



Land cover change and ecosystem water yield across climatic gradient in the Eastern Mediterranean

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The Earth dry land area, much of which is in the subtropics and includes $\sim 30\%$ of the world population, is expected to expand from 40% to over 50% and experience increasing water scarcity by the end of this century. The interactions of climate change and land use on ecosystem water yield, the residual between precipitation and ecosystem evapotranspiration ($WYe = P - ET$), can greatly influence local hydrology and water availability for consumption, but are seldom quantified in these regions.

Results from 5 years of flux measurements using a Mobile Lab across a precipitation gradient from dry to sub-humid Mediterranean sites (280 to 750 mm in mean annual precipitation; P) indicated that in the P range of 500-1000 mm, ecosystem evapotranspiration (ETe) is relatively "stiff" and changes little. The impact of any reduction in P (ΔP) on WYe is therefore enhanced, since $\Delta P \approx \Delta WYe$ and $\Delta P/WYe \gg \Delta P/P$, where P and WYe are current values. Accordingly, a decrease in P of 100 mm in the wetter part of the gradient (e.g. from 800 mm to 700 mm) constitutes a 12.5% decrease in P ($\Delta P/P$) but $\sim 50\%$ decrease in WYe ($\Delta P/WYe$), where P and WYe are current values. Comparative measurements across land uses indicated that due to reduced ET in the non-forest ecosystems (shrubs or grasses), WYe is larger in these ecosystems, with ΔWYe of +200 mm to +50 mm (+26% to +18% of P) across the study sites. Consequently, the effects of a drying trend such as noted above ($\Delta P \sim 100$ mm) on the water yield is reduced from $\sim 50\%$ to $\sim 33\%$ in the non-forest sites at the wetter part of the gradient. The effect of land use changes become negligible in the dry end of the gradient where ET approaches P in both vegetation types.

The enhanced sensitivity of water yield to potential drying is important to consider and quantify because of its impact on local hydrology and on water availability for human consumption in dry regions. The results also indicate that such effects can be minimized by management practices.