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Influence of geologic setting on slope wetland classification and hydrodynamics

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ABSTRACT

Slope wetlands exist where topographic or stratigraphic conditions allow groundwater to intersect the surface, creating a zone of perennial or near perennial moisture. The condition and resiliency of slope wetlands, therefore, are controlled by their hydrodynamics and recharge mechanisms. Understanding these mechanisms is essential for accurate assessment of potential indirect impacts and development of management actions in slope wetlands. To better understand relationships between geologic setting and the condition of slope wetlands, we characterized the physical and biological properties and hydrodynamics of 20 slope wetlands in the San Juan Creek Watershed in southern Orange County, California. Principal components analysis (PCA) resulted in the slope wetlands being separated into three distinct groups, based on geologic setting: those located in bedrock landslides, those associated with faults, and those associated with alluvial/colluvial deposits. Groundwater monitoring and hydrogeologic analysis showed that wetlands in alluvial/colluvial deposits respond quickly to precipitation, and subsurface water levels stay shallow for extended periods of time. In contrast, subsurface water levels in bedrock landslide wetlands respond more slowly to precipitation, exhibit greater variation, and ultimately decline more quickly. These trends (along with the analysis of groundwater chemistry) indicate that wetlands in alluvial/colluvial deposits are likely supported by relatively stable, large volumes of groundwater. In contrast, wetlands located in bedrock landslides are likely recharged from relatively localized groundwater sources with smaller volumes and greater year-to-year variability. Wetlands located along faults have an intermediate level of variation in moisture regime, indicating that their association with a fault may be providing a conduit for water delivery to the wetland. Plant species diversity did not differ between subclasses, although wetlands in alluvial/colluvial deposits supported slightly greater proportions of alkaline plant species. Understanding the different recharge characteristics of each subclass will allow for more informed decision-making regarding protection and management of slope wetlands.

Full Text

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