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Editorial

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Clinopyroxene-Dominated Lava Sand

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Introduction

Few long-term studies have explored how intensively managed short rotation forest plantations interact with climate variability. We examine how prolonged severe drought and forest operations affect runoff in eleven experimental catchments on private corporate forest land near Nacimiento in south central Chile over the amount 2008 to 2019. The catchments contain forest plantations of exotic fast-growing species at various stages of growth during a Mediterranean climate. Since 2010, a drought, unprecedented in recent history, has reduced rainfall at Nacimiento by 20%, relative to the long-term mean. Pre-drought runoff ratios were 0.4 under 21-yr-old Radiata pine and >0.8 where herbicide treatments had controlled vegetation for 2 years in 38% of the catchment basin. Early within the study period, clearcutting of radiata pine increased streamflow by 150 mm as compared with the year before harvest, while clearcutting and partial cuts of Eucalyptus didn't increase streamflow. During 2008-2019, the mixture of emerging drought and forestry treatments (replanting with Eucalyptus after clearcutting of Radiata pine and Eucalyptus) reduced streamflow by 400-500 mm, and regeneration of previously herbicide-treated vegetation combined with growth of Eucalyptus plantations reduced streamflow by 1125 mm. These results from one among the foremost comprehensive forest catchment studies within the world on private industrial forest land indicate that multiple decades of forest management have reduced deep soil moisture reservoirs.

This effect has been exacerbated by drought and conversion from Radiata pine to Eucalyptus, apparently largely eliminating subsurface supply to streamflow. The findings reveal tradeoffs between wood production and water system , provide lessons for adapting forest management to the projected future drier climate in Chile, and underscore the necessity for continued experimental add managed forest plantations.

Constructed wetlands are engineered systems for treating wastewater by sequestering nutrients and contaminants. Our aim was to assess the most phosphorus (P) binding states in operating CWs to assess P saturation and indications on P recycling potential of filter materials, which could be necessary under future peak P scenarios. The investigated vertical flow CWs (operation time up to 16 years) are supported either fluviatile sand or zeolite and clinopyroxene dominated lava sand. Organic and inorganic P accumulated altogether CWs independent of filter materials and showed a substantial increase with operation time. Concentrations of P decreased sharply with depth within the Fluv-CWs compared to only a small decrease within the lava sand CWs, with P concentrations of deeper horizons approximating the relatively P enriched original lava sand substrates. Orthophosphate was the dominant pool altogether CWs, while the sum of organic fractions ranged between 11% and 33%. Sequential extraction indicated that P was mainly related to Fe and Al oxides for Fluv-CWs and Ze-LS-CWs, while Ca and Mg bound mineral phosphates dominated in Cl-LS-CWs. Oxalate extractions pointed to a transparent dominance of P fractions related to poorly crystalline Fe- and Al-(oxy)hydroxides. Solution 31P NMR analyses revealed that inositol hexakisphosphates were a serious pool of organic P in surface layers of CWs, which increased with operation time. With a maximum of 0.5% P content, filter sands don't appear to be an appropriate fertilizer for direct application to agricultural fields.

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