Matière
à débattre & décider

Livestock grazing systems and sustainable development in the Mediterranean and Tropical areas

Recent knowledge on their strenghts and weaknesses

Alexandre Ickowicz and Charles-Henri Moulin, editors

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However, six of them also take into account other criteria (from two to four additional criteria depending on the breeder, including ancestry, fleece colour, breed standard, milking behaviour, dairy persistency and udder characteristics). As such, they combine the use of a collective tool and individual criteria to build a herd that is tailored to their expectations and systems (Perucho, 2018).

In addition, work on the practices of local breeders also reveals that in the processes that enable breeds to adapt to certain situations or constraints, other dimensions than biological ones can be considered, such as more social or organisational dimensions linked to the breeds. Consequently, Perucho et al. (upcoming) demonstrate how the group organisation of breeders around a breed can contribute to deal with a health hazard that the animals in that breed are facing.

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The issues of local breed adaptation therefore involve biological and genetic characteristics that are valued and managed by breeders in their individual and collective practices. The characterization of the biological and genetic mechanisms at work provide valuable information to improve the management of these breeds. Likewise, a better understanding of the practices of management stakeholders, and primarily of breeders, as well as the underlying views, contributes to the understanding of the evolution of genetic resources. The integration of approaches stemming from complementary disciplines is necessary for a better understanding of the interactions between human populations, animal populations and livestock environments, for which the adaptation of animal populations is one of the consequences.

The mechanisms of adaptation analysed at the level of families and local communities

Jacques Lasseur, Véronique Alary, Lina Amsidder, Martine Napoléone, Abdrahmane Wane

This section focuses on the analysis of adaptation processes of pastoral and agropastoral households in arid and Mediterranean zones, jointly addressing the social and biotechnical dimensions involved. Specifically, we analyse the contribution of three levers: (i) the diversity of situations considered at a household level from the point of view of a "capability portfolio" and at the local level from the point of view of a diversity of production systems, (ii) the importance of institutions and collective organisations considered through social networks and collective actions, (iii) the forms of learning while considering the references to standards and values that guide the action. The research conducted in Egypt, Chad, Morocco and France and described here illustrate the manner in which livestock owners mobilise and sometimes combine them, resulting in a shift from a situation that weakens households to one that strengthens solidarity and reinforces their sustainability.

The household capability portfolio as capital for implementing adaptation

In the context of a series of projects in Egypt between 2011 and 2021, a systematic approach of the living conditions of rural households was developed based on the conceptual framework of livelihood conditions developed by Scoones and made operational by Ellis (Sustainable livelihood Framework). From a conceptual point of view, we can distinguish between human capacities (the composition of the household and its degree of involvement in off-farm activities, in relation to the level of education), physical capacities (cultivated areas, their status and the numerical composition of the herd by species) and functional capacities (including the diversification of practices of supply and use of inputs, as well as the valorization of products and co-products at the interaction between agricultural and livestock activities, whether at the household, the community studied or the market level). This latter capacity is closely connected to existing social networks, such as intra-household and intra-community organisation capacity, but also in relation to the extended or formal family networks. These capacities were analysed in regard to the living conditions (at the studied time). The living conditions were determined through indicators of profitability (gross margin), food security (degree of food self-sufficiency in terms of family coverage of calorie and protein needs) and cash flow to meet basic needs (notably health, education and household food). Several approaches were used, namely narrative approaches based on life stories (enabling an understanding of the accumulation or lack thereof of physical capital), multifactorial approaches (highlighting the links between the various capacities) and multicriteria approaches to identify the causal processes between the various forms of capacities and living conditions.

All research demonstrates that the diversification of activities and practices, both agricultural and non-agricultural, constitutes a means (capacity for action) of sustaining household living conditions in the face of present hazards, whether it is a drought or a major health or ceremonial expense. And the intensity of this diversification is highly dependent on the diversity of social networks, particularly at the local level. However, this diversification of activities and practices does not systematically guarantee an improvement in living conditions. Moreover, it is most frequently developed to the extreme in households that have little physical capital and whose intergenerational sustainability through the land base is severely compromised (Alary *et al.*, 2014; 2016). In terms of medium-term adaptation capacity, research demonstrates how the diversification of livestock systems in terms of animal species, feeding practices, and the use of products and by-products can be used to deal with various hazards. As an example, in the newly developed lands in the West Delta, multi-species livestock production has made it possible to finance the costs of installation (whether it be a house floor or the cultivation of land) with the annual sale of calves, and to finance the operational costs of the household and the farm with the sale of sheep products (Alary *et al.*, 2018). In terms of long-term capacity (relative to intergenerational transmission),

the study in the Nile Valley region illustrates how livestock production, in particular through diversification towards more prolific species (sheep and goats), has the potential to become the main source of sustainability for production systems, in relation to land fragmentation (Alary *et al.*, 2015).

In short, as highlighted in other cases, livestock activity is a guarantor of the viability of rural households and the sustainability of systems (Duteurtre and Faye, 2003; Pica-Ciamarra *et al.*, 2015). This capacity of livestock farming to contribute to the adaptation of rural households to changes in their social, economic, or climatic environment is based on the variable and adaptable combination of different services, products, and co-products that it generates, in addition to its intangible value in terms of recognition.

The role of the family in the adaptive mechanisms of Sahelian pastoral societies in the face of shocks

Agro-pastoralists in the Sahelian zone live and operate in an environment subject to multiple hazards and shocks. Climate variability has a direct impact on the dynamics of natural resources, leading herders to manage an uneven space-time availability of these resources. This climatic variability is also a factor that aggravates other economic, social, cultural and political disturbances. In addition, herders are confronted with a lack of basic economic goods and services that significantly impact their living and working conditions. The unequal distribution of productive resources is accompanied by limited information on the markets for goods and services, so that herders have an incentive to adopt a cautious position that is contingent to their socio-economic environment (Wane *et al.*, 2020b). As a result, herders must constantly compromise between their short-term consumption needs and their long-term herding strategy to satisfy future consumption (Fadiga, 2013).

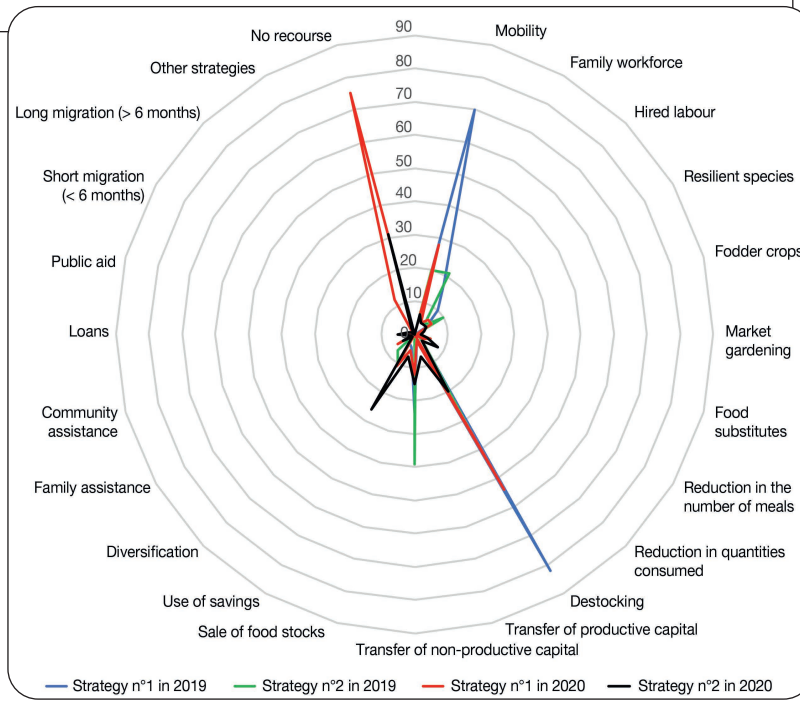
The multifaceted shocks faced by herders can be "idiosyncratic" when they affect one household exclusively, or "covariant" when they affect a group of households, a community, a village, a region, an agroecological zone or a country (Wane *et al.*, 2020a). Faced with idiosyncratic shocks, herding households react based on their perceptions and try to overcome them by mobilising their own available skills and resources in the short or medium term, such as their family social networks and their livestock (**coping capacity**). In the face of covariant shocks, they use their ability to adjust, to mitigate the harmful effects of shocks or to exploit their beneficial effects, notably through diverse mobility regimes (**adaptative capacity**). The differentiated responses of herders to multiform shocks can reveal the significance of their perceptions of variations in their environment. An illustration can be provided by the case of (agro)pastoral households in the Wadi Fira, Batha and Ennedi regions of Chad. First, 504 households were interviewed in 2015 through detailed questionnaires on their activity and living conditions. After constructing a typology of these households, a sample of about 100 households were selected to respond successively in 2019 and 2020 to the same questionnaires with

additional shock data. The objective was to identify various scenarios of shocks experienced during a predetermined period, to prioritize the three shocks that had the greatest effect on their income, assets, food production and purchases, food stocks and livestock, and to rank the various coping strategies according to their importance.

Herders in these three major livestock regions of Chad indicate that drought is experienced in the same way in 2019 and 2020 (around 15% of declarations reported by households). However, perceptions of the effects of bush fires and flooding are muted, and no reports of out-of-season rains have been recorded. The occurrence of animal disease has increased, while problems with access to veterinary care appear to be relatively less felt. Although proportionately small, animal health expenditures increased from 4 to 8 percent of reporting frequencies. Price shocks became more pronounced between 2019 and 2020 with an acute sensation of rising food and feed prices while animal prices declined.

In this context of multifaceted shocks, (agro)pastoral households developed a range of strategies deployed in sequence and implemented in a prioritized manner (Figure 2.13).

Figure 2.13. Changes in strategies deployed by (agro)pastoral households before and during the Covid-19 pandemic (Wane *et al.*, 2020a).



In 2019, households prioritized (no1 strategy) destocking livestock (35% of response frequencies), adopting mobility (30%) or disposing of non-directly productive capital (10%) such as jewellery. As a secondary strategy (no2 strategy), they favoured disposing of non-productive capital (22%), followed by destocking (21%) and finally, using family labour (12%).

In 2020, there was a shift in the form of stupor on the part of agropastoralists who, with the effects of the Covid-19 pandemic (drastic restriction of movements and ban on gatherings), lost an average 34% of their overall income. In fact, households reported having no strategy (32%) and to a lesser extent, seeking to destock (23%) or even adopt mobility (12%). As secondary strategies (no 2 strategy), they continue to report either their inability to develop any strategy (19%), or the use of family savings (16%) and destocking (13%). They are not inclined to favour the use of aid, demonstrating their conscious choice to mobilise endogenous strategies and to rely, first and foremost, on their own system of actions rather than relying on third parties in the form of subsidies, aid and credit.

Ultimately, Sahelian herders cope with shocks of various kinds by mobilising their own resources. Their capacities are the result of a long process of learning by experience (Wane *et al.*, 2020a). Nevertheless, they seem to be very limited in the face of new shocks such as the Covid-19 pandemic. This is because government strategies to control the pandemic (restrictions on movements, prohibition of gatherings) have greatly altered the individual and collective means of action of Sahelian herders.

The reshaping of herder social networks to access pastoral resources

Research conducted on societies that live off camel herding in arid and semi-arid zones in Morocco between 2017 and 2021 highlighted the importance of customary collective organisations in the herder mobility practices. Qualitative analysis of semi-structured interviews conducted between July 2018 and February 2020 with a sample of 43 camel herders in the Guelmim Oued Noun region of southern Morocco on their mobility practices highlighted the importance of the tribe. In an arid and hostile environment such as the Sahara, it constitutes a sense of belonging, based on kinship and the existence of a common ancestor, within which herders benefit from a "protective and nurturing solidarity" (Caratini, 2003). Whether it is the individuals with whom herders share information about grazing locations or those with whom they travel or camp, the vast majority of herders turn to their tribe members, whom they can rely on in the name of fraternity and the value of blood ties. The interviews revealed the gift/contribution system on which tribal solidarity is based, which relies on intra-tribal marital alliances as well as on gifts of animals or money during ceremonies such as tribal feasts or weddings, or in the event of difficulties (divorce, conflicts). While the tribe constitutes a network on which herders can rely in the event of difficulties, it is also a source of significant social pressure insofar as all of its members must honour the system based on reciprocity of exchange, or else "become an outcast, at the mercy of any calamity" (Gaudio, 1993).

The historical bibliography ranging from the pre-colonial period to the years of independence (1958) as well as open interviews conducted in December 2019 with five chioukhs[11] and four women aged between 50 and 60 years with their children in their twenties highlighted the numerous socio-political changes that the Moroccan Saharan and pre-Saharan areas have undergone. The framework of analysis of political geography has led us to interpret these changes in terms of the reshaping of power relationships between tribal customs and state stakeholders for the control of the grazing area. The herders have adjusted to these changes by diversifying their networks to access grazing resources. In the pre-colonial period, the pastoral space consisted of a "mosaic" of tribal territories (Caratini, 2003), which evolved according to the tribal wars during which each tribe ensured that the territory under its control was extended. In this way, the tribal network was the only one in which the individuals were integrated and on which they depended for access to the tribal lands and for the guarantee of safety and protection. The Spanish and French colonisation from the end of the 19th century onwards brought about the placing of tribes under guardianship, the establishment of state borders and the ending of tribal wars in the name of "colonial peace". The tribal network was still the fundamental network, but the climate of security created on the rangelands following "pacification" meant that herders had greater freedom of movement. In addition, the relationship with neighbours from other tribes became increasingly relevant as herders relied on these to gain access to new rangelands. Since Morocco's independence in 1958, the issue of territorial control has been at the heart of state concerns. This results in a grid of pastoral space by means of an overlapping of state territories (caïdats, rural communes), within which the state grants power of control over space and populations to several stakeholders (caïds, communal presidents, chioukh). This state control does not translate into a decrease in the power of the traditional tribal stakeholder. The tribe continues to act in an implicit manner by integrating state institutions. The sons or grandsons of traditional chiefs from the colonial period or descendants of large families have been given official functions (chioukh, communal presidents) and rely on them to defend the traditional territory. In the face of an increasingly complex territorial network, where traditional and state territories are intertwined, herders must maintain networks with a variety of stakeholders in order to gain acceptance for their presence in the various territories in which grazing resources are located.

From individual adaptations to the sustainability of collective actions in the case of a regional product

In this example, we examine the tension in the process of adjusting to changes in food systems arising from the development of territorial dynamics and the management over time of a regional product, seen as a common asset. We draw on work conducted in south-eastern France on the transformations of dairy and cheese activities, in particular

11. Tribal leaders as well as state agents.

within collectives managing regional products (Napoléone, 2016). This study focuses on the trajectories of dairy and cheese activities in the territories, as well as the connections between individual and collective dynamics. For this purpose, comprehensive interviews were conducted with livestock farmers, local product groups and regional stakeholders between 1990 and 2020.

The protected designation of origin (PDO) syndicates constitute a forum for the construction of standards and values based on a common project, for a diversity of stakeholders concerned with a local product: farm or dairy producers, refiners, artisanal processors, SMEs (small and medium-sized enterprises) or national groups. Each stakeholder has its own objectives and strategies, for example in terms of marketing, but all share the same concern for differentiation and protection of a product.

Consequently, since the 1990s, in order to protect their products from being copied from outside the region, producers and processors of the four goat cheese sectors in south-eastern France (Picodon, Pélardon, Banon, Brousse du Rove) have applied for official recognition of their products through a quality mark linked to their origin. For the various stakeholders involved, the PDO constituted a means of identifying themselves, of taking advantage of their specificity and of protecting themselves from out-of-area copies, at a time when the main distribution channels were long circuits. The path towards certification has enabled stakeholders in these sectors to identify themselves around common values relating to farm and artisanal processing and breeding practices, and then to manage these values over time, as the specifications are revised, in order to adapt to a certain number of changes, for example the evolution of societal values, by emphasizing the link to local resources.

Currently, the development of territorial dynamics, the enthusiasm for the local and proximity promote the emergence of forms of sale that put producers and consumers in direct contact. These dynamics multiply and diversify the possibilities of product sales, in particular for farm producers. This encourages individual dynamics, with producers redefining expectations with regard to production methods and products, directly with their partners and with consumers. Forums for discussion and dialogue on local products are becoming more diverse and fragmented. In some PDOs, the renewal of operators is a challenge. If this type of dynamic continues, there may be a risk of losing a platform for collective discussion of quality.

This clearly demonstrates how individual adaptation to a changing situation (the multiplication of outlets in short circuits) can jeopardize a collective issue related to the management of a common asset. However, this product is an asset attached to a territory, which benefits from the values of the territory. Conversely, the territory builds its image and appeal from its resources. Moreover, the product is a messenger for the territory through the various sales channels, from local to global.

In a sustainability approach, PDOs are working to strengthen the synergies between territorial dynamics and those related to local products and individual strategies. Adaptation

at the collective level therefore involves (i) connectivity between networks, those linked to product management and those linked to territorial dynamics, (ii) openness to diverse points of view, and (iii) multi-scale.

The diversity of exchange modalities between livestock farmers and other stakeholders to reinstate grazing activities in the territory

Livestock farming in the Provencal hinterland, primarily ovine, has changed over the last few decades as a result of changes in the conditions under which the activity is carried out in an adaptation or transformation process. Based on a study conducted on a regional scale in the Alpes-de-Haute-Provence (Lasseur and Dupré, 2017), we analyse ex post the contribution of these adaptations to the expression of a current diversity of modalities for carrying out the activity. We then illustrate the role of this renewed diversity and of the modalities of interaction between stakeholders in the ongoing redefinition of the local farming system. In order to do so, we rely on the theoretical and methodological proposals of J.-P. Darré, which aims to comprehend the production of action-oriented information as well as its transformation by considering it to be governed by standards and values that are established within communities (Compagnone *et al.*, 2015).

We have identified 3 contrasting types of livestock farming: small mountain farmers (PPM), dual transhumant herders (DTP), and diversified livestock farmers (DIV), which are distinguished (i) by their farming structures, (ii) by specific and distinctive practices, (iii) by the meaning given to their profession, and (iv) by special relationships outside the agricultural sector. These characteristics give them a unique weight in the innovations that have marked the recent period as well as in those that are currently in the making (Table 2.5).

The proximity of a farm to one or another of these ideotypes can be linked to specific conditions of location or resource allocation. In this way, the diversified livestock farmers are more likely to be at the head of small farms. These affiliations are also related to life choices and visions of the profession, which lead to highlighting one or other structuring practice of production orientations. For example, the PPMs emphasize forage cultivation (and mechanization) as well as the practice of grazing in parks.

This is in contrast to the DTPs, for whom a mainstay of their system is to favour grazing as far as possible, to keep large flocks, a sign of passion for the profession in reference to the emblematic figure of the “shepherd”. This has led them to develop winter mobility to ensure year-round grazing. This in turn has allowed them to free themselves from a high number limit conditioned by the quantity of forage that can be harvested from cultivated land, enabling wintering of the flock in the sheepfold, which is the basis of the reasoning of the PPMs for the sizing of the flock. The options for adaptation on the farm level are therefore not based solely on inherited structures, but also on the capacity to seize and create alternative opportunities, which must, however, remain compatible with local standards and values (under threat of ostracism).

Table 2.5. Main characteristics of the three identified breeding ideotypes.

	Farm structure	Emblematic practices	World view	Filiation and condition of emergence	Relationships with other parties involved (excluding agriculture)	Involvement in ongoing adaptations and transformations
Small mountain farmer (PPM)	300 to 500 ewes	Out of season lambing Quality label for marketing	Supporting each other within the farming sector to maintain the rural community	Inherited from farming modernization movement (1960)	Low: focused on the agricultural sector	Improvement of work productivity and farm margins
Dual trans-shumant pastoral (DTP)	500 to 2,500 ewes	Wide range mobility Focus on shepherding practices and favor grazing for the flock	A strong meaning of its work is within the relationship with the flock Manage room for its own individual freedom	Historical ways for pastoral livestock farming, supported now by the agri environmental policies	Medium: relationship with landowners and environmental operators to get new grazing areas	Strengthen the contribution of grazing to the management of ecological dynamics of «semi-natural» environments
Diversified (DIV)	Up to 300 ewes in diversified farms	**Marketing in short chains** **Get additional income from tourism activities** **Promote the use of local resources**	**Involvement in local interactions and valuing the activity among non-farmers**	**At first a default option, now supported by local development policies**	**High: targeting consumers** **Involvement in local associations** **Local elected**	**Development of marketing in short chains** **Associate the development of livestock with the development of tourism** **Care about the multiples uses of pastoral areas**

All of the livestock owners we met clearly identify with one or other of the ideotypes and distance themselves from the choices made by livestock owners who are closer to another type. Nevertheless, all agree that it is possible and legitimate to practice differently than they do. This allows some to transcend categories and to invest in the archetypal practices of other forms of animal husbandry: for example, one PPM displays a passion for herding that he implements as a mountain herder by subcontracting farming activities. Another PPM uses sylvo-pastoral developments and consequently develops intense interactions with territorial stakeholders in other sectors. This fluidity can be attributed to spaces that facilitate the sharing of opinions, notably within the pastoral groups, which are the collective organisation of summer grazing. As a result, all these livestock farmers meet in the summer grazing areas, and even combine their herds within the collective entities that constitute the pastoral groups. In addition to the structuring of a solid sector and organised

industries, the adaptations/transformations that will strengthen the future of livestock activities in these areas are based on the ability to forge alliances with other stakeholders and on the re-legitimisation of livestock activities, on the fluidity of the exchange of ideas and viewpoints, which goes beyond the agricultural stakeholders alone, and which allows for the evolution of the standards and values that govern the activity. The role of DIVs and DPTs is fundamental from this point of view, as they ensure the porous character of the local livestock system to issues carried by stakeholders in the territory outside the agricultural sector.

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These five case studies illustrate the link between the three dimensions - (i) diversity, (ii) the role of organisations and institutions, and (iii) forms of learning to strengthen adaptive capacities. The latter occurs both at the level of individual herder families and at the level of the activity as a whole. Diversity is involved in the sense that it allows families to build a portfolio of resources to deal with the uncertainty. This dimension is also strongly implied in its capacity to promote innovation in the communities. This collective capacity to respond to changes in the conditions in which the activity is carried out is closely linked to the institutions and networks that allow for the expression of solidarity and constitute places of learning.

These case studies highlight the mechanisms of adaptation of the breeding activity and the livestock families to changes in the conditions in which the activity is carried out. Diversity is one of the components, whether it is the household capability portfolio supporting the living conditions of the households or the coexistence of a diversity of activity systems contributing to adapt the range of standards and values that govern the activity. The collective organisations and institutions that govern relations between individuals and the collective, whether they are networks of social interactions, traditional organisations or project collectives, also play a central role in the emergence of these adaptations and learning support. The adaptation of livestock farming societies is based on their capacity to deal with diversity and learning by relying on formal and informal collective organisations that allow them to reinvent themselves according to the environmental, social, economic and political changes and the multiform shocks that arid and Mediterranean zones experience.