

Surface-groundwater interactions and nutrient transport in alpine and subalpine catchments, Front Range, CO

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Abstract. Nutrient fluxes from two high elevation catchments in the Colorado Front Range, Como Creek and the Green Lakes Valley, are compared across differing landscapes. These watersheds share similar climate, aspect, and geography. Como Creek primarily drains subalpine forest with little alpine area, while in contrast the adjacent Green Lakes Valley drains alpine tundra and talus slopes, before reaching the subalpine forest. Comparing NH_4^+ , NO_3^- , DON, and DOC yields from Como Creek and the Green Lakes Valley from the last 30 years, show that alpine areas subsidize transport of inorganic nitrogen down gradient into forested areas. In contrast, at Como Creek there is little export of inorganic N, higher export of organic N, and much greater export of DOC compared to Green Lakes Valley. Three-component hydrologic mixing models using O^{18} and Na as tracers from groundwater and surface water sources show that discharge at Como Creek is characterized by a well-mixed deep groundwater reservoir with a residence time of years to decades, whereas the Green Lakes Valley discharge shows more recent water characterized by shallow subsurface flow. These distinct flow paths confirm that changes in nutrient processing in shallow soil across the alpine – subalpine ecotone control nitrogen loss in these ecosystems.