EGU2020-12884
https://doi.org/10.5194/egusphere-egu2020-12884
EGU General Assembly 2020

Impacts of invasive fauna and wildfires on hydrological regimes in a tropical valley of New Caledonia (SW Pacific)

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In New Caledonia wildfires and invasive animal species (deers and wild pigs) constitute major agents of land surface degradation and an important threat to forests. As a result of land degradation the lagoon and the quality of drinking water are impacted by sediments transported by rivers. The study area, the Thiem watershed, is located on the northeast windward coast of New Caledonia and on micaschist basement. The landscape is constituted by a mosaic of savannahs and forests. Forests are restricted to highest remote areas or near talwegs and waterways. Savannahs are located on the crests and on the superior slopes of watersheds, near the villages. The hydrological regime of contrasted land surfaces is assessed using a 1 year record from three 100 m^2 plots located in a healthy forest, in a forest degraded by invasive fauna and in a woody savannah regularly burned. Significant isolated rainy events (50-100 mm rainfall) were observed during the dry season (May-December), while the wet season presented only few isolated dry periods. Difference of monthly rainfall between the three plots were less than 10% as a general rule. However rainfall difference reach 30% at the scale of a rainy event. Moreover, 40% of rain occurs during small events with less than 50 mm cumulated rainfall, although events larger than 200 mm were observed. The healthy forest corresponds to an annual runoff coefficient of 0.04 which is commonly observed in tropical forests. The savannah corresponds to a 0.16 coefficient which is in the high range of those commonly observed in similar tropical areas. The degraded forest presents a 0.86 runoff, rising to more than 100% for many rainy events of the wet season. The maximum event-based runoff coefficient was observed in the three plots during the OMA cyclone, corresponding to 0.18, 0.71 and 2.7 at the healthy forest, savannah and degraded forest respectively. It is proposed that the extra runoff (ER) regularly observed at SCAR results from subsurface flow originating from the upstream area and focused toward the plot. A reservoir model is proposed and calibrated against available data. The model results indicate that ER accounts for 47% of the total observed runoff in this plot. Our study confirms the major role played by subsurface flow in the water regime of forested and savannah areas. It is emphasized that subsurface flow exfiltration in degraded land surfaces could enhance erosion and transport of harmful bacteria (leptospira). Moreover savannah, as a dominant high runoff surface in upper

catchments of our study area, might control runoff at the scale of the watershed and might constitute a target for controlling downstream flooding and gullies erosion.