dropped by two-thirds and World Bank lending in the sector slipped from 30% to 8%. The reasons for this included the perceived success of Green Revolution technologies in Asia, and, indeed, some backlash against intensified farming among green groups. The downslide was most pronounced in sub-Saharan Africa, where the cutbacks were still severe even though there had been no Green Revolution comparable to that in Asia. A contributing factor to this decline from the 1990s on was Europe's attitude to genetically modified crops, which both chilled research in the area and reduced incentives for such technologies to be fielded in countries looking to European export markets.

One might assume that such cutbacks in research reflected poor results. Not so; the pay-offs to agricultural research are massive. The World Bank's *World Development Report 2008: Agriculture for Development* (http://tinyurl.com/2ngyqd) — the first of the annual reports to focus on agriculture for a quarter of a century, the bank noted with self-reproach — cites 700 published estimates of rates of return on investment in agricultural research, development and extension services in developing countries. It reports an average annual return of 43%.

Agriculture has poverty-busting powers beyond straightforward revenue increases. One reason for this is that poor people in poor countries who earn a little extra cash will spend it on basic local goods and services — agricultural growth spurs economic growth from the bottom up. A study of 42 developing countries covering the period from 1981 to 2003 found that growth in gross domestic product (GDP) that originated in agriculture increased spending by the poor two-and-a-half times more than does GDP growth in other sectors.

The past weeks have brought signs that global institutions and donors are beginning to bow, belatedly, to this logic. On 2 April the World Bank announced its intention to double agricultural lending to sub-Saharan Africa over the next year, and bank administrators say that a portion of the new money will go towards basic research. Britain, the International Monetary Fund and the Bill & Melinda Gates Foundation are also opening their coffers. In the case of the Gates's money, much will be channelled through the Alliance for a Green Revolution in Africa led by Kofi Annan.

There are many useful directions for such development; higher yields, drought resistance and reduced requirements for inputs such as fertilizers and pesticides are all promising. But the more pressing problem for poor farmers is not the development of new technologies but access to those already there. Plenty of good agricultural science — such as locally adapted seed varieties and soil surveys — sits unused because it has not been delivered in a form adequately tailored to the end users and their limited means. Resources need to go towards coordinating and strengthening local agricultural extension services as an integral part of revamping and reintegrating the research infrastructure. Agricultural research systems in sub-Saharan Africa are fragmented into almost 400 distinct agencies, eight times the number in the United States and four times the number in India.

"Agriculture has poverty-busting powers beyond revenue increases."

Access is not just a matter of seeds and bloodlines and new agronomic know-how. Weather services that rich-world farmers rely on are extraordinarily hard to get hold of in poor countries. The first attempt to evaluate the impact of climate change on agriculture in Africa, for example, had to rely on climate-sensitivity studies carried out in the United States for lack of any data from the continent in question. Better weather and climate data would allow lenders, be they development banks or local sources of microfinance, to create insurance products for farmers of a sort that is almost completely unavailable to the world's poor. These pragmatic solutions should get a large slice of a rapidly expanded pie. ■

A place for everything

More researchers must record the latitude and longitude of their data.

Who, what, where and when? Among the basic elements of scientific record-keeping, too often the 'where?' gets neglected. Now advances in satellite-positioning technology, online databases and geographical information systems offer opportunities to make good that neglect, and to add a much-needed spatial dimension to many types of biological research. Location data are essential for those modelling species' responses to climate change, or the spread of viruses, for example. Failure to include spatial information from the get-go may close off potentially highly productive routes to analysis — including those not yet foreseen. But those data are frequently inadequate or absent.

Many museums and herbaria are trying to make good this problem as best they can, geo-referencing their collections and putting them online. This frequently requires nightmarish work translating place names from various historical eras, languages and conventions into latitudes and longitudes. Although this is a necessary evil in matters retrospective, going forward there is a much simpler and easier answer in the form of coordinates and a time-stamp taken from the Global Positioning System (GPS) at the point of capture, or any other specified point of relevance.

This technology means that there is now much less excuse for allowing spatial data to fall by the wayside simply because they are not relevant to the data collectors' project in hand. Not only are the data easily collected, they are easily stored too. GenBank, for example, introduced fields for latitude and longitude in the metadata attached to its nucleotide sequence records in 2005. But few yet contain such information.

Gene sequence and structure databases have flourished in part because journals require authors to submit published data to them. It is worth considering a similar requirement that all samples in a published study be registered, along with GPS coordinates, in online databases such as the Global Biodiversity Information Facility. At the same time, it would behove spatial scientists to articulate to the broader research community the potential of recording and making accessible spatial data in the appropriate formats — and the painlessness of the process. ■