that the reader understands the periodic table and can interpret organic structural formulae. I will give my graduate students the reviews collected by Vögtle, Stoddart and Shibasaki. They provide an excellent, if idiosyncratic, view of new directions in organic chemistry — a field that has become actively evangelical, and is spreading the gospel of organic synthesis and synthetic nanostructures to all who will listen. Hall's book I will keep for myself. It covers a sufficiently broad scope that even those who have spent too many years thinking about atoms and molecules will find that its essays contain surprises. I will not trouble my wife with either: neither book is really suitable for explaining chemistry to those who are not chemists, although much of Hall's book should be easily understandable by other natural scientists.

Both books do a good job of describing chemistry to chemists in ways that catch the imagination. That is a good start in escaping the dread adjective 'boring'.

G. M. Whitesides is in the Department of Chemistry, Harvard University, 12 Oxford Street, Cambridge, Massachusetts 02138-2902, USA.

A constructive scheme unravelled?

The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming

by David Victor

Council on Foreign Relations/Princeton University Press: 2001. 169 pp. \$19.95, £12.95

Michael Grubb

The Collapse of the Kyoto Protocol is a serious, detailed, but ultimately paradoxical book. Apart from the introductory chapter — which contains some misleading caricatures about the Kyoto Protocol, the international agreement that set targets for greenhouse-gas emissions — it is written with an authority and detail that few can muster. It is also an absolutely independent assessment, beholden to no one. Yet the core conclusion reveals a fundamental inconsistency in the analysis.

David Victor gives short shrift to many of the sacred cows of US opposition to the protocol. Whereas most US criticisms centre on the lack of quantified commitments for developing countries, Victor argues the opposite, that the commitments should have focused only on the rich countries of the OECD. It would then have avoided the institutional difficulties raised particularly by including Russia and Ukraine. Most US economists argue that Kyoto's targets are too close, but Victor says they should have been closer, to minimize the uncertainties. Kyoto's targets cover many different gases; whereas opponents want the effort to focus more on

gases other than carbon dioxide, Victor says the targets should have been restricted to carbon dioxide only, because it is hard to monitor the others properly.

The core of Victor's analysis is thus an institutional critique, particularly with respect to emissions trading — the option for countries to trade their emissions allowances. Trading, he rightly asserts, is an inevitable consequence of adopting emissions targets. Yet he believes that bringing money into emissions control will create incentives to cheat the system that will exacerbate the already difficult problems of monitoring and enforcement. He also claims that, although Kyoto's flexibilities would allow the United States to meet its commitment through investing in emission reduction projects or systems abroad, the foreign institutions concerned may not be able to guarantee that this will really reduce emissions elsewhere.

Victor's book is built on years of experience and commentary on the climate-change regime. He has always been a critic of the targets-and-trading approach, and sees the collapse of the recent talks in The Hague as vindicating his stance. But his final chapter marks an important evolution in his thinking. Previously, he argued for a soft-law approach based on national reporting and review — a climate equivalent of the OECD's economic review process. Here he acknowledges that something stronger is needed. The answer? A mix of targets-and-trading with a tax system that sets a limit on the market price of emission permits.

Putting a cap on permit prices and restricting the system to carbon dioxide in the OECD countries, he argues, would overcome the institutional difficulties he has identified. But one senses an air of desperation. By the end of the book Victor has argued himself into supporting many of the Kyoto Protocol's fundamental principles. The problems he identifies are not unmanageable, and the changes he seeks are relatively minor compared with the prospect of negotiating an entirely new system. But as a long-standing critic, he cannot bear to recognize that. He would rather tear down the house and start again according to his own specifications.

Despite all its important insights, its ultimate negativity — and political naiveté — makes this a depressing book. For example, the difficulty of monitoring methane emissions does not preclude keeping the Kyoto basket of gases for national targets, while domestic policies target carbon dioxide and other gases separately. Monitoring need not involve unacceptably intrusive international inspection; a reasonable degree of democracy and transparency could minimize the scope for abuse. Victor complains that no one compared the benefits of including methane against the costs of (imperfect) monitoring, but he makes no attempt to compare such costs with his own alternative of abandoning the protocol along with the whole idea of cost-effectiveness across the different gases.

Victor's analytical strength and peculiar negativity are nowhere more striking than in his treatment of liability. He knows that emissions trading can do much to solve the thorny problem of compliance, provided that the validity of acquired emission allowances is made dependent on the selling country complying with its commitments ('buyer liability'). The alternative of seller liability "invites disaster ... it will fail because it is a fiction in international law". With buyer liability, however, selling countries would not get a good price unless they could convince the countries interested in buying that they have both the systems and the intent to comply. Indeed, the case Victor presents for such buyer liability is unanswerable and unsurpassed in the whole of the literature. Yet he then meekly notes that the "international debate" (actually the US position) at The Hague conference supported seller liability. He could have castigated the previous US administration for its cowardice and lack of imagination on the issue, and argued passionately that the rescheduling of the suspended Hague talks offers the world a chance to get this cornerstone of international emissions trading on the right footing. Instead, he simply concludes that the protocol is hopeless, but that if the world starts again with his own scheme, it will get the liability rules right.

There are too many such inconsistencies between Victor's critique of trading in the protocol and his endorsement of trading

according to his scheme. This is coupled with the casual assumption that the Kyoto deal can be completely rewritten. Victor vastly underestimates Kyoto's achievement in obtaining agreement and the centrality of the strong US target in return for extensive flexibilities. Indeed, despite its analytical depth, the book is marred—and perhaps the negativity explained—by viewing everything through a US lens. This results in scepticism about US implementation and cynicism about the rest of the world. For example, it is grossly misleading to assert that “no major government has a viable plan for compliance”. Ten years in advance of the Kyoto target period (2008–12), the United Kingdom is on track, and, like many other European governments, if its current plans prove inadequate, they will be strengthened and/or supplemented by using Kyoto's mechanisms to achieve compliance.

There are other peculiar inconsistencies. At the core of his attack on emissions trading is the assertion that negotiating allocations is the equivalent of agreeing on how to distribute money, and is hence impossible, or too weak. Yet Kyoto did reach agreement—Victor's claim that all this was an accident born of governmental ignorance is arrogant and does not hold water. And his complaint about Kyoto is that the targets are too strong. Indeed, in the United Nations, the European Union, and even in individual governments, negotiations regularly distribute budgets. All that is needed is the common understanding that there is a collective interest in agreeing, and that simply printing more money only leads to inflation. Victor has not factored in the politics of pressure in the hothouse of negotiating allocations. It is the achievement of having agreed in Kyoto that Victor wants to unravel.

Ultimately, Victor's book reminds me of Tolkien's Lord Denethor in *The Lord of the Rings*, who was given a crystal ball to see events around the world—but only negative ones. Overwhelmed with despair, he led his family to the pyre, decrying the ignorant fools who fought on. He burnt to death just as his allies were mustering for their final victory. David Victor's analysis is that of a fine mind overwhelmed by the problems he sees and led to a destructive conclusion.

Nevertheless, the book should be read by all policy-makers attempting to find international solutions to the climate problem. It identifies the important questions to be answered, and the big problems to be solved. There are answers, and ironically, some may be easier to find while the present US administration is withdrawn from the Kyoto negotiations. Do not follow Victor onto the pyre. ■

Michael Grubb is at Imperial College, London SW7 2BP, UK. He is author of *The Kyoto Protocol: A Guide and Assessment* (RITA/Earthscan, London; Brookings, Washington).

Knowing the value of nature

Wild Solutions: How Biodiversity is Money in the Bank

by Andrew Beattie & Paul R. Ehrlich
Yale University Press: 2001. 272 pp. \$25.95

E. J. Milner-Gulland

Every textbook on conservation contains a section where the authors attempt to justify why policy-makers should make the conservation of biodiversity a priority. Although people tend to become conservationists for reasons more to do with the heart than the head, those wishing to make a strong case for conservation tend to downplay arguments based on ethics, aesthetics or spiritual needs, and concentrate on the utilitarian reasons for conservation. It is argued that only if biodiversity is seen to be paying its way, preferably in the short term, will funding for its conservation be forthcoming.

Wild Solutions argues for the conservation of natural resources from a firmly utilitarian perspective. Taking examples from a wide range of taxonomic groups, Andrew Beattie and Paul Ehrlich demonstrate how often-overlooked species are fundamental to our continuing viability. There are many fascinating examples of useful species, such as the glue-squirting velvet worm and the antibiotic-producing Australian bull ant. The authors cover a range of topics, including decomposition, medicines, problems in construction and motion, water and nutrient cycles, and bioindicators.

Using the concept of the ‘natural internet’, they describe how the natural world is composed of connections, unknown to most people, which are allowing us to dispose of

our waste, clean our air and water supplies and pollinate our crop plants. Along the way, the authors also provide powerful ammunition for those who argue that taxonomic studies are crucial to our future well-being. They show how little is known about the planet's biodiversity, and give examples of obscure creatures, stumbled upon by chance, which were subsequently found to be useful to humanity.

The book is almost unrelentingly positive, and an easy read, generating a momentum of energy and excitement about the potential of the natural world to solve many of the problems that face us. By finding where a problem that we face occurs in the natural world, they argue, we are likely to find solutions, either as blueprints for technology or in the form of inspiration. For example, termite air-conditioning has been used as the inspiration for naturally cooled office blocks.

Generally, though, the examples given are discussed briefly, and in little depth—this is an inspirational book for the general reader rather than the scientist. But the chapter on biological control does touch on the complexities involved in exploiting ‘wild solutions’ to our problems. It explains how introducing new species to solve one problem can create another—the cane toad, water hyacinth and *Salvinia* are among the examples given.

Reading the book from a UK perspective, however, I was concerned at the absence of any exploration of the issues surrounding the genetic modification of organisms. These are complex issues, hard to discuss in a book of this type. Nevertheless, the target audience in the United Kingdom must be convinced of the benefits of gene technology before it will accept the authors' premise that a combination of sophisticated biotechnology and naturally produced chemicals is a good way to proceed.

The rise of ecological economics as a discipline has made many conservationists believe that, in order to put their case across, they must value biodiversity monetarily. This confuses utilitarian value with monetary value. Beattie and Ehrlich do not attempt this, which I find enormously refreshing. In fact, a strong implicit message in the book is how complex and poorly understood are the mechanisms behind ecological processes, and how meaningless it would be to attempt a full monetary valuation of them.

Some impressive examples of the monetary value of natural services are cited, however. One is the Catskill Mountains, the source of New York city's water supply. The increasing load of pesticides, fertilizers and sewage had threatened to overwhelm the natural water-purification services provided by the Catskills. The costs of constructing a water treatment plant were