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EDITORIAL

Special issue: "Land and water resources for agricultural activities: vulnerability and inequality issues"

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In many water-scarce areas, farmland and water may be considered common goods, given that water is vital for life and traditional farming systems are crucial for avoiding land degradation and protecting natural resources. At the same time, natural resources are subject to intense, ongoing, anthropogenic and climatic pressures that could potentially result in crises, requiring an updated vision for the management of farming systems.

Farmland and water are both subject to various competitive uses with diverse social impacts: increasing urban sprawl, tourist activities, highly labour-intensive agricultural activities, and energy infrastructures (Napoléone & Melot, 2021). However, farmland and water are intrinsically limited resources, and their unregulated use may pose major risks to the sustainability of both agriculture and natural ecosystems. Focusing on the Mediterranean region, we can observe that water constraints are already critical and likely to increase dramatically in the coming years, giving rise to environmental and geopolitical tensions. Farmland is also a resource under pressure: political choices concerning the allocation of rights have a direct impact on the organisation of farming systems and local communities. Governance mechanisms at local and national levels need to consider competing interests in rural areas (Perrin et al., 2018).

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The current dynamics of traditional systems' transformations correspond to opposing trajectories of intensification and abandonment of agricultural land (Goussios et al., 2025) that can be explained by socio-economic determinants linked to a common context: land concentration, agricultural financing and the de-territorialisation of food systems. The intensification of farming systems results in the greater vulnerability of socio-ecological systems: vulnerability to global changes (climate change, biodiversity collapse) and the fragility of economic models in the absence of sustainable land and water resource management. This vulnerability has already reached a tipping point in some regions and is resulting in irreversible changes in land use: land degradation and even desertification (Muñoz-Rojas et al., 2019).

In this context, the scope of this special issue is to explore the vulnerability and inequality dynamics facing land and water as limited resources for farming and ecological systems; and in particular, to bridge knowledge gaps to fully understand both these dynamics of vulnerability and inequality. As an example, the vulnerabilities of irrigated agricultural land are closely connected to power relations within land ownership systems in a context of multiple risks or even potential collapse for access to water resources (Petit et al., 2017). The articles address these challenges from a social-science perspective of agricultural activities and natural resource management, with a special but non-limiting interest in the Mediterranean context. The articles approach these socio-economic challenges by considering public policies, collective actions, power relations and conflicts.

Traditional forms of farmland management are also vulnerable in a context of heavy pressures for urbanisation and the intensification of farming systems. These challenges need to be seen in light of the inequality dynamics in access to land and water as limited resources. The lower availability of land and water leads to exclusionary processes, especially for small farmers with limited capacities in a landscape of increasing prices and stiff competition from export-oriented agricultural holdings. At the scale of the agrifood system, this may also impact low-income consumers (Carter & Mesbah, 1993). These vulnerability and inequality dynamics call for the design of new rules for sustainable land and water management (Chartres & Noble, 2015).

The special issue also seeks to understand how changes in the management of land use and water resources may be connected. Among others, the intensification of farming systems is a possible example of this interaction. The high fragmentation of land tenure patterns may induce intensification strategies requiring higher water consumption (see Debolini et al., 2018, or Soulard et al., 2017 for Mediterranean areas). In contrast, resilient strategies to maintain collective forms of land and water management are implemented in other contexts (Oteros-Rozas et al., 2013; Ragkos et al., 2020). These interactions between land and water resource management should be explored through the lens of socio-economic dimensions regarding farmers' and landowners' strategies, coordination and conflicts between stakeholders and the implementation of public policies (Bouleau, 2017; Hassenforder & Barone, 2019).

Conducting research that jointly studies the social and economic uses of land and water resources is essential to understand the evolutionary trajectories of agrarian landscapes at the socio-ecosystem level. This systemic vision refers to the

methodological proposals of the 'nexus' approaches that are very present in current research on taking into account the global changes affecting agriculture and the environment (Albrecht et al., 2018).

This special issue was inspired by work carried out by the FONCIMED Network (Research Network on Land Systems in the Mediterranean, https://www.foncimed.com/), recognised as an International Research Network (IRN) by INRAE, and its 13th international seminar held on 26–28 October 2022 at the University of Evora, Portugal, by the MED Institute (Mediterranean Institute for Agriculture, Environment and Development, https://www.med.uevora.pt).

Mediterranean areas are characterised by landscapes that are the legacy of diversified agricultural systems (combining cereal crops, viticulture, olive growing and livestock grazing). These traditional, diversified systems are reflected in complex landscape mosaics home to rich biodiversity and adapted to limited or fragile natural resources. One of the themes of the international seminar was specifically to examine the transformations of these traditional systems under the effect of rapid changes towards the intensification of production and the homogenisation of landscapes. This intensification particularly affects areas with some of the most productive soils and access to water, raising the question of how to address the dual intensification of land and water use together.

Presentation of the special issue's contributions

Intensification of agricultural systems and sustainable resource management

The sustainable management of water and land resources is the focus of three articles in this special issue. Set in very different geographical and social contexts, they share a common theme in examining the impact of the intensification of agricultural systems, driven by private investors, on water use and land rights allocation. In particular, they highlight that the overexploitation of water resources is accompanied by inequalities in access to land within the framework of intensive systems that rely on technical innovations requiring significant capital investment and disrupting the traditional organisation of rural societies.

In her study on the Jordan Valley, LiviaPerosino emphasises the fact that the intensification of irrigation systems based on technical solutions exacerbates environmental degradation and excludes vulnerable farmers from modernisation dynamics, in a context of geopolitical conflicts in the region. The case study of the production of dates illustrates inequalities issues linked to unsustainable uses of both water and land. The research conducted by Samir ElOuammariand Hélène Lagarde in Senegal also analyses the consequences of large-scale irrigation projects involving private investors. Their research shows that these projects reconfigure local land tenure systems by selecting farmers who are able to meet financing criteria and comply with specifications. This selection process puts family farming at a disadvantage and raises issues of social and economic inclusivity.

The article by Isabel Ruck and Mohamed AliHatimy uses political ecology approaches to examine the relationship between environmental vulnerability and

social inequalities in the context of agricultural modernisation in Morocco. It takes a historical perspective to analyse the agricultural policy choices that have favoured export crops, thereby weakening traditional water management systems.

Using a social geography approach, DiegoCidrásand Rubén Camilo Lois González contribute to the debate on the sustainability of these traditional land tenure systems by offering a detailed study of the relationship between fire risk and land tenure in a rural region of Galicia, Spain. Using a combination of quantitative and qualitative methods, they conclude that traditional forest commons systems are not in themselves determinants of fire risk, but that fire risk is part of a more complex context of rural depopulation.

Lastly, Judith LePelvé, Laurane Vepierre and Olivier Ducourtieux examine the relationship between environmental vulnerability and social inequalities in the context of agricultural reforms in Sri Lanka. They highlight that political efforts to drastically limit chemical inputs through regulation are hampered by structural inequalities in access to land and water. Land insecurity and small farmers' economic fragility explain the relative failure of a green revolution based on a purely technical interpretation of the obstacles to agroecological transition.

To conclude, this special issue aims to analyse the issues at stake in sustainable resource management, taking into account a variety of scales: the farm scale (particularly its organisation in terms of land ownership rights and water access rights), the landscape scale (taking into account, for example, water regulation within watersheds, fire risk management in forest areas, and ecological connectivity between habitats), and lastly the regional scale, which is relevant for analysing governance, sector structuring, food systems and urbanisation dynamics.

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