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Assessing water salinity along River Limón and Caño San Miguel irrigation paleochannel (Maracaibo, Venezuela) as affected by the balance of soluble salts in alluvium soils

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The saline degradation of soils that are irrigated with brackish water is worrisome increasing worldwide, and it may further affect the salinity of fresh water in those streams flowing across. The problem that is caused by an increasing concentration of salts that are more soluble than gypsum depends on the quality of irrigation water, climatic aridity, and drainage limitations. All these conditions meet in the alluvium soils of River Limón basin that are crossed by Caño San Miguel irrigation paleochannel. River Limón's regulation by closing Manuelote and Tulé artificial reservoirs has diminished the input of water and sediments from flooding events, which exerted dilutive effects in the past. In addition, the balance of soluble salts in these soils has also registered further net accumulation during those extremely dry years happened before 2006, because the great dilution contribution of ombrogenic dammed water coming from rain has not been enough to compensate salts concentration generated by water evapotranspiration in those irrigated soils of the middle basin, particularly in the absence of superficial runoff and deep drainage. Considering those semi-arid climate conditions prevailing in the area (annual precipitation = 710 mm; potential evapotransporation = 2361 mm), it resulted that water analyses in River Limón showed a ten-fold increased maximum annual salinity concentration (March) along the stream; that is, an electric conductivity (Ce) of 0.37 dS•m-1 (at 25 ºC) at Puente Carrasquero pumping station, where water for crop irrigation is subtracted, turns to 34.60 dS•m-1 (at 25 ºC) at its base level in Puerto Mara, where it discharges to Lake Maracaibo. In addition, the quality of irrigation water from Caño San Miguel, which aggregates to those coming from River Limón at the pumping station located in Carrasquero just before running through the alluvium of this water stream, resulted pretty irregular. In short, it spanned form C1 to C4 soil salinization risk classes depending on the sampling location and time of the year. In short, the farther away the sampling point from the initial pumping location, the higher the concentration of salts is measured; and these are even ten-fold higher in March, that is, after the end of the dry season, just before new rain dissolves the generated salt efflorescence on the surrounding soil (maximum Ce=9740 dS/m at 25 ºC). In conclusion, a balance of salts should be attached to the balance of water required to compensate crop evapotranspiration aiming to achieve a sustainable use of the agrosystem. This salts balance is assessed in terms of the quantity of water that is required to drain soil so that productivity would be retained.