

references, about half of which were published after the completion of Werner's book.

If you can afford it, buy a copy. (If you are wealthy, buy two — a second for your coffee table, to entrance friends and relatives.) If you can't, see that your librarian does so. (And if not, maybe you should find a more compliant librarian.) □

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Causes and cures

Stephen Cotgrove

Post Environmentalism. By John Young. *Belhaven: 1990. Pp. 225. £25. To be published in the United States in October by Harvard University Press with the title Sustaining the Earth, price \$19.95.*

ACID rain, the greenhouse effect, pollution, the exhaustion of fossil fuels, the population explosion — all these threats to the future of human existence can be laid at the door of science and technology. Such an accusation is, of course, simplistic. The uses to which scientific knowledge is put, the increasing control of the direction of research by governments and, behind these, the demands of the industrial-military complex for useful and relevant research, are more appropriate concerns. To rely on technological fixes from the environmental sciences will fail to get to the roots of the problem, which are embedded in the nature of industrial societies, and are fundamentally economic, political and moral.

John Young explores the extensive literature generated by the growing awareness of the environmental crisis in a search for its causes and cures. To sharpen the perspective, there is an account of some societies which have maintained a sustainable relationship with nature. "The genius of those peoples who have retained some of their land but also their ethos has lain in their ability to select from the experience of Western invasion and colonization, those aspects of our value system which reinforce their own, such as stewardship, reciprocity, family loyalty, community, service and charity, but to reject such goals as the accumulation of individual wealth as an end in itself, and ideas such as the separation of humanity from the natural world, which industrial society had developed" (page 49).

These, of course, are not the core values of industrial societies: they are certainly not the values of the marketplace. To identify these as the values crucial for a sustainable society is to underline the magnitude of the problem. And it is here that the writings of environmentalists are

so often unconvincing. Attitudes and values are remarkably resistant to change. And some are deeply embedded in Western culture. Young, for example, gives a more detailed account than most of the Christian tradition in which Genesis commands man to "be fruitful and multiply, and replenish the earth and subdue it, and have dominion over..... every living thing". Although the tradition also includes the notion of stewardship, the general thrust has been to legitimize mankind's exploitation of nature. It is to recent secular philosophers and environmentalists that Young turns for a critique of material values and the assertion that man is a part of nature.

The writings of Schumacher are of particular interest. He traced the roots of consumerism and a disproportionate emphasis on material values to the alienating technologies of production, which destroy the human satisfaction of creative work, generating conditions that make workers on assembly lines and in giant administrative and service bureaucracies easy prey to the fantasies of consumerist advertising. Hence industrial societies are firmly anchored to the treadmill of economic growth to buy compensation for unfulfilling work.

Young realistically recognizes that the "Green" constituency is a complex and heterogeneous conglomerate of radicals and reformers. Despite this, he finds hope in the emergence of common ground which challenges "the right of either profit-based capitalism or growth-oriented socialism to do what it likes with an important part of nature" (page 145). He finds grounds for optimism, too, in those exemplary initiatives by local governments in job creation, urban farms, public transport, recycling, and in developing skills which enable people to employ themselves. Whether such policies can achieve the profound transformations required to bring world population and exponential economic growth under control is a matter for scepticism.

As a contribution to the search for a more environmentally friendly culture, this book is interesting and useful. But for more down-to-earth guidance on causes and cures, one needs to look elsewhere, for example to Alan Schnaiberg's *The Environment from Surplus to Scarcity* (Oxford University Press, 1980), with its more rigorous analysis of the role of economic and political structures in the degradation of the environment. □

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■ Bill McKibben's *The End of Nature*, one of the most commercially successful of this year's environmental books, is published in Penguin paperback on 30 August. Price £4.99. (For review see *Nature* 344, 885; 1990.)

Twistor magic

Edward Witten

Twistor Geometry And Field Theory. By R. S. Ward and Raymond O. Wells, Jr. *Cambridge University Press: 1990. Pp.520. £50, \$79.50.*

TWISTOR theory, conceived about 20 years ago by Roger Penrose of Oxford University, is undoubtedly one of the most remarkable developments in mathematical physics in modern times. Penrose's achievement was to find a skilful way to reinterpret the coordinates of space-time as complex variables, while preserving the fundamental relativistic symmetries. The new complex variables that he introduced in this process he called twistors.

The original motivation for twistor theory was to find a new framework for the quantization of gravitation — for overcoming the longstanding incompatibility between general relativity, which is Einstein's theory of gravitation, and quantum field theory, which is the framework in which physicists have succeeded in understanding all the other forces. Many physicists have suspected that the concepts of continuum space-time, and of space-time points, would have to be abandoned to make sense of quantum gravity. Penrose suggested twistor space as the new concept that would replace space-time. To this day, one of the big mysteries is whether, and how, twistor theory will eventually fit into a theory of quantum gravity, perhaps in conjunction with some of the still raw ideas that have emerged from string theory.

Whatever the original motivation, the concrete successes of twistor theory, so far, have been in reinterpreting and often solving certain nonlinear classical field equations in four-dimensional space-time. In the mid 1970s, Penrose succeeded in interpreting the "self-dual Einstein equations" as integrability conditions for the existence of a "deformed twistor space". The self-dual Einstein equations, some of whose special properties had been first exhibited by J. Plebanski, are roughly speaking the equations for a gravitational field of one definite handedness or polarization. The twistor transform of the self-dual Einstein equations demonstrated that those equations were integrable equations, with miraculous properties similar to those of the celebrated soliton equations of two-dimensional mathematical physics. The self-dual Yang-Mills equations (equations that arise in modern gauge theories of the sub-nuclear particles) can also be solved by twistor methods, as was discovered soon afterwards by Richard Ward, one of the authors of this book and at the time a graduate student at Oxford University.