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**Non-linear Disruption of Ecological Interactions in Response to Nitrogen Deposition**

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Global environmental change (GEC) is affecting species interactions and causing a rapid decline in biodiversity. In this study, I present a new Ecosystem Disruption Index (EDI) to quantify the impacts of simulated nitrogen (N) deposition (0, 10, 20 and 50 kg N ha-1 yr-1 + 6-7 kg N ha-1 yr-1 background) on abiotic and biotic ecological interactions. This comparative index is based on pairwise linear and quadratic regression matrices. These matrices, calculated at the N treatment level, were constructed using a range of abiotic and biotic ecosystem constituents: soil pH, shrub cover, and the first component of several separate principal component analyses using soil fertility data (total carbon and N) and community data (annual plants; microorganisms; biocrusts; edaphic fauna) for a total of seven ecosystem constituents. Four years of N fertilization in a semiarid shrubland completely disrupted (112.4 ± 9.8 %) the network of ecological interactions, with a greater proportional increase in ecosystem disruption at low-N addition levels. Biotic interactions, particularly those involving microbes, shrubs and edaphic fauna, were more prone to be lost in response to N, whereas interactions involving soil properties were more resilient. In contrast, edaphic fauna was the only group directly affected by N addition, with mites and collembolans increasing their abundance with up to 20 kg N ha-1 yr-1 and then decreasing, which supports the idea of higher-trophic level organisms being more sensitive to disturbance due to more complex links with other ecosystem constituents. Future experimental studies evaluating the impacts of N deposition, and possibly other GEC drivers, on biodiversity and biotic and abiotic interactions may be able to explain results more effectively in the context of ecological networks as a key feature of ecosystem sensitivity.