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The Power of Politics in Agent−based Models of Ecosystem Management: Comment on "Ecological and Social Dynamics in Simple Models of Ecosystem Management" by S. R. Carpenter, W. A. Brock, and P. Hanson

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The prospect of having heuristic models that outline simple ways to account for the agency in managing complex ecosystems is inviting. Many might suggest that agency models in social science, particularly in economics and rational−choice political economy, already offer all that is needed. However, such agency models in the social science literature typically focus on the agent in a relatively predictable organizational or social environment. Stable environments are generally favored over evolutionary (or revolutionary) ones, linear processes over the nonlinear, synchronic approaches over diachronic (Arthur et al. 1997).

Ecosystem complexity (featuring multiple stable states, path dependence, and cross−scale interactions) offers a new way of privileging historical social science models. Historicity, the idea that certain system dynamics are historically bound and defined, is typically elided by history−free deductive models that ignore social system change. The Carpenter/Brock agency models, on the other hand, should set off some very productive debate about how to think about panarchic systems, especially the interactive cycling of human adaptation or adaptive management and ecosystem dynamics. The concept of hysteresis may suggest that, even in simple systems, recovery really isn't recovery in a strict sense. For human affairs, as for ecosystems, history does matter, but not as a simple background state or exogenous control. And if this is so, simple policy prescriptions of "getting the prices right" or even "getting the institutions right" are challenged.

Another attractive quality of the Carpenter/Brock model involves the elegance of its single−issue, single−ecosystem orientation. The phosphorus−lake system allows clarity that has heuristic value for other, more densely packed systems, including spruce budworm or human settlement in tropical forests. By modeling social processes around a narrow management focus using "caricatures," we get an idea of the degree of complexity necessary to explain real social and political processes, and of the difficulty in simple prescriptions for devolution of resource control, democratization of management, and "citizen science." The explanation of causality behind the complexity will remain more elusive, but this paper also helps us get closer to understanding current systems of management and their possibilities.

Explaining the causal as well as the descriptive aspects of human−impacted ecosystems should be our goal. In order to achieve this level of understanding, it is necessary to move in the direction of "embedding" agents within their own structuring processes, i.e., trying to figure out what lies behind the decision−making processes that guide agents' actions. Assuming that agents know their interests and that they participate attentively in resource management is problematic as a representation of the world. The Carpenter/Brock model is well−suited to begin

to examine these issues. Plausible political extensions to the model would consider indifference to decision making as a product of distancing, excessive problem complexity, or information saturation (Braud 1998), and would consider discounting and valuation as endogenous variables that are influenced by social interactions, strategic interest, and political culture. Discounting the future, for example, varies with agent perception, but it also varies with expected policies. "Mining" nonrenewable resources faster than sustainability allows is usually a symptom of high inflation, desperate shortages of foreign exchange, political instability, or some other political economic indicator of an impoverished future.

By moving a set of social processes "into the laboratory," and by decoupling them from the variables governing their structure, the Carpenter/Brock model provides the opportunity to tease apart various questions that are easy to confuse. How are agents structured, and what is the incidence of proximal and distal structuring elements? If the phosphorous−pulsed lake is simply driven by farmer preferences, what drives those preferences? Are they structured by relative prices of agricultural commodities? Is the country's exchange rate privileging agriculture over industry (or the converse)? There may be a spatial element to structuring: the distance between agent and macrosocial driver may predict the strength or weakness of their coupling; the distance between agent and ecosystem is probably also important (e.g., a farmer by the lake is probably more responsive than a fertilizer company). These elements would help greatly in building out from the Carpenter/Brock model toward a more complete understanding of agency.

Power is also typically absent from agency models, but always present in political systems. Power can be variously conceived, as a constructed collective output of society (the power of the electorate); as control of individual or collective action possibilities; as an ability to "do" something, as opposed to controlling things; etc. A political model of power with the elegance of the Carpenter−Brock Agency Model would be a great companion to our understanding of management and resilience.

This should not suggest that power is a nicety that these models can do without. Thinking about social action without politics offers (1) an economistic fallacy: that politics is a non−price rationing device and can be calculated using a price−based proxy; (2) the civil society fallacy: that all goods are private; and (3) even the fallacy of methodological individualism: that the whole is simply derivative of its parts, that organizations act like aggregates of individual wills.

This last, in turn, presents the "ethno−ecological" problem: that so much of what we derive about the relationship between human individuals (their aggregation and organization into societies; their life courses, pathologies, and cultural adaptations; and their relationships to nature) are taken from Western samples and populations without critical reference. Conventional literature (and much of management policy) has assumed pluralism, methodological individualism, and simple (although diverse) rules of aggregation. Yet, the literature of resilience and complexity has insisted on something much more sophisticated: alternative stability domains, state spaces, and emergent properties. The convergence of these two "mindsets" is important, for it provides the opportunity to challenge our assumptions about the nature and context of environmental decision making, both in theory and practice (Holling and Sanderson 1996).

More specifically, in the Carpenter−Brock market manager model, it is interesting to aggregate simply, as rational choice models do, to say that the aggregate of market management is the sum of individual market managers' actions. This does not allow for changes in the social system produced by "emergent properties" of social aggregates. Yet, we know that such properties do change behaviors. Ignoring the collective action problem in the various models (by postulating fixed institutions) avoids the issue of power, while modeling emergent social organization among agents with heterogeneous economic interests would allow the issues of power, distribution of benefits, and institutional subversion and reform to be examined.

Recognizing that simple models cannot necessarily reflect all that, future models of human behavior must challenge or at least question rational expectations. Likewise, the language of complex systems must not be lost, as managers seek to extrapolate a system's "apparent regularities." The complementary danger is to extrapolate apparent regularities in human agents. Several times over recent decades, human agents and their corporate counterparts (the firm is often a kind of agent) have been able to change behaviors according to important

exogenous signals. (Two examples include changes in consumer behavior after the 1973 oil crisis, and the extremely rapid reduction in the use of CFCs after the Montreal Protocol.) Thinking about the influence of the external on agents within the model is an important future step for this work.

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