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Livestock farming embedded in local development: Functional perspective to alleviate vulnerability of rural communities

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■ INTRODUCTION

The aim of this thematic issue was to increase our understanding of how livestock farming can contribute to the functional integrity of socio-ecosystems and which dimensions of livestock farming are embedded in local development. Today throughout the world, livestock farming is mainly considered for the goods it produces for the market. But it also has other major and secondary functions which include savings, food for home consumption, transport, draft power, production of by-products and manure to fertilize crops or for heating; it is a key factor in pastoral landscape management; and as an essential component of heritage, traditions and local knowledge it plays a major part in social rules and collective actions, relevant domains for policy making. In other words many roles of livestock interact with local development.

Based on local study cases, this issue presents a global overview of both the functional integrity and the roles of livestock farming in local development. The fourteen contributions that make up this issue cover various countries across the world, from China to South America (Brazil, Argentina and Uruguay), and from Europe (France and Norway) to New Zealand, passing through Africa (Egypt, Morocco and Sudan). The study cases regard contrasted biomes, from the Amazonian rainforest to the arid areas of Northern Sahara and Southern Patagonia, and from the dry highlands of

the Tibetan Plateau to the humid Pampa in Argentina, Uruguay and Southern Brazil.

Depending on the local context, the authors attempted to answer the four main following questions:

- How can livestock farming contribute to reduce the vulnerability of livestock farmer populations and how to build vibrant rural communities by adding value to local resources, especially from a natural and social point of view?
- How to assess the contribution of livestock farming to local development notably through the importance of its different functions? These functions address livelihoods and household economy, but also the life of communities and local society, the environment and agriculture, all domains interacting with sustainable development.
- How and under which conditions or contexts does livestock farming (even if it is just a fragment of rural history) contribute to local sustainable development?
- What is the role of policy making, at local, national and regional scale that guarantees income security or satisfaction of primary needs – food, health and education – in pastoral areas?

The present articles differently address the four questions. The role of livestock in reducing vulnerability is mainly discussed in Waquil et al., De Carvalho et al., Ding et al., Wedderburn et al., Metawi, Elfaki et al., Alary et al., and Dedieu and Pailleux. Articles more focused on the contribution of livestock to local development are those of Srairi, De Carvalho et al., Nogar et al., Wedderburn et al., and Coronato et al. The conditions and context of the interactions between livestock and local development are addressed by Waquil et al., Srairi, Asheim et al., Coronato et al.,

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and Dedieu and Pailleux. The role of public policies are dealt with especially by Sraïri, Ding et al., Lambert-Derkimba et al., and Jousseins et al., the latter highlighting method issues to assess the links between livestock farming and local development.

■ LIVESTOCK FARMING VULNERABILITY

Small-scale breeders, particularly in extensive pastoral systems, are vulnerable to any sort of crisis and in many cases do not have access to social protection systems. The dependence on mono-production, e.g. animal breeding, and external inputs such as feed, veterinary products, cereal grains, leads to the loss of control over the livestock system, and thus increases further small breeders' vulnerability to change. World trade rules, local environmental regulations, consumers' expectations, and decreasing agricultural prices for locally produced food reduce small farmers' competitiveness and aggravate even more poverty and indebtedness. These pressures will be intensified by the greater risk of harsh weather conditions caused by climate change that will specifically increase uncertainty in the extensive livestock system. This vicious cycle pushes many poor breeders out of their activities forcing them to join the masses of poor daily labor either in the rural areas or in the cities in developing countries. The situation is little different in developed countries. The pressure impacts on grasslands or rangeland livestock systems may contrive amalgamation of properties to achieve efficiency gains, shifting the farm ownership structure from family owned and operated farms to corporate structures that may or may not be family owned. These changes are reflected in changing rural communities and urban perceptions of agriculture.

■ VULNERABILITY AND SUSTAINABILITY: FROM RESOURCE SUFFICIENCY TO FUNCTIONAL INTEGRITY

The theoretical approach about the nature and function of socio-ecosystems became institutionalized at particular moments in history. This process leads to specific practices and policies which may outlast commitments for which they were built. For example, two philosophical approaches to sustainability have now emerged (Thompson, 1997): 'resource sufficiency' and 'functional integrity'.

The resource sufficiency measures the rates at which resources are used in food production, distribution and consumption. In livestock production, the main challenge is to maintain the increasing efficiency, while reducing pollution and finding substitutes for scarce inputs. Thus, the resource sufficiency approach leads to policies based on the ethical importance of agriculture in terms of its impacts on the welfare and rights of present and future generations. Vulnerability is thus related to insufficient resource maintenance or inefficient resource management that lowers producers' income.

The functional integrity focuses on the vulnerability caused by systemic interactions, especially the gap between productions practices, including innovations, and processes of ecological and social renewal. This approach positions agriculture as a socio-system, which embodies complex and poorly understood value commitments and ecosystem relationships. It gives rise to policy strategies that emphasize the preservation of the capacity for resilience, the avoidance of irreversible effects and systemic understandings designed to mitigate unintended consequences. The issue thus forestalls irreversible changes in the socio-ecosystem while pursuing better understanding of critical trajectories and tipping points.

The current organization of agricultural sciences favors the resource sufficiency approach. Resources are considered as a capital – or stock – more or less renewable or critical. There are three ways to maintain sustainability when resources are declining and become limited. Sustainability requires either a decreasing rate of consumption, or increased efficiency, or substitution with other resources. Thus, many technical recommendations regarding rangeland uses relate to a decrease in stocking rates (lower needs), the introduction of improved pasture (better efficiency and substitution). Critical factors are therefore the resources that are scarce, either by being in short supply or consumed at rates that cannot be sustained. As previously mentioned, research and policy have to focus on increasing efficiency of scarce resources by introducing new technologies with better yields, as well as by finding substitutes.

At the opposite, the concept of functional integrity presupposes a system based on crucial elements which are reproduced over time at a rate depending on the previous system states, as well as those generated by the dynamics of the different living communities interacting within the system, according to their own changes and variations. These elements may be, for example, soil fertility, herd reproduction, crop-livestock interactions, diversification and complementarity in land use, animal and vegetal biodiversity, but also the know-how in management practices or product processing, or even institutions such as the family, rights regimes, specific markets.

Extensive livestock farming is a good example of the functional integrity because its many aspects – e.g. stocking rate, forage, crops, biodiversity, produced goods such as milk, meat, wool and manure, landscape and water access, seasonal migration, herd management and services – produce complex relationships. These elements of livestock systems can remain in a dynamic equilibrium for extended periods of time, but disequilibrium can appear suddenly (or with substantial time lag) as a consequence of critical changes in the reproductive capacity of any single element. Several practices can threaten the functional integrity if they drive the system into states from which reproductive processes cannot recover. But, these practices are part of the system itself. That means the functional integrity can be disrupted in many ways, including the simple failure to perform an action, which is crucial to reproduce some system element or to maintain it in a changing context. Several context changes can occur, such as the market demand and price, new regulations, consumers' behavior, social troubles, and climatic events.

People will perform critical actions only when a complex web of social and cultural prerequisites is in place. They must have the knowledge and capacity needed to perform the activity, and they must have incentives or inducements to do so. Making changes in the socio-ecosystems relies on the knowledge of these socio-ecosystems, and how social institutions and human incentives can be regenerated. The key challenge for the functional integrity is to conduct researches that lead to a better understanding of the critical factors themselves, subsystems, or the systemic interaction of components that allow the system to regenerate or adapt. It presumes that norms, values and perceived obligations are themselves components of the socio-ecosystems.

In summary, the resource sufficiency assumes that an agro-ecosystem is simply the sum of the resource transformations and consumption elements involved, or that such relationships are sufficiently stable to be ignored. However, for the functional integrity it is precisely these system-level dynamics and changing interrelationships that are the primary objects of study, which presumes that ignoring the mechanisms for system regeneration and transformation is potentially a

fatal error. Thus, ecology, ecosystem modeling, systems analysis and systemic inquiry are crucial to this approach. Although much of the empirical knowledge about specific elements of socio-ecosystems can be found in traditional agricultural disciplines as well as in the local knowledge of day-to-day practitioners, the praxis of synthesis remains comparatively weak.

■ LIVESTOCK FARMING AND LOCAL DEVELOPMENT

Livestock farming refers to a human activity based on the management of domestic animals for various purposes at different scales. At farm level, the livestock farming role is the production of goods for market and self-consumption, savings, transport and workforce, rituals and social status, manure fertilizer and by-products, an added-value to cropping system and marginal areas, etc.

It also has several and diverse functions at local level in different domains such as economics, the environment, and social issues. In economics, many authors, especially Alary et al. (2011) mentioned the key function of livestock in animal supply chains, in particular the consumption of inputs, the created employment and the production of commodities for food industries. Livestock farming is a major component of the landscape through the presence of animals, grasslands and rangelands, animal husbandry tools and infrastructures, crop-livestock synergies and urban-rural relationships. From an environmental point of view, livestock interacts with the biodiversity, water cycles, soil nutrients. With regard to social issues, livestock contributes to the mental models of rural people, but also of urban populations. Frequently, it is the pillar of heritage and traditions.

Livestock farming is a global issue. On one hand the environmental impacts are significant, especially greenhouse gas emissions, around 18% of the total emissions, which are linked to the specific physiology of ruminants (Steinfeld et al., 2006). On the other, deforestation generated by pasture cultivation, biodiversity loss, underground and surface water pollution as well as soil pollution are some other significant effects of the livestock industry on the environment.

In the past in many countries and currently in many areas, cattle and sheep ranching is one of the main symbols of land conflicts between large-scale farmers, smallholders and landless peasants. The fence across the prairie is the image to both manage the herds and forbid the entrance to non-authorized people. The 'process of clearance' started in the United Kingdom in the 18th century, especially in Scotland and Ireland. Then it spread to the Americas, Australia, South Africa and to some islands. Across the centuries, animal husbandry has appeared as a tool of colonization and its expansion a key factor in genocides.

However, animal production is also a key factor of the global economy. Meat, milk, wool, leather are commodities that easily move around the world. Many times they are produced in one region and consumed in another according to the market and the international demand. Some authors consider that globalization started in 1885 in the town of Frey Bentos, Uruguay, with the building of a slaughterhouse by an English company to commercialize meat in the global market. Finally, the last decades have been plagued by scandals linked to animal production, e.g. bovine spongiform encephalopathy, dioxin in chicken meat, melanin in milk powder, avian flu, and horse meat as a substitute to beef in fast food preparations.

Livestock farming appears as a part of diverse systems which are interconnected. A relevant literature exists about the

multifunctionality of livestock at farm level, mainly in the last decades. More recently, several institutions have been interacting on the resource sufficiency of animal production at global scale. This thematic issue focuses more on the functional integrity of animal breeding at local level, especially how and where livestock interacts with local development. The local scale could be quite relevant to understand better the diversity and dynamics of farming patterns and functions of livestock farming activity which is contributing to local development processes. Moreover, this issue is mainly on extensive livestock systems which are here defined by the use of rangelands or grasslands as the main source of feed for livestock (Sere and Steinfeld, 1996).

Extensive livestock farming is intricately linked to spatial dimensions since animals are mobile, e.g. nomadic or transhumant, crossing vast areas under some conditions. Extensive livestock farming leaves a cultural and environmental imprint in areas where it is present as well as in areas where it has been historically present. The local or "territorial"⁵ level therefore seems like a relevant entrance point to reflect upon the future of extensive livestock farming because this is the level at which the choices made by societies play a role in the organization and transformation of local areas, especially through policy making.

The analysis of extensive livestock farming systems embedded in their local situations and influenced by their past and present may address questions such as how to alleviate the breeding system vulnerability and build adaptive capacity from farm to consumer. Taking into account individual and collective behavior, this analysis enables an innovation systems approach which identifies, in partnership with the stakeholders, what the issue is and looks for collective means to address it.

In conclusion, based on case studies located in contrasted biomes and socioeconomic contexts, this issue focuses on the contribution of livestock farming to local development. Livestock farming appears as a relevant component of the sustainability of pastoral and agropastoral socio-ecosystems, especially to alleviate the vulnerability of rural communities. The functional integrity approach allows describing and understanding better the interactions inside the socio-ecosystems, and not only the dynamic of its interacting entities.

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5. According to Brunet's (1992) definition: "The territory is a stretch of area used and managed by human societies." This definition thus embeds "territory" in the disciplinary field that associates nature and society and factors in their relationships. It confers upon "territory" a double dimension: a physical-spatial dimension and the other which is socially constructed. Territory is considered here at the local level, i.e. the level which allows for a system of interconnections and interrelationships between actors.

