

Ecological Society of America Meeting 2007

Title: Biodiversity risks from atmospheric nitrogen deposition in California

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Citation:

Weiss, S.B., 2007. Biodiversity risks from atmospheric nitrogen deposition in California. Ecological Society of America Annual Meeting, August 5-10, San Jose, CA.

Abstract:

Atmospheric nitrogen deposition can be viewed as “chemical climate change” that can profoundly alter ecosystems. Studies from California, a biodiversity hotspot with hundreds of threatened and endangered species, illustrate how atmospheric N-deposition drives losses of biodiversity, and highlights development of policies and actions in response to new scientific information. The Bay checkerspot butterfly and more than a dozen rare plant species occupy thousands of acres of nutrient poor serpentine grassland south of San Jose. These grasslands receive 10-20 kg-N ha⁻¹ year⁻¹, which allows nitrophilous exotic annual grasses to invade. Grass invasions are held in check by moderate cattle grazing. Innovative mitigation for powerplants, freeway expansion, and urban development promises to deliver permanent protection and management of virtually the entire remaining ecosystem. On a local scale in a relatively low pollution area, NH₃ and NO_x emissions from a heavily traveled freeway led to a “drive-by” extinction of a roadside population of Bay checkerspot butterflies in 2002. Ongoing restoration by precision mowing reduces annual grass cover, and has allowed reintroduction of the butterfly in 2007. A California-wide threat assessment indicates that the problem is quite widespread. Overlays of a 36km scale N-deposition map (developed from the CMAQ model) onto a vegetation map and point locations of rare species show that of 225 plant taxa officially listed as “Threatened and Endangered,” 99 are exposed to greater than 5 kg-N ha⁻¹ year⁻¹. Many are in habitats vulnerable to annual grass and other weed invasions that crowd out native species and change fire regimes.

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