36. Pastoralism

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1. Description of the livelihood

Pastoralism refers to mobile livestock herding for either production or livelihood (Dong, 2016). Pastoralism occurs on about 18-23 percent of global land area and it supports around 200 million pastoral households (Neely, Bunning and Wilkes, 2009; Blench, 2001). It usually occurs where resources are limited, and thus

movement to pasturage places provides enough biomass and water for the animals (cattle, camels, goats, yaks, llamas, reindeer, horses and sheep).

Mobility is also a key strategy to manage the quality of pastures and livestock (increase gene pool, provide a variety of food resources, occasionally include residuals of croplands), access market and increase social-cultural interaction including transboundary integration. The two essential forms of pastoralism are the nomadic and transhumance rearing of domesticated animals (Dong, 2016). The nomads migrate with their families according to the changing seasons from one area to another to meet the needs of their animals. On the other hand, transhumance is a movement of livestock (typically seasonal) by usually hired herders between fixed summer and winter pastures (often with stables). Besides, food production pastoralism is important to preserve traditional knowledge, provided that the grazing intensity is optimum under the local circumstances to maintain high biodiversity, prevent the spread of invasive species, maintain soil fertility, protect soil from erosion, and increase soil C sequestration (McGahey *et al.*, 2014).

Other pastoral systems (e.g. enclosed systems, ranching or agropastoralists) do not belong here because these are settled pastoral system and/or associated with the cultivation or uses of crops.

2. Range of applicability

Pastoralism simultaneously secures livelihoods, conserves ecosystem services, promotes wildlife conservation, and honours cultural values and traditions especially in dryland and semi-arid landscapes (Neely, Bunning and Wilkes, 2009), but in general occurs in places where feed resources are limited. Nomadic pastoralism is commonly practised in regions with little arable land, especially in the drylands of Africa, in the highlands of Asia and Latin America (Dong, 2016), and in the steppe lands of Eurasia. Transhumance pastoralism can be found on all continents.

3. Impact on soil organic carbon stocks

Dry and semi-arid rangelands are vulnerable to overgrazing and climate change, but these areas still capture and store large amount of carbon (C). Rangeland soils are considered to be far from saturation (McGahey *et al.* 2014). Literature with measured C stocks is scarce (Table 158). Movement of livestock could lead to increase or maintain soil C sequestration.

Table 158. Evolution of SOC stocks with pastoralism

Location	Climate zone	Soil type	Baseline C stock ± SD (tC/ha)	Additional C storage (tC/ha/yr)	Duration (years)	More information	Reference
Guinan county, China	Alpine-cold	NA	NA	0.18	NA	Seasonal movement of sheep and yak	Zhuang and Li (2017)
Ruoergai county, China				0.4	3		Zhuang *et al.* (2019)
Senegal	Hot steppe			0.04	1	Landscape level C sequestration	Assouma *et al.* (2019)
Botswana	Warm-semi arid	Entisols	39.4 ± 4.1	Light grazing had no effect on SOC, but heavy grazing decreased SOC	2	Pastoral farming is the principal livelihood activity across most of the Kalahari	Thomas *et al.* (2015)

4. Other benefits of the practice

4.1. Improvement of soil properties

In general, pastoralism improves soil properties (Zhuang *et al.*, 2019). When comparing pastoralism and sedentary livestock systems it was found that in general pastoralism improves soil properties (Zhuang *et al.*, 2019; Table 159). However, grazing management and sedentary livestock production systems with high stocking rate could lead to soil erosion, degradation of vegetation and encroachment by unpalatable shrubs, C release from soil organic matter decomposition, loss of biodiversity due to habitat changes, and adverse impacts on soil hydrological function and water cycles (McGahey *et al.*, 2014).

4.2. Minimization of threats to soil functions

Table 159. Soil threats

Soil threats	
Soil erosion	Enhances soil structural formation (manure production, litter accumulation) and compositional diversity (Zhuang *et al.*, 2019).
Nutrient imbalance and cycles	Improves nutrient cycling (Zhuang *et al.*, 2019).
Soil contamination/pollution	Slow release of N and other nutrients, preventing water pollution by leaching (Yilmaz *et al.* 2019).
Soil biodiversity loss	Improved plant diversity, nutrient cycling influences below-ground diversity (Zhuang *et al.*, 2019).
Soil compaction	Reduced trampling (Zhuang *et al.*, 2019).
Soil water management	Reduces pressure on water resources; the herds consume water on the move where it is available (Mekonnen and Hoekstra 2012).

4.3. Increases in production (e.g. food/fuel/feed/timber/fibre)

Products mainly include food (meat, milk, and dairy products), but it could also include wool, hay, medical plants, dung pellet or timber (in case of wooded pastures).

4.4. Mitigation of and adaptation to climate change

Pastoralism preserves soil C storage and increases C sequestration; therefore, it enhances mitigation capacity (Reid *et al.,* 2004). Extensive farming systems have been found to be climate friendly (Koncz *et al.,* 2017). However, climate change (drought) and desertification from livestock overgrazing (locally and depending on rangeland management, vegetation condition overgrazing could occur even under extensive management) emits globally as much as 100 million tonnes of CO_2 equivalent per year (McGahey *et al.,* 2014).

4.5. Socio-economic benefits

Pastoralism means the survival of many people especially for those with low incomes. This system is likely to be more resilient than sedentary livelihoods while preserving traditional knowledge (Neely, Bunning and Wilkes, 2009). However, higher economic valuation of the products and services provided by pastoralism and higher access to the markets could be a good tool to secure the benefits and C sink potential.

4.6. Other benefits

Despite increasing vulnerability of pastoralism (climate change, drought, marginalized market, etc.), pastoral systems provide a win-win scenario for preserving ecosystem services, sequestering C, reversing environmental degradation and improving the health, well-being and long-term sustainability of livestock based livelihoods (Neely, Bunning and Wilkes, 2009).

5. Potential drawbacks to the practice

5.1. Tradeoffs with other threats to soil functions

In rangelands, most C is stored below ground and up to 70 percent of dryland soil C can be lost through conversion to agricultural use (McGahey *et al.,* 2014). There is a trade-off between agricultural (cropland) and rangeland because cropland provides vegetable-based food production but lowers soil C and limits space for rangeland-based food production.

5.2. Increases in greenhouse gas emissions

Due to very low external inputs (lack of fertilization, irrigation, sowing, tillage, low use of electricity and industrialised equipment), pastoralism was shown to have very low GHG emission (0.59 t CO_2eq/ha), which were lower than intensive system (1.07 t CO_2eq/ha) when soil C sequestration was taken into account (Zhuang and Li, 2017). In another study in Senegal, the annual C balance of the pastoral ecosystem was 0.04±0.01 tC eq/ha/year (sink), showing that total GHG emissions were mitigated by C accumulation in trees, soil and livestock (Assouma *et al.,* 2019).

5.3. Conflict with other practice(s)

Investment in intensified grassland management, sedentary livestock farming, land use change to cropland management, afforestation, protected areas, and industrial developments (extractive industries) and urbanization is in competition with pastoralism (Dong, 2016). Transboundary movements of people and animals could also be a source of conflict. Security of livestock is challenged due to movements of animals.

5.4. Other conflicts

Pastoralism requires low external inputs but it is labour intensive. Many people are employed in this sector. However, in many cases pastoralism is not a choice (job opportunity) but rather a fate (heritage). Many of those who can choose switch to other job possibilities (Galvin, 2009)

6. Recommendations before implementing the practice

Suitable agricultural policy and additional support could strengthen pastoralism. Loss of C could occur if pastoralism is applied inappropriately (e.g. during transformation of semiarid thicket by goat pastoralism (Mills *et al.,* 2005)), or during introduction of domestic grazing on watersheds grazed by native herbivores (Bagchi and Ritchie, 2010). Grazing exclusion should be occasionally applied to restore C sink capacity of rangeland (Schönbach *et al.*, 2012).

7. Potential barriers for adoption

Table 160. Potential barriers to adoption

Barrier	YES/NO	
Biophysical	Yes	Desertification and land degradation in the drylands are reducing the capacity of the land to sustain livelihoods (Neely, Bunning and Wilkes, 2009).
Cultural	Yes	Pastoralism is less appealing and stereotyped. Declining prestige (Blench, 2001)
Social	Yes	Pastoralists are often socially marginalized (Neely, Bunning and Wilkes, 2009).
Economic	Yes	Pastoralism is associated with low benefits.
Institutional	Yes	National instead of regional policy is not favouring pastoralism, targeted subsidies are needed (Blench, 2001).

Barrier	YES/NO	
Legal (Right to soil)	Yes	Pastoralists have often insecure land tenure rights (Neely, Bunning and Wilkes, 2009).
Knowledge	Yes	Requires indigenous knowledge (Blench 2001).

Photos of the practice

Photo 45. Nomadic pastoralism in Mongolia (Khövsgöl Province), milking of yaks (2017).

Photo 46. Free livestock movements in Africa.

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