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Agroforestry-based management of salt-affected croplands in irrigated agricultural landscape in Uzbekistan

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In the lower Amu Darya River Basin, the decades of intensive irrigation led to elevated groundwater tables, resulting in ubiquitous soil salinization and adverse impact on crop production. Field-scale afforestation trials and farm-scale economic analyses in the Khorezm region have determined that afforestation can be an environmentally and financially attractive land-use option for degraded croplands because it combines a diversified agricultural production, carbon sequestration, an improved soil health and minimizes the use of irrigation water. We examined prospects for upscaling afforestation activity for regional land-use planning considering prevailing constraints in irrigated agriculture landscape. Assessment of salinity-induced cropland productivity decline using satellite imagery of multiple spatial and temporal resolution revealed that 18-38% of the marginally productive or abandoned cropland might be considered for conversion to agroforestry. Furthermore, a regional-scale water balance suggests that most of these marginal croplands are characterized by sufficient surface water supplies for irrigating the newly planted saplings, before they are able to rely on the groundwater alone. However, the 10-year monitoring of soil salt dynamics in the afforestation trials reveals increasing salinity levels due to the salt exclusion from the root water uptake by the trees. Further study focuses on enhancing long-term sustainability of afforestation as a management option for highly saline lands by examining salt tolerance of candidate species using 13C isotopic signature as the indicator of water and salt stress, salt leaching needs and implications for regional scale planning.