

Bottom-up and top-down human impacts interact to affect a protected coastal Chilean marsh

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Abstract

Many ecosystems, even in protected areas, experience multiple anthropogenic impacts. While anthropogenic modification of bottom-up (e.g., eutrophication) and top-down (e.g., livestock grazing) forcing often co-occurs, whether these factors counteract or have additive or synergistic effects on ecosystems is poorly understood. In a Chilean bioreserve, we examined the interactive impacts of eutrophication and illegal livestock grazing on plant growth with a 4-yr fertilization by cattle exclusion experiment. Cattle grazing generally decreased plant biomass, but had synergistic, additive, and antagonistic interactions with fertilization in the low, middle, and high marsh zones, respectively. In the low marsh, fertilization increased plant biomass by 112%, cattle grazing decreased it by 96%, and together they decreased plant biomass by 77%. In the middle marsh, fertilization increased plant biomass by 47%, cattle grazing decreased it by 37%, and together they did not affect plant biomass. In the high marsh, fertilization and cattle grazing decreased plant biomass by 81% and 92%, respectively, but together they increased plant biomass by 42%. These interactions were also found to be species specific. Different responses of plants to fertilization and cattle grazing were likely responsible for these variable interactions. Thus, common bottom-up and top-down human impacts can interact in different ways to affect communities even within a single ecosystem. Incorporating this knowledge into conservation actions will improve ecosystem management in a time when ecosystems are increasingly challenged by multiple interacting human impacts..

Keywords

Coastal Wetlands, Synergistic interactions, Multiple human impacts, Marine protected areas, Chile.