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## Telecoupled urban demand drives agro-ecological land use in desert regions: New challenges for governing natural resources

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### Abstract

A shift from subsistence-based to agricultural market production in remote oases at the southern fringe of the West African Sahara is particularly constrained by the availability of fertile land and quality irrigation water. While large demands of rapidly growing markets for specialty crops such as onion (*Allium cepa* L.) and potato (*Solanum tuberosum* L.) in West Africa's cities lead to a booming agricultural frontier in the South-Sahara, harsh environmental conditions in the Ar Mountains of North-Niger determine the extent of land use for cash crop production and therefore income generation of the local population. Oasis agriculture may thus serve as an example for how farmers struggle for access to scarce common resources, whose overuse leads to a direct threat for the survival of a whole community, a phenomenon well known as the tragedy of the commons. Based on 70 year old colonial photographs, remote sensing analyses of satellite images, and field data collection between 2021 and 2023 in two small-scale oasis systems on Mont Bagzam and Timia, this study analyses (1) land use change in the oases between 1950 and 2023, (2) falling groundwater levels determined by topography and increasing water consumption for the production of cash crops, (3) the importance of communal management of natural resources, and (4) the potential of agroforestry and integrated crop-livestock management for sustainable intensified land use and new livelihood opportunities. Oasis systems on the mountain plateau of Mont Bagzam undergo highly dynamic changes towards irrigation-intensive cash crop production of onion, garlic (*A. sativum*), and potato leading to a five-fold increment in the cultivated land area between the 1950s until today, water shortages, and increasing abandonment of small-scale oasis gardens. Contrary, oasis gardens in the valley bottom of Timia, which have tripled in size over the past 70 years, constitute well managed agroforestry systems generating income from the sale of diverse crops such as wheat (*Triticum aestivum* L.), potato, citrus (*Citrus* L.), and pomegranate (*Punica granatum* L.) and serve as an example for sustainable and commonly governed agricultural production systems under difficult environmental conditions.

**Keywords:** Agro-pastoral systems, globalisation, land use change, natural resource management, rural-urban transformation