Methane Emissions from Livestock

For Prelims: Food and Agriculture Organization (FAO), Methane Emissions,

For Mains: Initiatives in India to tackle methane emissions, Significance of methane as a greenhouse gas and its impact on climate change.

Source: DTE

Why in News?

A recent **Food and Agriculture Organization (FAO)** report, titled **"*Methane Emissions in Livestock and Rice Systems,*"** highlights the significant climate **impact of methane emissions from livestock and rice paddies.**

- Released during FAO's inaugural **'Global Conference on Sustainable Livestock Transformation'** in September 2023, the report emphasizes the importance of reducing methane emissions in achieving the **Paris Agreement's goals**, as noted in the **Intergovernmental Panel on Climate Change's Sixth Assessment Report.**

What are the Key Findings from the Report?

- **Sources of Methane Emissions:**
  - **Ruminant livestock** and **manure management** contribute to approximately **32% of global anthropogenic** methane emissions.
  - Rice **paddies** account for an **additional 8% of methane emissions.**
  - Besides agrifood systems, other human activities that generate methane emissions include **landfills, oil and natural gas systems, coal mines and more.**

Note

- Ruminants are mammals of the **suborder Ruminantia (order Artiodactyla).**
  - They encompass a diverse group of animals such as **giraffes, okapis, deer, cattle, antelopes, sheep, and goats.**
- Most ruminants have a **four-chambered stomach and two-toed feet**. Camels and chevrotains, however, have a three-chambered stomach and are often referred to as pseudoruminants.

- **Impact of Ruminant Livestock:**
  - Among ruminants, **cattle are the highest daily emitters of methane,** followed by **sheep, goats, and buffalo.**
  - Ruminant meat and milk are significant protein sources, and global demand for animal products is expected to **rise by 60-70% by 2050.**
- **Improving Feed Efficiency:**
  - Report focuses on improving feed to **reduce methane emissions by enhancing feed efficiency.**

        - This involves **increasing nutrient density, and feed digestibility**, altering rumen microbial composition, and selectively breeding animals with negative residual feed intake and smaller metabolic body weight.
    - Enhanced feed efficiency **boosts animal productivity per unit of feed,** potentially **increasing farm profitability** based on feed costs and meat/milk revenues.
- **Need for Regional Studies:**
    - The report underscores the need for **regional studies** to quantify the effects of improved nutrition, health, reproduction, and genetics to increase animal production and decrease methane emission.
        - Such studies would help assess the impact of mitigation strategies on net greenhouse gas emissions at a regional level.
- **Strategies for Mitigating Methane Emissions:**
    - The study noted four broad strategies in mitigating methane emissions:
        - Animal breeding and management.
        - Feed management, diet formulation and precision feeding.
        - Forages.
        - Rumen manipulation.
- **Challenges and Research Gaps:**
    - Challenges include the lack of regional information to **calculate carbon footprints** and limited economically affordable methane mitigation solutions.
    - Further research is needed to develop practical and cost-effective measures.

Methane

- Methane is the simplest hydrocarbon, consisting of one carbon atom and four hydrogen atoms (CH_4).
    - It is flammable, and is used as a fuel worldwide.
- Methane is a **powerful** greenhouse gas (GHG), which has an atmospheric lifetime of **around a decade and** affects the **climate for hundreds of years.**
- Methane has more than 80 times the warming power of carbon dioxide over the first 20 years of its lifetime in the atmosphere.
- The common sources of methane are oil and natural gas systems, agricultural activities, coal mining and wastes.

What are the Initiatives to Tackle Methane Emissions?

- **Indian:**
    - **'Harit Dhara' (HD):**
        - Indian Council of Agricultural Research (ICAR) has developed an anti-methanogenic feed supplement **'Harit Dhara' (HD)**, which can cut down cattle methane emissions by 17-20% and can also result in higher milk production.
    - **The National Mission on Sustainable Agriculture (NMSA):**
        - It is implemented by the Ministry of Agriculture and Farmers Welfare, involves **climate resilient practices** including methane reduction practices in **rice cultivation.**
            - These practices contribute to substantial reduction of methane emissions.
    - **National Innovations in Climate Resilient Agriculture (NICRA):**
        - Under the **NICRA project,** the **Indian Council of Agricultural Research (ICAR)** has developed technologies to mitigate methane emissions from rice cultivation. These technologies include:
            - **System for Rice Intensification:** This technique can increase rice yield by 36-49% while using 22-35% less water compared to conventional transplanted rice.
            - **Direct Seeded Rice:** This method reduces methane emissions by eliminating the need for raising nurseries, puddling, and transplanting. Unlike traditional paddy cultivation.

- **Crop Diversification Programme:** By shifting from paddy cultivation to alternative crops like pulses, oilseeds, maize, cotton, and agroforestry, methane emissions are minimized.

- **Bharat Stage-VI Norms:**
  - India shifted from **Bharat Stage-IV (BS-IV) to Bharat Stage-VI (BS-VI)** emission norms.

- **Global:**
  - **Methane Alert and Response System (MARS):**
    - MARS will integrate data from a large number of existing and future satellites that have the ability to detect methane emission events anywhere in the world, send out notifications to the relevant stakeholders to act on it.
  - **Global Methane Pledge:**
    - At the **Glasgow climate conference (UNFCCC COP 26)** in 2021, **nearly 100 countries had come together in a voluntary pledge,** referred to as the Global Methane Pledge, to cut methane emissions by at least 30% by 2030 from the 2020 levels.
      - **India is not a part of Global Methane Pledge.**
  - **Global Methane Initiative (GMI):**
    - It is an international public-private partnership focused on reducing barriers to the recovery and use of methane as a clean energy source.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q1. Which of the following statements is/are correct about the deposits of 'methane hydrate'? (2019)

1. Global warming might trigger the release of methane gas from these deposits.
2. Large deposits of 'methane hydrate' are found in Arctic Tundra and under the sea floor.
3. Methane in atmosphere oxidizes to carbon dioxide after a decade or two.

Select the correct answer using the code given below.

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

Q2. Consider the following: (2019)

1. Carbon monoxide
2. Methane
3. Ozone
4. Sulphur dioxide

Which of the above are released into atmosphere due to the burning of crop/biomass residue?

(a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1 and 4 only
(d) 1, 2, 3 and 4

Ans: (d)

R21/Matrix-M Malaria Vaccine

Why in News?

Recently, the **World Health Organisation (WHO)** has recommended the use of the **R21/Matrix-M malaria vaccine**, co-developed by the **University of Oxford and the Serum Institute of India.**

- The **Matrix-M component** is a proprietary **saponin-based adjuvant** developed by Novavax and licensed to the Serum Institute for use in endemic countries.
- As of now, the vaccine has been licensed for use in **Ghana, Nigeria and Burkina Faso.**

What is Adjuvant?

- An adjuvant is an **ingredient in a vaccine that enhances the immune system's response to that vaccine.**
    - Adjuvants help the immune system better recognize what's in a vaccine and remember it longer, increasing the amount of time that a vaccine may offer protection.
- **Matrix-M adjuvant** is derived from **saponins**, naturally occurring compounds found in the bark of the **Quillaja saponaria tree in Chile.** Saponins have a history of medicinal use.

What is Malaria?

- **About:**
    - Malaria is a life-threatening disease caused by the **Plasmodium parasite**.
        - This parasite is transmitted to humans through the bites of **infected female Anopheles mosquitoes.**
- **Plasmodium Parasite:**
    - There are **5 Plasmodium parasite species** that cause malaria in humans and 2 of these species, ***P. falciparum and P. vivax,*** pose the greatest threat.
        - ***P. falciparum*** is the **deadliest** malaria parasite and the most prevalent on the African continent.
        - ***P. vivax*** is the **dominant malaria parasite** in most countries outside of sub-Saharan Africa.
    - The other malaria species which can infect humans are ***P. malariae,*** P. ovale ***and P. knowlesi.***
- **Symptoms:**
    - Mild symptoms are **fever, chills and headache.** Severe symptoms include **fatigue, confusion, seizures, and difficulty breathing.**
- **Prevalence:**
    - According to the **WHO's World Malaria report 2022,** there were 247 million cases of malaria in 2021 compared to 245 million cases in 2020.
    - It is mostly found in tropical countries. Four African countries accounted for just over half of all malaria deaths worldwide: **Nigeria (31.3%), the Democratic Republic of the Congo (12.6%), United Republic of Tanzania (4.1%) and Niger (3.9%)**
- **Vaccine:**
    - Along with the recently confirmed **R21/Matrix-M vaccine**, WHO also recommends broad use of the **RTS,S/AS01 malaria vaccine** among children living in regions with moderate to high P. falciparum malaria transmission.
- **Elimination Strategies:**
    - **Global:**
        - The **WHO Global Technical Strategy for Malaria 2016–2030, updated in 2021,** sets ambitious but achievable global targets, including:
            - reducing malaria case incidence by at least 90% by 2030

- reducing malaria mortality rates by at least 90% by 2030
- eliminating malaria in at least 35 countries by 2030
- preventing a resurgence of malaria in all countries that are malaria-free.

- **India:**
  - **National Framework for Malaria Elimination (2016-2030)**
  - **Malaria Elimination Research Alliance-India (MERA-India)**

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. Widespread resistance of malarial parasite to drugs like chloroquine has prompted attempts to develop a malarial vaccine to combat malaria. Why is it difficult to develop an effective malaria vaccine? (2010)

(a) Malaria is caused by several species of Plasmodium
(b) Man does not develop immunity to malaria during natural infection
(c) Vaccines can be developed only against bacteria
(d) Man is only an intermediate host and not the definitive host

Ans: (b)
