

# Wanted: scientists for sustainability

Few observers expect much political progress at next week's summit on sustainable development. But it could mark the start of a transformation in the way scientists deal with sustainability issues. Tom Clarke reports.

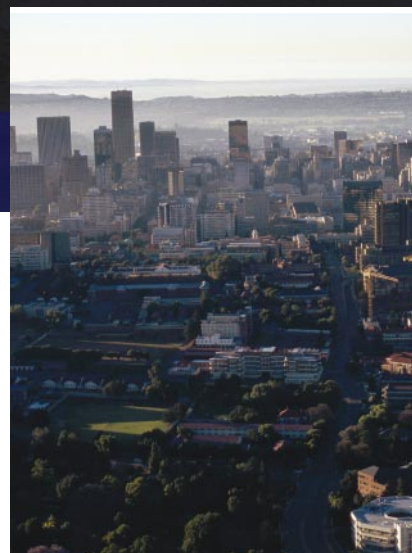
**Pamela Matson (below, left) and Jane Lubchenco hope to bolster the role of sustainability research.**



Politically speaking, the outlook for the World Summit on Sustainable Development is grim. Thousands of politicians, including the leaders of more than 100 countries, will fly into Johannesburg over the next two weeks — but most will have left their chequebooks at home. Delegates will spend ten days discussing how the world can continue to develop without jeopardizing the Earth's resources and life-support systems, yet even optimistic observers do not expect much in the way of new financial commitments.

But although the summit looks like being a political flop, it could be a turning point for scientists concerned with sustainable development. Whereas governmental attempts to address sustainability issues remain confused, researchers are slowly building a picture of what science can contribute. "The full power of what science has to offer has not even begun to be adequately tapped," says Jane Lubchenco, an environmental scientist and sustainability expert at Oregon State University in Corvallis.

At the summit, scientists like Lubchenco hope to hatch a new way of doing research that addresses the needs of sustainable development. How, for example, can fields from marine biology to economics work together to produce answers to specific local problems? And



**Enlightening the world: researchers hope to make their presence felt in Johannesburg (above).**

what can Western scientists do to help bolster research in developing countries, where local knowledge and scientific input into sustainability issues is often lacking? "Johannesburg is one of the first steps on an exciting and difficult journey," says Thomas Rosswall, executive director of the Paris-based International Council for Science (ICSU), which has been at the forefront of representing the interests of scientists at Johannesburg. "We need to create a science for sustainable development."

## Ten years on

The conference was conceived as a follow-up to the last similar United Nations event — the Earth Summit, held in Rio de Janeiro in 1992. This time around, delegates will move beyond the environmental focus of Rio, and address how to protect human and natural resources while ensuring continued social improvement. Depletion of fresh water reserves, the use of unsustainable energy sources, food security, habitat loss

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and global health — along with the important bearing that poverty has on these issues — are all high on the agenda.

The need to address these problems is clear. The six billion people currently living on Earth are thought to consume 40% of all terrestrial biomass, between a quarter and a third of marine resources and about 50% of the planet's accessible fresh water<sup>1</sup>. In June, a report from the United Nations Environment Programme warned that half of the world's population is likely to suffer water shortages by 2032 (ref. 2). Yet the global population is projected to climb throughout this century, reaching at least 9 billion by 2100. "The trajectory we're on is not sustainable," says Lubchenco, who is currently ICSU's president-elect. "We are most definitely destroying the life systems of the planet."

Working out how to put the world on a sustainable track is far from clear. A sustainable approach to fisheries management may, for example, damage the food supply to local communities and effect international trade in fish. Fossil-fuel use might become more sustainable if, as some researchers suggest, the carbon dioxide produced is stored in the deep oceans — but is this simply passing the problem on to future generations? With so many different issues involved, there is rarely one definition of a sustainable solution. "Getting to grips with the concept is a bit like trying to catch soap in the bath," says John Lawton, chief executive of Britain's Natural Environment Research Council.

### Science's summit

With political will in short supply at Johannesburg, government action is unlikely to clarify the situation. But many scientists are cautiously optimistic about the summit. The Rio meeting was organized by and for governments. Since then, growing networks of scientists, such as the Initiative on Science and Technology for Sustainability, based at Harvard University, have begun to address how to improve science's role in sustainable development.

Their efforts seem to be paying off, as scientists are now being invited to the party. Delegates at the summit's preparatory meetings consulted with researchers from a wide range of disciplines, and organizations such as ICSU have been asked to submit formal contributions to the summit. Together with the Third World Academy of Sciences in Trieste, Italy, and the World Federation of Engineering Organisations in Paris, ICSU will also be running a series of parallel meetings in Johannesburg. Early next year, the council hopes to summarize its findings in a report that could serve as a framework for science and sustainability. "We're no longer part of a fringe effort," says Rosswall.

High on the researchers' agenda is the problem of getting existing scientific expertise to where it is needed. The techniques,



Slippery issue: plans for sustainable fisheries management must also preserve local food supplies.

tools and experience to do the work already exist, argues Daniel Kammen, director of the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley. Geographical information systems, which combine spatial information on a particular area with environmental, social and political data, have become more advanced and less expensive over the past decade. Global-positioning technology and satellite monitoring of the environment have also matured since the Rio summit.

The advances represent a unique opportunity to study climate, resource use and the relationship between health, the environment and development for the first time — but these tools are rarely focused on producing results that politicians can use. "A lot of this information never finds its way to policy-makers," says Felix Dodds, executive director of the Stakeholder Forum, a London-based group that supports non-governmental organizations and other parties working towards sustainable development.

Major international projects, for example, commonly have problems with creating such 'policy-relevant' science. The Intergovernmental Panel on Climate Change (IPCC) is widely admired for having communicated a strong scientific message amid the lobbying of industrial groups and environmental activists. But because the IPCC's reports are global in scope and contain huge amounts of data, it is difficult for policy-makers concerned with local issues to make use of them. "The crucial synthesis is linking local action to the global level," says Rosswall.

Local projects fare better, but almost all focus on single issues. The Consultative

Group on International Agricultural Research (CGIAR), which coordinates crop-research institutes worldwide, has set up regional crop-breeding and evaluation systems that are tailored to meet the needs of local farmers throughout the world. For example, the organization helped Cambodian farmers to rebuild rice production after Pol Pot was deposed in 1979, and to develop disease-resistant strains of important African and Asian staple crops such as bananas.

What is needed, say sustainability experts, is the expansion of local research projects so as to address the sustainability of all resources at a particular location at once. Such projects are beginning to emerge. Last year saw the launch of the Millennium Ecosystem Assessment (MEA) — an ambitious endeavour to assess the impact of factors such as shifts in land use and loss of biodiversity on the Earth's ecosystems (see *Nature* 417, 112–113; 2002). Information on everything from fish stocks to nitrogen cycles will be produced, but the data generated are not just for ecologists. "The MEA focuses on things coming out of those ecosystems that people actually care about," says Lubchenco.

### Local interest

An MEA study of Norwegian ecosystems should, for example, help the country's government to decide whether its fishing and oil-exploration industries can be expanded without damaging marine ecosystems. Other MEA members are providing technical support to studies in western China — an area earmarked for development, but which already suffers in parts from severe environmental problems such as soil erosion.

The project being run in Mexico's Yaqui Valley by Pamela Matson goes several steps further. By involving local researchers and politicians, she hopes to produce data that can directly influence the development of the region. During the 1990s, her team at Stanford University in California began



Thomas Rosswall says sustainability researchers face an "exciting journey".

studying the impact of increasing fertilizer use in the heavily irrigated valley, one of Mexico's most important agricultural centres. But run-off from upland agriculture feeds into the region, and water from the valley flows ultimately to the Sea of Cortez off the country's northwest coast, home to many birds, marine mammals and an important fishing industry. It soon became clear that studying the effect of fertilizer use in isolation from other factors would be of limited use.

Matson's project now involves local authorities, together with scientists and engineers from ten disciplines and five institutions in the United States and Mexico. The effect of land and chemical use, irrigation schemes and crop type on the local ecosystem are all being studied, as well as the impacts of external factors such as agricultural policies, globalized markets and drought. By combining this knowledge, researchers hope to reveal how these factors affect the terrestrial and aquatic environment and the income of farmers and city dwellers. "Decisions made in one part of the system, concerning one sector, cascade through the system, affecting many other sectors," says Matson.

The Yaqui Valley project is a work in progress, but Matson hopes that with more information — particularly on the human societies in the valley — a truly integrated approach should be possible. "If people there aim to make decisions that sustain their resources and their livelihoods, the place needs to be studied as an integrated system. We're trying to do that," she says.

### Worldly wisdom

Projects such as Matson's could serve as a template for sustainability studies in other areas, and are certain to feature in the framework document being developed by ICSU and its partners. But implementing similar studies in other parts of the world could prove more difficult. Mexico has a good science base, but some countries in Africa, for example, would have difficulty in collaborating on a similar project. Discussions over how to improve scientific expertise and infrastructure in developing countries — 'capacity building' in the sustainability jargon — will be limited by the lack of new money available at the political summit, but the topic will be widely discussed at the parallel events.

Many sustainable-development organizations and governments are already aiding individuals and small projects in developing countries. The Swedish government, for example, is attempting to transfer its country's expertise in biomass fuels to the Baltic states. It hopes that use of the fuels, which are made from agricultural waste or specially planted crops, could reduce the Baltic region's reliance on coal and oil as energy sources.

Larger-scale projects are thin on the



Daniel Kammen, seen here with Samburu tribeswomen, says expertise must be sent to where it's needed.

ground, but one example is the European and Developing Countries Clinical Trials Programme, funded by the European Union. The 200-million-euro (US\$195-million) project, which is expected to be unveiled in Johannesburg, aims to establish centres for clinical trials at several locations in Africa by 2006. The scheme's backers hope that generating the right infrastructure and expertise will encourage pharmaceutical companies to run high-quality trials of treatments for diseases such as HIV, tuberculosis and malaria where they are most needed.

### Marshalling the troops

Such projects are significant steps forward, but many researchers retain doubts about whether concepts such as policy-relevant science and capacity building can be successful on a large scale. As Lubchenco and colleagues put their framework document together, they face some major challenges. They will have to decide how individuals and institutes can best collaborate to study sustainability, for example, and whether sustainable-development science would benefit from coordination at a global level, perhaps by the United Nations. Any attempt to clarify these issues could be enormously helpful, especially to the many scientists who are interested in sustainability but are unsure how they can help. But even if ICSU and its partners can provide a blueprint for organizing the field, big political stumbling blocks remain.

Both politicians and science-funding agencies want to see a short-term return from most of their investments, and preferably in their own country or research area. Money for long-term multidisciplinary projects is hard to secure and often dries up after an initial outlay. Funding for the CGIAR centres from developed nations has, for example, been falling over the past decade. Other areas that are critical to sustainable development are also suffering. Research on renewable energy sources, for instance, has moved up the political agenda, but funding for the field has fallen by more than half as many developed countries slash their energy-research budgets<sup>3</sup>.

There are exceptions — funding agencies in some developed countries are beginning to make greater provision for research that focuses on sustainable development. But

overall the prospects are bleak. "A five-year electoral cycle is not equipped to deal with initiatives that will take 20 years to begin to take effect," says Lawton. And politicians are, by their very nature, unlikely to opt for large, long-term investments. "In a democracy it's hard to get turkeys to vote for Christmas," Lawton says.

### Communication problems

But although individual researchers cannot overhaul political systems, they can ensure that politicians are aware of exactly how much science can contribute to sustainable development — which could in turn lead to changes in funding policy. "The limited actions towards sustainability that we already have are very largely driven by scientific data," says Jonathon Porritt, director of Forum for the Future, a London-based sustainability organization. "But science is not particularly good at selling itself." Communication about sustainability issues can be poor even among scientists, agrees Rosswall. "Many scientists can't properly explain what they are doing to other scientists," he says. "It's too easy to complain that it's the decision-makers who don't understand."

Avoiding such communication problems will be key to the success of the strategies being developed by ICSU and others. A solid description of exactly what researchers can do for sustainable development could provide a boost to everyone involved — from scientists in developed countries to administrators who hold the purse-strings of funding organizations. If those involved can make the right people realize what science can offer, they could help make up for the likely political failings of Johannesburg. "It is time for us to break out of the ivory tower," says Rosswall. ■

Tom Clarke works in Nature's news syndication team.

1. Pimm, S. L. *The World According to Pimm: A Scientist Audits the Earth* (McGraw-Hill, New York, 2001).
2. UN Environment Programme. *Global Environment Outlook 3* (Earthscan, London, 2002).
3. Margolis, R. M. & Kammen, D. M. *Science* **285**, 690–692 (1999).

### Web links

World Summit on Sustainable Development

♦ [www.johannesburgsummit.org](http://www.johannesburgsummit.org)

International Council for Science

♦ [www.icsu.org](http://www.icsu.org)

Initiative on Science and Technology for Sustainability

♦ [sustsci.harvard.edu/ists](http://sustsci.harvard.edu/ists)