CULTURAL PRACTICE

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COMPLEMENTARY CROP-LIVESTOCK FARMING

THE COMBINATION OF LIVESTOCK AND CROPS, WHICH WAS VERY COMMON IN THE PAST, IS ASSUMED TO BE A VIABLE ALTERNATIVE TO SPECIALISED LIVESTOCK OR CROPPING SYSTEMS AND CAN IMPROVE THE SUSTAINABILITY OF AGRICULTURE (RYSCHAWY ET AL. 2012).

Mediterranean agriculture is particularly threatened by biodiversity loss, freshwater overuse, disrupted nutrient cycles, soil degradation and altered fire regimes, in a context of high population density, water scarcity, high dependence on biomass and energy imports, and the prevalence of highly specialised, low diversity agroecosystems (Aguilera et al. 2020).

Several environmental and social impacts are related to specialised and intensive agricultural systems and, as a response, it is widely recommended to develop more integrated forms of agriculture to restore the sustainability of agricultural landscapes (Martin et al. 2016).

As one strategy toward ecological intensification, several authors have recommended a paradigm change from highly specialized production systems back to Integrated Crop Livestock Systems (ICLS) in order to increase diversity of land use and resource efficiency (Rockström et al. 2009; Godfray and Garnett 2014). Different levels of ICLS production are currently discussed: (i) integration of crop and animal production by exchanging materials, (ii) complementary exchange of materials with each system taking the production requirements of the cooperatives into account, (iii) temporal and spatial integration on farm-level using fully or partly the same territory, and (iv) the extrapolation to the regional level (Moraine et al. 2014).

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THREATS TO THE PRACTICE

The ecological and patrimonial value of crop-livestock systems is threatened by agricultural specialisation and intensification, resulting in abandonment of less productive areas and homogenization and simplification of land use in productive fields (Martin et al. 2016). Specialisation of animal production occurs in areas dominated by small farm units where animal production was already the main agricultural activity. The process of economic concentration favours livestock farms, industries, and commodities within regions with high livestock density (Peyraud et al. 2014).

Beyond the investments required to revert to diversified and integrated crop–livestock systems (purchasing specific machinery, fencing plots to hold animals, building or renovating animal buildings, etc.), which are often impossible for individual farmers, the skills and knowledge required to manage crop–livestock systems have often been lost after specialisation.

RECOGNITION AND FUNDING

An initiative designed and implemented innovative sustainable mixed farming systems, involving researchers across Europe and bringing together a European network of 24 existing experimental and commercial farms covering a wide diversity of natural and socio-economic conditions. The most promising complementary crop-livestock systems were implemented in order to verify their feasibility and to perform an in-depth economic and environmental assessment.

There have been defined policy recommendations promoting the development of the complementary crop-livestock farming. Innovative analysed integrated farming systems were based on the simultaneous utilisation of crops (cash, feed and energetic) and various rearing animals with full recycling practices of animal wastes in view to ensure high resource-use efficiency (notably of nutrients), reduction in dependence on external inputs (fertilisers, pesticides, concentrated feeds), and acceptable environmental and economic performances.

Also and according to several authors (Bonaudo et al. 2013; Lemaire et al. 2014; Moraine et al. 2014), crop–livestock integration pursues three aims: reducing the openness of nutrient cycles, following the rationale of industrial ecology, organizing land use and farming practices to promote ecosystem services, and increasing farm resilience to adverse climatic and economic events. To achieve these aims, two types of integration between crops, grasslands, and animals can be managed over space (co-location vs. segregation) and time (synchronisation vs. rotation).

Farmer Field School on livestock management

Transhumance in Sierra de Gredos, Spain © Concha Salguero

1. CULTURAL SUSTAINABLE LAND-USE PRACTICES

RESEARCH BY THE ALLIANCE FOR MEDITERRANEAN NATURE AND CULTURE (AMNC)

As part of a study by AMNC on cultural landscapes in the Mediterranean, the linkages between cultural practices and biodiversity were assessed in the traditional *mandra* system in the island of Lemnos. Conservation actions were also conducted to restore the *mandra* system and its elements, in collaboration with more than 30 local practitioners. These include *in situ* conservation of crop landraces and support of semi-extensive pastoral farming based on locally adapted breeds of sheep, and they were combined with pilot wild-rabbit control measures.

Mandra is a mixed agro-pastoral management regime where farming and stockbreeding complement each other to create a mosaic of land uses and landscape patterns. Fundamental elements of the system, apart from the traditional *mandras* (pens) themselves, are the creation and maintenance of level stepped surfaces on the hillsides with limited productive capacity; the alternate year cultivation of fields (fallow land and crop rotation practice); the care and maintenance of crops and livestock (until recently, based on local seed varieties and local breeds of farmed animals); the household –trade– economy; and the solidarity and cooperation between local inhabitants (Medina 2020).

2. BENEFITS OF THE PRACTICE

2.1. BIODIVERSITY

Crop-livestock systems promote ecosystem services, such as soil fertility or biological regulation of pests and diseases. In an agricultural context, ecosystem services are the products of interactions between farmland biodiversity (i.e., planned biodiversity—crops, animals, hedgerows, etc.—and associated biodiversity—soil flora and fauna, herbivores, etc. colonizing the farm) and adapted management practices that are integrated over different temporal and spatial scales (Altieri 1999; Kremen et al. 2012).

By implementing complementary crop-livestock farming, the main ecosystem services that derive from this practice correspond mainly to erosion control, biological regulation (including pollination) and maintenance of soil fertility

(including soil structure and nutrient cycling). Furthermore, most of the studies found a positive effect on soil organic carbon with increased rates of carbon sequestration and enhanced soil functioning properties (Garbach et al. 2014).

2.2. CULTURAL

Crop-livestock systems, with its strong anthropogenic character and its deep roots to a culture of self-sufficiency, result in a vital combination of socio-cultural, environmental and economic services. They can add the value of keeping alive sustainable agro-pastoral knowledge and promoting local identity (Medina 2020).

2.3. CLIMATE CHANGE

Carbon sequestration, climate regulation (regulation of greenhouse gas [GHG] emissions), and production of natural habitats are also strongly determined by this farming practice (Garbach et al. 2014).

Fresh organic eggs from Es Capell de Ferro farm © GOB Menorca

Field of Menorcan Oats on Talatí farm © GOB Menorca

2.4. SOCIO-ECONOMICAL

Crop–livestock systems are often considered providers of key economic and social benefits. The possibility of reorganising spatial allocation and therefore integration between crops, grasslands, and animals may develop diversified internalised markets (Havet et al. 2014; Wilkins 2008), promote risk sharing among farmers and adaptive capacity and as a result resilience of individual farms (Darnhofer et al. 2010). Internalised markets could also reduce the risk of income variability due to conventional market fluctuations (Peyraud et al. 2014).

Complementary crop-livestock farming also offers the opportunity to increase resource-use efficiency through spatial allocation of agricultural activities according to relative advantages of activity-location combinations of farmland (Havet et al. 2014; Lemaire et al. 2014; Wilkins 2008). It would avoid or decrease cultivation of crops on unsuitable land, which leads to inefficient resource use.

Several social benefits are provided by crop–livestock integration, and mainly concern (i) farm management and workflow, (ii) social learning and collective empowerment, and (iii) social acceptance of agricultural activities (Martin et al. 2016).

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