

# When Ecology Doesn't Play Straight, How Can Responsibility Be Allocated?

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In those cases where ecological responses are proportional to stress it is likely that scientists will be able to 1) convincingly demonstrate cause and effect relationships, 2) substantiate predictions of responses to increased stress, 3) substantiate predictions of improvements via remediation efforts and 4) convince people that the sacrifice of current benefits will result in future benefits. Few cases are this simple.

Unfortunately, in many cases, observed ecological responses do not appear to be proportional to stress in any obvious manner. In many realistic cases, especially those involving enclosed coastal seas, continuing and increasing stresses seem to be absorbed by the system's "assimilatory capacity" without obvious effects that impel costly modifications. This may be an artifact of complex water movements and seasonal variability of biota. Measurements in estuaries are so variable that virtually any measurement is within "normal range." Often, existing sources of nutrients and toxicants increase their inputs, and new input sources come into existence. Each unit believes it has the right to contribute as much new stress as every other unit, as a condition of fairness. This is often exacerbated by having several entities feel that their development depends on being allowed the same privileges as the historical units.

Early warnings of harm are often ignored because the troublesome events are episodic, unpredictable and possibly caused by factors such as the weather. Subsequently, demonstrations of large scale harm are dismissed as being only vaguely related to controllable stresses or too expensive to correct given the uncertainties of improvements in the face of large scale expenditures. In the absence of strong causative proof, skeptics can undermine preventive or corrective actions, since either approach involves costs and restrictions.

Often, observed ecological responses appear to be non-proportional to stress intensity because the stress is a "necessary, but not sufficient condition" to cause observable damage. Because observations are the net result of several processes, knowledge of isolated processes can fail to explain the observations. Not only do limiting factors differ among different ecosystems, they vary seasonally within a given ecosystem. Given the many processes involved, it is not surprising that ecosystem responses are often not proportional to the intensity of a stress. These scientific realities create problems for the political sector. The inability to relate damages as a linear response to a single factor, makes it difficult for political entities to allocate responsibility and costs among themselves. This results in time and effort lost as each tries to interpret the data to minimize its own costs.