

Two-decade evolution of livestock farming systems in Mediterranean arid rangelands

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In a context of limited resources and opportunities in arid rangelands, livestock systems are a key source of income for local communities. These systems have experienced relevant changes in the last decades, which although might affect farm's vulnerability, have not been given much attention in the scientific literature. Understanding farming systems trajectories of evolution at farm level will help informing the development of policies and programmes to face future challenges. This is particularly crucial in arid rangelands that will be severely impacted by climate and global change. We aimed to analyse the main changes occurred since 2004 in livestock farming systems in El Ouara rangelands, a paradigmatic example of arid rangelands in South-East Tunisia. A face-to-face survey was implemented to 73 farmers in 2004 and 2019 to gather information about farm structure, production orientation, feed management, and economic performance. We identified the trajectories of evolution of farming systems using multivariate statistics. The number of livestock units of sheep has doubled and agriculture (i.e. cereal) areas increased by 66% ($P < 0.001$), while there was a one-month and two-month average reduction of the period herds spend in rangelands and transhumance, respectively ($P < 0.05$ and $P < 0.001$). We identified three farming systems types, which were similar across years: (1) small sheep-specialized farms; (2) large sheep-focused farms; and (3) camel-focused farms. Farms shifted among farm typologies from 2004 to 2019, with small sheep-focused farms being more common in 2004 and large sheep-focused farms more common in 2019. Our results showed a clear relationship between the geographical location and the evolution of farming systems. Camel-focused farms were found in the most marginal areas, while farm in areas close to main cities evolved from pure sheep farms to mixed cereal-sheep farms. Our work showed a slow but steady substitution of feed resources from arid rangelands with by-products from agriculture, whose long-term sustainability cannot be assured.