METHANE EMISSION FROM LIVE STOCK AND ENVIRONMENTAL SUSTAINABILITY

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ABSTRACT:

Nature has given us an incredible amount of flora and fauna to sustain our existence on earth, with the growing requisition of anthropogenic activities, the dimension of the global economy is changing rapidly. Global warming is most concerning and therefore the serious predicaments that the world is facing today. Livestock contributes more towards the expedition of global warming as compared to human beings and vehicles. The greenhouse gas contains, mainly a mixture of harmful gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), Sulfur dioxide (SO2), water vapor, CFCs, and so on. Among these gases methane (CH4) is more harmful and responsible for creating global warming. Methane is emitted during the manufacturing and transmission of coal, natural gas, crude oil, livestock feeding habits, anthropogenic activities, agricultural practices, decaying or decomposition of organic matter in the lagoon or holding tanks, rice fields and several other ways. The ruminants (milch animals) and other non-ruminants (non milch animals) are unique because of their four-chambered digestive system mainly the rumen, reticulum, abomasums, and omasum. The rumen is the large hollow muscular organ where macrobiotic fermentation occurs; it contains the bacteria known as ruminoccous, which promotes the development of harmful gasessuch as CO2, CH4 and NO2. The negative externality which is created by livestockis a major burning issue in a current scenario, thus there is a consequential need forthe development of certain sound strategies especially to control the emission of methane from livestock. It can be only possible through adequate adaptive mitigation strategies by making changes in animal grazing habits, dietary practices,providing them vaccination or dry content in the feeding process of animal diet, etc. Then only a sustainable picture of nature and the natural environment can be presented in front of future generations.

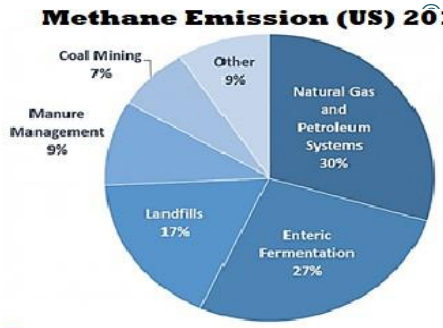
***Keywords*: - Ruminant animals, Global warming, methane emission, mitigation strategies, micro-biotic fermentation.**
JEL codes: - O1 (O3, O44), Q5 (Q52, Q53, Q54, Q56, Q57)

INTRODUCTION:

The world is experiencing per year about 4 million sq. km of ozone layer depletion(ozone layer is present in the stratosphere), which is a major challenging issue faced by the world in today's context. Various environmental protocols and agreements were signed between nations to rectify the problem of global warming such as the Montreal protocol about CFC molecules released from the earth, The Vienna convention (1985), which is about the protection of the ozone layer, Kigali convection about greenhouse gas emission, Paris agreement under COP22 of UNFCCC held in Morocco is about issues of climate change, International civil aviation organization about carbon tax emission, Kyoto protocol (1997), Rio summit, etc., all occurs to discuss the challenges of world's climate change situations, and gases responsible for it, thus to bring best mitigation strategies.

After the completion of Millennium Development Goals (MDGs- 2005), In 2016 UN SDGs were started by the UN general assembly, which intended to resolve global, social, economic, and environmental problems, with a set of 17 goals 169 targets till 2030. As per India and state Global air report (2017), there is a significant increase in inhalable fine particles of PM 2.5 since 1990. Outdoor air pollution has changed the death rate in India and at the world level because of increased greenhouse gases in recent decades.

The temperature inside the earth starts increasing and results in melting of glaciers,rise in ocean water level, severe droughts, change in climatic condition, extinct of some flora and fauna, etc. The earth gets high temperature because of the heat and the energy coming from the sun get trapped in the earth's atmosphere, and also because some of the gases come into the earth's atmosphere through natural activities or some by anthropogenic activities, which is being responsible fortapping more heat and raising the temperature and causing global warming or climate change inside the earth. The increases in the atmospheric concentrations of these gases cause the earth to warm rapidly, by trapping more of this heat and energy from sum and through greenhouse gases. This is because a single item or activity can generate multiple GHG, but to keep things simple they are grouped asa 'carbon dioxide equivalent' (the amount of carbon dioxide that would have the same climate-change impact on the earth), or (CO2e).Among the various GHGs, such as CO2, CH4, NO2, SO2, ammonia, water vapor, ozone, etc., CO2 and CH4(methane), is more harmful gases and together constituteabout 76% of global GHG emission. Carbon dioxide is concerns as major primaryGas for global climate change and remain present in atmosphere in the orm of carboncycle (as the circulation of carbon molecules from ocean, land, flora, fauna, and through various anthropogenic activities etc.). Methane is one of the supreme as in GHG family, it is basically

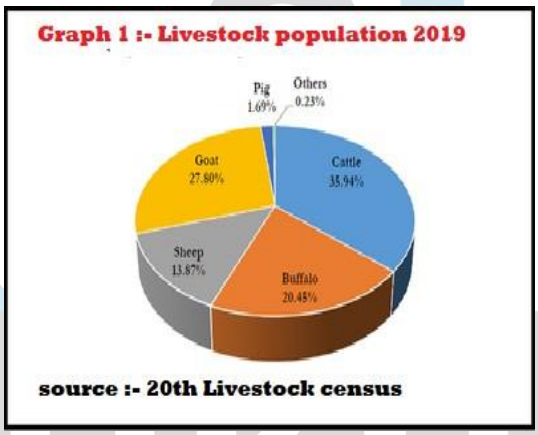


Source:-

U.S. Environmental Protection Agency (2021). Inventory of U.S Greenhouse Gas Emissions and Sinks: 1990-2019

colorless and Odorless with chemical formula (CH4). As per the 2019, US inventory data of methane emission; most of the methane is emitted in the atmospherethrough natural gas, land fill & wasteManagement activities, animal manure is stored in lagoons and holding tanks gas, and also through the enteric fermentation (animal feeding and digestive activities).

Since the Neolithic revolution, domestication of the livestock was driven by the need for food, nutrition, and energy to the people, with an advancement economic and social life. It touches the many aspects of society such as agriculture, health, nutrition, environment, business, culture, and many more. As a result, humans can get benefitted as a buffer to crop failure and monetary loss. However the future of the animal husbandry sector facing uncertainties and give rise to serious questions and concerns regarding its performance and sustainability, uncertainties revolve around different factors such as- livestock population, ruminants dietary habits, growth, control from disease, sustainability of the environment, and income generation, technological backwardness, financial constraints, and inadequate veterinary services, etc., are few issues that hinder the progress in this sector. Indian animal husbandry sector is one of the largest sectors, sharing 11.6 % of livestock, in the whole world. Agriculture is the prime sector of rural economy and rural employment. The transition from farm to more productive non-farm sectors isconsidered to be an important source of economic growth and helps in transformation in rural sectors and the total economy.



Animal husbandry is an integral part of the agriculture sector in the whole world. Domesticating a wide range of animal species like yaks, camels, and Mithun apart from cattle, sheep and goats are unique characteristics of animal husbandry in India. As per the 20th livestock census (2019) conducted the Department of animalhusbandry and dairying which published data regarding various species of livestock population such as cattle, buffalo, Mithun, yak, sheep, goats, pigs, horse, donkeys, camels pigs, etc., which are possessed by households, household- enterprises and non-household entities. The main outcomes of the 20th Livestockcensus can be summarized as India is playing avital role in the animal husbandry sector and having a total livestock population is 535.78 billion, and showing an increase of 4.6% over livestock census 2012. Periodically, in India livestock census conducted and it usually covers the headcounts of domesticated animalsboth in urban and rural areas. The total Bovine population* (Cattle, Buffalo, Mithun, and Yak) is 302.79 million, which shows a hike of 1.0%, similarly, the percentage of cattle's increasesby 0.8% (192.42million), and female cattle population by 18.0% as compared to 2012 livestock census. There is a 6% decline in indigenous (both descript and nondescript) cattle population.

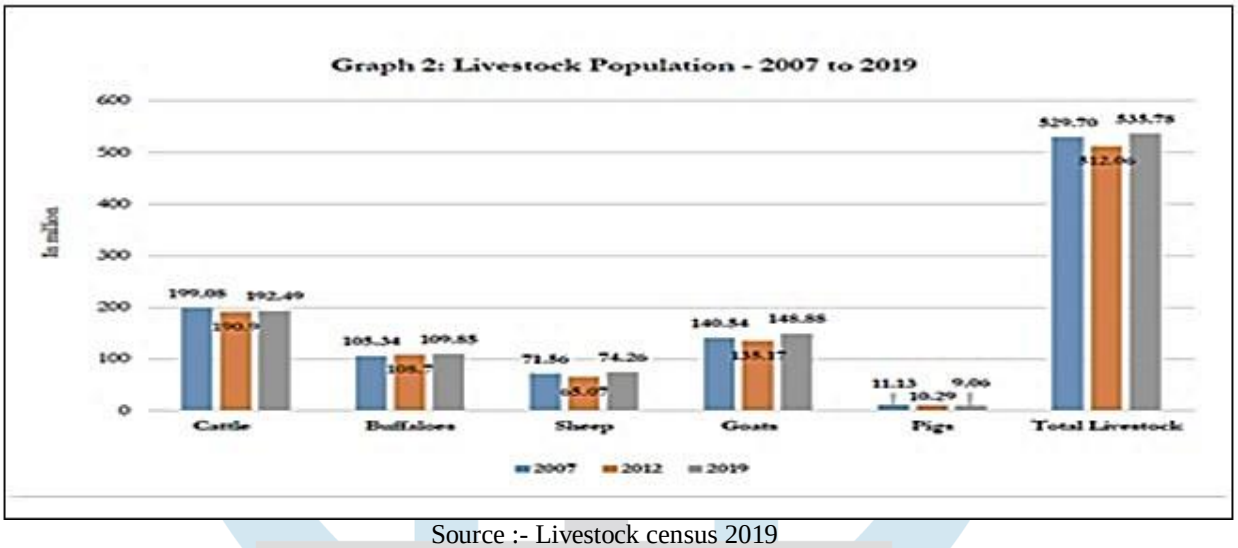
Graph (1) – shows livestock population 2019 – and data shows the overall percentage of share of various species of livestock as cattle contribute 35.94%, buffalo 20.45%, sheep 13.87%, Goat 27.80%, pigs 1.06% and other ruminates 0.23% in overall livestock population in India. Table 1:- figure out a comparative analysis is overall India in 2012 and 2019 and also percentage of growth of animalsin two periodical analyses. Among various milch animals growth of cattle ishighest (0.83%) and camels is lowest (-37.05%), as a significant comparison from livestock census report 2019.

Table 1 Livestock Population – Major species

Category	Population(million) 2012	Population(million) 2019	%growth
Cattle	190.9	192.49	0.83
Buffalo	108.7	109.85	1.06
Sheep	65.07	74.26	14.13
Goat	135.17	148.88	10.14
Pig	10.29	9.06	-12.03
Mithun	0.3	0.38	26.66
Yak	0.08	0.06	-25
Horses & Ponies	0.63	0.34	-45.58
Mule	0.2	0.08	-57.09
Donkey	0.32	0.12	-61.23
Camel	0.4	0.25	-37.05
Total Livestock	512.06	535.78	4.63

Source: - Department of Animal Husbandry and Dairying

While (graph-2) the bar graph of livestock population from 2007 to 2019, its shows among the various livestock population, increase in cattle population is highest and pigs is lowest. 2007 and 2019 shows approximate same numbers of cattle's growth in India (535.78million), while in 2012 it's little less 512.06, livestock population in 2019 is 4.6% more as compared to 2012 data.Graph 2:- Livestock Population – 2007 to 2019



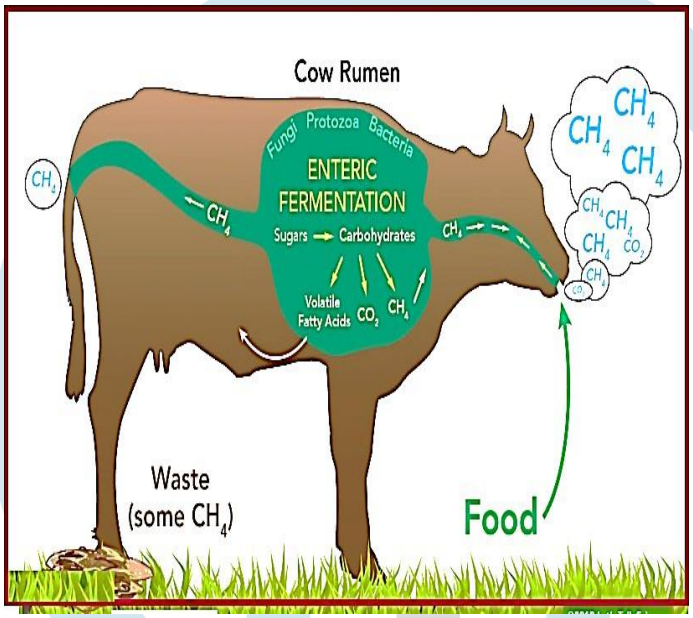
Source :- Livestock census 2019

In the Indian economy livestock plays a very dominant role. About 20.5 million people directly and indirectly depend upon livestock for their livelihood. Livestockprovides livelihood nearly about 2/3rd of the rural economy, and also contribute approximately 9% of employment to the total employed population in India. India is one of the largest economies in context of livestock resources. The livestock sector contributes 4.11% of GDP and 25.6% of total Agriculture GDP. Livestock islikely to important livelihood activity for most of the rural and urban household activities, they also refers as helping hands of farmers in agriculture activities, contributing to the health, energy and nutrition for the households, providingalternatives for income, enhancing employment opportunities, providing financial benefits, etc. Livestock production and agricultural practices are directly linked, both for crucial role and for overall food security. As per the 19th livestock census (2012), India is world's highest livestock owner at about 512.05 million of livestock population, it also first in the total buffalo population about 105.3 million, second in cattle and goats population which is about 140.5 million goats.

Animal husbandry, despite their significant contribution towards enhancing food and nutritional security and reducing poverty issues but are often criticized for theircontribution on negative externalities through the emission of greenhouse gases mainly methane carbon di oxide and nitrogen, also by overgrazing, deforestation, and by creating some level of pollution on water and air. The impact of livestock on the environment is different from the production system, the process of energy exchange mechanism are associated with a number of positive or negative externalities, but on the other hand, most of the animals can bring positive contribution in the environment which includes prevention of carbon dioxide (CO_2) use of animal energy in place of fossil fuel, saving natural recourses mainly land as a result of recycling the agricultural products and residues as animal feed. Livestock is basically computed for emitting up to 14% of all greenhouse emissions. Methane is largely belched out by ruminants such as cattle, sheep and goat, etc., which is estimated as more than a one third of the total emissions from farming and non-farming activities. The average ruminant (milk providing animals) produces 300 to 500 liters of methane a day. Globally, livestock isresponsible for releasing the methane through burping activities equivalent of 3.1 Giga tones of CO_2 into the atmosphere annually. The methane produced by bovine animals through the vast number of microbes that present in the digestive part of animal known as rumen. Through a process releasing methane through rumen is known as enteric fermentation, the present bacteria in rumen helps in decomposition and fermentation the food materials eaten by the animals, and thus they release carbon dioxide as a byproduct, further carbon dioxide mixed with water molecules and converted into methane gas, which is more harmful for environment rather than methane gas. Ruminant and non-ruminant animals Produce large amounts of methane as a part Worldwide livestock is anintegral component of agricultureand supports

the livelihood of billions by fulfilling 13% energyand 28% protein requirement, due to the rapid change of food habits the global demand for food and milk and other byproduct of animals, every year 1990 it is expected to increase methane by 30, 60 and 80 percent respectively, this may multiply the livestock demand.

Livestock and climate change is interconnected with each other. The climate influences the livelihood of animal husbandry in direct or indirect ways and alters in ambiance (stresses) quantitative and qualitative changes in fodder, crops, health, and a few of them. Methane an important gas has a global warming potential, it is 25 to 30% more harmful than carbon dioxide and has atmospheric residence about 8-11 years India's contribution in global emission of GHGs is about 2.7 percent due to livestock and anthropogenic activities. Agriculture and animal husbandry is the primary source of methane emission. Ruminant animals are unique because of the four-chambered stomach components and these are mainly Rumen, Reticulum, Abomasum, and Omasum. The rumen is a large muscular organ where micro biotic fermentation occurs mainly through ruminoccocus, which is a kind of bacteria present in a rumen and promotes the development of certain gases like CH4 and CO2 these gases are found in the upper part of the rumen.



The proportion of these gases is dependent on rumen ecology and fermentationbalance approx 132 to 264 gallons of luminal gases is produced by fermentation andblenching each day. The eructation of gases via blenching is important in bloat prevention but also a way that methane is emitted into the atmosphere. Methane production arises from microbial methane emission process by hydrolyzed carbohydrates and considered on energy lost for the host, many factors influence thefood intake, type, and quality of feed, energy consumption, and animal size, level of production, genetics, and environmental temperature.
Uttar Pradesh (UP) is the highest leading state in India, in context of both in human and livestock population. It is also the greater producer of food products, and accounts 1/5th of the country's total food grain production in 2014-15. Consequently, the contribution of the Services sector has exceeded 50 percent in Gross State Domestic Product.
As per the 19th Livestock Census, the bovine population in Uttar Pradesh stood at50 million, which is 16 percent of the total bovine population of India. Contrary to the national trend, the total livestock population has increased in UP. According to the latest Livestock Census 2012, the milch animal population has increased by about 30 percent - from 17 million in 2007 to 22 million in 2012. It also indicates that the indigenous cattle population has marginally decreased, whereas the population of crossbred cattle and buffaloes increased significantly. This change in the composition of dairy animals has also helped sustain growth in milk production, and with 16 percent of the total bovine of the country, Uttar Pradesh is producing about 19 % of the total milk production.

As per livestock data of 2012 and 2019, it states that- in among various states of India, in Uttar Pradesh livestock population is significantly higher (67.8 million) and the lowest is Gujarat (26.9). As per the 19th Livestock Census (2012), the bovine population in Uttar Pradesh stood at 50 million, which is 16 percent of the total bovine population of India. Contrary to the national trend, the total livestock population has increased in UP.

Table 2:- Geographical division of Uttar Pradesh

GEOGRAPHICAL DIVISION OF UTTAR PRADESH					
S.NO	UNIT	UNIT	YEAR	UP	INDIA
1	Geographical Unit	000 sq kms	2011	241	3.28
2	District	"	"	71	640
3	Taluka	0	"	312	5924
4	Village	million	"	106	6409
5	Household	million	"	33.4	249.5
6	Rural household				
7	Rural household 2001	0	2001	20	44
8	Rural household 2011	0	2011	24	55
9	HUMAN POPULATION				
10	Population	%	2011	199.8	121.02
11	urban	"	"	22	31.2
12	rural	"	"	78	68.8
13	LIVESTOCK POPULATION				
14	Bovine	million	2012	68.7	512
15	Indigenous cattle	"	"	50.2	299.9
16	Crossbreed	"	"	16	151.2
17	small ruminents	"	"	16.9	200.2
Source: Various ISS reports of Govt. of Uttar Pradesh					

However, half of the bovine in the State are low yielders. According to the latest Livestock Census 2012, the milch animal population has increased by about 30 percent – from 17 million in 2007 to 22 million in 2012. It also indicates that the indigenous cattle population has marginally decreased, whereas the population of crossbred cattle and buffalos increased significantly. This change in the composition of dairy animals has also helped sustain growth in milk production, and with 16 percent of total bovine of the country, the State is producing about 19 percent of the total milk production of the country, as shown in table 3.

Table 3:- Livestock population, 2012 and 2019 of major states in India

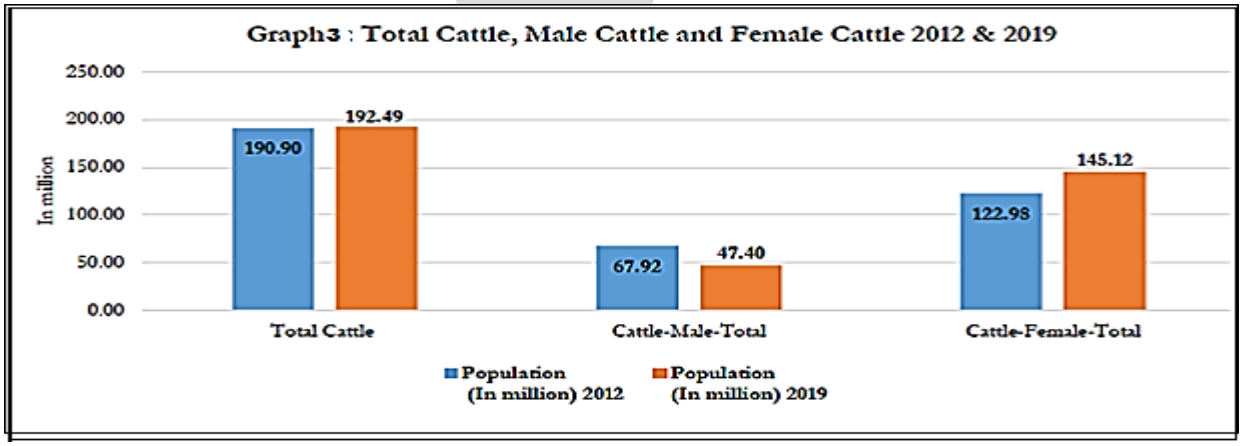
S.No.	States	Population (In million) 2012	Population (In million) 2019	% Change
1	Uttar Pradesh	68.7	67.8	-1.35
2	Rajasthan	87.7	56.8	-1.66
3	Madhya Pradesh	36.3	40.6	11.81
4	West Bengal	30.3	37.4	23.32
5	Bihar	32.9	36.5	10.67
6	Andhra Pradesh	29.4	34	15.79
7	Maharashtra	32.5	33	1.61
8	Telangana	26.7	32.6	22.21
9	Karnataka	27.7	29	4.7
10	Gujarat	27.1	26.9	-0.95

Source :- Department of Animal Husbandry and Dairying

Graph 2 is related with number of Cattle population (192.49million) in India during 2019, which is increased by 0.8% as compared by 19th livestock census 2012. Thus among total livestock 18% is contribution by castles. Comparing male and female cattle population, female cantles were significantly high.

Source: - Department of Animal Husbandry and Dairying

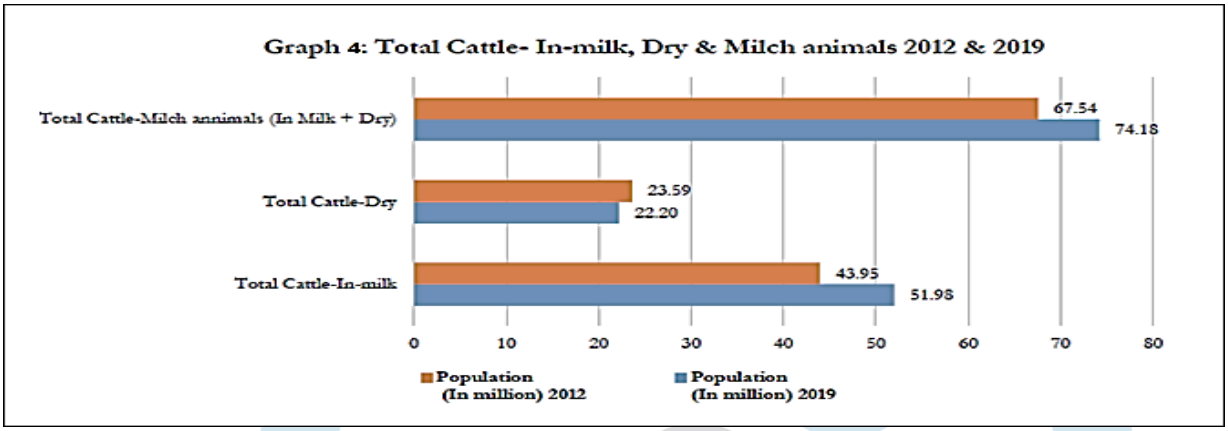
Graph 3 :- Total Cattle, Male –Cattle and Female Cattle 2012 & 2019



Source :- Department of Animal Husbandry and Dairying

India is the home for many breeds, which features low maintenance, weather resistance, sound lactation, drought power, and a crucial role in the rural economy. Among the various livestock, they are divided as milch (milk provider) and non- milch (nonmilk provider/dry) animals, their percentage increased from 67.54million (2012) to 74.18million (2019). While segregating dry and milchanimals the percentage of dry livestock is 22.20 million and milch is 51.98million, which shows that India is the home of maximum milch animals and the productivity of milk is comparatively higher as compared to many other countries in the world (graph 4).

Graph 4 :- Total Cattle, In-Milk, Dry & Milch animals 2012 & 2019

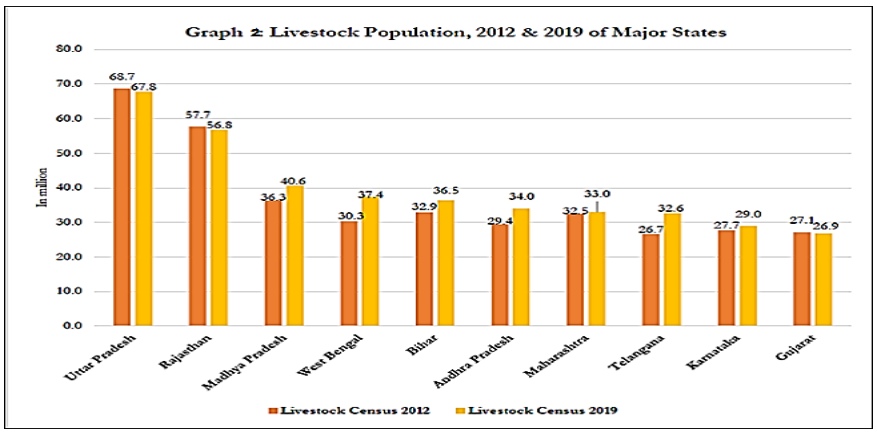


Source: - Department of Animal Husbandry and Dairying

As per 19th and 20th livestock census 2019 (shown in graph 5 and table 3and Table 4), Indian female total exotic/crossbred livestock population 46.9 million is higher as compared to male exotic livestock (3.46million). Similarly female indigenous livestock population (142.11million), which is comparatively higher with male indigenous/non-descript livestock population (98.17 million), but there is a six percent decline

Breed Group	Category	Population (In million) 2012	Population (In million) 2019	% Change
Exotic/Crossbred	In-milk	14.3	20	39.8
	Dry	5.12	5.67	10.8
	Milch	19.42	25.67	32.2
Indigenous/Non-descript	In-milk	29.65	31.98	7.87
	Dry	18.48	16.53	-10.53
	Milch	48.13	48.51	0.81

In the growth of female indigenous livestock population from 2012 to 2019 livestock census. Milch Cattle of Exotic-



Crossbred has increased by 32.2% overthe previous census Milch Cattle of Indigenous/Non-Descript has increased marginally by 0.8%.

Table 4:- Exotic and Indigenous Cattle Population-Male and Female and Total indigenous in India

Category	Population (In million) 2012	Population (In million) 2019	% Change
Total Cattle	190.9	192.49	0.8
Exotic/Crossbred			
Male	5.97	3.46	-4.2
Female	33.76	46.95	39.1
Total Exotic/Crossbred	39.73	50.42	26.9
Indigenous/Non-Descript			
Male	61.95	43.94	-29.1
Female	89.22	98.17	10
Total Indigenous/Non-Descript	151.17	142.11	-6

Table 5:- In-milk, Dry and Milch Cattle for Exotic and Indigenous in India

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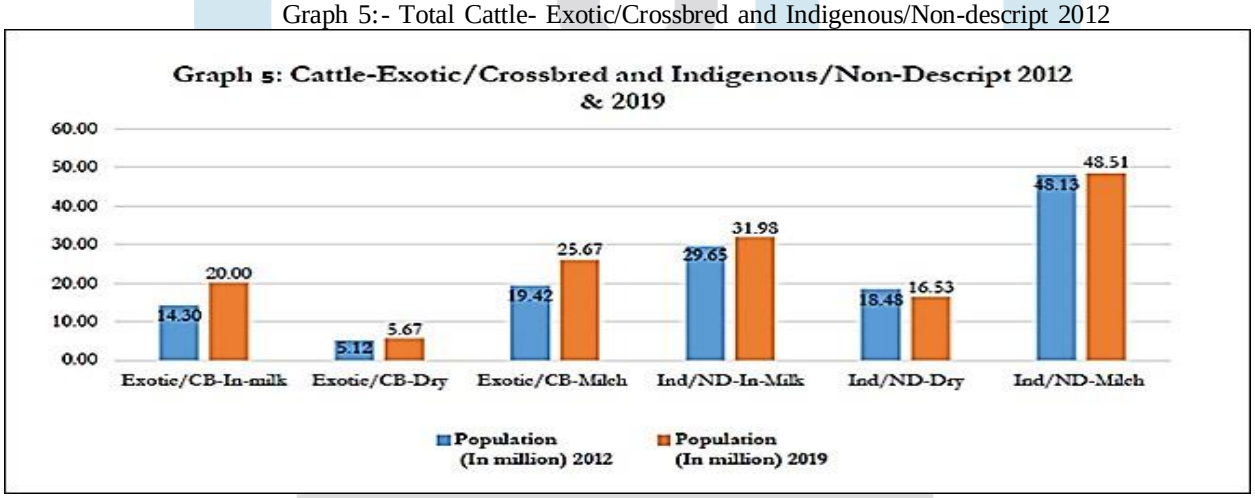
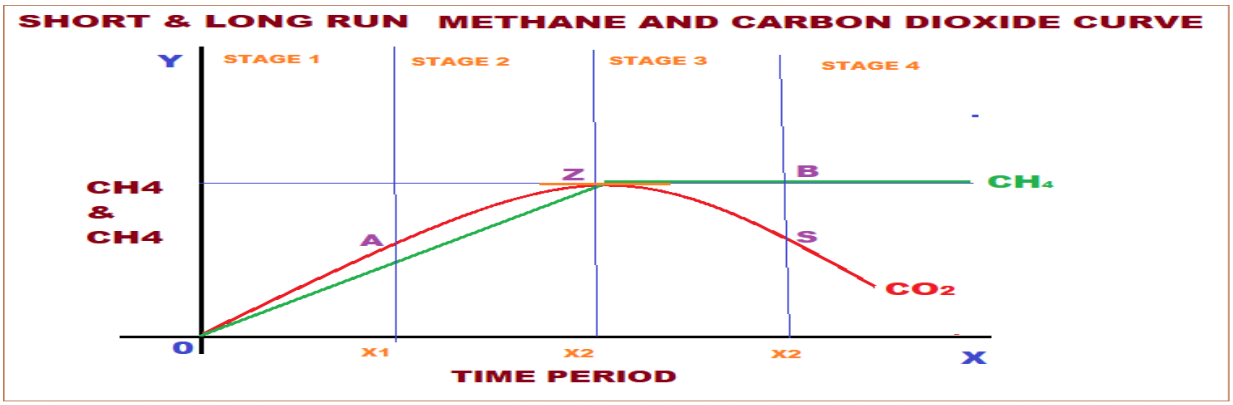
Graph 5:- Total Cattle- Exotic/Crossbred and Indigenous/Non-descript 2012



Source: Department of Animal Husbandry and Dairying

As per the 20th livestock census (2019) conducted the Department of animal husbandry and dairying under Ministry of fisheries, animal husbandry and Dairying published data regarding various species of livestock population such as cattle, buffalo, Mithun, yak, sheep, goats, pigs, horse, donkeys, camels pigs, etc, which are possessed by households, household-enterprises, and non-household entities. The main outcomes of the 20th Livestock census can be summarized as- India is playing a leading role in the animal husbandry sector and having a total livestock population is 535.78 billion, and showing an increase of 4.6% over livestock census 2012. The total ruminant population (like Cattle, Buffalo, Mithun, and Yak) is 302.79 million, shows a increase of 1 percent similarly, the percentage of cattle's hike by 0.8percent (192.42million), and female cattle population by 18 percent as compared to the 2012 livestock census. There is a 6% decline in indigenous (both descript and nondescript) cattle population.Graph (1) – shows livestock population 2019 – and data shows the overall percentage of share of various species of livestock as cattle contribute 35.94%, buffalo 20.45%, sheep 13.87%, Goat 27.80%, pigs 1.06% and other ruminates 0.23% in overall livestock population in India.Relationship between Carbon Dioxide (Co2) and Methane (Ch4) Curve



This diagram is basically mentioned the long and short-run relationship between methane (CH4) and Carbon dioxide (CO2) Curve, through various stages as:

STAGE I: - Initially, CO2 and CH4 curves start at the same level, but the emission by CO2 the curve is higher in the environment due to the establishment of more chemical factories, speedy urbanization, high industrialization basically in developing countries like India during the period of 1980s. Methane (CH4), the emission is less because cattle production is less as compared to the increase in urbanization in the economy.

STAGE II:- During the 1990s, with LPG policy, industrialization took a boost in the economy, till mid of the 1990s the production was on peak, results +ve BOP, but at the same time the emission from CO2 is comparatively at is the peak and then became stagnant as due to rising awareness regarding the environment, global warming, and various summits start taking place as Rio summit (1992), Rio +5 (Kyoto protocol in 1997), etc., with the enhancement in the awareness, the level of CO2 is higher but become stagnant.

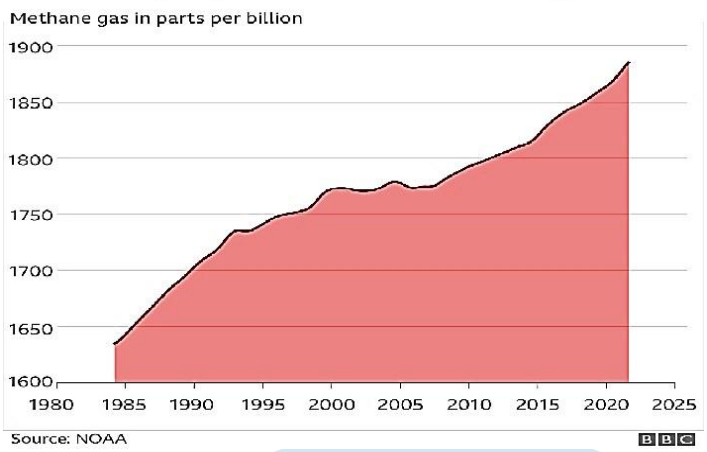
On the other hand, CH4 emission slowly gets increase because of the need of diversification of agriculture and allied activities, livestock are considered as drought power, and a good source of energy, nutrition, and as monetary assets etc.Thus the methane emission became equal to carbon di oxide curve, as point 'z' in the diagram depicting the same.Thus CO2 and CH4 became equal to each other, at point z, known as point of intersection or highest pollution level in the economy.

STAGE III:- With the growing concern about the environment, various committeesheld at global level and discuss to bring down the level of temperature at 1.5 degrees C, till 2030 from 1.5 degrees from the pre-industrial level. CO2 is the maincause and responsible gas as it contains the highest percentage of emission as compared to other greenhouse gases. Thus the level of CO2 starts declining, the main reason for this reduction in CO2 is as follows:-

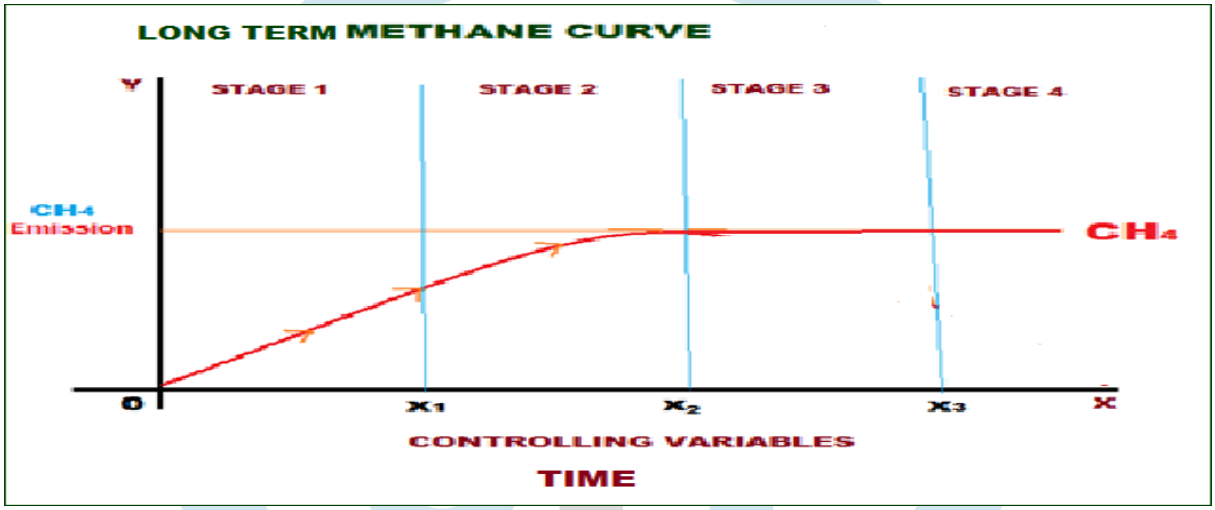
STAGE 4:- In the last stage economies understand the effect of negative externalityon the environment so try to reduce the level of CH4 and CO2 emissions at a global level, later on in long-term the CO2 starts declining rapidly as comparedto CH4, due to afforestation, environment-friendly 5-star technology, etc., but the CH4 curve in spite of coming down, it became 'horizontal to x-axis' in long-term because of methane gas never get absorbed by environment automatically, neither by the process of photosynthesis nor by recycling process, soit remain in the atmosphere for more than 10 to 12 years and remain constant. So atlast stage it became horizontal to x axis.

In short-run CO2 curve is like inverted 'U', and in long run "N shaped", rapid deforestation and high demand of land for industries and infrastructure, but comparatively, it is lower than the pre-industrial level as high carbon tax/cess. It's just like environmental "Kuznets curve".

Short run CH4 curve in little like inverted 'S', due to the less growing factors responsible for methane emission, but in long term, the shape is horizontal to x-axis. Thus mitigation of methane can reduce from the environment in following ways :- a) Industrial management b) Technology advancement c) CO2 abatement technology d) Carbon tax e) Photosynthesis the process by nature etc.But methane emission (CH4), continues to increase and remains higher than thelevel of CO2 after point z, because a)Trapping Methane gas is not an easier task's) No technological development c) Poor the dietary practice of animals) Multiplying no of milch animals like cattle goat sheep etc. e) High the demand of milk production in developing countries like India. f)Transportationof natural gas, coal, oil, etc.g) Waste management plants and lagoon h) Poor landfills,i) Fossil fuel industries etc. A comparative analysis the CH4 is more harmful as compared to CO2, because methane is a far more potent greenhouse gas, as it lasts in the environment for more than a decade, while the CO2 will stay in the atmosphere for about a couple of years. The sourcesresponsible for carbon-di-oxide is abiotic and can easily controllable, while the sources of methane are biotic basically the burp gases released by milch animaland human beings, which is quite hard to control directly. The burp gases released by milch animals like cattle, goats, sheep, pigs, through the micro bacterial process which covert food into methane inside the rumen, the digestive system of a livestock body, thus it is times more powerful than carbon-di-oxide for bringing global warming on earth.Thus the data also shows that methane gas (CH4) is reaching on heights in recent years and remains at a higher level. Cutting methane emission is the only best possible way to safeguard the earth from the harmful effect of global warming. As one of the mitigation strategies like a carbon tax, flatulence tax can be applied to farm animals.



LONG TERM METHANE CURVE



STAGE I: - Increase in livestock population + Anthropogenic activities + pollution = Increase in CH4 and decrease in controlling variables.

STAGE II: - Increase in livestock population + Anthropogenic activities + pollution = Constant in CH4 and constant controlling variables.

STAGE III: - Decrease in livestock population + Anthropogenic activities + pollution = decrease in CH4 and increase in controlling variables.

STAGE IV: - Decrease in livestock population + Anthropogenic activities + pollution = decrease in CH4 and increase in controlling variables= Optimumsituation

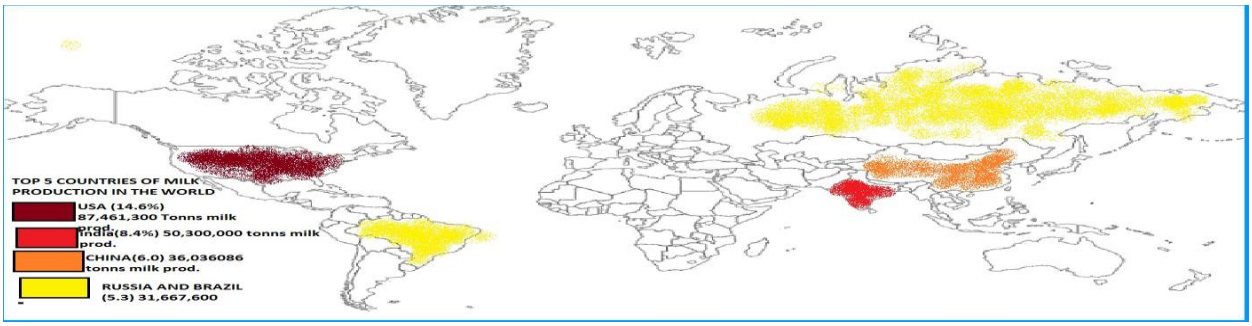
Conclusively the controlling variables animal husbandry management are Pollution control, Population control (i.e.- both livestock and human) and change in dietary habits of livestock etc. is best way to neutralize methane from environment thus 3rdstage is best stage as Methane emission is maximum and tended to further decrease.

DATA ANALYSIS

Table 5: Dairy cow's population in the World

World Rank	Country	No. of dairy cows	Percentage of world dairy cowsin population
1	India	43,600,000	16.5
2	Brazil	22,942,900	8.7
3	Sudan	14,968,800	5.7
4	China	12,503,190	4.7
5	Pakistan	10,100,000	3.8
6	Kenya	9,350,000	3.5
7	USA	9,117,000	3.4

SOURCE: FAOstat (2012)



The table and the map compare the top milk producing countries in the world in comparison to the no. of dairy cows in top 5 countries. While India has the most no. of cows it produce only 2/3rd of the milk in the world as the amount of milk produced by USA every year. As per FAOstat 2012.

ENTERIC METHANE EMISSION: INDIAN SCENARIO

In short-run CO2 curve is like inverted 'U', and in long run "N shaped", rapid deforestation and high demand of land for industries and infrastructure, but comparatively, it is lower than the pre-industrial level as high carbon tax/cess. It's just like environmental "Kuznets curve".

Short run CH4 curve in little like inverted 'S', due to the less growing factors responsible for methane emission, but in long term, the shape is horizontal to x-axis. Thus mitigation of methane can reduce from the environment in following ways :- a) Industrial management b) Technology advancement c) CO2 abatement technology d) Carbon tax e) Photosynthesis the process by nature etc.But methane emission (CH4), continues to increase and remains higher than the level of CO2 after point z, because a) Trapping Methane gas is not an easier task.

b) No technological development c) Poor the dietary practice of animals d) Multiplying no of milch animals like cattle goat sheep etc. e) High the demand of milk production in developing countries like India. f) Transportation of natural gas, coal, oil, etc. g) Waste management plants and lagoon h) Poor landfills, i) Fossil fuel industries etc. In short-run CO2 curve is like inverted 'U', and in long run "N shaped", rapid deforestation and high demand of land for industries and infrastructure, but comparatively, it is lower than the pre-industrial level as high carbon tax/cess. It's just like environmental "Kuznets curve"

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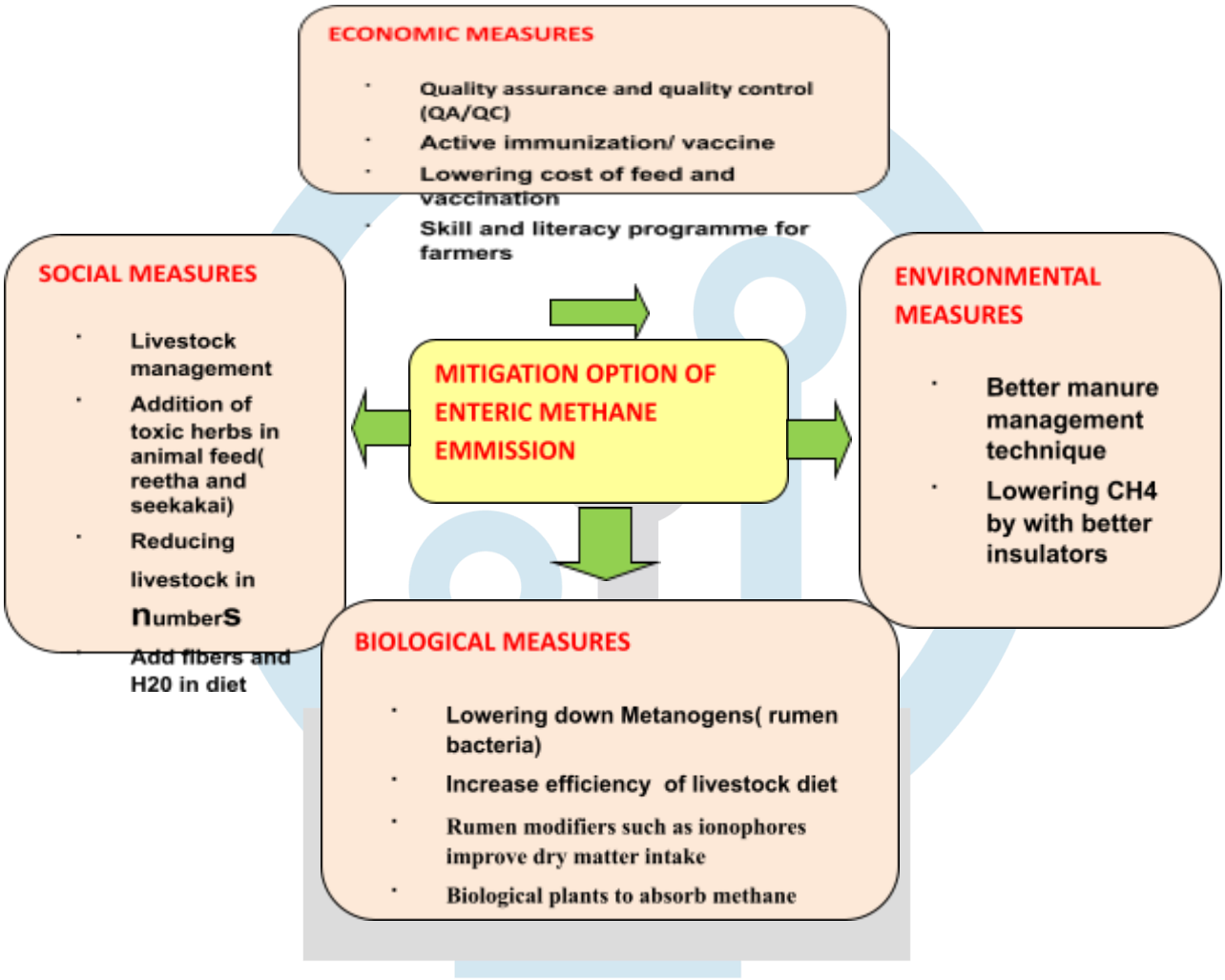
Under normal rumen functioning, methanogenesis due to the thermodynamic efficiency (high temperature) is the most prominent hydrogen tropic pathway. Warming as it cannot dissolve easily into the atmosphere. Larger bovine animals which emit more methane than other livestock species, on average cattle and buffalos contribute 90% of the total enteric methane emission of a country. The contribution of small animals are respectively small and contributes only by 7.7% rest of the methane emission is arises by other animals like yak and Mithun which are distributed up to particular states only. Livelihood data are used directly to map livestock production systems.

MITIGATION MEASURES OF ENTERIC METHANE EMISSION

Protecting the environment is the immediate concern of the society, Lowering the methane is yet another challenging task as methane is and longer span on environment, and it's not easy to destroy the effect of it from atmosphere, thus to mitigate the effect of methane gas, mitigation measure can be divided into 4 parts, aseconomic, social, environmental and biological



Apart from these measures India can also bring significant changes in farm and non-farm sectors, like use of farming residues as a dry fodder intake for animal dietas a food supply chain, and for this farmer get also benefitted from demand side, For example Thailand pay to the farmers for per km crop residues and use it for making various craft items and also as dry fodder for animal diet this gives direct benefit to farmers.

CONCLUSION

Livestock and Dairy production might face a confluence of challenges that need to be overcome to keep the growth momentum underway. Despite an improvement in the availability of animal feeding resources, the country still remains a deficitent in dry fodder by 10%, in green fodder by 35%, and in concentrate feed by 33%. Thus to improve this problem following options done:-

(i) Better utilization of crop residues such as paddy straw,
(ii) Promotion of cultivation of high-yielding fodder crops, and
(iii) Discouraging exports of nutrient-rich oilseed cakes,
(iv) Lack of participation of women in higher level participation,
(v) Farmers have traditional cattle rearing system,
(vi) Problem of adulteration causes heavy use of health challenges for humanbeings,

(vii) Down to earth food chain,
(viii) Lack of management and organization of the dairy sector in rural andsemi-rural areas.
(ix) Lack of proper price mechanism of food and nonfood products,
(x) Problems and diseases related to livestock,
(xi) Lack of credit and financial availability for overall development of farmers.

Indian economy is one of the largest growing economies in the world and thushaving almost more than 48 million male cattle and buffaloes for draught purposes.The utility of these animals has diminished because of the increasing mechanization of agriculture and decreasing farm size. A long-term solution is to optimize population via sexed semen technology that allows the birth of off-springs of the desired sex. The dairy sector of India is still somewhat fragmented, so it becomes pertinent to improve our understanding of what constrains income growth from the non-farm business at the household level. Increasing farmer's income needs funds at the institutional level as well as at the enterprise level, for which a robust institutional credit flow mechanism is required. There is a need for women to participate at a higher level, need a balanced and proper feed and fodders for animals, to ensuretheir health conditions. With a good strategy, well-designed schemes, adequate resources, and good governance in implementation, cooperation of large no people from farmer to government, from product to price policy, mainly both cattle and product insurance also beneficial from the recovery over crisis from accidental or diseases loss. With the proper awareness and training, this target is achievable. Here livestock can play an indispensable role in doubling farmers' income There were over 264 million dairy cows worldwide which produce approximately 600 million tons of milk, as India has the greatest no. of milch animals so the level of methane emission is directly proportional to them. America has 29% of more emission of methane as compared to India as is have highest no. of cows in the world. While India has the world's largest bovine population, as per the Ministry of Agriculture has reported 3% decrease in bovine population between 2006 and 2019, which means that emissions from this sector is a great concern. While India has regional differences among various sectors of rural economy which need to be bottom-up approach from tier wise development for consistent environmental progress. Livestock is the major source for GHG emissions as they tend to emit CH_4 from enteric fermentation and NO_2 from manure management. A country like India cannot afford this energy loss, as it demands additional feed resources to compensatefor the loss. The adoption of mitigation options for enteric methane emission should be based on the feasibility of intervention(s) in a specific region. Methane and nitrous oxide emissions from manure management demand different storage conditions.

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