them — in effect, a sort of radioactively augmented electrostatic precipitator — should then attract the charged grains from the air. Sadly, as Millikan found in his determination of e, charged droplets drift very slowly, even in strong fields.

So Daedalus is abandoning the charged plates. An alpha track must contain equal numbers of positive and negative ions. Of the grains that capture them, half will go positive while the other half will go negative. These will be mixed together at very small separations, and will attract each other forcefully. This strong local attraction, aided by brownian wandering, will rapidly bring the two types together. On impact, each pair will form a neutralized clump. Each clump will take up more charge, and clump again and again.

Daedalus concludes that a suitable alpha source must rapidly agglomerate dust particles in the air into very coarse grains. And coarse grains are not hazardous. Our noses filter them out very efficiently. Even asbestos fibres are only dangerous if they are very fine. In any case, a coarse air suspension must soon fall to the ground as ordinary dirt.

So DREADCO's 'Dust-Slayer' is simply a suitable highly ionizing but short-range alpha source, with a fan to blow the room air steadily past it, clumping the fine dust into a rapidly precipitated grit. To avoid endangering the customers, it will be carefully screened and shielded, and (like smoke alarms themselves) will mention its radioactive content only in very small print. Indeed, a combined Dust-Slayer and smoke alarm seems feasible. It will agglomerate all the smoke in the vicinity, allowing the victims to breathe it safely.

David Jones