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Commentary

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Professor Francis is to be commended for his thorough, scholarly work in tracing the evolution of ecosystem theory during the 1970s and 1980s. Indeed, George has done the conference, and indeed all researchers and managers interested in sustainable development, a service by explaining and simplifying the development of a confusing array of competing and overlapping concepts. His paper deserves to be widely read.

Rather than summarize in detail the ideas which Dr. Francis presented, I will focus instead on some modest changes which could be made to the paper prior to publication to increase its effectiveness. The first of these deals with the theory. It would be useful for those of us who are neophytes in ecology to include a final section prior to the Great Lakes case study explaining which of the many models and concepts presented in the paper appear to be emerging to form the current ecosystem management paradigm.

In attempting this revision, this part of the paper could profitably be structured as a model of the kind which O'Riordan used to explain competing concepts which had been proposed up to 1980. At the same time it would also be useful to note explicitly which of the concepts reviewed in the paper have already been rejected, which are being modified, and which have appeared to have a chance of being accepted in future. The conceptualization of such a model would guide nonecologists through the maze of competing theories and offer an explanation of the way that we should think about these complex problems. As it is presented in the conference proceedings, I was unable to decide how I should combine the many competing ideas presented, such as O'Riordan's four part schema, notions from human ecology, and the four competing ecosystem analogies, into an useful approach to sustainable ecosystem management. Such a simplified schema would be useful to guide our thinking in attempting to understand complex ecosystem questions.

The second deficiency relates to our understanding of the Great Lakes ecosystem management example. George, if you are able to synthesize a simplified model to interpret and manage ecosystems as suggested above, it could be profitably be used to interpret what has happened to date in the Great Lakes. By interpreting events through such a model we would have a concrete example of how this complex system can be under-

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stood and which of the ecosystem management concepts presented in the theoretical section apply in this instance. At the same time it would also be useful to include a thumbnail sketch of how advanced the Great Lakes experiment is at present, what level of success or failure has been achieved, and what the implications and cost would be if the chosen indicator species, Lake Trout and Pontoporeia hoyi, do not attain the selected criteria thresholds. For example, if an acceptable concentration of the indicator species is not observed by a pre-selected time, what is implied in terms of cost and time required to monitor the relevant tropic levels and required remedial measures? And who would be responsible for such work?

In summary, George Francis' paper is a useful explanation of the evolution of the concept of ecosystem management and its application to complex real-world problems. The IJC has experimented with the concept of ecosystem management during the 1980s and efforts in the Great Lakes by the Great Lakes Fisheries Commission represent the most complex remedial restorative action which has been attempted to date. No doubt this is the most advanced application of ecosystem management attempted to date on either the Canadian or Mexican borders with the United States and it deserves careful evaluation for potential application in other shared drainage basins.