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## ► To cite this version:

Huyen Le Thi Thanh, Guillaume Duteurtre, Jean-Daniel Cesaro, Stephen Ives. The multi-functionality of extensive cattle livestock and its importance for agricultural systems in northern highlands of Vietnam. 10. International Rangeland Congress, Jul 2016, Saskatoon, Canada. 132 p. hal-02738937

**HAL Id: hal-02738937**

**<https://hal.inrae.fr/hal-02738937>**

Submitted on 2 Jun 2020

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# The multi-functionality of extensive cattle livestock and its importance for agricultural systems in northern highlands of Vietnam

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## INTRODUCTION

The concept of multifunctionality is used by many authors to stress the non-market dimensions of agriculture. In that respect, multifunctionality comprises the existence of multiple commodity and non-commodity outputs that are jointly produced by agriculture (Caron P. and Le Cotty, 2006). As multifunctionality was progressively adopted by research, three issues emerged as focus points for the scientific debates (Multagri project, 2005) including: (i) the interrelations between functions; (ii) increasing the links between agriculture and society; and (iii) the relation between multifunctionality and sustainability.

The Northern Mountainous Regions account for about 30% of the total surface area in Vietnam, and more than 2000 administrative communes. Around 39% of the communes are located at a medium altitude between 200 and 600 m, and 39% of them are over 600 m. There are different mountains ranges, with some peaks reaching 3000 m or more (Phan Xi Păng, 3143 m.), and several large intermountain basins. Due to this topography, the regions are characterized by a wide range of ecosystems. We differentiate the low mountain zone (around 200 to 300 m of elevation), mid-elevation mountain zone (between 300 and 800 m), and high mountain zone (over 800 m altitude) (Tran Duc Vien, 2006). The regions contain about 15% of the national population. It is characterized with medium population density (100 inhabitants/km<sup>2</sup>) and high proportion of ethnic minorities in addition to the Kinh population. In the low mountain zone, which is relatively better watered, with higher temperature, and closer to the roads and market infrastructures, the main ethnic minorities are the Muong and the Thai. In the mid-elevation mountain zone, there are mainly ethnic groups, among which might the Dao, the Kho Mu, the Xin Mun, the Ha Nhi and others. In the High mountain zone, which are more remote areas, the main ethnic minorities are the H'Mông, the Lo Lo, and, in some places, the Dao (Tran Duc Vien, 2006).

These regions cope with many difficulties compared to lowland and delta areas in terms of steep slopes, uneven terrain, access difficulties, low soil quality, poor infrastructure, and high poverty rate. Particularly, the pressure on land is strong in the highlands, where a high proportion of unfertile land spots does not favor for crop production (Minot et al., 2003; Tran Duc Vien, 2006). These regions are considered as a favorable area for ruminant production with the availability of pasture lands. According to Minot et al. (2006), a majority of households in Northern Mountainous Regions can improve their living standard from animal husbandry. Epprecht (2005) calculated that the share of livestock is more than 22% of total household income in the northern uplands.

Cattle are considered as the most important ruminant species. In Northern Mountainous Regions, the majority of cattle are raised in highland extensive mixed farming systems in hilly and mountainous landscapes of high altitude and steep slopes (Dixon et al., 2001). According to Maltzoglou and Rapsomanikis (2005), the highest proportion of households raising cattle is in the Northern highlands (nearly 70%). However, the share of beef in the market from these Regions is lower than the share of draught animals. Therefore, beef cattle still contribute a relatively small share in the total income of households (Epprecht, 2005).

Furthermore, cattle population in the Northern highlands is strongly affected by diseases and high mortality rate in the winter due to poor health care service as well as feed shortage, especially for cattle grazing in the natural pasture in the hill tops (Huyen et al., 2011). Smallholders in the uplands of Vietnam are mostly dependent on natural pastures for cattle feeding. In the high altitude areas, each family usually owns between two and five heads of cattle. Pastoral systems are characterized by multi-functions of livestock that contrast with the vision of commercial firms invested in the development of mono-cropping maize production or pig intensive rearing. These important multi-functions of extensive livestock need to be taken into account for assessing the functions of grasslands in local communities. Free-grazing and tethered grazing are the main feeding systems, in which cattle are generally grazed every day on natural pastures in the forest land far from the homestead with little or no use of crop-by products (Mui, 2003; Huyen et al., 2006; Phung, 2009). However, there is a lack of information on quantitative and qualitative of grass in the pastures. Phong (1995) and Mui (2003) reported that Northern Mountainous Regions and the middle highlands occupy more than half of the total grassland in Vietnam. However, the grazing area is declining due to crop production, re-settlement or reforestation programmes. As a result, available native pastures tend to be overgrazed and there is little formal grazing management until now.

## **OBJECTIVES**

This study analyzed the diversity of the functions of grasslands that are characterized by multi-functions of cattle in the pastoral systems, and their perception by various stakeholders resulting in motivation to (or in low interest for) improving pasture management in Son La province, a mountainous province in the northern highlands Vietnam.

## **DISCUSSIONS AND LESSON LEARNED**

### ***The multiples functions and linkages of livestock, pastures, forest and crop cultivation at farm scale***

Son La province is the largest province in the Northern Mountainous Regions. Looking back the historical development in keeping cattle in the province, the availability of natural pasture/ grazing land and land tenure affect the cattle population and structure of cattle herd. According to Huyen et al. (2006), increased keeping cattle in recent years might reflect a recent increase of farmers' prosperity in Son La province. Security of farmers' land tenure through national land allocation policies (1993 and later) and local implementation programs possibly further supported this investment.

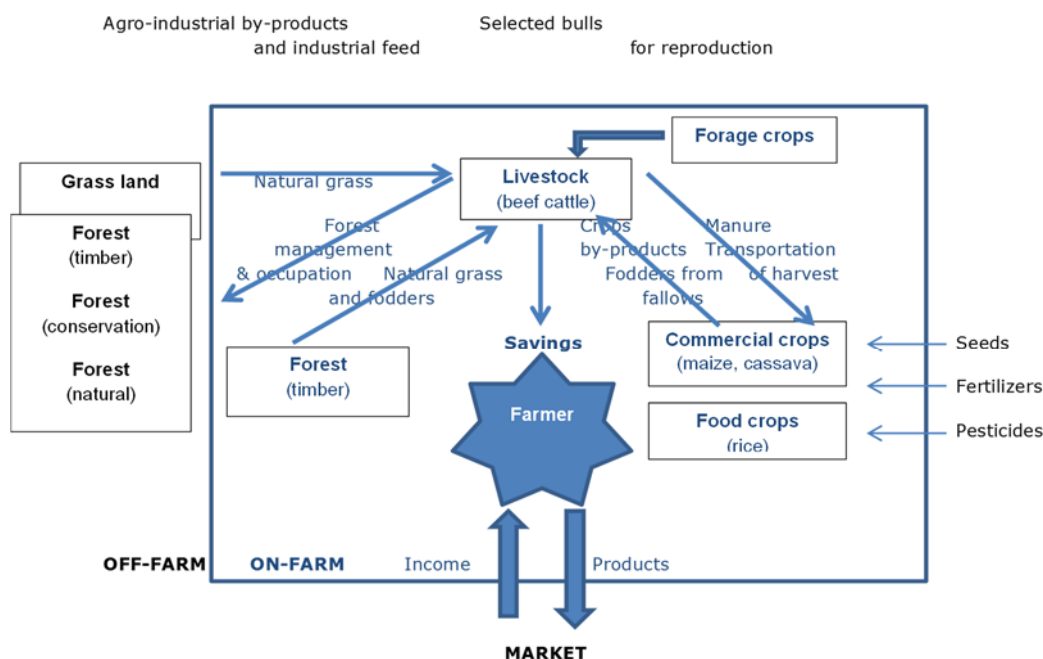
In the past, large ruminants were kept for draught and for reproduction and restocking of the herds and occasional sales. As ruminants were grazing freely, losses due to theft were high. High losses were also caused by epidemics, as there was few health controls. The reduction of the number of females between 1990 and 2002 was interpreted as an effect of ever more limited pastures, forcing households to reduce herds in general and females in particular, while maintaining males for draught. Decreasing pastures had also driven farmers to reduce the number of other ruminants. Between 2001 and 2004, most farmers gave up upland rice for the new, high-yielding maize varieties. An increasing share of rice for home consumption had now to be purchased. Maize became a major cash crop and animal feed. Farmers raised cattle and buffaloes still as draught animals, but cows for reproduction became less frequent than before or even rare in some villages (Huyen et al., 2006).

Extensive cattle production plays important roles not only in supplying meat in the beef-cattle marketing value chain, but also in providing draught power for soil preparation and harvest transportation, manure for soil fertilization, household savings, and cultural goods to be used for important social events. In addition, grazing animals involve in forest management and occupation, and in fallow management. Figure 1 summarizes the multiple functions and linkages of grasslands, livestock, forest and crop cultivation at farm level.

The grazing areas are composed of uncovered grasslands, but also of forest lands, fallows and interstitial areas (border of fields, roads..). Pastoral systems are characterized by multi-functions of livestock with strong linkages of livestock, grassland, forest and cropping that contrast with the vision of commercial firms invested in the development of mono-cropping such as maize production.

A study conducted in Son La province from 2007 to 2010 (Huyen et al., 2012) indicates that small farms were at their limits of forage availability and had labor shortage. Non-market values of cattle were higher than the beef market value. Cattle were sold at low frequently, less than one cattle per year (Huyen et al., 2013; Tuan et al., 2014b).

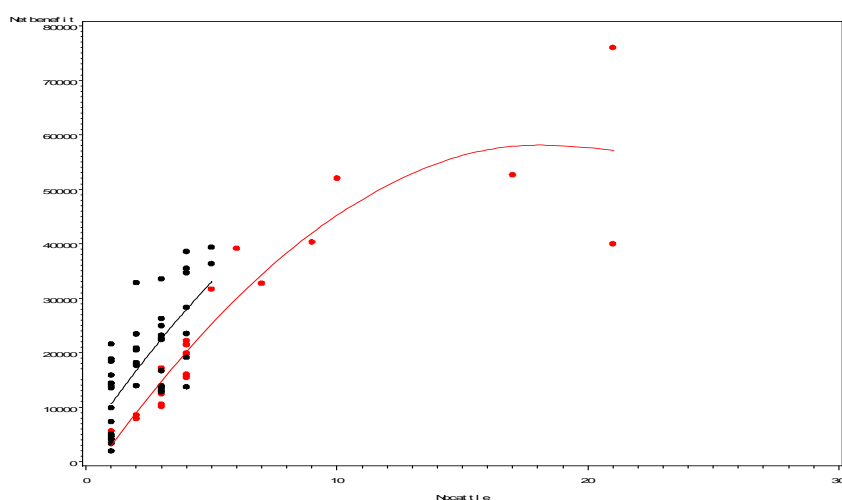
Cattle competed with other livestock in the use of limited farm resources on small farms. Better-off farms could reduce this competition by more frequent adoption of innovation (forage cultivation, use of agricultural and industrial by



**Figure 1.** The multiples functions and linkages of grasslands, livestock, forest and crop cultivation at farm scale

products, etc.). The less poor farmers had more advantages than the poorer in allocating different resources for keeping higher numbers of cattle together with other livestock, while resource poor farmers had to reduce the numbers of animals. For the poorest, small animals were more suitable than cattle (Huyen et al., 2013; Tuan et al., 2014 a). The large entrepreneur-type of farms, were characterized by high economic losses, high feed costs and low animal performance, mostly because of poor forage availability and still not developed beef markets. The most promising type of farm for profitable beef production in the study region was the mixed farm in high mountains, where the farmers could increase their cattle production on the basis of available fodder resources from pastures with limited use of supplemental feed. Figure 2 compared net benefits from cattle production in the low mountains with that in the high mountains.

Rinawati Setianingrum (2010) and Trung (2011) carried out a follow up research in the same study sites, where the natural pastures are available for raising cattle. Setianingrum (2010) found that the size of communal pastures varies a lot, dependent on the villages, and ranged from 20 to 187 ha.



**Figure 2.** Plots of net benefit from cattle production versus number of cattle (c) kept per farm in highlands (Huyen et al., 2010)

In general, all households in a village are allowed to graze their cattle on the communal pastures of the respective village. However, in some villages, there were arrangements for dividing communal pastures into several plots, bordered by stream or fence. The plots were further occupied by different groups of cattle keepers, which were formed based on family relationship or neighborhood. The communal pastures could be in the form of woodlands, which is pasture under perennial trees in the forest, or in the form of grassland with less perennial trees. Farmers who had access to communal pastures practiced mainly free-grazing or tethered grazing. Stall feeding was not common practice in the study sites. Some cattle keepers, practicing free-grazing, kept their cattle on communal pasture for the whole year, while some others practiced seasonal movements: they grazed their animals in communal pastures during the cultivation period, and in harvested fields after the harvest. Those who did not move their cattle from communal pasture to harvested fields justified this by the too far distance between the pasture and the fields. Tethered-grazing was also influenced by season in terms of available feedstuffs. During the cultivation period, cattle were herded or tethered on roadsides or fed on a cut-and-carry basis. Farmers did not access to the pasture practiced herding or tethering their cattle on roadsides, field borders, and fallow land. Tethered-grazing was also practiced by cattle keepers who do not utilize communal pasture, even though they have access to such pasture areas. Reasons for not utilizing pastures were far distance, lack of labor, and unsafety due to theft. The distance to communal pastures on hill tops or sloping areas from the homestead ranged from three to eight kilometers and it takes hours to reach them.

It is recognized that natural pasture areas declined time by time in the study region. For instance, in one H'Mong village (Pa Dong in Mai Son), Huyen et al. (2006) indicated that around 100 ha of natural pasture were available in 2004, whereas according to Rinawati Setianingrum (2010), no more natural pasture were used in 2010.

It is noted that where protected forests are accessible, cattle can graze in. Maize and rice fields' area are used for grazing in post-harvest period. Coffee fields do not allowed access to cattle. Therefore, expansion of coffee fields reduces post-harvest fields for cattle. Nevertheless, coffee needs cattle and buffalo manure. It can be understood that on the one hand the development of coffee need the development of cattle. On another hand, the development of coffee reduces grazing lands (Cesaro, unpublished field data).

The utilization of crop residues for cattle feed is related to the kind of crops cultivated by the cattle keepers. For example, the utilization of rice straw in mid-elevation mountain zone is more prominent than in high altitude. It is understandable because all cattle keepers at mid-elevation mountain zone are cultivating rice, which is not the case in higher altitude. However, not all cattle keepers utilized their crop residues. The revealed reasons are long distance between crop fields and cattle stable, lack of labor and enough native grass for cattle during harvest time. Table 1 gives an example of the major use of pastures by different cattle production systems.

Crop-Livestock integrated Smallholder farms				Specialized beef farms
Location	Lowland/highland	Highland	Highland	High land/ Lowland
Cattle per farm	1–5	1–9	3–21	90–650
Ethnicity	Thai/ H'Mong	H'mong	Thai	Kinh
Pasture	No	Natural pasture	Natural pasture	Growing pasture
Feeding	Tended /Cut-and-carry	Free ranging on communal pasture; or seasonal movement to harvested field	Free ranging on communal pasture	Stall feeding and additional ranging on the pasture
Type of feeds	Natural grass; growing elephant grass; crop by-products (rice straw, maize leaves and stems, rice bran, sugar cane tops); cassava, banana stems, pumpkin	Natural grass	Natural grass	Fresh elephant grass; silage feeds (maize stems and sugar-cane tops and elephant grass); dry rice straw; additional concentrate feed (maize meal and premix)

Source: Modified from Huyen (2010)

**Table 1.** Example of the major use of pastures in different cattle production systems in Son La province

## PROSPECTS FOR IMPROVING PASTURES MANAGEMENT AND THE VALUE OF GRASSLANDS

According Huyen et al. (2010) and Tuan et al. (2014b), the availability of feed resources for cattle was found to be a major factor affecting herd size and cattle management on household farms in Son La province. Feeding systems practiced by smallholders are governed by several factors such as access to communal pasture, labor, ethnic, altitude and production objective. Specialized beef enterprises practice zero-grazing with utilization of improved grasses, collected or purchased crop residues, silage, and concentrates, which is not the case for smallholder farmers. The mixed farms with access to natural pastures reveal a potential for profitable beef production in the future when keeping more than 10 animals, a number that could be realized if cattle management was improved (Huyen et al., 2010). A more in-depth investigation of feed quality and pasture improvement possibilities would be the next required step in determining the scope for development of this system. The latter will also depend on the potential for the establishment of a beef market in the region, which needs to be evaluated by market research. The support of the province is recommended for the development of market structures and the implementation of appropriate policies and credit programs is required, at least in the initial phase (Huyen et al. 2011; Tuan et al., 2014 a). Cooperative organization of short food supply chains could be an appropriate solution for marketing a defined meat quality from younger animals, further contributing to the shortening of production cycles. The formation of farmer groups, which has enabled medium farms to reduce labor costs for cattle keeping, could be developed favorably towards cooperative beef marketing (Huyen et al. 2010). The initial evidence implies that the development of pasture management is highly related to the existence of improved value chains. The setting up of weekly market places, or local modern processing units linked with distribution companies in big cities like Hanoi, are likely to boost farmers outlets, and their motivation to improve their feeding practices in Son La province (Tuan et al., 2014a) as well as in other northern highland regions (Tuan et al., unpublished; ACIAR project LPS/2008/049).

For years, with an attempt to improve beef cattle performance, the Son La province has implemented some policies carried out by several extension programs by introducing improved Laisind bulls<sup>1</sup> and breeding cows to smallholders. The province also supported some large-scale specialized beef breeding farms in the import of exotic beef breeds (Draught Master, Brahman) with the aim of providing breeding animals to households. However, the large farms, in spite of important governmental subsidies during their establishment, could not cope with the high feed cost because of scarcity in natural pastures areas and consequent high shortage of green feed resources, especially during the winter. Furthermore, smallholder did not want to keep exotic cattle because of their lack of knowledge and resources for managing exotic cattle, less adapted to the local conditions than the local breed. In addition, the large farms could not get access to markets for high-quality beef, a market segment that is in great demand through-out the country (Huyen et al., 2006; Setianingrum, 2010; Huyen et al., 2012; Duterutre, 2014). Setianingrum (2010) stated that farmers seemed to prefer cattle breed with higher body weight, such as Laisind. However, in reality, cattle breeds kept by farmers do not entirely correspond to farmer's preferences, due to their lack of feed, lack of labor and lack of knowledge about preferred breed. Moreover, altitude, ethnic groups and remoteness were also influencing traits preferences. In addition, large-framed cattle in semi- and free-grazing systems need supplementation in the dry season. For small-framed cattle, stall-feeding with a fixed ration and supplementation with urea-treated straw is not an option. Economically, supplementation in the rainy season does not make sense. This is not expected to change as long as marketing of meat is not developed (Trung, 2011 and Huyen et al., 2012). Many policies and programs for developing cattle fattening in northern highlands focused on evaluating and selecting bulls and cows for natural breeding to improve the cattle quality, supporting households in building cattle sheds, forage cultivation (mainly King grass and Ghinee grass), vaccinating cattle to prevent infectious diseases, and providing free of interest loans. There was very little support in terms of grass cultivation by giving VND 2.5 million/ha for grass seedling purchase in the first season of grass cultivating to households which transformed the low productive annual crop or mixture-plants-garden land to cultivate grass for animal raising. However, the improvement of available pasture management and the promotion of farmer motivation for using certain unfertile plots for improved grass are not considered (Duteurtre, 2014).

The results of Uplands Program - SFB 564 and ACIAR project AGB/2008/002 in Son La suggests that planting of hedgerows or vegetation strips with king grass is one of the long-term methods to slow down the soil erosion in the upland fields. However,

<sup>1</sup> The Laisind cattle (in Vietnamese: bò Lai Sind) is a cross-bred cattle obtained from local zebus (yellow cattle - bò vàng in Vietnamese) and an exotic Indian zebu breed (Red Sindy)

farmers only make the decision in changing their practices only when they see a better benefit. It means that if planting grass in a certain unfertile plots to extend cattle production, the higher benefit from this need to be clearly defined. Recently, a number of farmers who want to extend cattle production recognize the importance role of having a suitable land for grass cultivation in addition to natural pastures and crop residues to ensure the green feed for the cattle. A percentage of cattle keepers in Son La spend some land area at home garden or around ponds for forage cultivation 48% of farmers do not use natural pasture and 25% of farmers using only natural pasture (Setianingrum, 2010). A study of Tuan et al. (2014 b) in the frame of the beef project ACIAR LPS/2008/049 in Mai Son also found that households in different scales have different grass

areas. Some households with 10 cattle and more have larger improved grass areas than others (10,000 m<sup>2</sup> compared to 677 m<sup>2</sup> in the scale of 6-9 cattle/ farm; and 200-250 m<sup>2</sup> in the scale of smaller than 6 cattle/ farm).

Duteurtre et al. (2012) carried out an initial study on the institutional and policy options for improving the economic value of grasslands in the Son La Province. The authors found that the importance of grassing land for cattle production is perceived by all stakeholders in the beef cattle value chain. In which, beef produced in the traditional extensive production in the grazing land is preferred by traders and consumers, and can get higher price. This is also confirmed by Tuan et al. (2014a). The availability of grazing land for reducing the production costs is a major attractive factor of cattle keepers. However, grazing lands are not formally recognized and not concerned by local institutions as cropping and forest lands. So far, the increase in the demand on beef might lead to the promotion of value chains to encourage local meat production. This might bring land users and local authorities to recognize the value of grasslands and to develop cattle production in a sustainable manner.

### **LESSON LEARNT**

In the above overview in Son La province, the results reveal that the extensive smallholder cattle production based on natural pastures need to be promoted and improved by additional use of appropriated land for forage and alternative residue feeds. Further, the development of grassland management is highly related to the existence of improved value chains. The setting up of regular market places, or local modern processing units linked with distribution/ retail enterprises in big cities, are likely to boost farmers outlets, and their motivation to improve their feeding practice.

So far, the care for long term of efficient use of grassland is autonomously by few farmers having some successful already in beef production. However, in this region, without the involvement and governance of local authorities (at village and communal levels), the over-grazing problem could not be solved, and the value of grasslands could not be improved. Currently, this issue is neglected.

In general, farmers only think and try on the investment when they can see or have foreseen about a good benefit from the action. This is also true for the care and support of local authorities. The matter is how to provide reasonable proof for the necessary of improving pasture management to all stakeholders and local authorities.

The coordinated actions should be on the establishment of farmer organization; the knowledge in grassland management and required support from local authorities; and the policies to the development of market chains. The perception about the value of grasslands will go along with the success of beef cattle value chains in the regions and as a base of the consideration for improvement of pasture management.

The formation of common interest groups can help the poor farmers in accessing to the grass lands or other resource needs for beef cattle production. The linkage of farmer organization with traders and local institutions can develop beef value chain as well as enhance the effort in improving the management of grasslands.

### **CONCLUSIONS**

Although Government has encouraged beef production development in the highlands, multi-functionality of livestock, forest and crop cultivation are not mentioned in the development programs. Furthermore, grasslands are not formally recognized by local institutions as a valuable feed source for livestock production. Consequently, government support funding is rarely available to sustain and improve natural pastures. Collective action is required from all different stakeholders to develop strategies for sustainably managing this important and valuable resource.

The involvement of local authorities and other stakeholders with the researchers during the study is very important. The main objective of the study should be in the same route with policies and direction the local authorities. Further, it is also very important if the study can fill the gaps of the policies and local plans. The sustainable and efficient results from improving beef value chains linking with grassland management need to be aware by farmer themselves, other stakeholders in the value chain and local authorities.

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