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2008 : December 2008 : Jim Elser

**EMERGING RESEARCH FRONTS - 2008**

December 2008



**Jim Elser talks with *ScienceWatch.com* and answers a few questions about this month's Emerging Research Front Paper in the field of Multidisciplinary. The author has also sent along images of their work.**



**Article: Global analysis of nitrogen and phosphorus limitation of primary producers in freshwater, marine and terrestrial ecosystems**  
 Authors: Elser, JJ;Bracken, MES;Cleland, EE;Gruner, DS;Harpole, WS; Hillebrand, H;Ngai, JT;Seabloom, EW;Shurin, JB;Smith, JE  
 Journal: ECOL LETT, 10 (12): 1135-1142 DEC 2007  
 Addresses: Arizona State Univ, Sch Life Sci, Tempe, AZ 85287 USA. Arizona State Univ, Sch Life Sci, Tempe, AZ 85287 USA. Univ Calif Davis, Bodega Marine Lab, Bodega Bay, CA 94923 USA. (addresses have been truncated.)

**SW: Why do you think your paper is highly cited?**

The paper involves a meta-analysis of more than 1,000 nutrient enrichment experiments testing for nitrogen (N) or phosphorus (P) limitation (and interactions) of primary production in all of Earth's ecosystems (marine, freshwater, terrestrial). It is likely highly cited because nutrient limitation is a fundamentally important phenomenon in ecosystems, because the paper addresses both N and P limitation, and because the paper involves ALL kinds of ecosystems. Thus, there seems to be something for everyone in there!

**SW: Does it describe a new discovery, methodology, or synthesis of knowledge?**

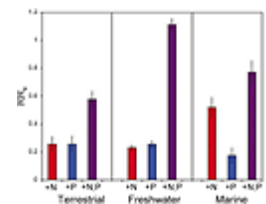
Yes. It provides data challenging some existing paradigms in ecosystem ecology, such as the generalizations that phosphorus is predominantly limiting in freshwaters (our data show an equal role for nitrogen), that N is predominantly limiting in terrestrial systems (our data show an equal role for P), and that N is predominant in marine systems (our data show that, yes, N enrichment results in stronger response than P, but P is also important). Our data also show quite clearly that there are strong N x P synergistic interactions in all ecosystems.

**SW: Would you summarize the significance of your paper in layman's terms?**

Our study shows that plant production is generally equally limited by available nitrogen and phosphorus in all of Earth's ecosystems, from lakes to forests to grasslands to oceans. Thus, proper management of human sources of nitrogen and phosphorus (fertilizer, sewage, **air pollution**) is important in order to preserve ecosystems from over-enrichment.

**SW: How did you become involved in this research and were any particular problems encountered**

Figure 1:



+ View larger image & details

## along the way?

+enlarge



The working group at Jim Elser's Lab.

I became involved in nutrient limitation research at the beginning of my career in the early 1980s, studying N and P limitation in reservoirs. It has been a major theme of my work since then. To do this study, however, was well beyond the capacity of a single person. Instead, a large number of colleagues, working together in a group at the **National Center for Ecological Analysis and Synthesis** at the University of California, Santa Barbara, was able to put together all available knowledge about nutrient enrichment effects from previous studies to obtain this broad view.

The problems are those always encountered in meta-analysis: finding all the studies, extracting the data from graphs or incomplete data tables, correcting for possible differences in methodology, quality control, etc. It required a group of dedicated and outstanding colleagues in order to complete this study.

## Where do you see your research leading in the future?

We need better information about both the external and internal factors that control N and P availability in ecosystems. Especially important will be to understand how anthropogenic influences, such as atmospheric N deposition to ecosystems, may have impacted patterns of nutrient limitation in ecosystems.

## Do you foresee any social or political implications for your research?

Yes, this study implies that ecosystem managers and environmental regulators need to pay attention to inputs of both N and P in protecting ecosystems from anthropogenic perturbations. And they need to do this for ALL kinds of ecosystems, freshwater, marine, or terrestrial.

**James J. Elser**  
Professor and Associate Director  
School of Life Sciences  
Arizona State University  
Tempe, AZ, USA

Figure 1:

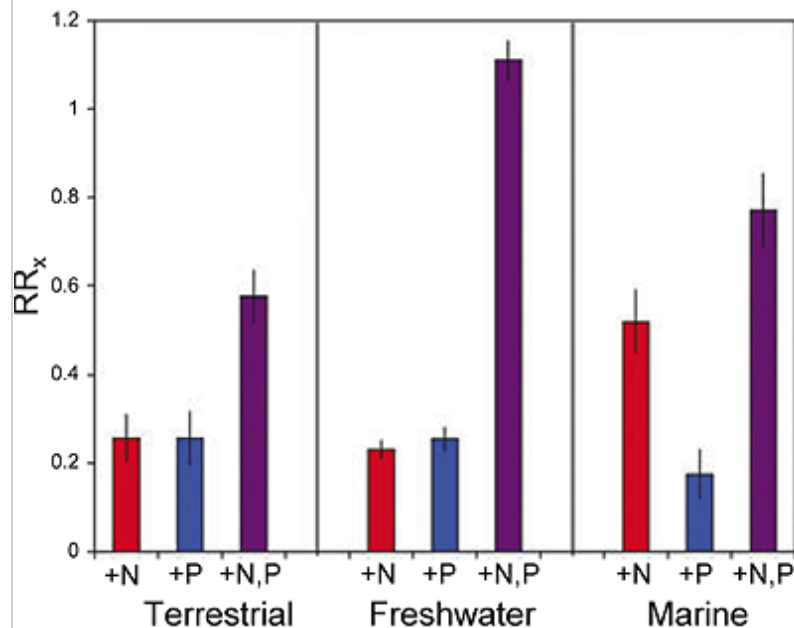



Figure 1:

Average Relative Response (biomass in enriched treatment / control treatment) to N enrichment alone, P enrichment alone, or combined N&P enrichment in more than 1000 experiments in freshwater (lake, stream), terrestrial (forest, grassland, tundra, etc) Note that relative response is log-transformed on the y-axis.

**Related:** [listen](#) to a Science Studio interview with Jim Elser.

Keywords: nutrient enrichment experiments testing for nitrogen or phosphorus limitation, meta-analysis, earth's ecosystems, existing paradigms in ecosystem ecology, synergistic interactions in all ecosystems, anthropogenic influences, patterns of nutrient limitation, anthropogenic perturbations.

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