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Response to Ludwig et al. (1997), "Sustainability, Stability, and Resilience"

Advancing Toward "Eden"

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ABSTRACT

There are two ways to exploit natural systems. Rip-off or restore. While self-serving euphemisms (e.g., "green," "sustainability," "reforestation," and "the" ecology) may be as repulsive to purists as they are appealing to reformers and spin-hypers alike, they do serve the purpose of laying a stone or two toward bridging the gap between the rampant masses and the enlightened. So what's the next stepping stone between scientific understanding, applications that work, and broad enough acceptance of the implications of the applications and the science behind them? In most of my work (highway cuts and fills, pipelines, landfills, and the like), "equilibrium" is not an issue. The patient is, theoretically, dead. Therefore, equilibrium, or at least the initiation and acceleration of a trend that is in that direction, becomes the issue. The issue is: "Is restoration necessary?" What measures beyond the incredible resilience of natural processes, given enough time, are feasible, and will restoration of the ecosystem equilibrium be the result? How closely will, and how closely can, the "restored" ecosystem resemble the "original?" When is equilibrium achieved? The scientifically stringent performance criteria proposed independently by both St. John and Ewel in the 1980s require that a successful ecosystem restoration project must: (1) be capable of perpetuating itself without outside subsidy (no irrigation or fertilizer); (2) be resistant to long-term weed invasion; (3) closely match the original ecosystem's productivity; (4) recycle nutrients; and (5) exhibit the entire range of critical biological components. These criteria should stand until improved. How are these criteria to be measured and judged? Any takers?

KEY WORDS: ecological restoration, ecosystem restoration, environmental policy, exploitation, futurism, habitat restoration, intervention, natural systems, resilience, succession, sustainability.

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This is an important paper on a crucial subject.

"The highest exercise in intellectual discipline," Raymond M. Gilmore (*personal communication* 1972) used to say, "is the suspension of judgment." Out here in applied-land, the dog-eat-'possum world of ecosystem restoration consulting, I also operate by the motto: "The roughest guess that gets the job done." Sometimes we probably shouldn't, but we usually justify our actions on the idea that we can't wait until the Savior comes -- the whole damn Nordensee is lapping at the dikes.

PREREQUISITES

That is to say, we've got to use what we have learned: "The important thing is to know what you don't know" (Margaret Mead, *personal communication* 1973) and do as little additional harm as possible (nine-tenths of the hell being raised in the world is well-intentioned). I would advance this "simplest," but most inconvenient hypothesis, as a dynamic balance between acting on ignorance (Goethe, von Clausewitz) and being certain (Hitler), the latter of which can be said to define the former.

STEERING THE ECO-SHIP

"Nature will shrug off *Homo sapiens* just as she has countless other species since The Beginning" (Louis B. Ziegler, *personal communication* 1966). We WILL adapt, or we won't. We have abandoned "Eden," the nutrient, the energy cycle. "I am become Death, destroyer of worlds" (J. R. Oppenheimer's quote regarding the atomic bomb, around 1944). We are "dead sure" we are Utopia-bound (objective)--or bust! Adaptive or maladaptive, those are our choices, eh? The "battleship curve" advances to decline. It's the trend, the direction of movement, that really counts.

I visualize this with a helmless ship analogy: The iceberg(s) loom. The free-loading majority is on the poop deck, drinking the last of the champagne. Several of the eco-passengers are frantically pounding the tiller, the rudder, everything that comes to mind, with repeated blows from sledge hammers; a few others are applying steady finger pressure, watching the bow's barely discernible movement, watching the winds and currents and stars, varying their pressure accordingly. Classic pessimists and optimists. It takes a long time to learn, in this fear-ridden world, that optimism is the only option.

FOR RELEVANCE TESTING

Perturbations or cycling or transitions or exploitation or no return-times of any length: where does "sustainability" come in -- and go out? What matters? Where do we draw "the line?"

Are linear models of any use in trying to describe a fuzzy, dynamic, fluctuating, transitioning world? Could their use be fatally misleading in the realm of our ignorance? I don't know. I don't know that anybody does. Do we face our ignorance--truly? Even education is measured by simplistic arithmetic, so what hope is there for similarly complex ecosystems? Hubris or humility (unfortunately semantically, therefore psychologically, allied with humiliation)?

My gut tells me that the tool must fit the job. My gut is fuzzy. My brain is more linear than I would like it to be. If I think about concepts, ideas, images, symbols, and their relationships and relevance in degrees to each other and among groups, I can write this. When I start thinking "linearly," I get slo and make mistakes. Thank goodness for editors. Thank goodness I don't have to chisel anything in stone the first time. I would live in a rockpile.

In the last 40 years or so, the trends have been mixed, but there's far more in the direction of social and ecological stability (very few gave a damn, those that did didn't have much say, but the bow of the ship is moving, if wavering, in a better direction) than anybody predicted--even though we're still slipping. Any organism acts upon and transforms its habitat/environment as it transforms the organism. The elements of stress between them must be reconciled. The result is "... a self-organized system of astounding, but not unlimited, resilience (C. S. Holling, *personal communication* 2000)."

"Human interventions to increase productivity" in natural systems: is there a contradiction somewhere? If natural systems are defined as those that function without intervention, do they remain a (natural) system with intervention, especially when subsidized or when parts are exploited beyond the level that permits a "normal" return time? Do true systems require external inputs? What happens to "Peter" systems that are raided to increase the productivity of "Paul" systems? What corollary price do "Paul" systems pay? Is it ever reasonable to presume that there are none? If not, why is it so common to act as if there are none? What about reducing return times with interventions, as in accelerating "succession" (i.e., in ecosystem restoration)? What about discussing uncomfortable options despite PC (passionate correctness)?

As to setting priorities, how about, for starters, the old-fashioned battlefield triage? The range of possibilities certainly must be larger than the resources available. Are we fiddling around the periphery while the supporting structure burns? What to do; what not to do: that is the question. The question that is rarely, if ever, truly asked.

RESPONSES TO THIS ARTICLE

Responses to this article are invited. If accepted for publication, your response will be hyperlinked to the article. To submit a comment, follow [this link](#). To read comments already accepted, follow [this link](#).

Acknowledgments:

I want to thank my totem; all of those quarks and sparks and errant particles who have let me walk with them a little while, sometimes for a millisecond, challenged me at even minor slips toward The Rut, allowed me to stand on their shoulders to see the procession beyond the parade.

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