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Explanation of aspects and indicators in the Livestock Sustainability Assessment Tool

Getting to know the Livestock Sustainability Assessment Tool

Contents

Introduction

Wageningen Livestock Research (WLR) is working on social, economic, and environmental sustainability (i.e., sustainability for people, profit, and planet) of livestock development. The livestock sector creates a livelihood for millions of smallholder farmers. It generates affordable and safe animal products and sustains the agroecological resource base.

Wageningen Livestock Research have developed the Livestock Sustainability Assessment Tool (LSAT), which provides a scorecard to assess current sustainability issues as well as a format for stakeholder dialogue to discuss these issues.

In an area as broad as sustainability, it is important to narrow the focus to the particular features that will be examined. In the LSAT, these are called the 'aspects'. Specific characteristics of each aspect must also be examined; these are called 'indicators'.

Fifteen sustainability aspects were chosen along with several indicators for each aspect, giving a total of 55 indicators. Each indicator can be scored on a scale of 'very low', 'low', 'medium', to 'good'. The scale at which these indicators are considered is also important, with three scales being possible: farm level (F), regional or milkshed level (R) and national level (N).

This document provides some background to the sustainability aspects and indicators used in LSAT. It explains what dilemmas underlie the sustainability concerns covered by the 14 aspects used in LSAT. It also offers explanations about the indicators used to assess the sustainability of each aspect.

The tool has now been tested in several regions and countries in East Africa: Ethiopia, Uganda, Kenya, Tanzania and Rwanda.

In the LSAT test, participants select priorities from the 15 aspects of sustainability. Next, they score the indicators linked to these aspects. The results are represented in a spiderweb diagram, an example of which is shown below.

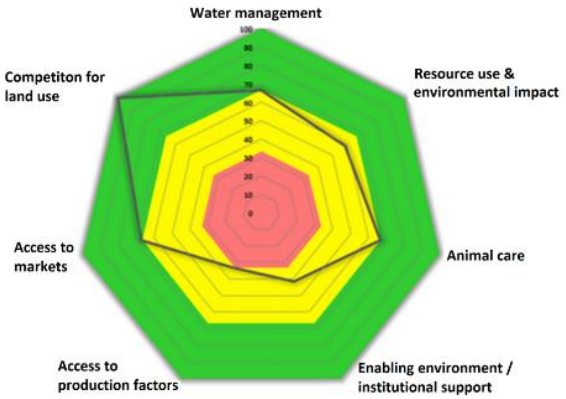


Figure 1: Example of a spiderweb result from using the LSAT

The LSAT test triggered interesting discussions and insights about, for example, the potential of animal manure to improve soil quality, when managed correctly.

1. Soil health

Soil health is the ability of the soil to sustain the productivity, diversity, and environmental services of terrestrial ecosystems. (ITPS, 2020)

The ability of dairy systems to produce milk depends on the ability of the soil related to these systems to continue to produce animal feed of an acceptable quality. Soil degradation – when soil deteriorates because of human activity and loses its quality and productivity – makes it challenging to keep supplying food to the global population and for farmers to keep making a viable income from that same land. Soil degradation occurs when soil loses its nutrients, when it loses its organic matter, when the soil structure breaks down (including because of erosion) or if the soil becomes toxic from pollution. Four basic soil health principles are:

- Soil should be covered as much as possible.
- Soil should be disturbed as little as possible.
- Plants should grow throughout the year.
- Monocultures should be avoided.

Recommended reading: FAO SOILS PORTAL

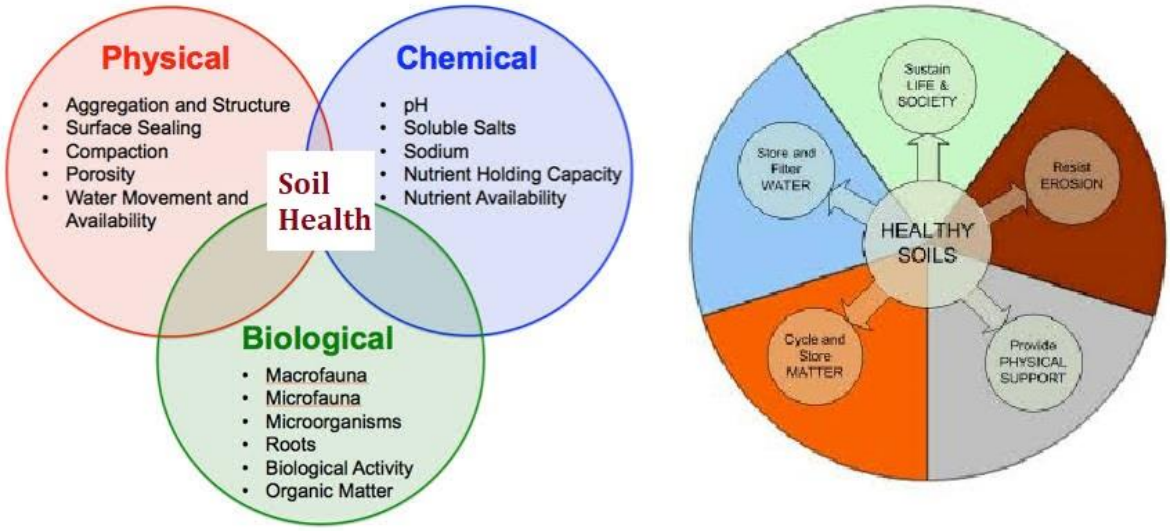


Figure 2: Some properties and functions of healthy soils
Source: NDSU, 2022

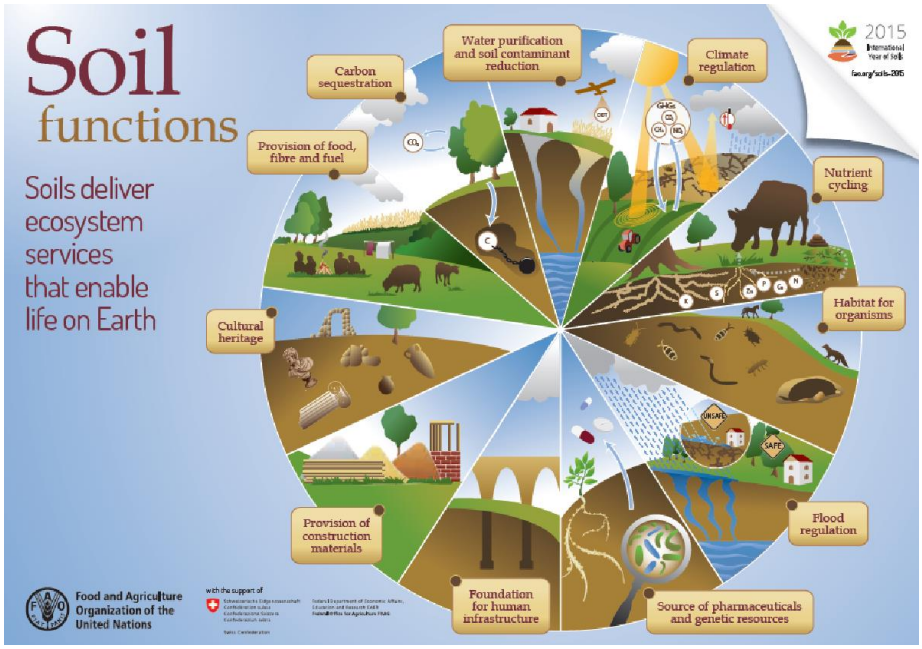


Figure 3: Soil functions (FAO, 2015)

Indicators for soil health

a. Soil organic matter (F-R-N) (D-B-AP)[1]

What is the soil organic matter (SOM)? SOM refers to the organic fraction of the soil apart from undecayed plant and animal residues.

SOM plays a crucial role in maintaining sustainability of cropping systems by improving soil physical properties (texture, structure, bulk density, and water-holding capacity), chemical properties (nutrient availability, cation exchange capacity, reduced aluminium toxicity, and allelopathy), and biological properties (nitrogen mineralization bacteria, dinitrogen fixation, mycorrhizae fungi and microbial biomass). The preservation of SOM is crucial to ensure long-term sustainability of farming systems.)

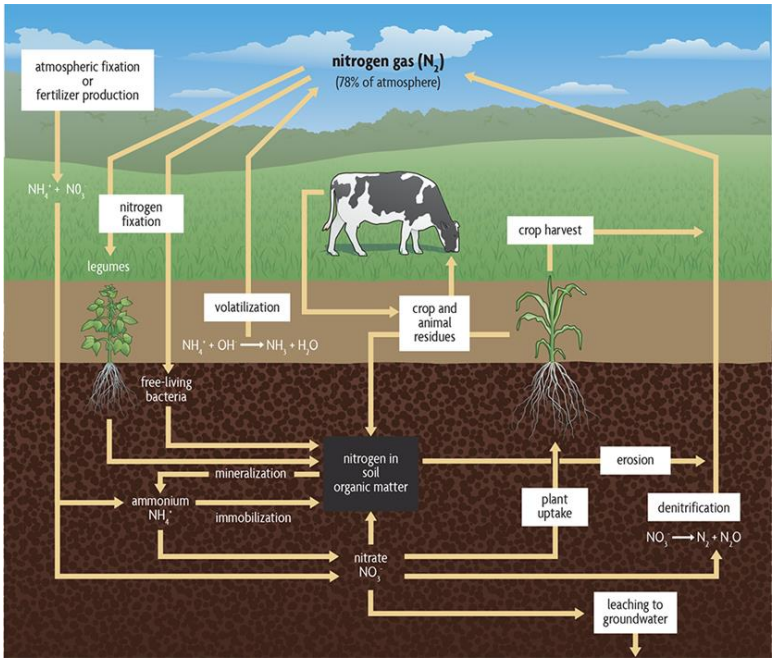


Figure 4: Role of soil in the carbon cycle
Source: Magdoff and van Es, 2021

[1] *F-R-N notation indicates on which levels an indicator is being used. F – farm level, R – regional (milkshed) level and N – national level. D-B-AP notation indicates on which system, D dairy, B beef, AP agropastoral.*

b. Soil acidification (F-R-N) (D-B-AP)

What is the pH of the soils? Most crops grow in soils with pH between 6.0 and 7.5; some plants, however, prefer acid or alkaline soils.

Soil chemical reactivity is expressed in terms of pH and is a measure of the acidity or alkalinity of the soil; more precisely, it is a measure of hydrogen ion concentration in an aqueous solution. pH ranges in soils from 3.5 (very acid) to 9.5 (very alkaline) and has the effect of either removing or making available certain ions from the soil. Aluminium and manganese strongly affect soil pH. Soils with high acidity (<5.5) tend to have toxic amounts of these elements, while soils with high alkalinity (>8.5) tend to disperse them. Soil organisms are hindered by high acidity, and most agricultural crops do best with mineral soils of pH 6.5.

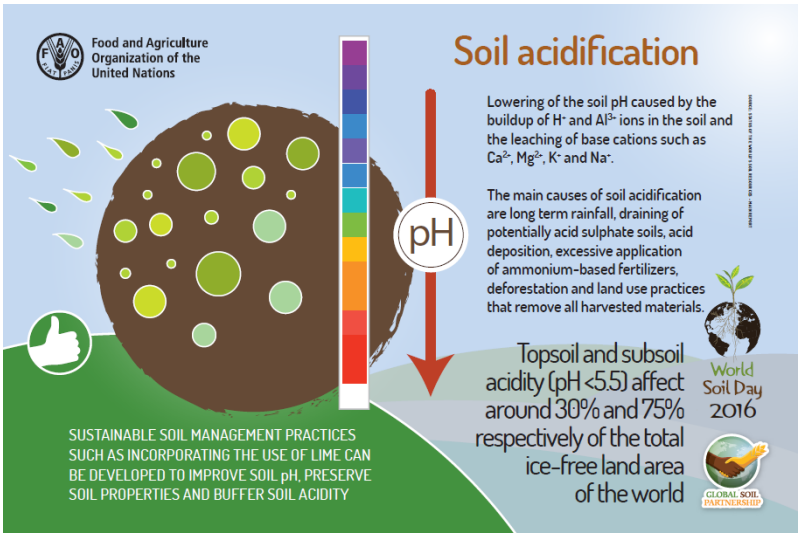


Figure 5: Soil acidification and ways to address it
Source: FAO, 2016a

c. Soil erosion (F-R-N) (D-B-AP)

How serious is evidence of soil erosion (removal of topsoil)?

A major cause of reduced soil quality is soil erosion, the removal of the topsoil. Although soil erosion is a natural geological process, it is often accelerated by cultivation and resource development to meet human needs. Erosion degrades soil condition by lowering organic-matter content, decreasing rooting depth and decreasing available water capacity.

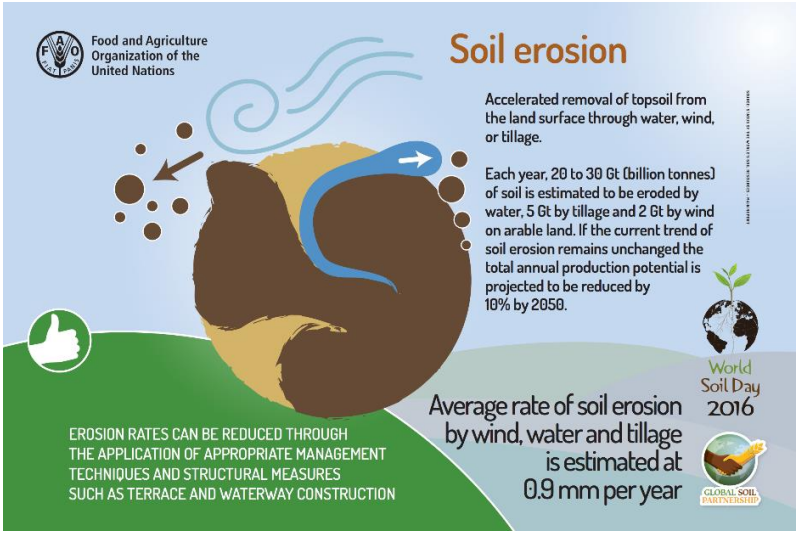


Figure 6: Soil erosion and how to reduce it
Source: FAO, 2016a

d. Soil compaction (F-R-N) (D-B-AP)

How serious is soil compaction? More compaction means soil structure loss, means reduction in water retention capacity.

Soil compaction, also known as soil structure degradation, is the increase of bulk density or decrease in porosity of soil due to externally or internally applied loads. More compaction means soil structure loss, which reduces the ability of the soil to hold water. Compaction can adversely affect nearly all physical, chemical, and biological properties and functions of soil. A high bulk density indicates either compaction of the soil or high sand content.

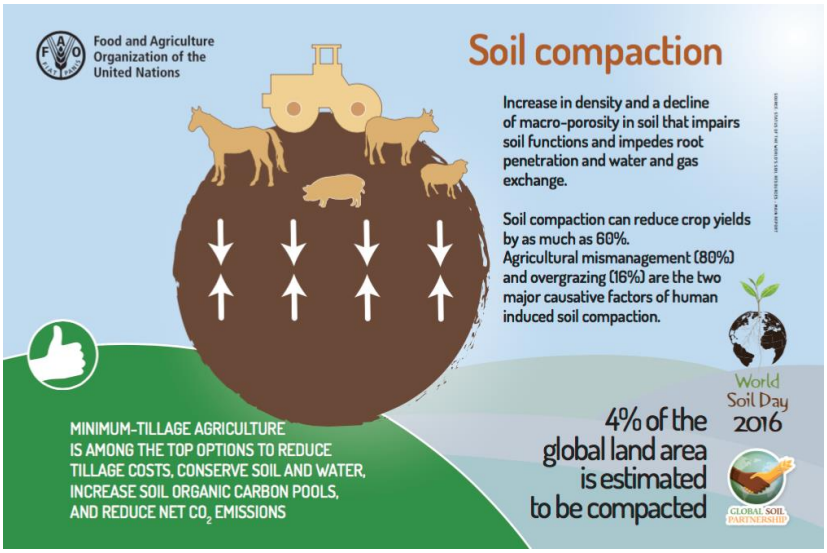
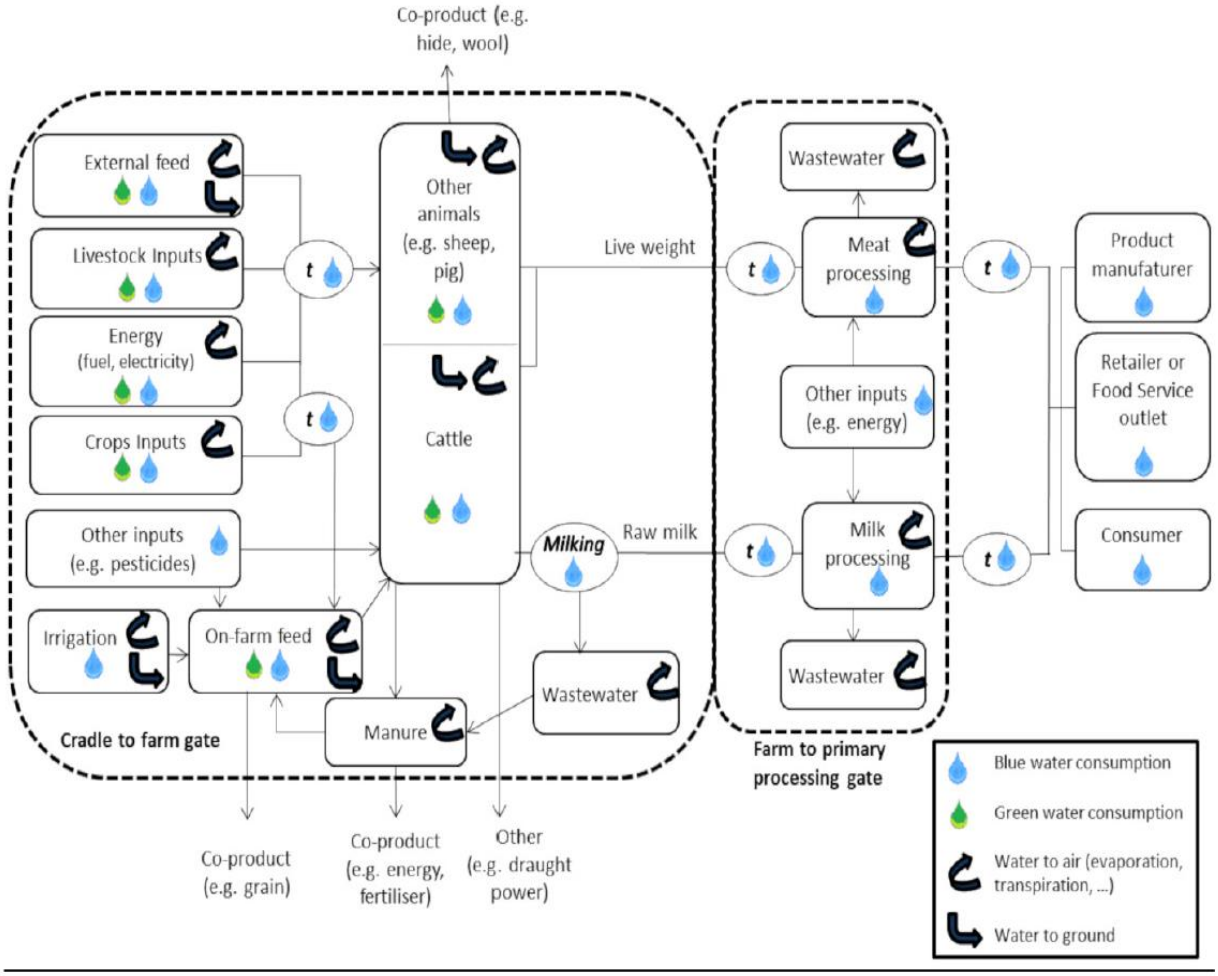


Figure 7: Soil compaction and ways to reduce it
Source: FAO, 2016a

2. Use and management of water

Water management and water use efficiency also apply to use of water on-farm, and cleaning in processing plants.

Water is an essential resource. On-farm it is necessary for feed production, for animals to drink and for maintaining milk quality. Water is also needed for downstream dairy industry activities. More broadly, it is involved in a wide range of social and economic applications within the broader communities to which the dairy industry belongs (including providing a basic necessity for human life). Water use for dairy production competes with water use for a broad range of other applications, and in many instances takes place in the context of water availability constraints.



Note: t = transport.

Figure 8: System boundary and main water flows of livestock production systems: cradle to processing gate
Source: FAO, 2019a

Indicators for use and management of water

a. Agricultural water availability (trend) (F-R-N) (D-B-AP)

How is the availability of agricultural water? (Water that is used to grow fresh produce and to sustain livestock).

The use of agricultural water makes it possible to grow fruits and vegetables and raise livestock, which supply most of the human diet. Agricultural water comes from a variety of sources: surface water such as rivers, streams, irrigation ditches and open canals; impounded water, such as ponds, reservoirs, and lakes; groundwater from wells; and locally collected water from sources such as cisterns and rain barrels.

b. Water quality (F-R-N) (D-B-AP)

To what extent does the quality of water (physical, chemical, and biological characteristics) meet the needs of the users (dairy/beef/agropastoral farming and the supply chain)?

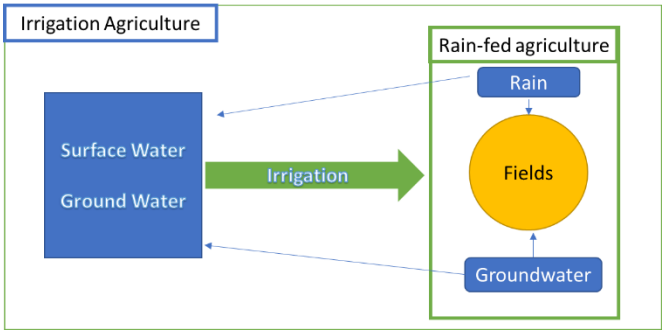


Figure 9: Sources of water for agriculture
Source: Adapted from FAO, 2019b

Water quality refers to the characteristics of a water supply that will influence its suitability for a specific use, that is, how well the quality meets the needs of the user. Quality is defined by certain physical, chemical, and biological characteristics. The dairy industry is both a user of water, with a clear interest in the availability of water that has acceptable quality, and a producer of outputs (nutrients, biological and chemical contaminates) that are associated with negative impacts on both ground and surface water quality.

c. Social conflicts over water (F-R-N) (D-B-AP)

Does water scarcity result in conflicts between the different users (e.g., between livestock farmers and other farmers, between farmers and other parties)?

Water conflict is a term describing a conflict between countries, states, or groups over the rights to access water resources. As fresh water is a vital, yet unevenly distributed natural resource, its availability often affects the living and economic conditions of a country or region.

3. Biodiversity for food and agriculture

Biodiversity for food and agriculture is the diversity of plants, animals, and microorganisms at genetic, species and ecosystem levels, present in and around production systems (FAO, 2019b).

Biodiversity for food and agriculture is all the plants and animals – wild and domesticated – that provide food, feed, fuel, and fibre. It is also the myriad of organisms that support food production through ecosystem services (also known as "associated biodiversity"). This includes all the plants, animals, and microorganisms (such as insects, bats, birds, mangroves, corals, seagrasses, earthworms, soil-dwelling fungi, and bacteria) that keep soils fertile, pollinate plants, purify water and air, keep fish and trees healthy and fight crop and livestock pests and diseases.

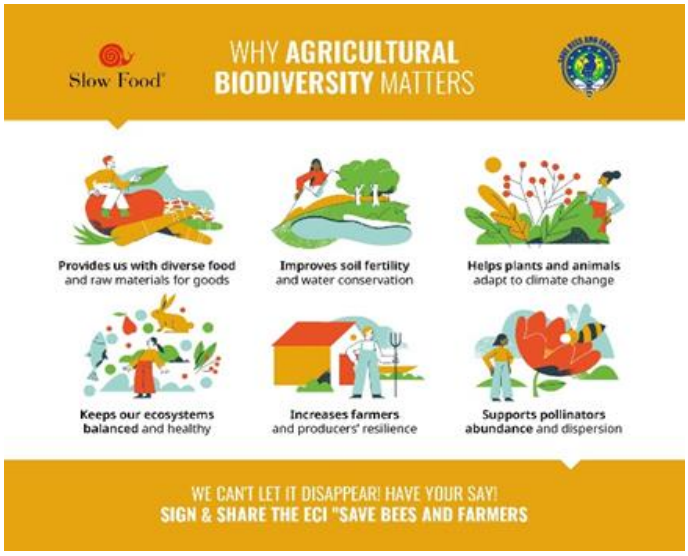


Figure 10: Why agricultural biodiversity matters
Source: Slow Food Initiative, 2021

Indicators for biodiversity for food and agriculture

a. Agrobiodiversity (F–R–N) (D-B-AP)

Is the diversity of livestock, crop, and tree species high?

Agrobiodiversity is the variety and variability of animals, plants and microorganisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry, and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fibre, fuel, and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil microorganisms, predators, pollinators), and those in the wider environment that support agroecosystems

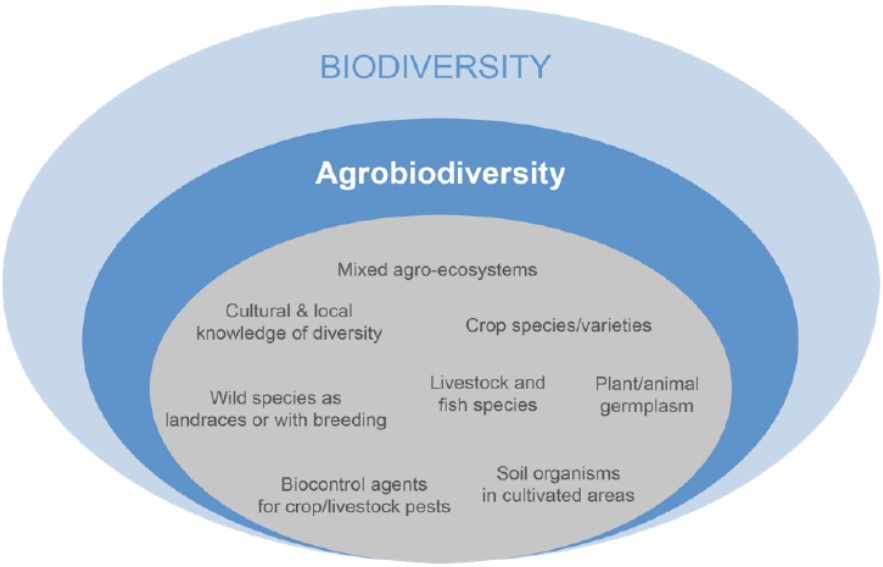


Figure 11: Components of agrobiodiversity
Source: adapted from FAO, 2004.

(agricultural, pastoral, forest, and aquatic) as well as the diversity of the agroecosystems (FAO, 1999).

b. Livestock genetic diversity (R-N) (D-B-AP)

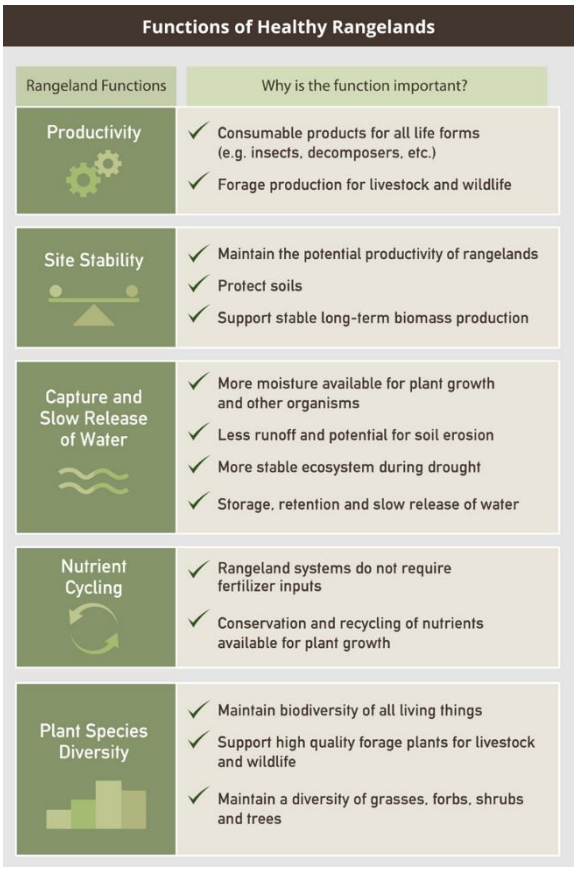
Is the genetic diversity of livestock sufficient to maintain and increase productivity across livestock generations?

Livestock genetic diversity indicators should be interpreted with care because (i) there is still no agreement among countries on the definition of "native" and "non-native" breeds, and (ii) loss of native breeds, when they change status from endangered to extinct, can reduce the proportion of native breeds that are endangered. Although native breeds may be less productive than highly specialized breeds, they are generally well-adapted to local circumstances and resources and may increase resilience in the long term. They are an important source of genetic variability for future breeding programmes.

Figure 12: Livestock diversity and climate change
Source: FAO, 2016b

c. Rangeland conditions (R-N) (B-AP)

What is the current condition of the rangeland in your community or territory? It refers to the ability of the rangeland to support various levels of productivity, given rangeland objectives and land use plan. Specifically, it relates to the health of the rangeland in terms of soil quality, forage values and species richness of vegetation.



Range condition describes an evaluation of the current status of rangeland vegetation compared with that of the potential for the site. Rangeland health – the condition or state of the land – has been defined simply as "the status of the soil, water and biological resources in rangeland ecosystems" (Pyke et al. 2002, 2003). A more comprehensive definition of rangeland health is "the degree to which the integrity of the soil, vegetation, water and air, as well as the ecological processes of rangeland ecosystems, are balanced and sustained" with integrity meaning "the maintenance of the functional attributes characteristic of a locale, including normal variability" (SRM 1999), which is a concept that is known to be important in rangelands (West et al. 1994). Rangeland health viewed as functional integrity relates it to biodiversity across landscape scales, from local to regional (Ludwig et al. 2004), where

simple indicators of the intactness of vegetation structure and function have been demonstrated as being significantly related to the diversity of birds, invertebrates, and plants (Karfs and Fisher 2002, Landsberg et al. 2003, Fisher and Kutt 2006).

d. Biodiversity loss in the landscape (R-N) (D-B)

Is there a decrease of natural habitat (grazing lands, natural forest etc.) around farms, due to pollution, real estate development, infrastructure development, deforestation, or disasters?

Biodiversity loss refers to the decline or disappearance of biological diversity, understood as the variety of living things that inhabit the planet, its various levels of biological organization and their respective genetic variability, as well as the natural patterns present in ecosystems. [OBJ]

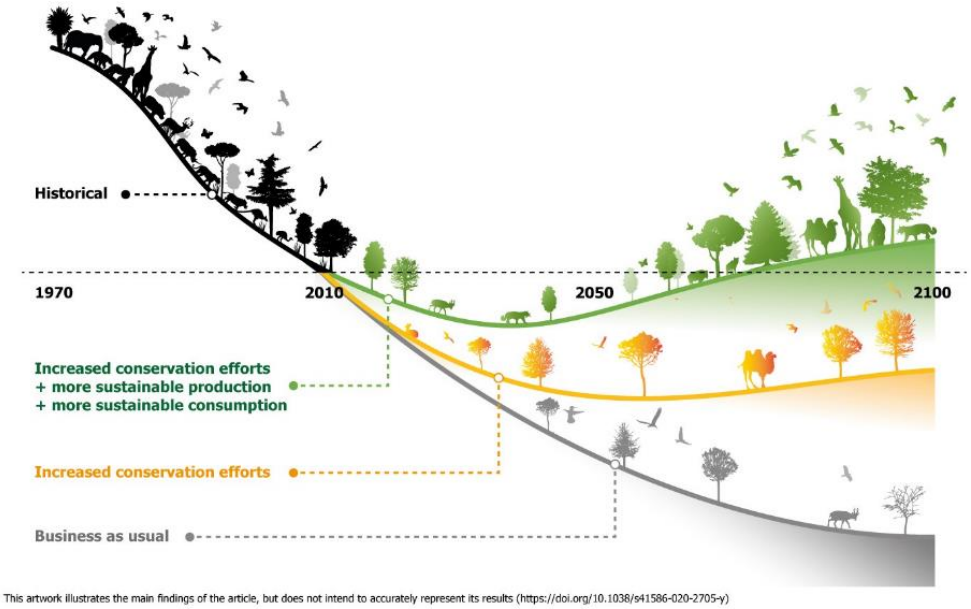


Figure 13: Bending the curve of terrestrial biodiversity
Source: Leclère et al., 2020

4. Resource use and environmental impact

Use of resources in ecosystems – such as soil, wood, water, and minerals – will have positive or negative effects on environmental quality.

Livestock production relies on the input of natural resources, which are extracted from the environment and often processed or manufactured to form the final products and services that we produce and consume. Farming, which produces our food, drinks, and the clothes we wear, depends significantly on natural resources, including land, soil, and water, as well as ecosystem services like pollination. It also depends on burning fossil fuels such as coal, oil, and gas to generate the energy that powers machinery, feed factories, processing plants, transportation and the use of many products and services. Even services like finance, extension, animal health care and telecommunications that do not produce physical products rely on infrastructure, technology and energy that are built and powered using natural resources.

Resource use and environmental impact can be reduced through the application of practices and technologies that minimize the input of finite resources (e.g. phosphate rock, fossil fuel and land), encourage the use of regenerative ones (e.g. wind and solar energy), prevent leakage of natural resources from the food system (e.g. of N and P) and stimulate recycling of inevitable resource losses in a way that adds the highest value to the food system.

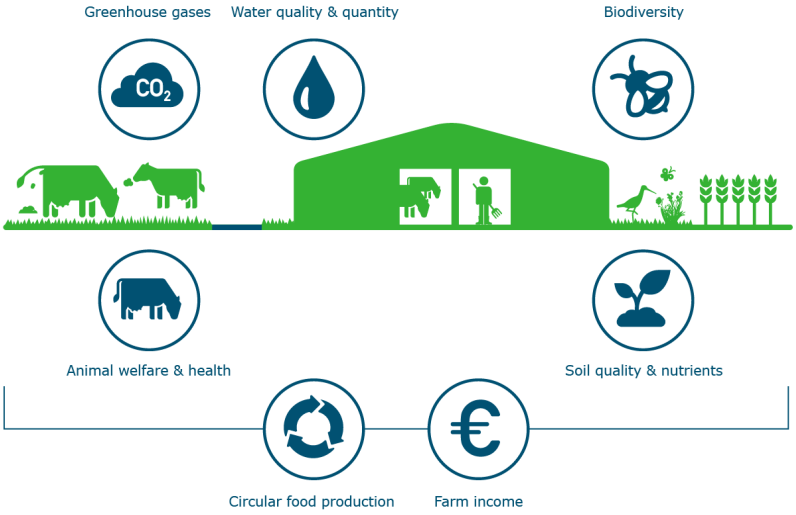


Figure 14: Sustainable livestock's seven points
Source: Marantelou, 2021

Indicators for resource use and environmental impact

a. Nutrient balance (F-R-N) (D-B-AP)

How is the balance between inputs (feeds/fertilizers) and outputs (manure/products) of nitrogen, phosphorus and potassium in the farming system? (N - P - K)

The nutrient balance is defined as the difference between the nutrient inputs entering a farming system (mainly livestock manure and fertilizers) and the nutrient outputs leaving the system. Nutrient balances provide information about environmental pressures. A nutrient deficit (negative value) indicates declining soil fertility. A nutrient surplus (positive data) indicates a risk of polluting soil, water, and air. Inputs of nutrients are necessary in farming systems as they are critical in maintaining and raising crop and forage productivity. However, a build-up of surplus nutrients in excess of immediate crop and forage needs can lead to nutrient losses, representing not only a possible cause of economic inefficiency in nutrient use by farmers, but also a source of potential harm to the environment, through water pollution or air pollution, notably ammonia or greenhouse

gas (GHG) emissions. This indicator is presented for the three main nutrients: nitrogen, phosphorus, and potassium (OECD, 2022).

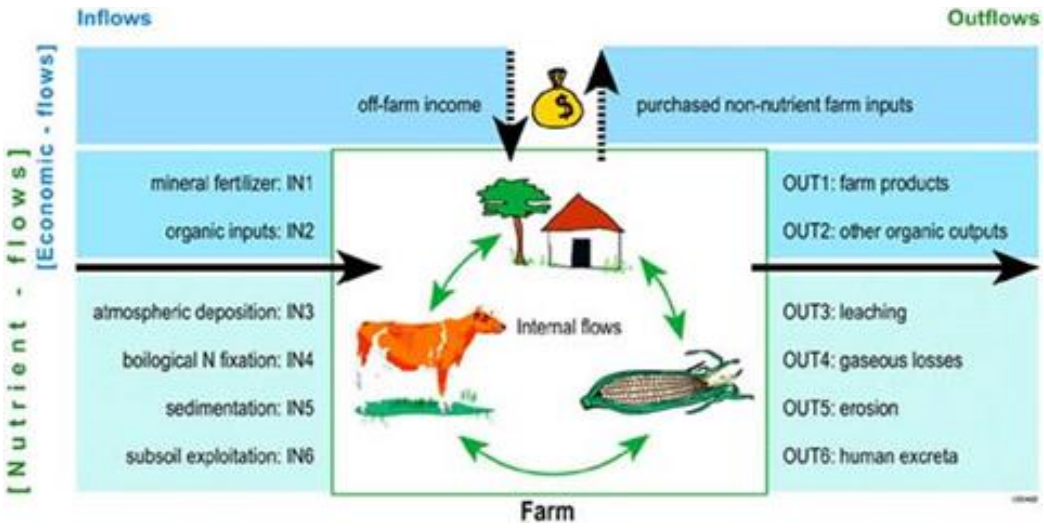


Figure 15: Nutrient flows on a farm
Source: FAO, 2003

b. Manure management (F-R) (D-B-AP)

How do manure management practices affect mineral balance or lead to pollution of the environment?

Proper manure management entails good collection, storage, treatment, transportation, and application of manure. It is important for the nutrients in manure to be preserved during these steps, to have the nutrients for plant fertilization and to prevent them from polluting the air and contaminating groundwater.

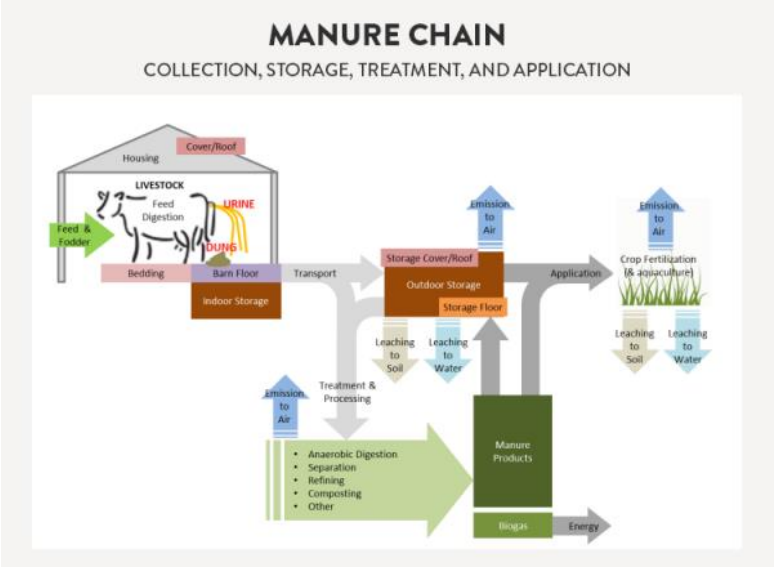


Figure 16: The manure chain Source: Teenstra et al., 2015

c. Use of agrochemicals (F-R-N) (D-B)

What are the usage levels of agrochemicals, fossil energy and fossil water?

Agrochemicals: A chemical, such as a fertilizer, hormone, fungicide, insecticide, or soil treatment that improves the production of crops.
Fossil energy: A fossil fuel is a hydrocarbon-containing material formed underground from the remains of dead plants and animals that humans extract and burn to release energy for use. The main fossil fuels are coal, petroleum, and natural gas.
Fossil water: an ancient body of water that has been contained in some undisturbed space, typically groundwater in an aquifer, for millennia.

d. Renewable energy use (F-R-N) (D-B)

To what extent does the energy come from renewable resources (solar, biogas, etc.)?

Renewable energy comes from sources that the earth can naturally replenish, such as crops and biomatter. Sustainable energy comes from sources that do not need to be replenished because they can never be depleted, such as sunlight and wind energy.

e. Conflict over use of land for grazing (F-R-N) (D-B-AP)

How frequent is the occurrence of conflict over the use of rangeland in your territory?

Conflict over use of land for grazing are disagreements and disputes over access to grazing land. These conflicts often emerge because people have different uses for resources such as forests, water, pastures, and land, or want to manage them in different ways. Disagreements also arise when these interests and needs are incompatible, or when the priorities of some user groups are not considered in policies, programmes, and projects. Such conflicts of interest are an inevitable feature of all societies. Acknowledging that conflict is a common feature of any resource use system is a prerequisite for sustainable management that is participatory and equitable.

f. Greenhouse gas emissions (R-N) (D-B-AP)

According to FAO estimates (Annex 1), what is the GHG emission in kg CO_2eq. per kg fat and protein corrected milk (FPCM) for dairy and in kg CO_2eq. per kg carcass weight for beef (national level)?

The release of GHG into the atmosphere is an externality of dairy and beef production. The global dairy and beef sectors have made a commitment to taking action to reduce the GHG emissions associated with dairy production (carbon, methane, and nitrous oxide) in a way that is scientifically sound, socially responsible, and economically viable. Two main strategies can be applied regarding reduction of GHG at the national level: (i) reduction of total GHG emissions (absolute emissions) by reducing the intensity of production (lower production of dairy and beef products), and (ii) reduction of GHG emissions per unit of product (emissions intensity) by improving the production system using more environmentally friendly approaches. As total GHG reduction might be misleading, the focus needs to be on reduction of emissions per unit of product.

5. Animal care

Improving animal care is often seen as a pathway to sustainable production, social acceptance of farming or as evidence of reduced environmental impact.

According to the American Veterinary Medical Association, animal welfare means how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well-nourished, safe, and able to express innate behaviour; and not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling, and humane slaughter. Animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry and humane treatment. The need to ensure acceptable welfare outcomes for those animals contributing to the dairy industry is widely accepted by the industry and the international community (e.g., through OIE guidelines on animal welfare). There is no common definition of animal welfare, but the "five freedoms" form a widely accepted set of principles or targets.

Indicators for animal care

a. Animal health (F-R-N) (D-B-AP)

How is animal health affected by health care and husbandry practices?

Animal health has a direct influence on final product quality and, in the case of zoonotic diseases, on the safety of milk/meat/eggs for human consumption. Maintaining good animal health is important for the economic viability of farms and to deliver product for a wide range of processing applications that are safe for human consumption.

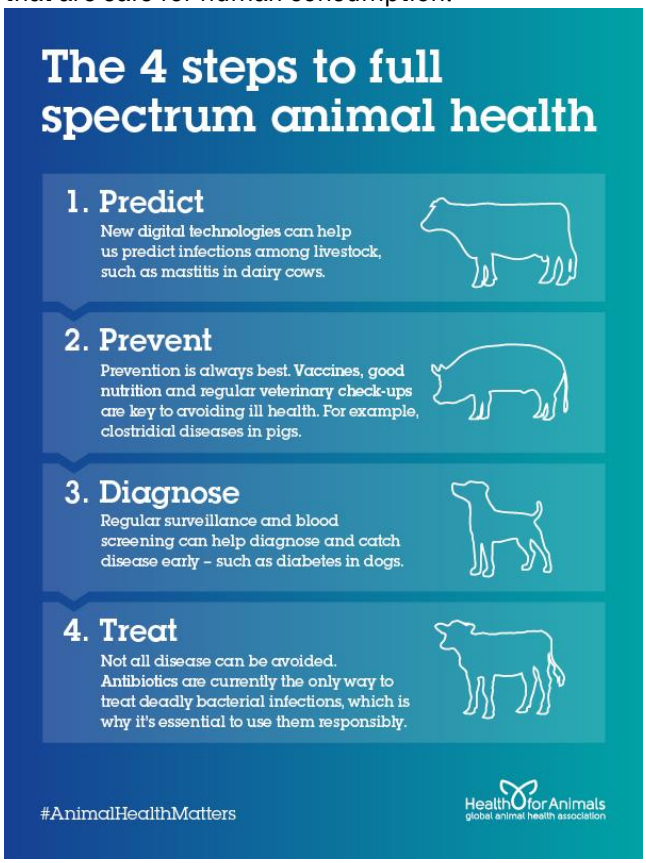


Fig 17 Steps to animal Health

Source: Health4Animals

b. Animal welfare (five freedoms) (F-R) (D-B-AP)

How does animal comfort rate according to the Five Freedoms principle (health, feed & water, animal comfort, distress, and ability to perform their natural behaviour)?

Table 1: The five freedoms
Source: FAWC, 2004

1. Freedom from hunger and thirst	access to fresh water and diet to maintain full health and vigour
2. Freedom from discomfort	provision of an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease	prevention or rapid diagnosis and treatment
4. Freedom to express normal behaviour	provision of sufficient space, proper facilities and company of the animal's own kind
5. Freedom from fear and distress	ensuring conditions and management which prevents mental suffering

Animal welfare is the minimizing of stress in the animal's environment in order to maximize productive capability. Stress to the animal robs its of potential production and health that we have gained through breeding programmes and better nutrition.
An animal should be eating, drinking, lying down, making milk, or being milked. These activities are in accordance with the five freedoms shown in the table.

6. Impact on human health and nutrition

7.

The health of animals, plants, people, and the environment are connected (One Health), which means that it takes control of zoonotic diseases and safe animal products to contribute to nutrition security.

Consumption of adequate amounts of food-safe animal products aids in nutrition security. Zoonotic diseases may threaten human health. One Health is an integrated approach, which recognizes the fundamental relationship and interconnections between the health of animals, people, plants, and the environment. It ensures that specialists in multiple sectors work together to tackle all health threats. Dairy production and consumption affect human health and nutrition in several ways.

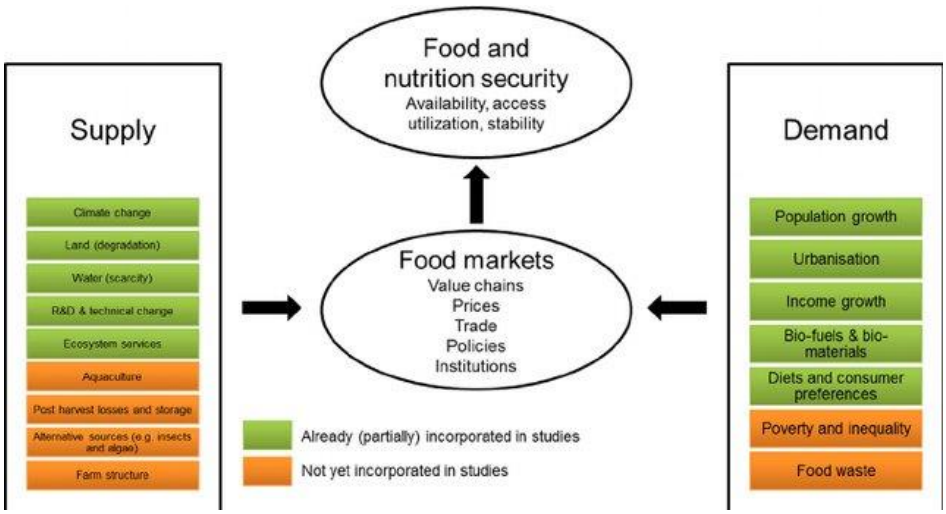


Figure 17: Aspects of supply and demand that have been studied for their impact on food markets and on food and nutrition security
Source: van Dijk and Meijerink, 2014

Indicators for human health and nutrition

a. Food and nutrition security (R-N) (D)

How high is dairy consumption by small children (under 2)? This is a key indicator for food and nutrition security for all individuals. Look at website www.dhsprogram.com to find the appropriate level for your country.

Food and nutrition security is achieved when adequate food (quantity, quality, safety, sociocultural acceptability) is available and accessible to, and satisfactorily used and utilized by, all individuals at all times, to live a healthy and active life (UNICEF, 2008). The higher quality protein and essential nutrients found in dairy foods are of increasing value for food security goals that hope to ensure nutritional quality. This provides the worldwide dairy community with a unique role in supporting global food and nutrition security.

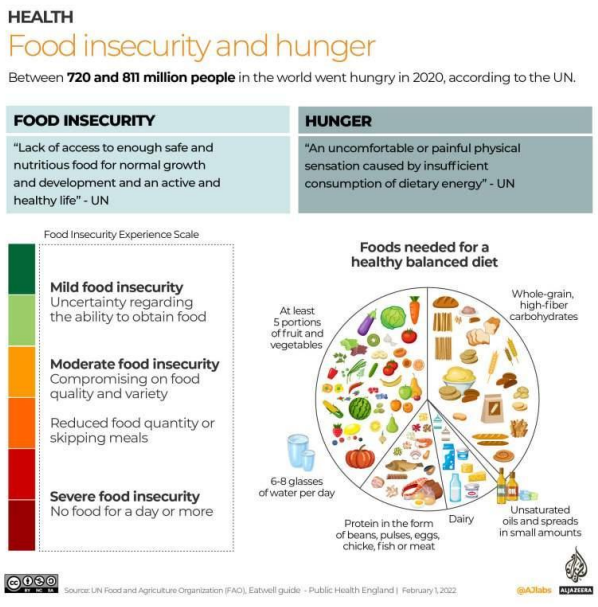
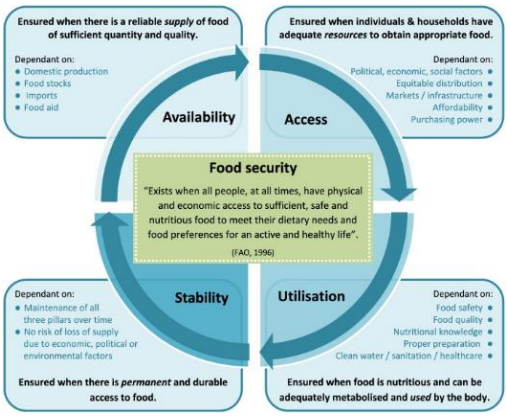


Figure 18: Definitions of food insecurity and hunger
Source: UN and FAO, 2002

b. Food availability for the household (F) (AP)

What is the state of food availability for the household over the past 3 months?



Household food security can be defined as a household having assured sets of entitlements from food production, cash income, reserves of food or assets and/or government assistance programmes such that in times of need they will be able to maintain sufficient nutritional intake for physical well-being. According to FAO, household is food insecure when it lacks regular access to enough safe and nutritious food for normal growth and development, and for an active and healthy life. This may be due to unavailability of food and/or lack of resources to obtain food. Food insecurity can be experienced at various levels of severity.

c. Animal protein intake in daily ration (F-R-N) (B-AP)

What is the animal protein intake in the daily ration of individual in the household compared to the recommended level by WHO?

The WHO and FAO define a safe minimum level of protein intake of 0.83 g/kg of a person's weight per day of both animal-based and plant-based food to meet the requirements of 97.5 % of the healthy adult population (WHO, 2007).

d. Food safety (R-N) (D-B)

What proportion of marketed animal products meets national/CODEX food safety standards?

Food safety means assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (Codex Alimentarius). This means that the animal product should be free from biological, physical, and chemical contaminants. Biological contaminants include disease-causing microbes like listeria, salmonella, staphylococcus, etc. Physical contaminants include foreign material like soil, hair, manure, etc. Chemical contaminants include residues from washing detergents and adulterants like hydrogen peroxide, urea, etc.

Figure 20: Threats to food safety
Source: Technology Networks, 2019

7. Livelihood opportunities and working conditions in the sector

What opportunities does the sector offer to individuals to maintain their living conditions? How attractive is working in the sector?

Sustainability of the livestock industry depends on access to a pool of labour for farms and on the support of local communities. Acceptable working conditions are part of the social contract between the industry and these communities. The conditions need to include payment for work undertaken as well as the ability of the worker to balance their commitments to work and their commitments to family and community. This means consideration of working hours, employee safety and potential for people to fulfil their aspirations within their working lives.

Indicators for livelihood opportunities and working conditions in the sector

a. Average age of livestock farmers (R-N) (D-B)

What is the average age of livestock farmers? High average age indicates that farming is not attractive to young people.

Explain reasons why young people do not take this up.

b. Youth employment opportunities in the sector (R-N) (D-B-AP)

What are job opportunities for youth in livestock farming or the value chain?

Can the children of farmers continue in farming or in the chain, or do they need to find jobs in other farm activities (agriculture/forestry) or migrate to the cities to find jobs in other sectors? Are job opportunities along the chain attractive enough to youths? Does the sector offer possibilities for innovations which could attract the young generation?

Fig 21: Empowering Youth
Source: Youth of 18 (https://youthof18.home.blog/)

c. Gender balance in the activities (F-R-N) (D-B-AP)

To what extent do women benefit from the activities (labour, decision power, income, access to training, membership in farmer organizations)?

To what extent do women benefit from these, and to what extent do men and women equally share in implementing and benefiting from them?

Fig 22: Gender balance.
Source: https://inomics.com/blog/the-gender-ratio-in-economics-in-2022-1531225.

d. Social status of the sector (F-R) (D-B)

Farm or cluster level: How high is the social acceptability of this type of farming activity as compared to other types of farming (working conditions, working hours, income/salary levels etc.)?

Do people generally consider livestock farming an attractive business? Are livestock farmers seen to have good social status compared with other farmers?

e. Recognition of cultural heritage by the society (F-R-N) (AP)

How is pastoral tradition and culture generally perceived by the people in your community and the society at large?

The term 'cultural heritage' has changed content considerably in recent decades, partially owing to the instruments developed by UNESCO. Cultural heritage does not end at monuments and collections of objects. It also includes traditions or living expressions inherited from the ancestors and passed on to the descendants; such as oral traditions, performing arts, social practices, rituals, festive events, knowledge, and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts. Cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals that create, maintain and transmit it; without their recognition, nobody else can decide for them that a given expression or practice is their heritage.

8. Voice in decision-making at different levels

"Voice" means the opportunity to express opinions in decision-making processes from community to national level.

The right for farmers to participate in decision-making processes at different levels is a well-established right within the human rights framework.

Figure 19: DSAT Uganda workshop (Ndambi, 2022)

Indicators for voice in decision-making at different levels

a. Membership of farmers organizations (R-N) (D-B-AP)

What proportion of farmers are member of a cooperative (or other type of farmers organization)?

It is believed that farmers in cooperatives or producer organisations have a better chance to lobby for better prices and could have access to services that might not be available to farmers that are non-members. They could for example have access to more information and jointly purchase inputs at wholesale price.

b. Influence of farmers in shaping the formal market (R-N) (D-B)

How well can farmers participate in the formal market?

Farmers' participation opportunities in the market are evidenced by market share of cooperatives and other types of farmer organizations.

c. Influence of farmers and value chain actors in national livestock policy and regulatory processes (R-N) (D-B-AP)

Do all chain actors have adequate influence on regulations?

9. Enabling environment and institutional support

Are government agencies (or government-supported institutions) effectively supporting livestock sector activities through regulations, financing, marketing, training, etc.?

The desired transformation in agricultural production systems requires supportive policies, institutions, and financing, which together create an enabling environment. A supportive and enabling environment is essential for agricultural innovation. Enabling environments include both formal and informal elements:

- Formal elements include public policies, governance structures, regulatory frameworks, investment programmes.
- Informal elements include the social, cultural, and economic norms, rules and practices that influence how innovation actors, networks, and systems function (IFPRI, 2019).

Indicators for enabling environment and institutional support

a. Institutions' ability to deal with major shocks (F-R-N) (D-B-AP)

Are institutions able to deal with disease outbreaks, market shocks, security issues and food safety issues?

This includes public and private institutions.

b. Budget invested in research, extension and education benefiting the sector (R-N) (D-B-AP)

To what extent do investments in research, extension, and education lead to innovations in chain configuration, service provision and good farming practices?

c. Level playing field (F-R-N) (D-B)

Are regulations (and their enforcement) adequate and fair, so that companies and cooperatives get equal chances to produce, market and export the products?

It is recommended that all players in the various parts of the chain have equal opportunity to implement the required quality control measures. The opportunities for some actors to get a free ride on quality control should be minimized.

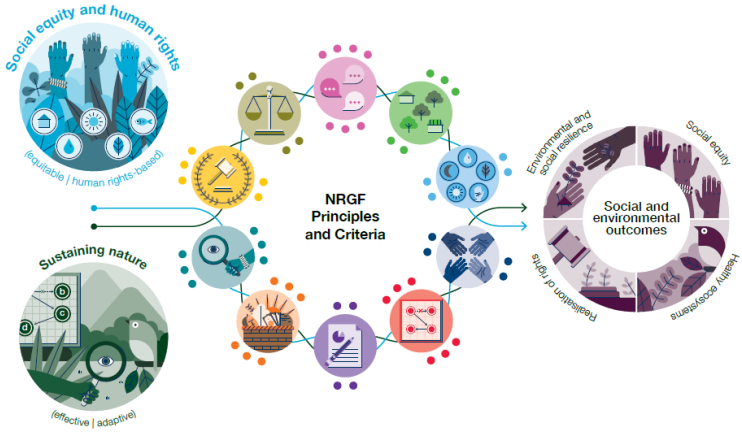
d. Essential infrastructure services (F-R-N) (D-B-AP)

Are the infrastructural services in place that are essential for livestock production, marketing, processing, and retailing, such as roads, telephone, water supply, power stations, milk processing plants, etc.?

e. Natural resource governance (R-N) (D-B-AP)

What is the present state of natural resource governance in your communities? It refers to norms, rules, institutions, structures, and processes that determine access, use and control over natural resources including how the local communities participate in and benefit from the management of the natural resources.

Natural resource governance can be defined as the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens — including women, men, youth, Indigenous peoples, and local communities — participate in and benefit from the management of natural resources (Graham et al., 2003).



10. Access to production factors

Farmers need access to sufficient land, labour, and capital for their livestock farming activities.

The factors of production are the resources that are the building blocks of the economy – they are what people use to produce goods and services. Economists divide the factors of production into different categories. The key ones are land, labour, and capital. Sometimes, entrepreneurship or the state of technological progress are included as well.

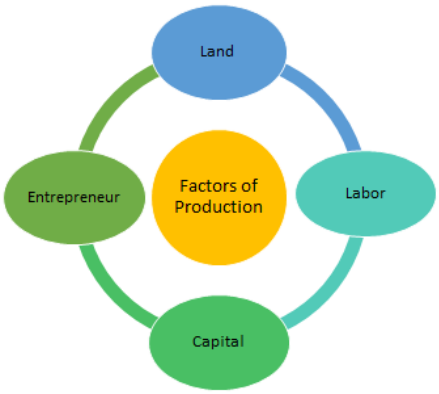


Figure 20: The factors of production
Source: toppr.com

Indicators for access to production factors

a. Access to credit (F-R-N) (D-B-AP)

How easy it is for farmers and livestock chain actors to get credit?

Are farmers and chain actors able to meet the credit access conditions (e.g., collateral security)? Credit is the ability of farmers to obtain goods or services before payment, based on an agreement to pay later or using borrowed money.

b. Financial autonomy (debt level) (F-R) (D-B-AP)

How high are farmer debt levels, and how concerned are farmers about their ability to repay debt?

Do farmers always have to borrow money to make farm level investments? Can they rely on own savings for future investments? Are they having debts because recent technologies demand new investments, increasing farm loans?

c. Availability and skill level of household and hired labour (F-R-N) (D-B-AP)

What is the availability and skill level of household and hired labour in terms of their farming activities?

Depending on the level of intensification and size of farms, different skill levels are required in farm management. Very large and specialized farms might require a veterinarian or an Animal Science graduate. In some smaller and less intensive farms, only unskilled workers are hired. With time, workers develop working skills from experience and can handle tasks better. It is important to consider both training skills and work experience of family members working in the farm and hired labour too.

d. Indigenous knowledge level (including livestock tradition) of the household (F-R-N) (AP)

What is the level of indigenous knowledge (including livestock tradition) of members of your household or community and how is it transmitted?

Local and indigenous knowledge refers to the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous people, local knowledge informs decision-making about fundamental aspects of day-to-day life (UNESCO).

f. Access to land (F-R-N) (D-B-AP)

How easy or difficult is access to land for livestock related activities (consider land use rights, land tenure system, land scarcity)?

The possibilities for farmers and companies to buy or rent land according to their needs.

e. Feed availability (F-R-N) (D-B)

How is the availability of sufficient quantities of feed of appropriate quality, from own production or from the market?

This should consider both protein and roughage feed sources. Seasonality in feed availability might affect animals if feed conservation is not practiced.

11. Livestock mobility

Livestock mobility can be seen as a cumulative measure of the movements of livestock within a given period across open rangelands.
Livestock mobility, so defined, can be associated with the mobility of all or just some of the people managing and depending on mobile livestock (Adriansen 2008). Livestock mobility is a long-term adaptation to climate change and variability especially in dryland ecologies, and it is important to livelihood strategies of the agro-pastoralists. The movement of cattle, sheep, and goats by the agro-pastoralists may be seasonal in search of pasture and water and may be over a short or long distance. Livestock mobility is one of the critical factors of sustainability of agro-pastoral systems (Turner et al., 2014).

Indicators for livestock mobility

a. Distance that livestock can move freely to access pasture and water (R-N) (AP)

How far do the livestock have to move to access pasture and water within and outside the community?

b. Security along the grazing routes (R-N) (AP)

What is the level of security along the grazing routes within and outside your territory where your animals normally graze?

c. Seasonal fees/levies to access grazing areas (R-N) (AP)

Do you have to pay fees/levies to access grazing areas? If yes, what is the level of fees/levies you normally pay?

d. Access to crop residues for grazing (R-N) (AP)

Are the crop residues normally accessible for the animals to graze or are they removed from the crop field?

12. Access to markets and services

Access to markets and services refers to the capability of individuals or companies to participate in certain markets in terms of buying or selling.

Better access to domestic and international markets allows small producers to reliably sell more produce, with better quality and at higher prices. This in turn encourages farmers to invest in their own businesses and increase the quantity, quality, and diversity of the goods they produce.

Indicators for access to markets

a. Access to output markets (F-R-N) (D-B-AP)

How accessible are markets for animal products for farmers - in terms of infrastructure, number and dependability of collectors, unexpected price fluctuations, etc.?

b. Access to farm inputs (F-R-N) (D-B-AP)

How is access to inputs (feed, drugs, agro-chemicals, equipment) - both in terms of quantity and quality?

Access to high-quality agricultural inputs is key to increasing productivity.

c. Access to farm services (F-R-N) (D-B-AP)

How is access to services (artificial insemination, veterinarian, extension) - both in terms of quantity and quality?

Access is needed to machinery services, training, credit, veterinary services, and marketing assistance for agricultural outputs.

13. Profitability

How does livestock contribute to the economy of farm household/region/country?

Livestock production cannot be sustainable unless it is economically viable. Economic viability means that the real returns from farming operations, relative to the farm's asset value and labour inputs, are competitive with other small business, career, or investment alternatives. Economic viability requires returns for livestock production and other co-products to cover expenses, taxes, and debt servicing and to provide a reasonable return for the farm owners and operators.

Indicators for profitability

a. Farmers gross income (F-R-N) (D-B-AP)

How attractive are income / wages from livestock compared to other agricultural activities?

b. Acceptable and competitive animal products prices (F-R-N) (D-B)

What is the ratio between the retail price and the farmgate price and between the farmgate price and the world market price? How fair are these ratios?

How do the animal products produced compete locally in price and quality, compared to products coming from abroad or neighbouring regions?

14. Self-sufficiency in production

Does the country/cluster produce enough animal products to be self-sufficient?

According to FAO, "The concept of food self-sufficiency is generally taken to mean the extent to which a country can satisfy its food needs from its own domestic production" (FAO, 1999). This basic definition can apply at the level of individuals, countries, or regions.

Indicators for self-sufficiency in production

a. Contribution to demand for animal products (R-N) (D-B)

What is the contribution to cluster/national demand for animal products (as applicable) (within and across years)?

b. Meeting future demand (R-N) (D-B-AP)

Can livestock production match expect demand growth, e.g., as a result of income increase?

15. Competition for land use between human food and animal feed

"Feed–food competition" generally refers to the tensions and trade-offs between two alternative uses for edible crops: direct consumption by humans versus feeding livestock.

Livestock directly contribute to food supply by providing essential nutrients to humans, and indirectly support cultivation of food crops by providing manure and draft power. Livestock, however, also consume food that is edible for humans, and they graze on land suitable for cultivation of food crops. As we face the challenge of feeding 9.7 billion people by 2050, preferably without expanding the amount of agricultural land, there is an increasing need to avoid competition for land between animals and humans.

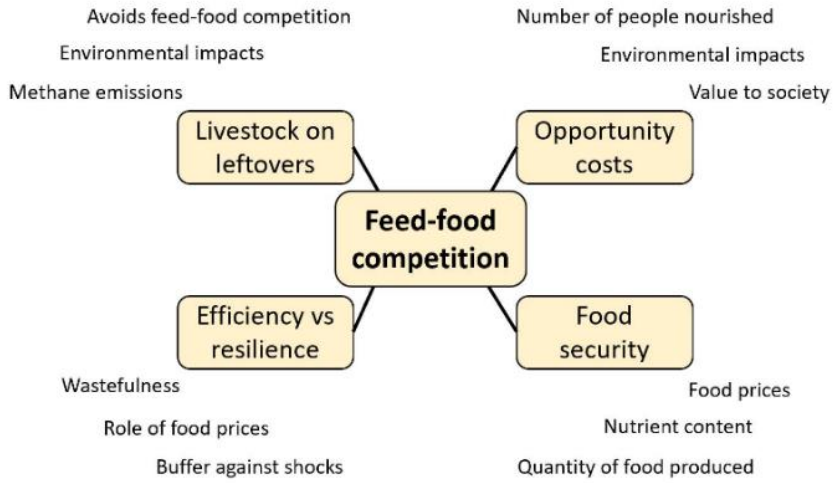


Figure 21: Some key issues related to the feed–food competition debate
Source: Breewood and Garnett, 2020

Indicators for competition for land use between human food and animal feed

a. Proportion of land used for forage or grazing that could be used for food crops (F-R-N) (D-B-AP)

What is the proportion of land used for forage production or grazing for livestock that could be used for food crops?

Land use for forage production, including for off-farm feed production, can have an impact on natural landscapes and habitats. Livestock has a role to play, alongside other land users, in contributing to the protection of high value conservation areas.

b. Proportion of cropping encroachment into grazing land (R-N) (D-B-AP)

What is the proportion of cropping encroachment into the grazing land in the past 20 years?

The increasing trends towards growing off season vegetables as cash crops is exacerbating the marginalization of centuries-old pastoral practices due to reducing grazing space and limited fodder production (Mishra, 2001; Magchi et al., 2002). This massive crop expansion in many pastoral

regions in turn led to loss the carrying capacity of ecological niches to sustain long-standing ecosystem services and pastoral livelihood (Brown, 2002). The expansion of cropping area into grazing space is often driven by demographic pressure to produce more food to feed a rapidly growing population in low- and middle-income countries.

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Annex 1: GHG emissions – Indicator baseline establishment

Source: Gerber et al., 2013
The baseline for the global dairy sector is to be set at the FAO (2013) figure of 2.8 kg CO_2eq per kg of fat and protein corrected milk (FPCM). Considering regional variations, this figure has a global range of 1.6–9.0 kg CO_2eq per kg of FPCM and has a variance of +/- 26% (to a 95% confidence level). The figure covers milk production from both dairy cows and buffalo.
The baseline for the global beef production is around 46 kg CO_2eq per kg beef which varies from 14 kg CO_2eq kg beef to 76 kg CO_2eq per kg beef.

The baseline figure includes emissions associated with fertilizer and external feed production and all farm processes, processing at farm and transportation. For dairy, meat production from related culled and fattening activities is not included in this figure.

This figure for milk is equivalent to approximately 2.8% of global anthropogenic GHG emissions. If we were to include the emissions from meat production from dairy-related culled and fattened animals, the figure would be approximately 4%.
There is difference between the emissions intensity between beef produced from specialized beef and dairy systems. this difference is because beef and dairy are the products of dairy system while beef is the only product of specialized beef system. There the total GHG emissions of dairy system is allocated to both beef and milk. Therefore, less emissions are allocated to the produced beef from a dairy system

Global context
In line with data from FAO reports, the table below provides a regional baseline for GHG emissions from dairy and beef production and processing. This will enable future aggregate reporting to be completed with valuable context.

Table 2: Regional baseline for greenhouse gas emissions

Region	kg CO_2eq per kg of FPCM	kg CO_2eq per kg Beef
North America	1.69	29
Latin America and the Caribbean (LAC)	3.84	72
Western Europe	1.65	18
Eastern Europe	1.60	14
Russian Federation	1.90	15
Near East and North Africa	4.25	27
Sub-Saharan Africa (SSA)	9.01	71
South Asia	5.40	76
East and South-East Asia	2.51	47
Oceania	1.60	25
World	**2.80**	**46**

Source: *Gerber et al., 2013*

Rationale

The baseline figure is an important starting point to establish how the dairy and beef sector is progressing to reduce emissions relating to the production, processing and sale of dairy and beef products. Over time, with the established three-yearly reporting commitments for Dairy Sustainability Framework (DSF) members, the trend line will provide a more robust and relevant indication of the sector's progress.

In establishing the baseline, the DSF initially sought from its members (who together account for more than 30% of global milk production) reference studies that they had already undertaken or were utilizing at a local level.

DSF members submitted approximately 20 different studies. Through a review process, it became apparent (which is often the case) that with the wide variation of methodologies applied and assumptions made, aggregation is not a feasible route to establishing a meaningful baseline. External expertise was sought at this point to test this hypothesis, which was confirmed.

In 2010, the FAO undertook a study titled 'Greenhouse gas emissions from the dairy sector' a lifecycle assessment and subsequently (Opio et al. 2013) published as *Greenhouse gas emissions from ruminant supply chains*. The results are summarized in Gerber et al. 2013 *Tackling climate change through livestock*. Both studies included not only an expert team of authors, but also involved expert advisory groups to ensure approaches to methodology and data were as robust as possible.

Since publication, both studies have been peer reviewed and been cited in many other studies as the reference for the dairy sector's contributions to anthropogenic GHG emissions.

It has been agreed, in the knowledge that there are no other global studies that have undergone the same levels of rigour for both study design and peer review, to utilize the outputs of these reports as the basis for the DSF baseline for GHG emissions.

In adopting these figures, the dairy sector acknowledges that there are some slight differences in methodology from what the FAO has applied and how the dairy sector will be quantifying its progress. As mentioned above, though the FAO figure is important as an initial benchmark, over time and as a trend line is established, and the range of results reported at specific reporting intervals appreciated, the initial baseline will become less important.

The international dairy sector has developed a "common methodology" (which has also now been adopted as the methodology for the FAO Livestock Environmental Assessment and Performance Partnership), which will be utilized by the sector in evaluating its performance. The International Dairy Federation is responsible for monitoring scientific developments and ensuring the methodology remains current. It is this methodology that DSF members will be applying when establishing their GHG performance, thus allowing aggregation to take place.

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