

USE OF LOCAL BREEDS

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Among the 17 Sustainable Development Goals (SDGs) adopted in 2015, the Goal 2 (Zero Hunger) aims to (a) end hunger and improve nutrition, (b) promote sustainable agriculture and double the productivity and incomes of small-scale food producers, and (c) maintain the genetic diversity of seeds, cultivated plants, and farmed and domesticated animals and their related wild species (United Nations 2015; Boudalia et al. 2020).

In the Mediterranean region, husbandry is a key economic and cultural feature of communities to whom domesticated animals provide key resources including food, clothing and labor. A large diversity of breeds of poultry, sheep, goat, pig and cattle evolved under specific local environments and became very well adapted to microclimate conditions and the needs of the communities (Marletta 2006; Nardone 2000; Bozzi and Crovetto 2013; Boudalia et al. 2020; Perucho et al. 2021). The development and spread of modern agriculture led to the progressive replacement of the wide diversity of local breeds by few improved breeds along with the intensification of husbandry.

Agricultural intensification and rural areas abandonment processes, related to recent changes in production schemes and planning, result in local breeds being threatened worldwide (Marletta 2006; Nardone 2000; Bozzi and Crovetto 2013; Perucho et al. 2021). As a result, the relationship between breed diversity and environmental factors is increasingly decoupled (Velado-Alonso 2020). The disappearance of pastoral farming resulted in the degradation of traditional rural landscapes (Hadjigeorgiou et al. 2005; Caballero et al. 2009), the loss of wild and agricultural biodiversity and the degradation of ecosystems, particularly with respect to their regulating and supporting services (Hoffmann 2013).



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THREATS TO THE PRACTICE

In June 2012, the FAO's Global Databank for Animal Genetic Resources within the Domestic Animal Diversity Information System (DAD-IS) reported 8262 breeds of mammalian and avian species, 7202 of which being local breeds (FAO 2012, Hoffmann 2013). Livestock genetic diversity today is rapidly declining globally resulting in 22% of evaluated breeds classified at risk and 8% as already extinct (FAO 2012). One reason for the decline of the genetic diversity of breeds is the trade-offs that exist between genetic management at farm or herd level and (a) economic development goals, (b) broader environmental goals and (c) conservation of breeds in the interest of society (Hoffmann 2010; 2011).

Globally, the production of the livestock sector has increased, with global output growing by more than 4% annually between 1980 and 2010. This increase resulted from productivity enhancement in developed countries but also from increased animal numbers in developing countries (Hoffmann 2013). This intensification of production was driven by cheap grain and energy, technological advances in animal breeding, biotechnology, feeding and transport, and a policy environment that favored intensive production (FAO 2010). In areas where production cannot easily be intensified, such as mountains or rangelands, the maintenance of low-external input livestock production will need support if they are to take advantage of the opportunities provided by an expanding livestock sector (Hoffmann 2011). Although extensive grazing can be subsidized through agri-environmental schemes, the Common Agricultural Policy (CAP) is the most central factor affecting grasslands and the management of large herbivores in the EU, offering subsidies for less sustainable farming systems and insufficiently supporting or even posing barriers to extensive grazing and pastoralism (Pe'er et al. 2021).

RECOGNITION AND FUNDING

The dehesa is recognized as one of the few agrosystems of high natural value due to the levels of biodiversity it harbors (Paracchini et al. 2008; Oppermann et al. 2012) and as such is included in the EU Habitats Directive (Habitat 6310: Evergreen *Quercus* spp. Dehesas). In addition to being inhabited by numerous bird species, some of them highly threatened (e.g., Imperial eagle, Black vulture, Black stork), large areas of dehesa are also qualified as Special Areas for the Protection of Birds (SPA) under the Habitats Directive, also becoming part of the Natura 2000 Network. Once included in the Natura2000 network, each state member has the commitment to protect representative areas of this habitat, generally under the figure of SCI (Site of Community Interest), being integrated into the Natura 2000 Network.

There is a growing interest of many European customers for quality foods, especially organic and biodynamic. Customers and international organizations are also pushing on FAO to advise against intensive animal husbandry, to reduce meat consumption in developed countries and to increase its quality (Pardini 2004). Several options have been identified for a better integration of pastoralism with the general economy. Land use diversification contributes to biodiversity and diversified vegetation/land use units can be efficiently valorized by mobile pastoralism. Furthermore, the diversity of land-use contributes to the maintenance or improvement of landscape which in turn can attract tourism and customers for husbandry products.



Local goat breed,
Taurus mountains in Turkey
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Vermella Menorquina cow breed © GOB Menorca

1. CULTURAL SUSTAINABLE LAND-USE PRACTICES

Local breeds are often used in extensive or semi intensive agricultural practices because they are less productive in intensive practices than modern breeds but conversely are more resilient and adapted to coarse food resources and environmental conditions. The practices listed below are commonly associated but not restricted to local breeds:

- **Rotational adaptive grazing:** High-load, time-controlled mass grazing (short grazing times and adequate recovery periods) is used in dehesas and montados (Iberian Peninsula) but can be implemented in a wide range of ecosystems and with any type of breed. This practice is yielding improvements in ecosystem health and farm profitability. It is more efficiently used in fenced plots but can be adapted to grazing in unfenced areas if the recovery periods can be secured. Various species can be used, alone or combined (sheep, goats, cattle, pigs, ..).
- **Penning** (enclosure): In the mobile pastoralism context, animals are confined in corrals for overnight stays or during the rest, in order to fertilize the soil and protect the animals from predators.
- **Mobile pastoralism:** Includes various practices including transhumance, semi-nomadic and nomadic pastoralism, and some practices of extensive grazing, where people and their livestock move on foot through the landscape in search of pasture and water. Transhumance corresponds to the use of different fixed grazing sites in winter and summer, respectively low and high elevation sites. In nomadic and semi nomadic pastoralism, livestock are herded in an irregular pattern of movement in order to seek pastures often on shared pastures. Nomadic pastoralism is mostly practiced in North-Africa and Asia while transhumance is more frequent in Europe.
- **Semi intensive pastoralism:** Combining free ranging in natural vegetation and on cultivated pots (on the island of Lemnos) using a mixture of local (e.g. Lemnos, Chios, Lesvos) and non-local (e.g. Lacaune, Friesian) breeds.



Gallina de Menorca chicken breed © GOB Menorca

2. BENEFITS OF THE PRACTICE

2.1. BIODIVERSITY

Biodiversity related to local breeds is found at two levels, the genetic diversity of domestic animals and the biodiversity of the landscapes shaped by the pastoralism practices associated with local breeds.

Local livestock breed diversity is threatened to a level which can be compared to the threats on wild species. Among the 7,136 livestock breeds that have been identified that occur only in one country cataloged by FAO worldwide, 27% are endangered and 65% have an unknown status (Velado-Alonsa et al. 2020). A study by Hoffmann (2013) on 1881 assessed breeds found similar results with 22% at risk, 8% already extinct and 34% with unknown status.

Extensive silvopastoral systems such as the Iberian dehesas/montados are known for their high biodiversity (Bugalho et al. 2011; Díaz et al. 2013). High levels of species richness of vascular plants, butterflies, birds and other vertebrates (including several endangered species) have been recorded by various authors, measuring from plot to landscape scale (review to Díaz et al. 2013). Diversity is subject to the influence of woodland, soil type, exposure, grazing management and disturbance regime (Pulido and Picardo 2010). The arrangement

of trees (density, distribution and size) conditions the occupation of dehesas by forest species, such as tree-specific arthropods, certain forest birds or numerous species of lichens and bryophytes on tree bark (Díaz 2008).

Although the species richness can be higher at the field / plot level in open grassland than in dehesas, the diversity at the landscape level is higher for the latter as a result of higher heterogeneity between plots. Accordingly, it was found that spatial heterogeneity or β -diversity was highest for earthworms, followed by spiders, bees and plants. This is consistent with the sedentary behavior and high isolation of edaphic habit animal populations (Costa et al. 2013).

Livestock is a fundamental component of the extensive silvopastoral systems. Livestock and its management will affect the structure and functioning of the ecosystem. These effects are very diverse and contradictory and depend to a large extent on livestock management (livestock density, intensity, grazing time, recovery time of the pasture) (Catalan Balmaseda 2017).

2.2. CULTURAL

Cultural landscapes of high environmental value have been shaped by a long history of close human-environment relationships, characterized by sustainable agro-pastoral landscape management practices. These landscapes vary according to regional characteristics and the agro-pastoral management practices. Elaborate ancestral knowledge and know-how, related to the management of water and pastoral resources, are part of an intangible culture.

Local sheep breed at Lemnos, Greece © MedINA



2.3. CLIMATE CHANGE

The relationship between pastoralism and climate change is complex involving different issues such as the budget of carbon and GreenHouse Gas (GHG) emissions, the changes in vegetation resulting from climate change, the adaptation of animals to warmer and drier conditions and the use of pastoralism to prevent wildfire extension in Mediterranean dry landscapes.

Climate change may threaten the sustainability of many livestock production systems and their associated breeds and dependent communities. Being local breeds makes them more resilient to harsh environmental conditions.

The GHG emissions related to husbandry are usually much higher than those from crops. However, GHG emissions and techniques to reduce them have been little studied and more work is needed in this area. The storage of organic carbon is a key variable in the analysis of the carbon budget. C-sequestration in grasslands, may partially offset GHG emissions from other components of the production process (Smith et al. 2007). In dehesas or other types of forested grassland C-storage is higher than in open grassland as trees contribute to sequestration and soil accumulate more organic matter (Seddaiu et al. 2018). Furthermore, by preventing wildfires, grazing management also prevents the emission of large quantities of carbon to the atmosphere. Reducing the carbon emission can be achieved through avoiding soil mechanical disturbance (tillage) (Grossi et al. 2020) and by the selection of species and genotypes (Hoffmann 2013).

Grazing in natural landscapes is a commonly used tool to prevent wildfires, by reducing the standing biomass at the landscape scale or on fire breaks. Grazing is more effective when using mixed feeders, when grazing and browsing herbivores are combined and when herbivore food preferences match the local vegetation (Thornton et al. 2009; Rouet-Leduc et al. 2021). However, complementary tools can be needed such as mechanical shrub clearing. Shepherds contribute to shrub control through selective destruction of grazing refusals (often by burning them).



Traditional threshing © Inanc Tekguc

2.4. SOCIO-ECONOMICAL

Food certification, sale organization and diversification of animal breeds and species can sustain pastoral development (Papanastasis 1999). Pastoralism could benefit from the Payment for Ecosystems Services, notably related to fire prevention and the restoration and conservation of driven roads (Oteros-Rozas et al. 2013; Rouet-Leduc et al. 2021). Thus, breed conservation needs to move to a more holistic perspective of livestock conservation and management integrating ecological and sociocultural dimensions beside production and genetics (Velado-Alonso et al. 2020).

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