



## Remote Sensing Technology to Enhance Monitoring of Methane Emissions from Waste

The impact of methane in the atmosphere has become a major concern in the climate change arena, as it is the second-largest contributor to anthropogenic global warming. Methane's global warming potential (GWP) over a 20-year timescale is approximately 80 times greater than that of carbon dioxide, although its atmospheric lifetime is shorter. Since pre-industrial times, methane has contributed to a 0.5°C increase in global temperatures (Yuhan Jiang, 2024). The Global Methane Budget 2024 Report indicates that global methane emissions have accelerated over the past five years. To date, climate experts have not observed any significant decline in methane emissions from human activities.

Waste is the fourth-largest source of global methane emissions. Between 2000 and 2020, South Asia generated 334 million tons of waste annually, of which about 70% was organic (Toha Mohammad, 2025). Methane emissions from landfills remain a continuous and pressing issue; in Sri Lanka, nearly 16% of total greenhouse gas (GHG) emissions originate from waste.



The 26th United Nations Climate Summit (COP26), held in 2021, marked a significant milestone in global climate action. During the conference, the Global Methane Pledge was launched, focusing on six key action areas are summarized in the table below :

Methane Action Areas	Summary
<b>Energy Pathway</b>	Monitoring and Reducing methane emissions produced through energy production and distribution ie oil and gas sectors
<b>Waste Pathway</b>	Monitoring and reducing methane emissions generated through waste sources ie Soild waste disposal, Sewerage and industrial waste.
<b>Food and Agriculture Pathway</b>	Identifying methods to minimise methane emissions from agricultural practices such as livestock management and rice cultivation
<b>Methane Plans and Policies,</b>	Developing policies and procedures to track methane and mitigation plans for their own nation demands
<b>Finance for Methane Abatement</b>	Financing mechanism for countries to achieve methane mitigation actions and deliver methane reduction projects

Table 1 Methane Action Areas

Many countries, including Sri Lanka, joined the pledge, committing to voluntarily reduce methane emissions by 30% by 2030. Sri Lanka has also pledged to reduce its overall GHG emissions by 14.5% by 2030, including an unconditional reduction of 4%. Additionally, the country aims to gener-

ate 70% of its electricity from renewable sources by 2030 (Padukkage, 2022).

The chart below illustrates methane emissions in Sri Lanka compared to other South Asian countries in 2019.

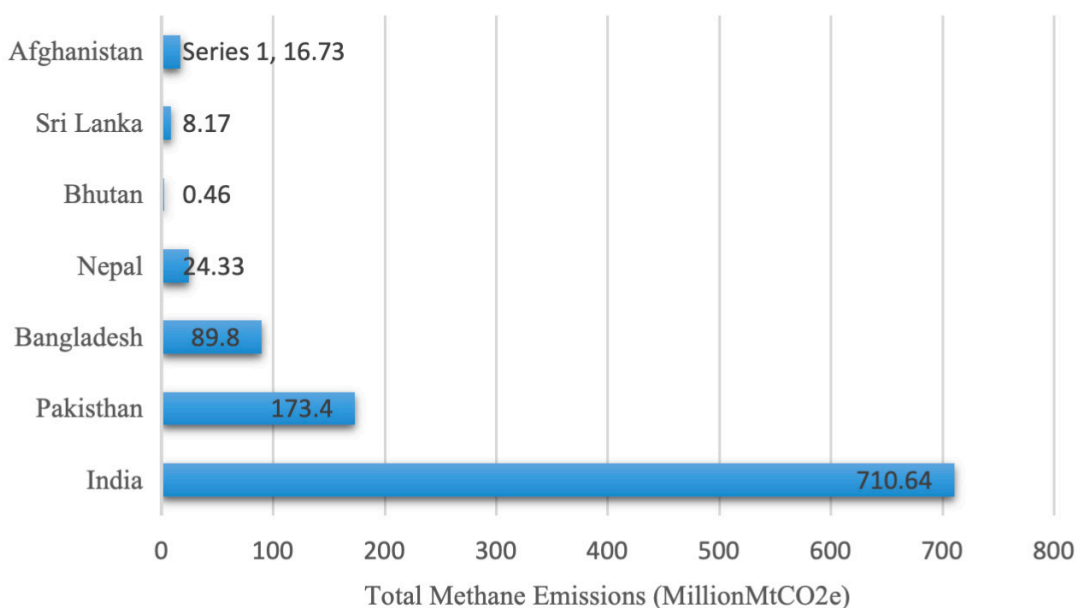


Figure 1 Total methane emission by countries in 2019 (World Economics , n.d.)

To provide a fair comparison, the table below presents the per capita methane emission for the same year. This approach accounts for difference in population size, which can significantly influence the emission.

	Country	Per capita Methane emissions (MtCO <sub>2</sub> e) as of 2019	Emission Ranking high to Low
1	Nepal	0.82	1
2	Pakistan	0.77	2
3	Bhutan	0.59	3
4	Bangladesh	0.54	4
5	India	0.51	5
6	Afghanistan	0.42	6
7	Sri Lanka	0.38	7
8	Maldives	0.264 <sup>1</sup>	8

Table 2 Per capita methane emissions of SAAC countries in 2019

Sri Lanka generates approximately 7000 tonnes of waste per day, according to the Waste Management Division of the Central Environmental Authority. The country currently has 339 open dumpsites and 136 operational composting facilities. However, these facilities lack modern technology and fail to meet environmental standards, making them significant sources of methane emissions. Poorly managed solid waste disposal units release toxins, including methane, into the environment, posing serious ecological and health risks to nearby communities (Piero Fraternali, 2024). A tragic example of the consequences of inadequate methane monitoring was the Meethotamulla disaster (see figure 2), which occurred at one of the largest dumpsites just outside Colombo (Petley, 2017).



Figure 2 The aftermath of the Meethotamulla garbage dump landslide, from Lankenews, taken in 17th April 2017 (Petley, 2017)

A key pillar of the Global Methane Pledge is monitoring and reporting. However, quantifying methane emissions from waste remains complex. Methane can be measured using various techniques, and monitoring technologies have evolved significantly in recent years. Initially, emissions were tracked using ground-based technologies, followed by airborne monitoring. Today, space-based monitoring has become the preferred approach (Broghan M. Erland, 2022), enabling the measurement of total column atmospheric methane levels.

In majority of countries Methane emission inventories are constructed using bottom-up methods, where activity levels were multiplied by IPCC emission factors. The similar approach is followed in Sri Lanka. However, these methods are often inaccurate and fail to comply with the country's comprehensive understanding of emissions.

Methane emissions from landfills and open waste dump yards vary depending on meteorology, topography, organic matter content, and infrastructure changes. Remote sensing offers high-resolution, reliable data and is widely adopted by many nations, particularly in the oil, gas, and energy sectors.

Top down approach monitoring methane from space or air via Satellite-based remote sensing is an asset, as it can provide near to real-time data. Advanced sensors—such as hyperspectral imaging, LiDAR, and shortwave infrared (SWIR) technology—can effectively detect changes in atmospheric methane concentrations, helping identify emission sources. Some satellite missions provide free data and visual images of average methane emissions for individual countries, though data availability varies by region. This powerful technique supports the development of top-down emission inventories (Yuhan Jiang, 2024).

Integrating satellite data with ground-based and airborne monitoring can deliver accurate and reliable results. This approach is crucial for shaping Sri Lanka's Methane Road Map and developing a bioenergy resource map to support the country's future renewable and sustainable energy goals and commitment to the methane pledge.

The highest methane-emitting solid waste disposal sites were identified through climate trace satellite data provider, and it has overlaid on Sri Lanka's average methane emission map for 2023 and 2024. This map was derived using data from the Sentinel-5P satellite.

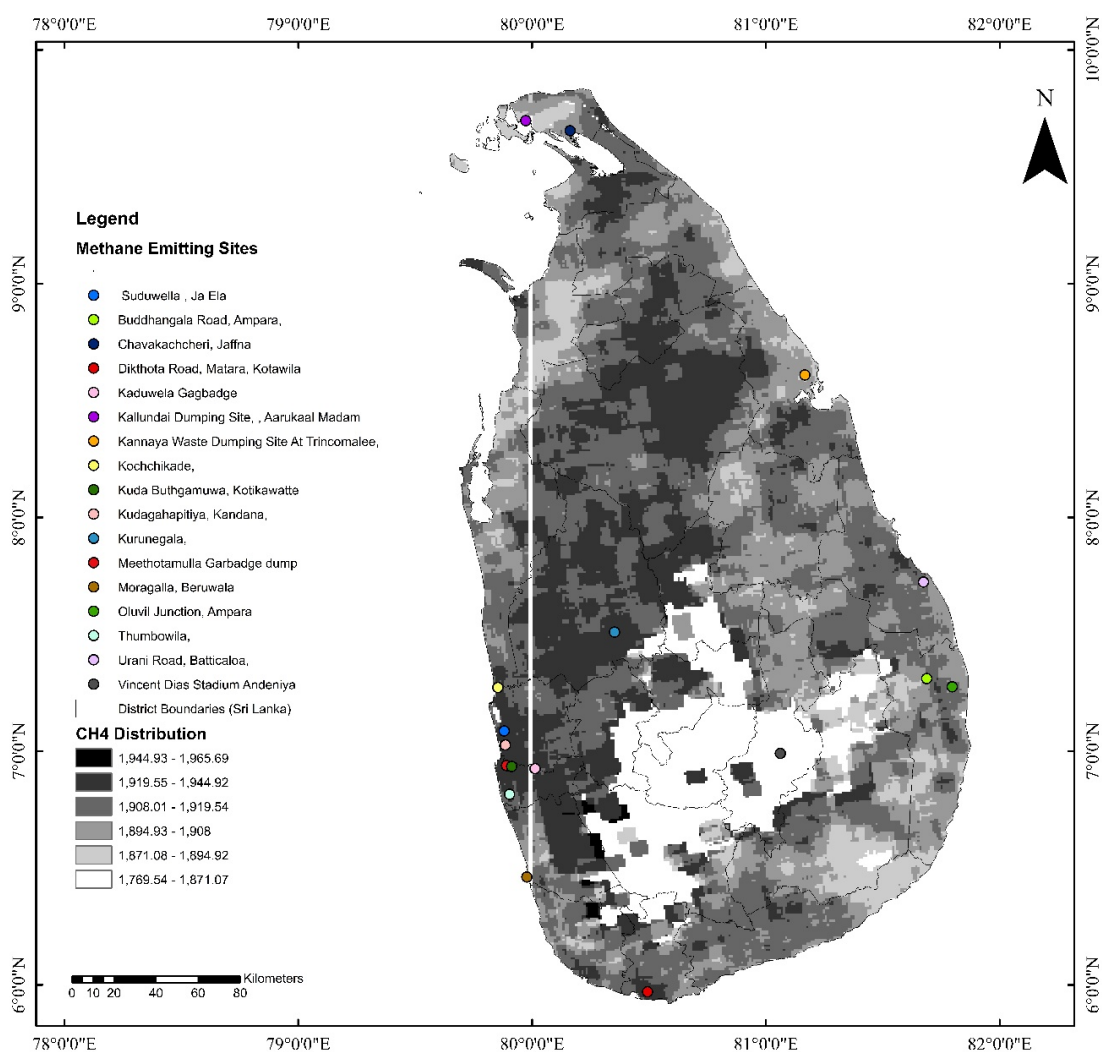


Figure 3: Sri Lanka Average methane emission satellite map indicating highest methane solid waste disposal units

In summary, approximately 40% of Sri Lanka's methane emissions originate from waste. A deliberate effort to establish a robust methane quantification methodology is essential, combining top-down approaches with current practices. Developing a baseline emission map is a critical step toward fulfilling our commitment to the Global Methane Pledge and creating a bioenergy resource map from waste.

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