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## Remote Sensing based comparative analysis of cotton irrigation and water productivity in Pakistan, Turkey and Uzbekistan

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Textile products made with cotton produced in Pakistan, Turkey, and Uzbekistan are largely imported to European markets. This is responsible for high virtual water imports from these countries and thus puts immense pressure on their water resources, which is further exaggerated due to climate change and population growth. The solution to combat the issue, on one hand, is to cut water usage for cotton irrigation, and on the other hand, to increase water productivity. The biggest challenge in this regard is the correct quantification of consumptive water use, cotton yield estimation and crop water productivities at a finer spatial resolution on regional levels, which is now possible by utilizing remote sensing (RS) data and approaches. It can also facilitate comparing regions of interest, like in this study, Pakistan, Turkey, and Uzbekistan by utilizing similar data and techniques. For the current study, MODIS data along with various climatic variables were utilized for the estimation of consumptive water use and cotton yield estimation by employing SEBAL and Light Use Efficiency (LUE) models, respectively. These estimations were then used for working out water productivities of different regions of selected countries as case studies. The results show that the study area in Turkey achieved maximum cotton water productivity (i.e. 0.75 - 1.2 kg.m<sup>-3</sup>) followed by those in Uzbekistan (0.05 - 0.85 kg.m<sup>-3</sup>) and Pakistan (0.04 - 0.23 kg.m<sup>-3</sup>). The variability is higher for Uzbekistan possibly due to agricultural transition post-soviet-union era. In the case of Pakistan, the lower cotton water productivities are mainly attributed to lower crop yields (400 - 1200 kg.ha<sup>-1</sup>) in comparison to Turkey (3850 - 5800 kg.ha<sup>-1</sup>) and Uzbekistan (450 - 2500 kg.ha<sup>-1</sup>). Although the highest crop water productivity is achieved for the study region in Turkey, there is still potential for further improvement by introducing on-farm water management. In the case of the other two countries, especially for Pakistan, major improvements are possible through maximizing crop yields. The next steps include comparisons of the results in economic out-turns.