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Combatting desertification of Jordan's agro-pastoral watersheds through linking upstream mechanized rangeland restoration with downstream indigenous agriculture

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Natural resource exploitation triggers the degradation of Jordan's dry rangelands. Huge efforts are being undertaken to restore the desertified agro-pastures and to provide water and livelihood resilience to its host communities. But hydrological trade-offs at different scales and especially downstream water availability impacts may create conflicts. A case study from Jordan demonstrates how field experiments of mechanized micro rainwater harvesting in combination with physically-based modeling can assist to better understand the hydrological trade-offs at the micro to the watershed scale. Three models were used to simulate the hydrology of the micro-scale water harvesting structures and the watershed scale impacts. The upland runoff generation was simulated using the Rangeland Hydrology and Erosion Model (RHEM). The HYDRUS2D model was used to simulate the soil moisture dynamics in the water harvesting structures. Finally, the landscape's water-fluxes towards the downstream 'Marab' water harvesting based agriculture were simulated with the Soil and Water Assessment Tool (SWAT). The calibration of models was done using quantitative field-scale rainfall, surface runoff and soil moisture data, while semi-quantitative watershed data was provided by local Bedouins on flood event occurrence and magnitudes observed in the downstream Marab. The experiment translates the highly detailed upland data, obtained at the micro rainwater harvesting level, to a complex watershed scale. Eventually this approach allows both, the targeted upland restoration, matching the soil and vegetation development requirements, as well as confining the out-scaling of restoration attempts linked with the downstream Marab crop water requirements. The experience will support the out-scaling of a holistic watershed restoration approach matching ecosystem resilience with its host communities' demands.