as 'novel ecosystems' — areas not currently being managed by people, but so changed by human activities that they have become different ecosystems, with different players and a different trajectory from the system they replaced. Many of these places have changed so much that attempting to return them to their historical condition would be prohibitively expensive, if not impossible, especially with climate change added to the mix. Nevertheless, these alternative states are often species-rich, energetically productive and vigorous providers of ecosystem services (see page 450).

Given these realities, more researchers and conservationists need to expand their interests to encompass urban and agricultural ecologies, as well as novel ecosystems in general. Many have already done so. Next month's meeting of the Ecological Society of America in Albuquerque, New Mexico, plans symposia on soil microbial ecology in sustainable agriculture, agroecosystems of the future and urban design. But such work merits increased support from all of the government agencies and non-governmental foundations that fund ecological and conservation work. A good example is the US National Science Foundation's Long Term Ecological Research Network, which includes among its 26 sites two cities — Baltimore, Maryland, and Phoenix, Arizona — where researchers examine how the human and ecological systems in the city interact and change over time.

Likewise, funders that support research into ecosystem services, such as the US Environmental Protection Agency in Washington DC, should put a special emphasis on anthropogenic areas. Some of these places may even warrant protection, as odd as it might seem to create a park around an overgrown orchard or a lake filled with foreign fish.

None of this is to say that anything goes. Exotic species, pollution and mindless development have wreaked widespread havoc in the past, and strong safeguards are still needed to minimize future damage. Moreover, some novel ecosystems — monocultural stands of invasive plants such as leafy spurge, deserts created by nibbling goats and rabbits or bodies of water devoid of all life larger than algae — are universally considered undesirable and are crying out for intervention and restoration. But not all change is bad. Where a reasonably healthy, reasonably diverse ecosystem is providing at least some kind of service, we might be better off to embrace our altered Earth.

Indeed, when society learns to appreciate ecosystems as they are, rather than always yearning to return to an impossible, pristine past, we may be able to make that 77% work for us so well that we never need to disturb the rest. Preservation of the pristine may depend on our understanding and careful use of the worn and grubby. We may even learn to find some charm there. ■

The carbon count

Scientists need better Earth-monitoring tools to see whether climate policies are working.

When the world's nations meet in Copenhagen this December to try to construct a successor to the 1997 Kyoto Protocol on climate change, one major point of discussion will be 'offsets'. These are deals that could help countries meet their targets for reducing emissions by paying for others to absorb greenhouse gases in natural carbon sinks such as rainforests, or by otherwise reducing the threat of global warming.

Any new agreement would presumably build on the existing Kyoto framework that allows certified credits from offsetting projects, such as planting trees, to be traded on the international emissions market. Voluntary carbon offsets are also becoming increasingly popular among businesses and air travellers who want to compensate for the carbon footprint of their activities.

As things stand, unfortunately, the success or failure of any such policy is largely a matter of guesswork: there has never been a global observation network capable of verifying whether the carbon dioxide emissions and offsets reported by individual countries make any sense. Carbon-cycle scientists estimate, for example, that around one-third of the CO_2 from fossil fuels burned globally is taken up by land vegetation. But they have no idea what the precise fraction is, or where the carbon actually goes: *in situ* measurements of biosphere-to-atmosphere carbon fluxes are scarce, and ecosystem inventory data are often unavailable. In addition, monitoring efforts suffered a dire setback on 24 February when NASA's US$278-million Orbiting Carbon Observatory (OCO) crashed into the ocean minutes after launch.

Any new international climate agreement, whether it emerges at Copenhagen or later, must therefore provide for a much-improved carbon-monitoring infrastructure for verifying its effectiveness. One key element will be satellite observations, which provide large-scale mapping of greenhouse-gas emissions and land-cover changes. NASA should get the support it needs to build a cheaper copy of OCO, which could be launched as early as 2011 (see *Nature* **458,** 8; 2009).

But equally crucial will be high-precision, *in situ* measurement of carbon fluxes between soils, vegetation and the atmosphere. The many international agencies that make up the Integrated Global Observing Strategy partnership should implement, without further delay, their 5-year-old plan for an Integrated Global Carbon Observation programme. A good place to start would be to expand FLUXNET, an existing surface network of some 400 carbon-measurement towers that still has huge gaps, particularly in the tropics.

At the same time, the agencies that comprise the intergovernmental Group on Earth Observations (GEO) could aim to produce globally harmonized data sets on global, national and local scales, using common algorithms, variables and units. GEO, which coordinates efforts to create the Global Earth Observation System of Systems, should also commission scientists to develop an integrated model that stitches all carbon observations together. It should then make these available for use at all levels by scientists and policy-makers alike.

A global carbon-measurement system along these lines should make international climate policies much more solid than they have been in the past. It might reveal that what we are doing is not enough, and that many offset projects fail to deliver. It might expose swindlers and profit-makers in the carbon business. Or it might prove that nature is a stronger ally than we have dared to hope. Whatever the outcome, a serious investment in carbon monitoring will be money well spent. ■