Sattva Knowledge Institute SKI primer

MITIGATING CLIMATE CHANGE WITH LIVESTOCK MANAGEMENT

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Acknowledgements

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EXECUTIVE SUMMARY

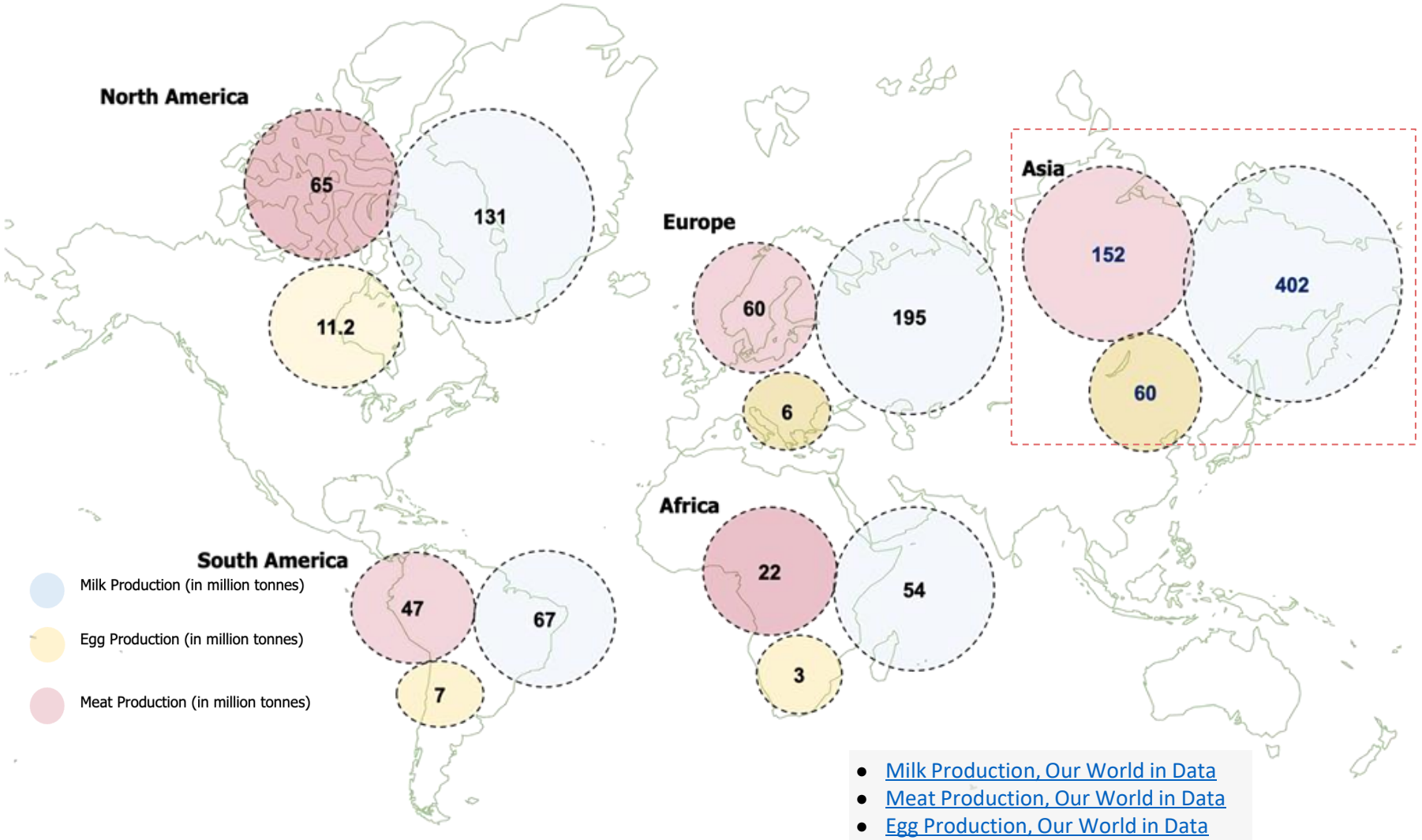
Livestock activities play a crucial role, contributing **40% to the global agricultural GDP** and holding immense significance in bolstering farmers' income, facilitating global exports, and ensuring food security. They also contribute to improved nutrition by serving as a reliable source of essential nutrients and protein. However, despite their substantial contribution to economic growth, livestock activities have been identified as a **major source of negative climate impact,** accounting for nearly **50% of greenhouse gas emissions in agriculture.** These emissions, encompassing CO_2, methane, and N_2O, arise primarily from feed production, enteric fermentation, and inadequate manure management.

Farmers in the livestock sector face challenges in adopting climate-smart practices due to factors such as expensive feed and forage, limited technology for alternative feed sources, and insufficient awareness about efficient grazing systems. Additionally, the absence of monitoring systems for animal health management and lack of public services for disease management has contributed to yearly emissions from the livestock sector. To address this, it is imperative to focus on enhancing practices related to **animal feeding, breeding, and manure processing** to reduce agricultural emissions.

Scientific evidence and technological models can serve as catalysts in promoting sustainable practices across these three pivotal aspects. Financial incentives for farmers are also crucial in driving the adoption of climate-smart practices. Key initiatives include optimizing the use of existing feed resources through processing, preservation, and supplementation within value chains. Furthermore, implementing data evaluation and monitoring systems for animal health and disease management are essential components. A sustained and concerted effort towards climate mitigation from the government, research organisations and agribusinesses engaged in sourcing livestock products from farms directly, is required to develop climate financing models that support small farmers in embracing climate-smart practices.

LIVESTOCK: AN ECONOMIC OVERVIEW

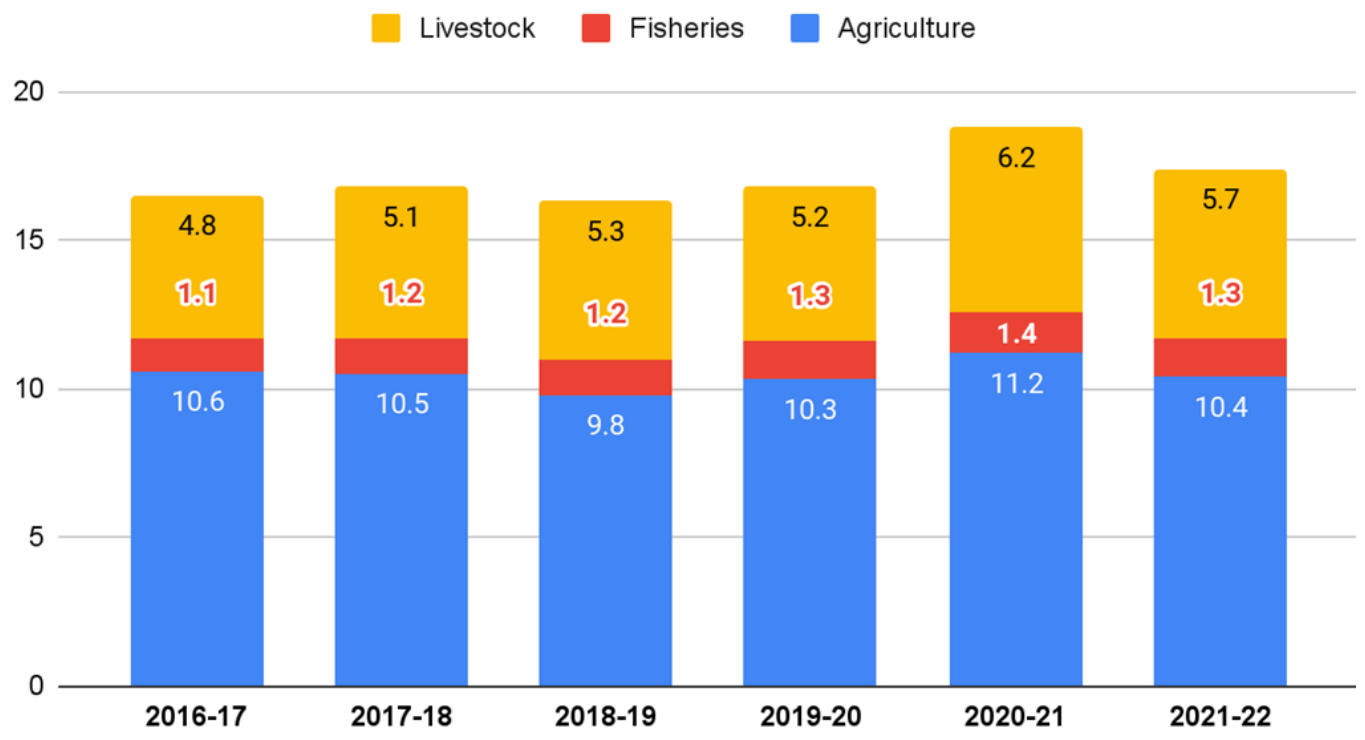
Livestock accounts for 40% of global agricultural GDP, with Asia leading in meat, dairy and poultry production



- Milk Production, Our World in Data
- Meat Production, Our World in Data
- Egg Production, Our World in Data

In India, Livestock contributes almost 25% to the total agricultural GDP.

% Share of Agri, Fisheries and Livestock in Total GDP of Agri [4]



Total GDP of Agriculture in 2021-22:
INR 1,960,706 Crores

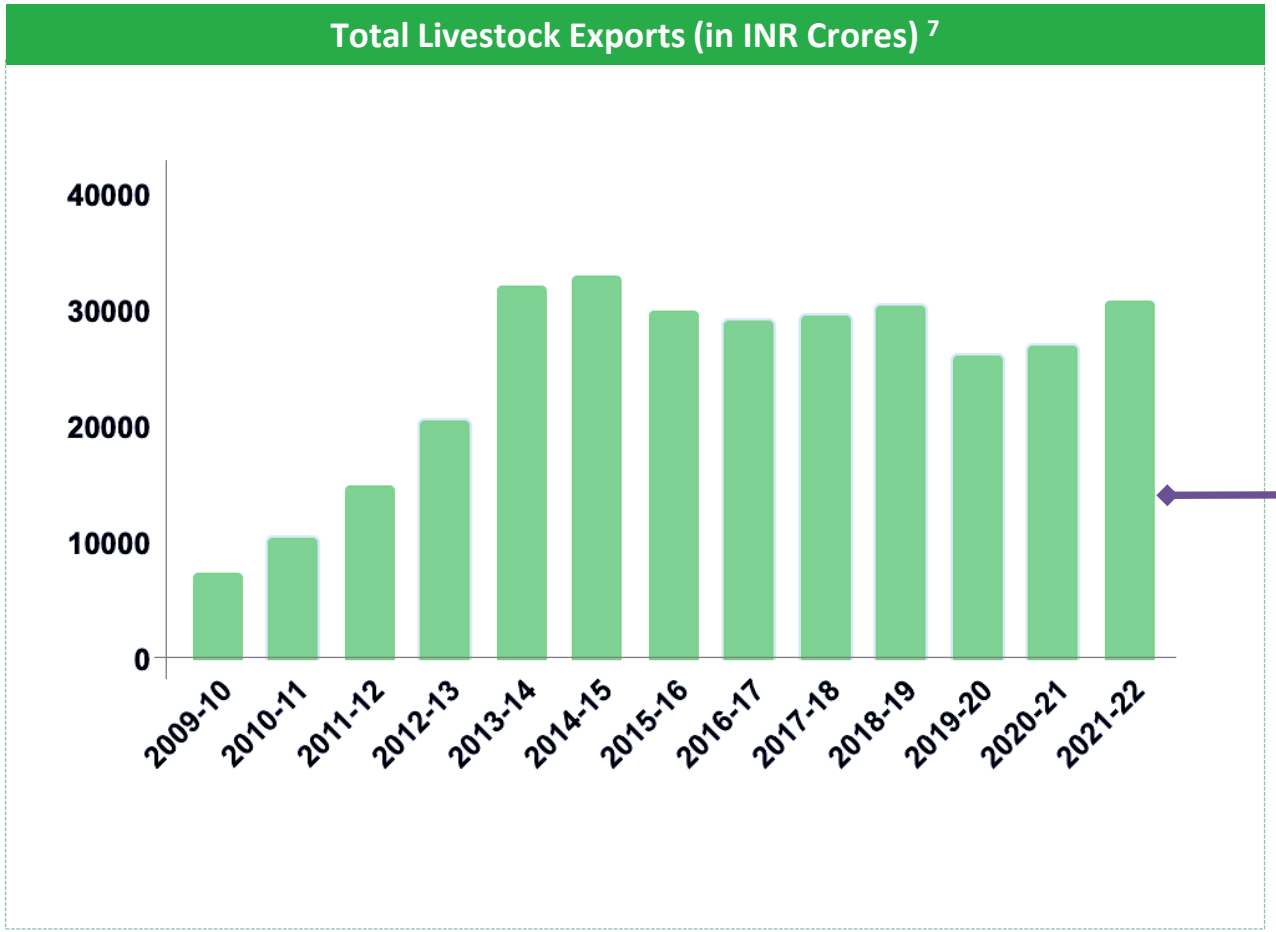
Total Livestock GDP in 2021-22:
INR 6,54,937 Crores

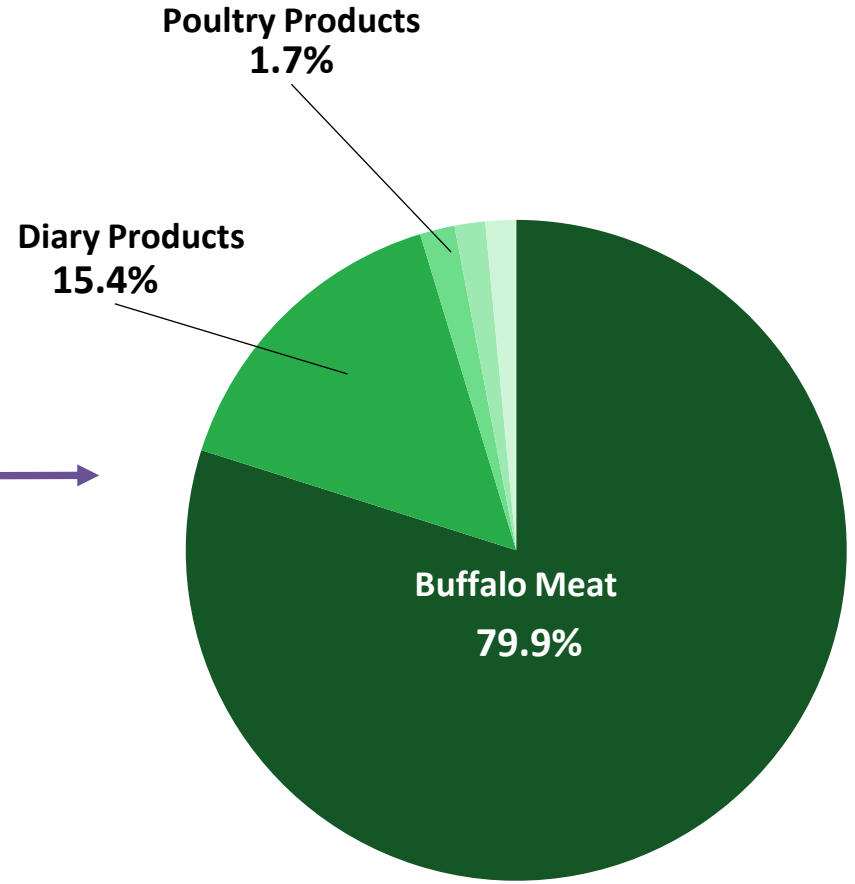
Key Insights

CAGR of Gross Value Added added by the livestock sector stands at second-highest in agriculture and allied activities at 7.93%.[5]

With the current progress rate, the livestock market is expected to reach INR 1,68,300 crores by 2028.[6]

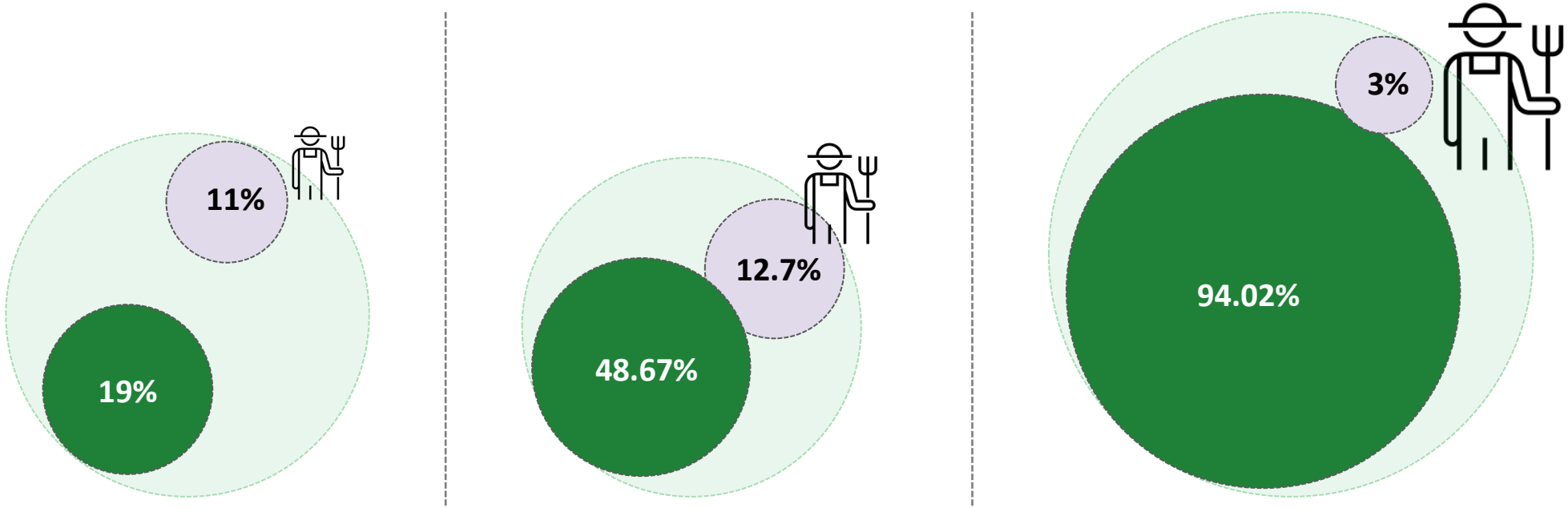
India's export of livestock products has increased 3x in the last decade, but slowed down in post 2019, with buffalo meat being the most exported product.





Livestock activities contribute 10% more to small farmers' monthly earnings than their contribution to monthly earning of large farmers.

Total monthly average income of a farmer: Rs. 34,657 [8]

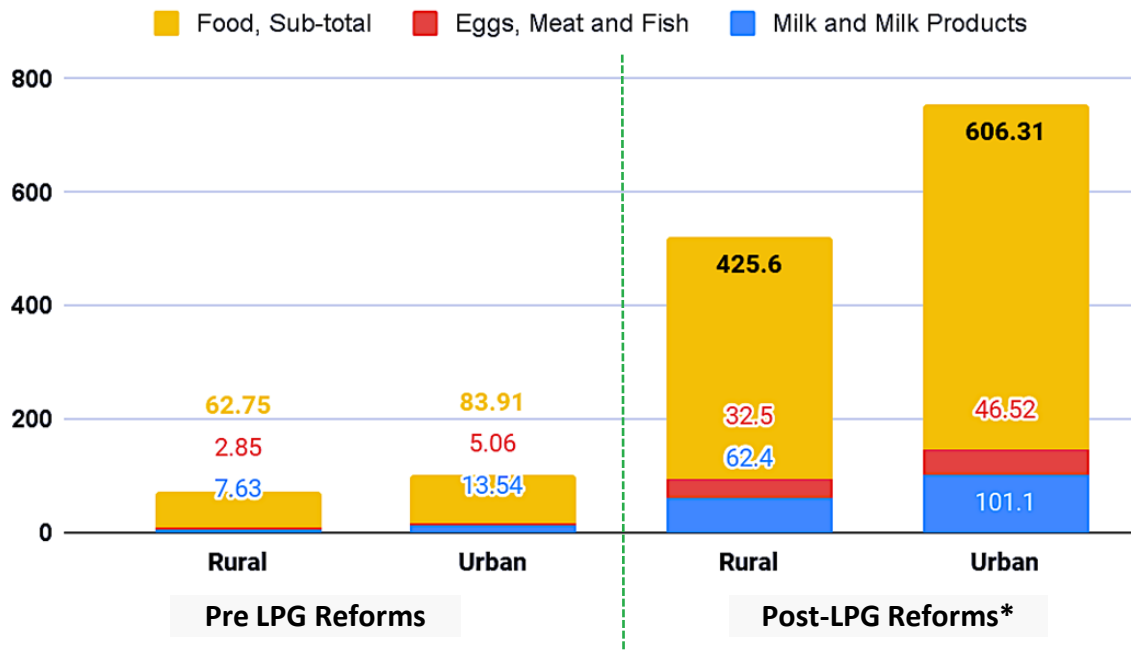


Average income of Marginal Farmer: Rs. 8,193	Average income of Small farmer: Rs. 11,069	Average income of Large farmer: Rs. 84,711

Income from Agriculture Income from Livestock Rearing

Indians spend approximately 15% of their monthly income on milk and meat-based products, while the Chinese spent 16 times as much.

Per Capita Monthly Expenditure (in INR) : Pre- and Post- 1991 Reforms

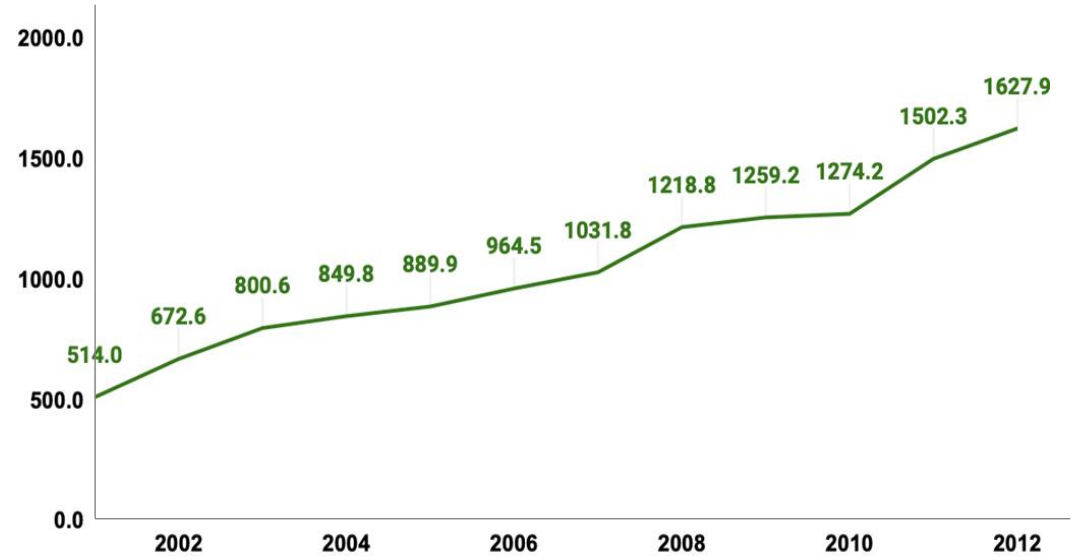


*Post LPG Reforms includes data averaged out for 1990-91, 2000-01 and 2011-12.

The MONTHLY EXPENDITURE on milk and milk products in URBAN INDIA is ₹100, while the same in RURAL INDIA'S is ₹62.5.[9]

Volatility in income levels (of rural and urban India) and growth in GDP levels, has led to increased spending on meat and dairy products.

Per Capita Consumption Expenditure for Milk and Milk Products in China (in INR)[10]

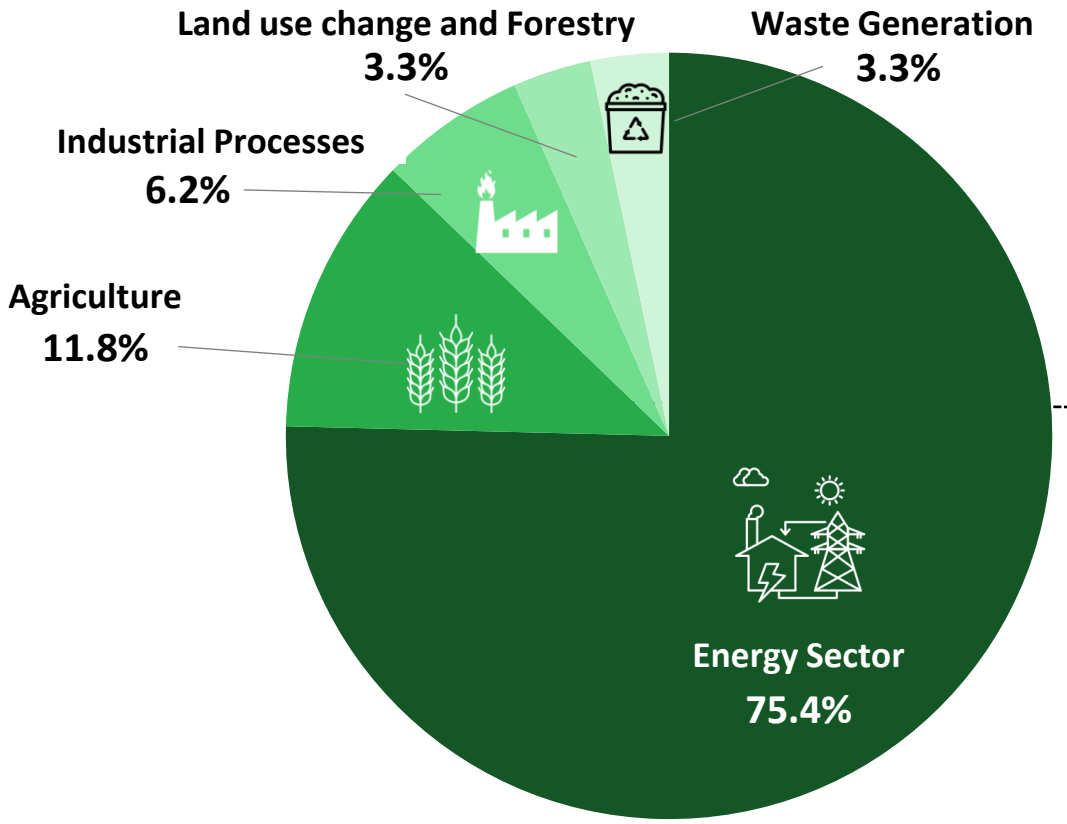


LIVESTOCK AND CLIMATE CHANGE

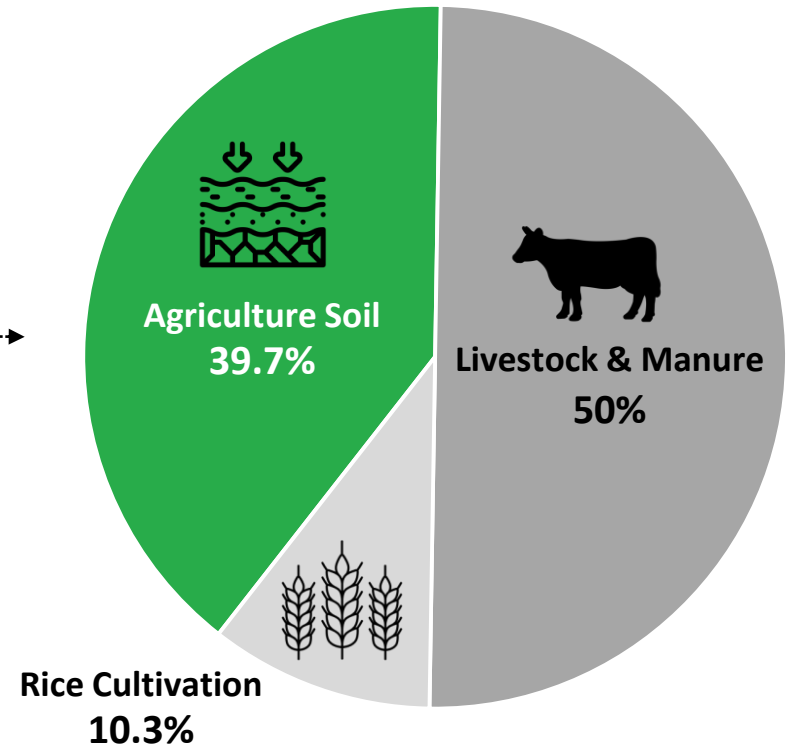
Agriculture is the second largest contributor to GHG emissions globally; 50% of GHG emissions in agriculture come from livestock and manure.

World Greenhouse Gas Emissions in 2019 (Industry-wise) [11]

Total: 49.8 Gt Co2 eq.



World Agriculture GHG Emissions in 2019 (by sector)



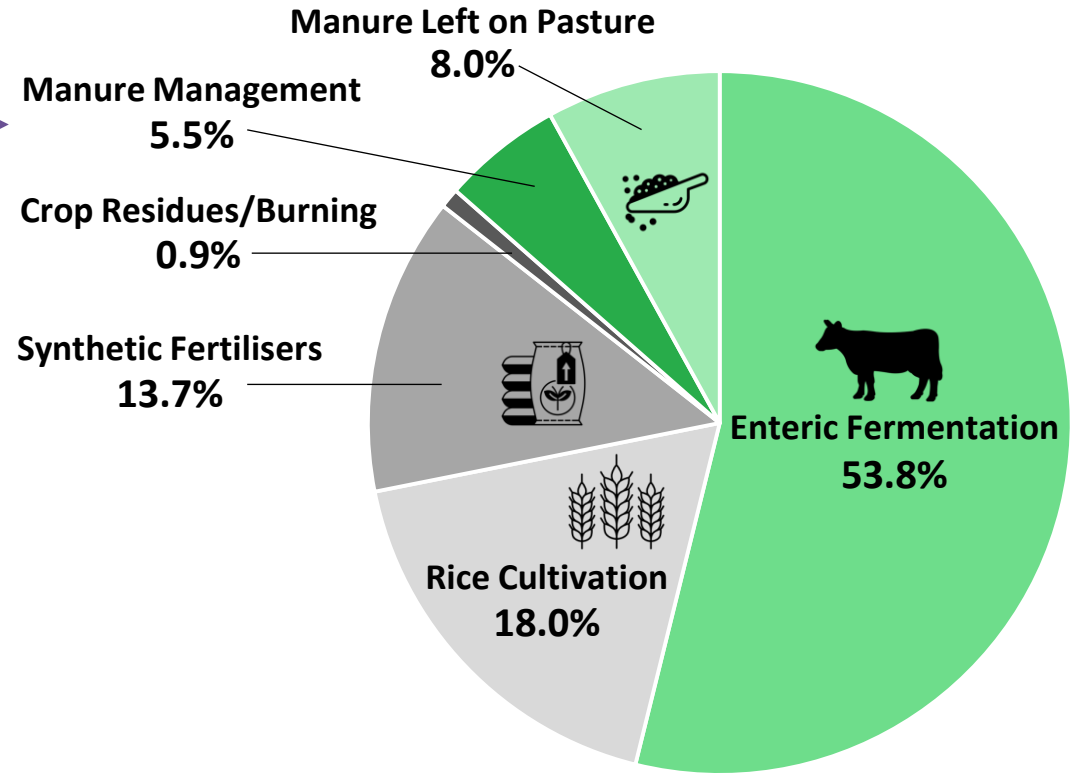
In India, agriculture is the second-largest emitter of GHG, with enteric fermentation in livestock being the leading cause.

Total GHG (2014): **3202 Mt. CO2eq**[12]

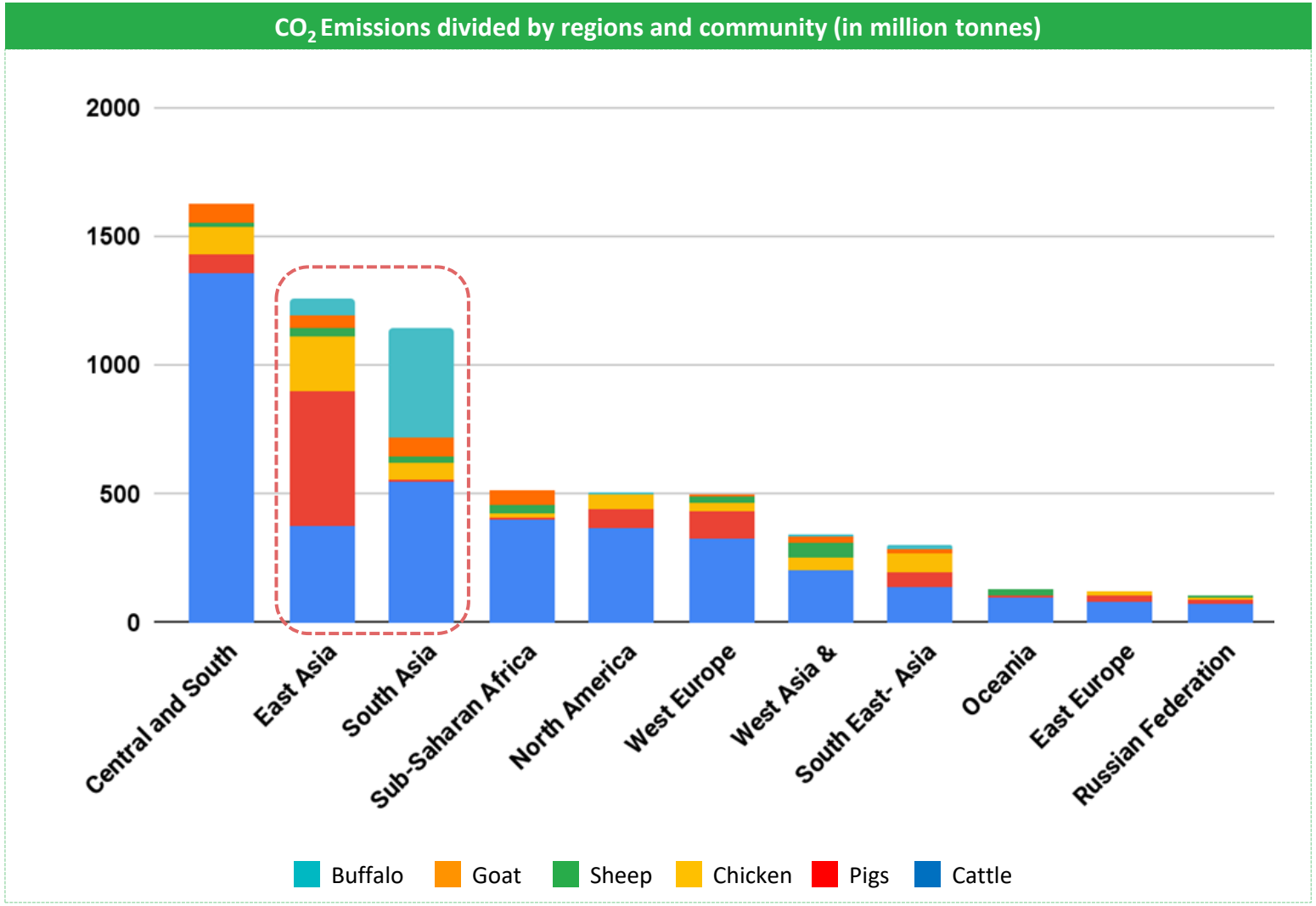
Energy Sector: Power Generation	68.7 %
Agriculture Sector	19.6 %
Industrial Processes	6 %
Land-use Change and Forestry	3.8 %
Waste Generation	1.9 %

Agriculture Breakdown of Emissions (2014-2020)

Total Average (2014-2020) GHG from Agriculture[13]
720,309 Mt. CO2eq



Asia is the top emitter of GHGs in livestock, with cattle producing the most emissions.



Latin America and the Caribbean have the highest level of emissions (almost 1.3 gigatonnes CO2eq), driven by production of cattle. [14]

East and South Asia stand are the second and third largest emitters by cattle, with buffalo being top emitter by species.

Feed production, Manure Management, and Transportation and Processing are key drivers of GHG emissions from the livestock sector.

Increasing share of GHG Emissions

Sources of GHG Emissions	Processes that lead to GHG Emissions	
 **Feed and Fodder Production**	• Application of Synthetic Manure • Crop Residue Management	• Direct Deposition of Manure by Scavenging Animals • Energy use in feed transport
 **Livestock Production**	• Enteric Fermentation • Direct and Indirect N_2O from manure management	• Direct on-farm energy use for livestock (cooling, heat, ventilation etc.)
 **Manure Management**	• Transport, storage and processing of manure	
 **Transportation and Processing of Livestock***	• Transport of live animals and products to slaughter and processing facilities	• Transport of processed products to retail point • Refrigeration during processing of meat

**Note: Emissions are recorded in retail and agrifood systems*

Feed Production leads to almost 50% GHG emissions in the livestock sector globally.

Classification by Emissions

Emissions from feed production, processing and transport.

Carbon dioxide emissions originate from expansion of feed crops and pasture into natural habitats.

Nitrous oxide emissions: Emitted due to the use of fertilisers (organic or synthetic) for feed production, direct deposition of manure on pastures or during the management and application of manure on crop fields.

Methane emissions from rice cultivation for the purposes of feed production.

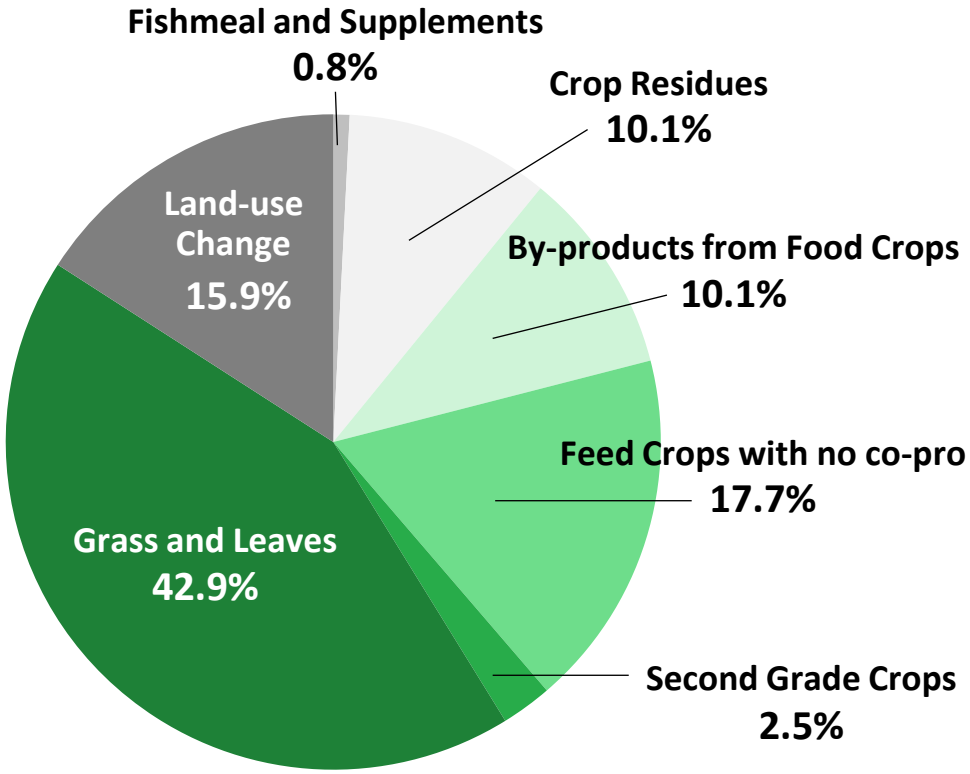
Classification by Feed Production Activities [15]

Crop Residues: Residues from feed crops, e.g. maize, stover, straw. Majorly attributed to the main product.

By-products from food crops: Include soybean, bran cakes

Feed Crops with no co-products: Crops cultivated directly, such as maize and barley.

Second Grade Crops: Include food crops that do not match quality standards for human consumption



Livestock production accounts for another 50% of GHG emissions in the livestock sector.

Classification by Emissions

Emissions from livestock production, manure management and energy consumption.

Methane emissions from enteric fermentation: Ruminant (cattle, buffalo, sheep, goat) and non-ruminant animals produce CH4 as part of their digestive processes.

Methane and N_2O emissions from manure management: Methane is released from anaerobic decomposition of organic material.
During storage and processing, nitrogen is mostly released in the form of ammonia and later transformed into N_2O.

Carbon dioxide emissions from energy consumption: From animal production unit (from heating, ventilation etc.)

Classification by Livestock Production Activities [16]

Most Polluting

Enteric Fermentation: Emissions from enteric fermentation or digestion activities cause most of the GHG emissions.

Manure Storage and Processing: Manure contains two chemical components: Organic matter that can lead to CH4 emissions and Nitrogen that leads to Nitrous Oxide.

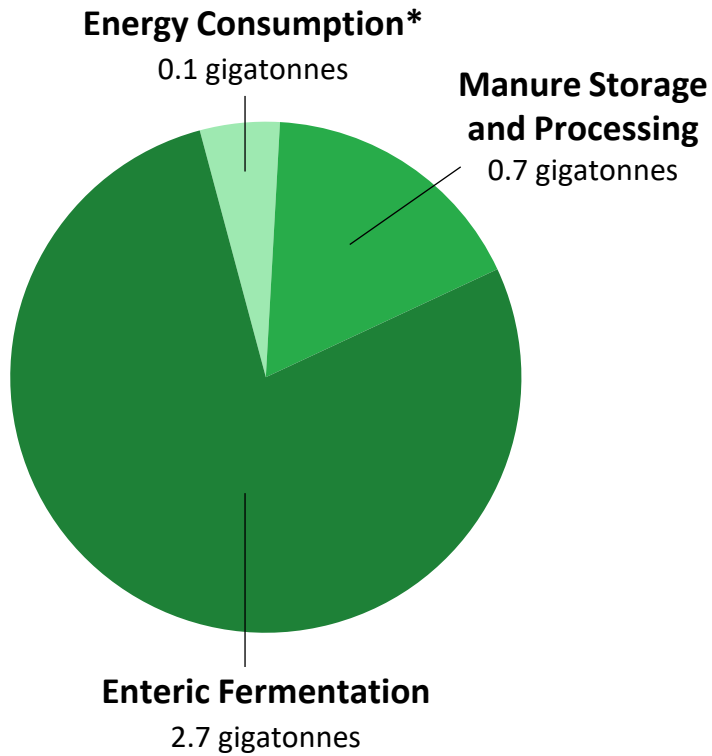
Least Polluting

Energy consumption includes

Direct emissions: Energy used in animal production unit, and

Indirect emissions: Construction of animal production units

LIVESTOCK PRODUCTION



SOLUTION PATHWAYS AND CASE STUDIES

Reducing agricultural emissions will require better practices in animal feeding, breeding and manure processing.

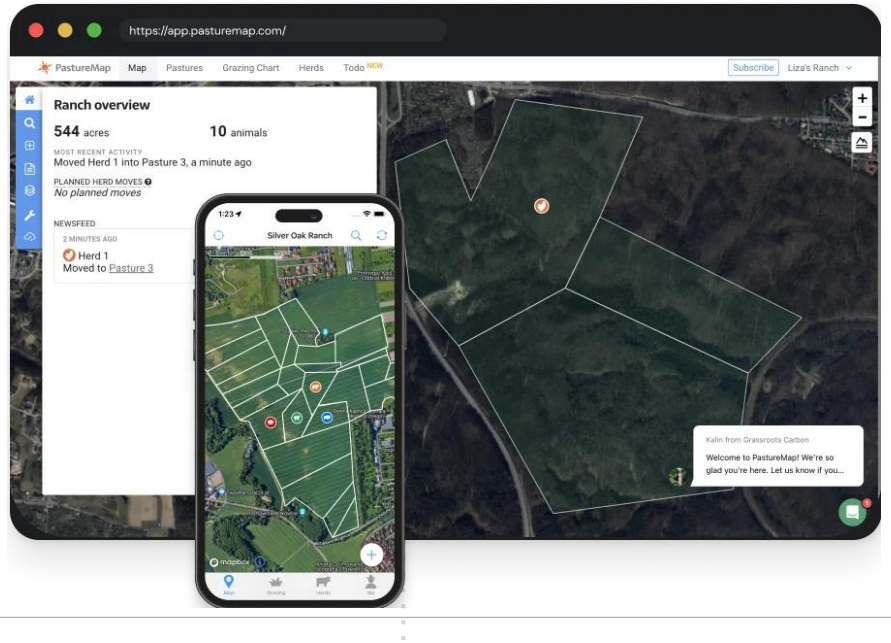
	Improving Feed Productivity	Better Animal Health Management	Manure Management
Objectives	Provides alternative feed sources, reduces disease burdens and hence reduces GHG emissions.	• Reduces disease burden among animals; • Enhances productivity in livestock products like milk, meat etc; • Improved medication and vaccination to reduce cost of livestock production	• Increases yield and hence farmers' income • Leads to lower GHG emissions • Improves soil quality and hence food security and farmer livelihoods
Impact on Emissions	Improving feed additives in beef production can reduce enteric fermentation by over 80%[17,18]	Total GHG emissions reduction from better breeding: 28.58%[19]	Reduction of CH4 emissions by 87.42% and N2O emissions by 16.97% [20]

Supporting Levers			
Technology: Improved technological practices in feed production and new livestock breeding techniques	**Finance:** Climate-smart financing based on reduced GHG emissions to incentivise livestock farmers	**Gender:** More women-led farms and SHG groups to manage livestock farming	**Research and innovation:** In breeding, better feed production to reduce disease burden and strengthen production

1 Feed Consumption

Pasture Map uses technology to promote climate-smart grazing through virtual fences.

- **PastureMap** is a startup that developed a **digital grazing management platform.**[21]
- Their uniqueness rests in their ability to provide ranchers with a **user-friendly mobile app** that utilises **GPS technology** to track **livestock movement and manage grazing.**



Key Highlights

1. Pasture Map's platform allows ranchers to create customised grazing plans, set virtual fences, and monitor livestock movement in real-time.
2. It promotes rotational grazing, ensuring that animals graze on an area for a specific period before moving to a new one. Ranchers can also record data about forage conditions, animal health, and grazing history.

Impact

- **Helps reduce overgrazing and its associated negative impacts**
- **Contribute to better soil health and reduces soil erosion**
- **Contributes to carbon sequestration, making it environment-friendly**

2 Animal Health Management

Sterile Insect Technique in Zanzibar eradicates animal disease burden, and reduces GHG emissions led by diseased livestock.

- The **Sterile Insect Technique (SIT)** programme was implemented between 1994 and 1997.[22]
- The objective of the SIT programme was to control tsetse flies and combat trypanosomosis, a deadly disease affecting both humans and livestock.
- The SIT involved mass-producing and **releasing sterilised male tsetse flies** to outcompete wild males, leading to a decline in the tsetse fly population and ultimately disease eradication.

Key Highlights

1. The SIT programme was a biotechnological tactic that integrated biological and engineering techniques to produce, on an industrial scale and then release, reproductively sterilised insects of the target pest.
2. The SIT act in an inverse density-dependent way. Sterile males became increasingly effective, with the declining pest population, in finding and mating with the remaining wild females.

Impact

Increase in cattle farmers from 31% in 1985 to 94% in 2002

Milk production nearly tripled from 1985 to 1999

30% increase in the farmers' average monthly income

3 Breeing/Animal Health Management

Bangladesh organises farmer groups to provide veterinary services, resulting in improvement of animal health.

- The **PVS (Productivity Veterinary Service)** approach, implemented through **CDVF,** focuses on optimising herd health, management practices, and milk quality to boost smallholder dairy farmers' income.[24]
- This involves organising farmers into groups, generating revenue through milk sales, and providing a package of on-farm activities to improve animal health, reproduction, nutrition, and overall productivity.

Key Highlights

1. Establishment of a Community-based Dairy Veterinary Foundation (CDVF) to deliver productivity veterinary services to smallholder dairy farmers.

Impact

Monthly milk production increased from 75 tonnes to 360 tonnes.

Number of farms receiving PVS services increased from 150 to 2935.

Farmers' income increased from $1 to $19.4 per cow per month.

4 **Livestock Production**

Nestle implemented a climate-smart farming programme to incentivise farmers for GHG reduction.

- The Climate-smart Dairy Farming Project in Switzerland aimed to reduce GHG emissions from dairy production, particularly methane from cattle, by 10% from 2014-16 to 2020.[25]
- It was a participatory bottom-up approach that incentivises farmers to implement GHG reduction measures through goal-oriented premium payments.

Key Highlights

1. A public-private partnership involving the Swiss Federal Office for Agriculture, Nestlé, and Aaremilch AG, offered farmers a range of GHG reduction measures.
2. Nestlé provided premium payments based on actual GHG reductions, motivating farmers to adopt climate-smart practices.

Impact

46 pilot farms achieved substantial GHG emissions reduction.

22 million kg of milk produced using climate-smart livestock practices

Contributed significantly to SDG 13 by combating climate change

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