Mongolian Journal of Biological Sciences 2010 Vol. 8(1): 27-39

The Relationship Between Grazing, Erosion and Adult Aquatic Insects in Streams in Mongolia.

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Abstract

Overgrazing along stream channels in Mongolia may impact streams by increasing stream channel erosion and in-stream sediments, water temperature, pH, and conductivity. Grazing and erosion impacts may impair stream insects. The Mongolian Aquatic Insect Survey sampled 250 streams during summer seasons in 2003-2006 and 2008. On-site identifications of aquatic insect families mostly based on collections of adults were recorded for each site, leading us to ask whether the family-level data were useful in biological assessment related to impacts and impairment from grazing and erosion. A double dendrogram based on hierarchical cluster analysis was used to find patterns in sites and aquatic insect communities. Sites did not group by sampling period, but some sites did group by stream size and elevation. However, elevation was not a significant predictor of variation in aquatic insect metrics. Analysis of variance was used to determine whether insect metrics and water quality variables varied significantly between categories of erosion in the stream channel. Plecoptera and Diptera richness decreased with increased erosion and Percent Diptera Richness was the only aquatic insect metric to vary significantly between categories of erosion along the stream channel. Water temperature, conductivity, and pH also significantly increased with increased erosion. Multiple regression analysis was used to determine whether aquatic insect metrics could be predicted by variation in landscape, water quality and stream reach variables. Trichoptera, Ephemeroptera, and Coleoptera richness increased with increased erosion, conductivity, and pH, but not significantly. Percent Diptera Richness formed the only significant model in the multiple regression analysis, with conductivity the only significant predictor of variation in Percent Diptera Richness. Family-level data generated in the field indicated that sampling for Trichoptera and Ephemeroptera diversity would be maximized by sampling streams undergoing intermediate levels of disturbance from grazing and erosion, that sampling for the Diptera and Plecoptera diversity would be maximized by sampling streams with less erosion and grazing, and that Diptera richness was impaired by erosion related to grazing in Mongolian streams.

Key words: Mongolia, Erosion, Grazing, Aquatic Insects, Bioassessment

Introduction

Pastoralist herders in Mongolia have changed their grazing practices over the past two decades by increasing the intensity of grazing and the concentration of domesticated herbivores along stream channels. Increased grazing may directly impact riparian and stream channel condition, impacting stream quality and impairing aquatic insects. In-stream larvae will be affected by changes to water quality, substrate type and heterogeneity, and increased sedimentation. Terrestrial adults may additionally be impacted by a loss of refuge and mating habitats. The Mongolia Aquatic Insect Survey (MAIS) team made field identifications of adult aquatic insects at each collection site during summer season over five years. Data from these identifications are used here to determine whether adult family level data alone is responsive to changes in environmental gradients and if so to demonstrate the use for this data in guiding on-going surveys and biological assessments of streams in Mongolia.

Mongolia is a landlocked country characterized by grassland steppe, desert, and mountain regions which have been grazed for up to 4000 years. Domesticated grazing livestock include yaks, cattle, camels, sheep, horses, and goats; and wild rangeland grazers include gazelle, ibex, wild ass, and the critically endangered saiga antelope (Johnson *et al*. 2006).