Ecological Thresholds and Critical Loads in Western National Parks

Recent scientific research in national parks and other wildland areas has produced significant information on thresholds, or critical loads, for air pollution effects to lakes, streams, soils, and biota. This information can be used to assess potential effects from new air pollution emissions on park resources. In the West, research has focused on the effects of excess atmospheric nitrogen deposition, as western ecosystems have been found to be extremely sensitive to nitrogen (Fenn et al. 2003). The critical load for eutrophicaton of high-elevation lakes in Rocky Mountain National Park (NP) is 1.5 kilograms of wet nitrogen deposition per hectare per year (kg/ha/yr) (Baron 2006). Similar critical loads (1.4 kg wet nitrogen/ha/yr) for eutrophication have been identified for lakes in Sequoia and Yellowstone NPs. Lakes in the Beartooth Mountain Range of Wyoming show symptoms of eutrophication at current levels of wet nitrogen deposition of 2 kg/ha/yr (Saros et al. 2003), suggesting that the actual critical load was somewhat below 2 kg/ha/yr (wet). These studies, covering a broad geographic range, suggest that an appropriate critical load for eutrophication of nitrogen limited high-elevation lakes in the West is 1.4 to 1.5 kg/ha/yr of wet nitrogen deposition.

Nitrogen also affects terrestrial ecosystems in the West. The critical load for changes in Colorado tundra plant species is 4 kg/ha/yr of total (wet and dry) nitrogen deposition (Bowman et al. 2006). The critical load for epiphytic lichen communities in the Sierra Nevada is 3.1 kg/ha/yr (Fenn et al. 2008). The critical load for increased fire frequency in southern California desert ecosystems, including Joshua Tree NP, is 7 kg/ha/yr of nitrogen.

<u>Key References (specific to western U.S. ecosystems):</u>

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