

ervation, politics, and sociology, though not all existing in each example, are demonstrated in the chapters on pesticides, Peregrine Falcons (*Falco peregrinus*), Guillemots (*Uria aalge*), zinc smelters, and many other topics ranging from cadmium to marine plankton, which are dealt with in less detail.

The final six chapters look to the future. In a frank comment, the Author writes 'like many applied scientists I started my career believing that the principal block to effective action was lack of scientific knowledge, and that [when] once the true facts were known the appropriate action would follow almost automatically. Experience taught me that in most cases enough was already known to solve the problem. The difficult part was to explain the necessity for action to people with different points of reference and habits of thought...' (pages 222–3). The real challenge facing conservationists is to convince other people, ranging from the national legislators to the general public, that *conservation matters*. It is really only in this final section of the book that the international perspective of conservation is introduced into the British context. Amongst the sentences in the final chapter is an explicit statement that 'This book is a plea to take conservation seriously' (page 261). The analysis of the future is essentially encapsulated in those few words.

One cannot approach this as a textbook on either biological or environmental conservation; it is not a textbook. One cannot approach this as a novel; it is not a work of fiction. One cannot approach this as a biography; it is not, although much of it is based on the Author's life and real situations in which he was involved personally. The book is something different from the ordinary; it is a mixture of all of the above, blending the science with the characters who play the roles, and blending both with the Author's career. Treat the facts critically. There are few errors, but how does one get 20,000 human generations into the 7,000 years since the English Channel was formed (page 5)? Treat the examples as case-studies. In most of them the important information and conclusions are brought out without the usual quantity of peripheral information that tends to obstruct rather than clarify the example. Treat the analyses critically. There is, for example, only scant acknowledgement of the increasing human population, the root cause of so many environmental problems. But, above all, treat this book as one to be read. It is a 'good read', and a book that, once started, is difficult to put down.

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E³: Energie, Ecologie, Economie, by GONZAGUE PILLET & HOWARD ODUM. Georg Editeur, 1205 Geneva, Switzerland: xvi + 259 pp., 24 × 16 × 2 cm, illustr., index, English summary, SFrs 48, 1987.

It is often said that interdisciplinarity should be the rule, especially when one analyses environmental problems and related economic activities. A Swiss economist, Gonzague Pillet, and an American ecologist, Howard T. Odum, have taken up this challenge by working together. The common language used for communication-flows between these two scientists was the embodied solar energy (enmergy*).

The result of their collaboration is this very interesting and for us exciting book. Its aim in particular is to consider and analyse environmental and macroeconomic systems in a complementary way, as a preliminary requisite to devel-

oping further public-policy recommendations that use their methods of analysis to maximize economic vitality.

This book is addressed to specialized research workers on environmental issues, as well as to students and general readers for whom the Authors have included the essential background material to each concept, instrument, and method.

The book is in three parts, in the first and second of which the Authors explain the methodology that they use to describe natural or semi-natural ecosystems. Part three discusses evaluating the interface between ecological and economic systems.

In Part I, which is an introduction, the Authors outline the basis for the enmergetic* analysis of the environment: they define the framework of the analysis and its important elements (systems, models, symbols, energy diagrams, language, etc.).

In Part II, fundamental principles and formal characteristics of enmergy* analysis are presented in depth. The Authors explain how thermodynamic principles are considered in their method, and translate the elements of ecosystems as sources, storages, and ways, and their relationships as intersections, autocatalytic modules, series, and webs, using the enmergy* language. Case-studies on Floridian ecosystems are reviewed.

In Part III the Authors examine the methods of environmental micro- and macroeconomics, using both the enmergy* method and the economic concept of externality. The enmergy* analysis is therefore employed to quantify interfaced environmental and economic systems. Different kinds of energies can in this way be compared: the concept of transformity is developed to define different qualities of energies, and in fact to organize energy into a hierarchy. Environmental (micro-) economics is presented with an emphasis on the concept of external effects. The necessity to find new instruments and methods is demonstrated by the new interdisciplinary concept of energy externality, whose role has brought about an improved understanding of the macroeconomy of the environment. Finally, the Authors present various case-studies on the Swiss economy and its environmental basis, Genevese vineyards and wine production, and Japanese ricefields and *sake* production. Energy externality gives a new and interesting light to these analyses.

In conclusion, E³ reflects change, as much of the material is not found in environmental economics texts, and we think that the book should stimulate considerable interest and discussion among readers who are interested in an improved understanding of environmental problems.

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* Our use of this term and the derived 'enmergetic' is in deference to earlier attempts in our Journal and elsewhere to escape from confusion of the then-proposed 'emergy' with the common word 'energy' (the latest occasion being on pp. 263–4 of our Autumn issue this year), but we now understand that 'eMergy' has come into common use in this book under review and other recent publications and may well persist.—Ed.