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## Book Review - The End of Science: Facing the Limits of Knowledge

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## REVIEWS

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**Lost Landscapes and Failed Economies.** Thomas Michael Power. 1996. Island Press, Covelo, CA. 315 pages. ISBN 1-55963-368-9. \$32.00 hdbd.

In an intensive and methodical manner, Power casts doubt upon notions of environmental protection choking economic development. He demonstrates the fallacy of such a position and successfully advocates environmental protection as economically sound. The confusion that exists between the environment and the economy is largely the result of misguided convention.

Power's book challenges conventional wisdom. Power defines folk economics as "[T]he set of popular cultural beliefs about the economy that may or may not have any empirical or theoretical basis." He questions the dichotomy between environmental protection and economic activity in particular. "Environmental protection and extractive industry are both economic activities that can contribute to local economic well-being."

The argument that Power presents is quite simple. Areas typically experience environmental degradation and economic stagnation simultaneously. Conversely, areas that are actively protecting the environment are correlated with vibrant and diverse economies. Power concludes the choice between economic activity and the environment is a false dilemma. Taken to its extreme, protection of the environment is, in fact, essential to economic development.

The mechanism for this apparent contradiction is firmly rooted in economic principles. Power observes that the labor supply component of growth is often overlooked, even though both labor and employment are mobile. Business and the jobs associated with it will locate where the labor supply is the best value. People may chase after employment, but Power argues that a more plausible claim is that environmental amenities will attract an excess labor supply, depressing wages and spurring investment.

Power supports his argument with numerous examples. The extraction of mineral resources follows the pattern that Power presents. Areas that are heavily dependent upon mining are seldom stable and are often improved by the closing of mining activities. Power goes on to observe that the dependence on extractive industry is usually overstated. The timber industry mirrors mining in its instability and the inflation of its importance. The wild fluctuations in both industries are not explained by environmental protection.

Agriculture is the last example provided. It is a more abstract analysis, but no less valid. The economic benefit of subsidized overproduction is dubious at best. When such subsidies carry environmental costs, the wisdom of such policies becomes more suspect. If the allocation of water rights, for example, is suboptimal, an economic loss to society will occur. According to Power, the result will be two-pronged, however. The farmer receiving the subsidy will also receive lower marginal returns if the program boosts supply to a level that triggers lower prices. The taxpayer could be subject to another round of subsidy payment if price floors for the commodity are in place. Power concludes that the importance of agriculture to the local economy deserves a much closer look.

The book is thoughtfully organized. Chapters 1 and 2 provide an

overview of local economies and how they operate. Chapter 3 examines the shift from extractive industry to service jobs and the implications of such a transition. Chapter 4 is a critical exploration of the connection between mineral extraction and the economic health of mining communities. Chapter 5 complements Chapter 4 by analyzing the economic impacts of mineral policy reform. Chapter 6 addresses the linkage between the timber industry and local economies. Chapter 7 then examines the role of federally owned forestland in local economies. Chapter 8 focuses upon the special status assigned to agriculture relative to local economies. Chapter 9 questions the economic wisdom of manipulating the environment to promote agricultural activity. Chapter 10 is a frank discussion of substituting tourism industries for extractive industries. Finally, Chapter 11 summarizes the various issues and recommends that future economic decisions utilize a more informed view of the role of environment.

One shortcoming of the book is that it does not articulate the positive correlation between environmental quality and economic vitality. Many scenarios are presented in which environmental protection has produced positive economic results, but how often this actually occurs is unclear. Power is willing to compromise readability so quantitative analysis can be included, but he does not include enough analysis to make such a compromise worthwhile. However, Power clearly states that environmental interests and economic interests are not mutually exclusive, and such a statement is indeed worthwhile.

An economic justification for environmental protection may be helpful. Power expresses some hope that "...the polemics of extraction versus environment should change. " This change could result in improved environmental policy that maximizes the welfare of society. Recognition of cases where environmental protection is associated with economic benefits is promising. But the difficult cases are protecting the environment when little economic value is apparent. Even if the divide between environment and economic growth is rejected, the economic value of protecting the environment can remain unrecognized until the supply is irreversibly limited or destroyed. The persistence of these unfortunate cases is nevertheless an improvement over the armchair economist's view that the environment should always be sacrificed to maximize social welfare.—TOM VETTER, *Department of Biology, University of Northern Iowa, Cedar Falls, IA. 50613.*

**The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age.** John Horgan. 1996. Addison-Wesley Publishing Company, Inc. Reading, MA. X + 308 pages. ISBN 0-553-06174-7. \$28.00 hdbd., \$15.00 pbk.

The June, 1997 issue of Harper's Magazine included a list of recently published books that have titles beginning with "The End of". There are thirty-one titles on the list. Publishers have been rushing to cash in on the public's emotional reaction to the coming end of the century. It is difficult to take some of these works seriously. Perhaps the hardest thesis to swallow is that science, including physics, chemistry, biology, and neuroscience, not to mention the social sciences and the philosophy of science, is coming to an end just as our somewhat arbitrary calendar ticks over to a new millennium. John Horgan, a science writer for *Scientific American*, draws on years of interviews with leading scientists and philosophers to support this thanatopic thesis in *The End of Science*.

Horgan writes that scientists today are practicing "ironic science",

a "speculative postempirical mode" of science. Traditionally science has addressed questions that can be answered through observation and experimentation. Horgan asserts that scientists have nearly exhausted the questions that can be answered through this traditional empiricism. As a result they are reduced to speculating about the unknowable, including "superstring theory", the origin of the universe, and human consciousness. The works of the great scientists of the past, Newton, Darwin and Einstein, for example, will never be matched. Scientists work for diminishing returns of knowledge.

In order to establish a case for ironic science, Horgan needs to supply the reader with the necessary background in empiricism and positivism. Earlier in this century philosophers of the Vienna Circle asserted that the meaning of a scientific proposition is in the method of its verification. Karl Popper's contribution was to assert that verification is not as defensible a criterion for science as falsification. A fuzzier but more common assertion is that science consists of propositions that are testable. Horgan does not give the reader the necessary context in which to put the concept of ironic science. The book blurs the distinction between testable and tested. Many scientific propositions are testable in principle but not in practice. The opportunity for a test often waits for a change in technology (e.g., the Hubble Telescope) or a good idea for an experiment. It may be that some of the science termed postempirical in the book is really preempirical.

As an empirical hypothesis, the assertion that science is ending seems already falsified. Horgan suggests in the first chapter that if life were to be found on other planets his thesis would be wrong. In

fact, the book was published just months before the August, 1996 announcement that scientists believed they found evidence of life in a meteorite originating from Mars. Other scientific developments since the book's publication include the Galileo spacecraft's photographs of the Jovian moon Europa, which have led to the conclusion that liquid water may be present; the discovery of a skeleton that may be a new species of human being; and the cloning of a sheep. Taken together with the increased horizons afforded by the Hubble Telescope, these developments might be interpreted as the beginning of a new era of science instead of as the end of science.

So why read the book? Readers will be attracted to the collection of interviews that Horgan has assembled. He has interviewed dozens of the most famous scientists and philosophers of science on the contemporary scene. The book is a "who's who" of contemporary genius. The book also serves as a primer of theories and speculations in a variety of scientific fields. Thus the general scientist or science educator can gain a quick understanding of the scope of modern science. With regard to the thesis of the book, perhaps a useful way to read *The End of Science* is to treat the title as a pun. The dictionary lists "object or purpose" as one definition of end. What will be seen as the purpose of science in the Twenty-first Century? The book raises questions about how science will be defined and practiced. Which projects will win public support and funding? How will pure science fare in an environment that demands applications? Science does not face extinction, but scientists will need to think carefully about the shape of things to come.—DAVID LOPATTO, *Department of Psychology, Grinnell College, Grinnell, Iowa 50112.*