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Water footprint assessment of livestock: a need of hour

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Abstract

The world is facing increasing water scarcity and agriculture is one of the biggest consumers of water. Livestock farming is a major contributor to the overall water consumption in the agricultural sector and can have a significant impact on the environment, including water pollution and degradation of aquatic ecosystems. By assessing the water footprint of livestock animals, we can better understand the environmental impact of livestock farming and identify ways to reduce water use and improve water efficiency.Assessing the water footprint of livestock animals can help identify areas where water use can be optimized, leading to more efficient resource allocation. This can result in cost savings for farmers and better use of resources for society as a whole.

Keywords: Efficient, Footprint, Livestock, Resource

Introduction

The most important nutrient is water, which makes up between 60 and 70 percent of the bodies of farm animals.Water is necessary for digestion, metabolism of energy and nutrients, maintenance of proper ion, fluid, and thermal balance, so dairy cattle must drink enough water daily to suit their needs (Houpt, 1984; Murphy, 1992).Livestock animals use water for various purposes such as drinking, feed production and sanitation. The type of animal, its activity, feed consumption and diet, the quality of the available water, the temperature of the water, and the ambient temperature all have an impact on the overall need for water in livestock production. (Lardy *et al*., 2008).In general, the largest proportion of water used by livestock animals is for drinking. The amount of water required for drinking can vary significantly depending on the species of animal, with cattle requiring more water than sheep or goats.Livestock animals also require water for feed production, as crops such as corn and soybeans require large amounts of water to grow. The amount of water used for feed production is known as virtual water, and it can account for a significant portion of the total water footprint of livestock products.Finally, livestock animals require water for sanitation purposes, such as cleaning barns and equipment. The amount of water required for sanitation can vary depending on the type of animal and the farming system used.

Water footprint

The entire amount of freshwater required to generate the goods and services that an individual, corporation or nation consumes is known as the water footprint of that person, entity, or country (Hoekstra and Chapagain, 2007). Water depleted in the production area and water embedded in other inputs used in the production process makeup the overall water depletion in the production process. These are also often denoted as 'internal' and 'external' water footprints (Hoekstra, 2003). The latter i.e. external water footprint is also called 'virtual water'(Allan, 1998).

The water footprint of domestic animals refers to the amount of water required to produce the feed and other inputs needed to raise these animals for consumption.Different types of domestic animals have different water footprints depending on factors such as their size, diet, and the conditions in which they are raised. For instance:

- Beef cattle have a large water footprint because they require a lot of feed and water to grow. According to some estimates, it can take up to 15,500 liters of water to produce one kilogram of beef.

- Dairy cows also have a high water footprint because they require large amounts of water and feed to produce milk. The water footprint of a liter of milk can vary widely depending on factors such as the cow's diet, the climate, and the type of feed used, but it can be as high as 1000 liters.
- Pigs have a smaller water footprint than cattle or dairy cows, but still require a significant amount of water and feed to raise. It can take up to 6,000 liters of water to produce one kilogram of pork.
- Poultry, such as chickens and turkeys, have relatively small water footprints because they require less water and feed than larger animals. It can take around 3,500 liters of water to produce one kilogram of chicken meat.

Types of water footprint

The water footprint of livestock can also be classified into three types based on the type of water used in the production process:

- Green Water Footprint of Livestock: The green water footprint of livestock refers to the amount of rainwater used to grow the crops and vegetation that are used as feed for the animals. This includes the water used to irrigate the pastures and fields where the feed is grown.
- Blue Water Footprint of Livestock: The blue water footprint of livestock refers to the amount of surface and groundwater used for drinking, washing, and other purposes related to animal husbandry, as well as the water used to process and transport the animal products.
- Grey Water Footprint of Livestock: The grey water footprint of livestock refers to the amount of water required to dilute the pollutants generated by the animals, including manure and other waste products, in order to maintain water quality.

The terms blue and green water flows and resources were familiarized by Falkenmark (1995). The dilution water requirement, which represents the grey component of water use, has been acknowledged Chapagain*et al.* (2006).The water footprint of livestock can vary depending on the type of animal, the feed consumed, and the management practices used in the production process. In general, beef cattle have the largest water footprint, followed by dairy cows, pigs, and poultry. However, there are many factors that can affect the water footprint of livestock, including the local climate, soil conditions, and water availability, as well as the specific production practices used by individual farmers and ranchers.

Factors affecting water footprint of livestock animals

- Type of Animal: Different types of livestock animals have different water requirements and use water in different ways. For example, cattle and sheep have higher water requirements than poultry and pigs.
- Feed: The water footprint of feed is a major factor in the water footprint of livestock animals. Crops grown for animal feed can be water-intensive, and the amount of water required to grow a particular crop can vary depending on factors such as soil type, climate, and irrigation practices.
- Location: The amount and quality of water available for livestock production can vary widely depending on the location. Some areas have abundant water resources, while others experience water scarcity and drought conditions.
- Production system: Livestock industries consume 8% of the global water supply, with most of that water being used for intensive, feed-based production (Schlink*et al.,* 2010). Since concentrate has a larger water footprint than roughage, it reduces the overall water footprint of animals maintained in industrial systems while enhancing grazing system rearing. The contribution of blue water footprint to the total water footprint per ton of milk produced ranged from 2% to 19% across all production systems (Irfan and Mondal, 2016). Blue and grey water footprint is generally higher in industrial system as compared to mixed and grazing due to larger component of concentrate feed for animals and high use of fertilizers and agro-chemicals.
- Processing and Transportation: The processing and transportation of animal products also have a water footprint. For example, the water used in meat processing, cleaning and sanitation, and transportation can contribute to the overall water footprint of the livestock industry.
- Climate Change: Climate change can affect water availability and quality, which can in turn affect the water footprint of livestock animals. Changes in temperature and precipitation patterns can lead to increased water scarcity, and extreme weather events such as floods and droughts can affect water quality and availability.

Methods to assess water footprint of livestock animals

There are several methods used to assess the water footprint of livestock animals:

- Life Cycle Assessment (LCA): LCA is a comprehensive method that assesses the environmental impact of a product or process throughout its entire life cycle.
- It is employed to assess a product's environmental sustainability.(Dewulf and Van Langenhove, 2006).This includes the water footprint of livestock animals, from the production of feed to the processing and transport of animal products.
- Water Footprint Assessment (WFA): WFA is a method that assesses the water use and impacts associated with a specific product or activity. In the case of livestock animals, WFA can be used to estimate the blue, green, and grey water footprints associated with the production of animal products.
- Water Accounting and Productivity (WA&P): WA&P is a method that assesses the water use and productivity of agricultural systems. It can be used to identify areas where water use is inefficient, and to develop strategies to reduce the water footprint of livestock production.
- Field Water Balance (FWB): FWB is a method that assesses the water balance of a specific field or agricultural system. It can be used to estimate the green water footprint of livestock animals by quantifying the amount of rainfall that is used to grow the feed consumed by the animals.
- Water Scarcity Assessment (WSA): WSA is a method that assesses the availability and quality of water resources in a specific region. It can be used to identify areas where water scarcity is a problem, and to develop strategies to reduce the water footprint of livestock production.

These methods can be used individually or in combination to provide a comprehensive assessment of the water footprint of livestock animals. The choice of method depends on the specific objectives of the assessment, the available data and resources, and the context of the production system being studied.

Reducing water footprint of livestock animals:

- Improve feed efficiency: Improving feed efficiency can reduce the amount of water required to produce a given amount of animal protein. This can be achieved by using more nutritious feed, improving feed management practices, and reducing feed waste.
- Implement water-efficient technologies: Water-efficient technologies such as drip irrigation and precision livestock farming can help reduce the water footprint of livestock production.
- Reduce water use in processing and transportation: Reducing water use in processing and transportation can reduce the water footprint of animal products. This can be achieved by improving water reuse and recycling, optimizing cleaning and sanitation practices, and using more efficient transportation methods.
- Implement better waste management practices: Improved waste management practices can reduce the water footprint of livestock production by minimizing water use and reducing pollution of water resources. This can be achieved through practices such as composting, anaerobic digestion, and manure separation.
- Use alternative protein sources: Using alternative protein sources such as insects and algae can reduce the water footprint of animal protein production, as these sources require less water and land than traditional feed crops.
- Implement conservation measures: Implementing conservation measures such as rainwater harvesting, soil conservation, and water storage can help improve water availability for livestock production.
- Reduce meat consumption: Reducing meat consumption can reduce the overall demand for animal protein, which can in turn reduce the water footprint of livestock production.

Overall, reducing the water footprint of livestock production requires a holistic approach that considers the entire production system, from feed production to processing and transportation. The most effective strategies will depend on the specific context and objectives of the production system, as well as local environmental and socioeconomic factors.

Conclusion

The water footprint of livestock production is a critical factor that needs to be considered in agriculture, as it has significant environmental, economic, and social impacts. The excessive use of water for livestock production contributes to water scarcity and pollution, soil degradation, and deforestation, which can lead to long-term environmental damage. Moreover, the water footprint of livestock can impact the economic sustainability of farming communities, especially in regions with limited water resources. Consumers are also becoming more aware of the impact of their food choices, and understanding the water footprint of livestock production can help them make

informed decisions that contribute to a more sustainable future. Therefore, it is crucial to reduce the water footprint of livestock production through sustainable farming practices, efficient water management, and consumer awareness.

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