Dystrophy and eutrophy in lake ecosystems: implications of fluctuating inputs

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Abstract: Eutrophic and dystrophic states of lake ecosystems are associated with distinct differences in phosphorus (P) input, refractory dissolvedorganic carbon (RDOC) input, and certain internal processes. Eutrophic lakes have high P input and high primary production. Dystrophic lakes have high RDOC input. In both types of lake, bacterial metabolismmay help reduce RDOC levels. In dystrophic lakes, bacterial metabolism may be suppressed by low pH, and primary production is reduced dueto light attenuation by RDOC. We analyzed several simple models to ask whether eutrophy and dystrophy are alternative stable states of lake ecosystems. In-lake processes could create alternative states under certain circumstances, but more likely watershed processes maintaineutrophy or dystrophy through contrasts in inputs of P and RDOC. Simulations suggest that pulses of RDOC result in dystrophic conditions that reverse very slowly. Land-use changes or climate fluctuations that change RDOC input rates may have long-lasting effects on trophic state of temperate and boreal lakes. Lack of information on microbial degradation of RDOC, and the dependency of degradation rate on RDOC levels, primary production, and pH, are major sources of uncertainty in our analysis and are suggested as priorities for further research. [*ABSTRACT FROM AUTHOR*]