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Can groundwater supply match irrigation water demand in Mediterranean environments?

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In many Mediterranean countries water demand outstrips natural, renewable water supply. In the Republic of Cyprus average annual water demand has been estimated as 252 Mm^3 per year, with 60% (152 Mm^3) for irrigation. Average annual precipitation over the area of the country, for the hydrologic years 1970/71-2009/2010, was 466 mm. Groundwater resources amount to approximately 180 mM^3/yr (6.7% of the precipitation) and surface water resources 190 Mm^3/yr (7.1% of the precipitation). The country has more than 50 large dams and another 30 small dams and ponds, providing more than 300 million m^3 storage capacity. But the typical Mediterranean variability of the climate is amplified in the surface water resources; annual inflows into the major dams have ranged from as low as 12 Mm^3 to as high as 168 Mm^3 during the past 20 years. This unstable supply has been balanced by uncontrolled groundwater exploitation and 12 of the country's 19 groundwater bodies have been affected by salt water intrusion.

Land use data of the country's 427 communities, climate data from 30 meteorological stations and an additional 32 rain gauges were used to make a more detailed assessment of the country's green and blue water demand for crop production, for the period 1997-2008. Temporary crops (cereals, forages, potatoes, vegetables and melons) covered 109.5 thousand ha and permanent crops (olives, vines, nuts, citrus and other fruit trees) covered 40.8 thousand ha, during the 2003 agricultural census year. But changing socioeconomic conditions and droughts are resulting in a slow decline in agricultural land. Irrigation water demand for the 12 year period ranged between 195 and 250 Mm^3/yr. Government irrigation water supply from dams for this period ranged between 8 and 58 Mm^3/yr, with an additional 5-8 mM^3/yr supplied from groundwater and some 5 Mm^3/yr from treated sewage water resources. Private groundwater pumping for irrigation was estimated to range between 141 and 216 Mm^3/yr. This paper analyses the uncertainties in these numbers, considering variabilities and changes in climate, land use and soil properties.