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“Reconcile land system changes  
with planetary health”

## Agricultural restructuring and groundwater depletion in morocco’s oasis of figuig

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### Abstract

Over the past decades oasis systems in Morocco have undergone rapid transformation. Traditionally, these fragile ecosystems withstood harsh environmental conditions using local knowledge, particularly for communal water management and nutrient cycling. However, their increasing integration into a liberalised market economy has contributed to their destabilisation. Morocco’s agrarian reforms have promoted the expansion of date palm (*Phoenix dactylifera* L.) cultivation within large-scale farming schemes, emphasising export-oriented production, intensive irrigation, and advanced agricultural techniques such as selective breeding and mechanisation. Despite their intent to support oasis populations, these reforms have sparked criticism of their adaptation to social and ecological contexts of oasis systems. This study investigates transformation processes in the oasis of Figuig and sheds the light on social and ecological consequences of agrarian reforms particularly groundwater resources. Historical maps and recent drone imagery are used to identify land use patterns and transformations within the oasis, while semi-structured interviews with farmers—both in the old palm grove and in newly cultivated extensions—explore socio-economic characteristics and agricultural practices. In parallel, physical and chemical analyses of groundwater, based on measurements of depth, flow rates, isotopic composition, and heavy metal concentrations in wells and springs, were employed to investigate changes in groundwater structures and potential sources of conflict between stakeholders. Initial findings indicate a threefold expansion of newly cultivated areas characterised by modern farm models centered on date palm monoculture, particularly of the Aziza landrace and the Medjool variety. This growth is accompanied by an abandonment of almost half of the land within the old palm grove. Economic incentives favouring date palm production, along with progressive land fragmentation following traditional inheritance practices, appear to be key drivers of these changes. At the same time, 40 % of the traditional springs serving the old palm grove have dried up, and the number of boreholes and wells extracting groundwater from the shared watershed to supply the new fields continues to rise. This has led to conflicts over common water resources in Figuig.

**Keywords:** Agrarian reforms in Morocco, date palm cultivation, groundwater conflicts, monoculture expansion, oasis systems, rural transformation, sustainable oasis management

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