Regression Analysis Of Methane Emmission On Livestock Population In Assam, 2001

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Abstract:
Global warming is a pivotal issue for the world community as of now. The issue of climate change is being addressed through the United Nations Framework Convention on Climate Change (UNFCCC). The EU's commitments are to stabilize CO2 emissions by 2000 at 1990 levels and to reduce emissions of the main six greenhouse gases by 8% in 2008-2012 from 1990 levels (Kyoto Protocol) [1]. Green House Gas other than CO2, Methane is also responsible for global warming. Its global warming potential is about 28 times greater than that of carbon dioxide[2]. It is the second most prevalent greenhouse gas (GHG) emitted through human activities, accounting for about 15 per cent global GHG emissions in 2012[3]. Methane emissions account for more than one-third of total anthropogenic (or manmade) climate forcing, making methane the second most important greenhouse gas (GHG). Methane is also a constituent of natural gas, so capturing it offers a unique opportunity to increase energy security while mitigating climate change. By targeting five main methane sectors (agriculture, coal mines, municipal solid waste [MSW], municipal wastewater, and oil and gas), the Global Methane Initiative (GMI) provides an international framework for reducing and recovering methane gas as a clean energy source, with significant benefits to the global environment, the economy, and human health[4]. In this paper, a relation between Methane emission and Livestock population has been established in the districts of Assam for the year 2001. A medium positive relation is found between the independent and dependent variable.

Index Terms **–** Global Warming, UNFCCC, GHG, GMI.

INTRODUCTION

Assam is situated in the north Eastern Region of India between 24°7'0" and 28°00'0" North latitude and between 89°42'0" and 96°02'0" East longitude. Arunachal Pradesh in the North, Mizoram in the South, Nagaland and Manipur in the East and Meghalaya, West Bengal and Bangladesh in the West bound the state. It has river valleys, Plateaus and mountains. The state occupies a total area of 78,438 sq. km. representing about 2.39 % of the total geographical area of India. It is reported that 31.1 lakh hectares of land of Assam is used for agriculture in 2000. Coal mining areas of Assam are Makum Coal field, Dilli Jeypore Coalfield, Saraipung Tarajan Coal Deposits, Sheelveta, Koilajan, Garampani, Khota Arda Coal Deposit, Deithor Coal Deposit. Oil exploration in India commenced with the discovery of the Digboi oilfield in Upper Assam more than 100 years ago, when, based on surface oil shows, a well was drilled on an exposed anticline, associated with the Naga thrust. Other significant milestones in oil exploration in Upper Assam were the discoveries of the Nahorkatiya, Moran and Rudrasagar oil fields in 1953, 1956 and 1960, respectively. Subsequently, more than 100 oil and gas fields, including Jorajan, Kumchai, Hapjan, Shalmari, Lakwa, Lakhmani, Geleki, Amguri, Charali, Borholla, Khoraghat, Baghjan, Dirok etc. have been discovered. Apart from these, another factor triggering methane emission is the livestock. 172 lakh livestock population is recorded in Assam as per livestock census of Department of Animal Husbandry and veterinary, Government of Assam (2001). An attempt has been made here to establish relationship between Methane emission and Livestock population in the districts of Assam.

METHODS AND DATABASE

I) Secondary data for Methane emission is collected from the Research Paper, " Exploration of 'hot-spots' of methane and nitrous oxide emission from the agriculture fields of Assam, India" published by Satyendra Nath Mishra, Sudip Mitra, Latha Rangan, Subashisha Dutta and Pooja Singh in Agriculture & Food Security 2012 and Livestock population data is collected from Statistical Handbook of Assam, 2001.

II) Method(s) used to compile and analyze data are,

Simple Linear Regression:

It is used for bivariate data, of which one is independent (X) and the other is dependent (Y). The regression equation is Y= a ± bX, where 'a' is intercept and 'b' is determinant or slope or regression coefficient. Symbolically, $a = \bar{y}\text{-}b\bar{x}$ and $b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$

't' test : For smaller number of observations, student 't' test is conducted.

$$t = \frac{b-0}{S.E(b)}, \text{ where S.E. (b)} = \frac{\delta^2 \mu}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}}} \text{ and } \delta^2 \mu = \frac{\sum y^2 \frac{(\sum y)^2}{n} - b\left\{\sum xy - \frac{\sum x^2 - y}{n}\right\}}{n-2}$$

III) Coefficient of Determination (R^2) :

To see how good the assumption of linearity in the relationship is, R^2 is worked out.

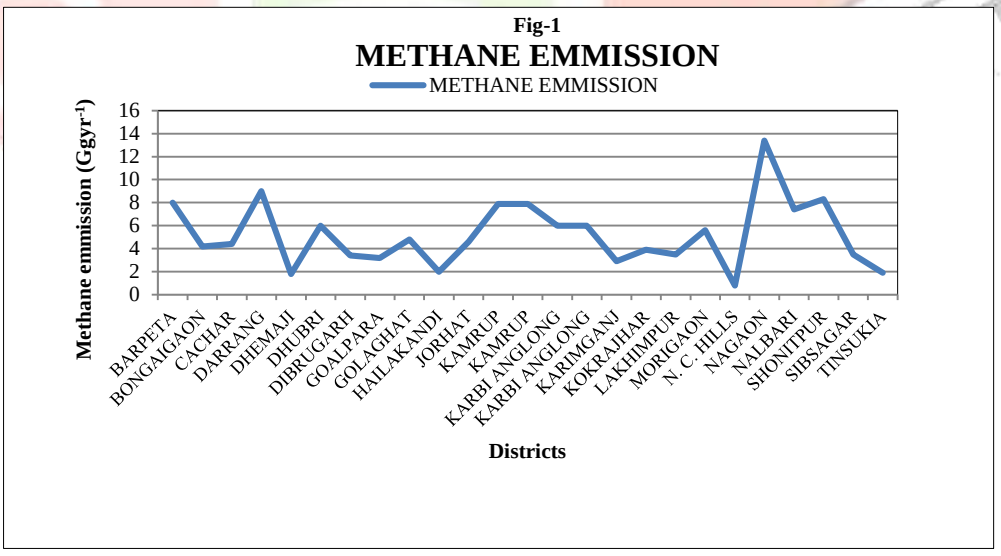
$R^2 = \frac{Explained\ Sum\ of\ Squares}{Total\ Sum\ of\ Squares}$, where Total sum of squares = $\sum y - \frac{(\sum y)^2}{n}$

Explained sum of squares = $b\left\{\sum xy - \frac{\sum x \sum y}{n}\right\}$

IV) **Tools used :**

IBM-SPSS24 is used to calculate various tables of Regression, Correlation, ANOVA and Residuals. MS-Excel is also used to draw basic statistical diagrams and scatter plots.

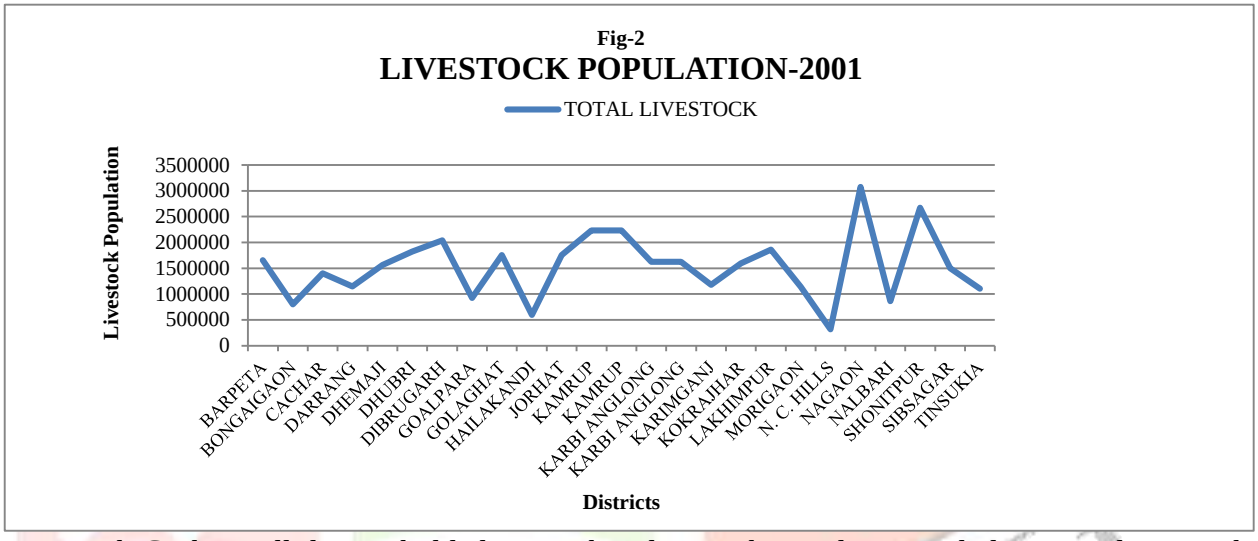
Fig-1



RESULTS AND ANALYSIS

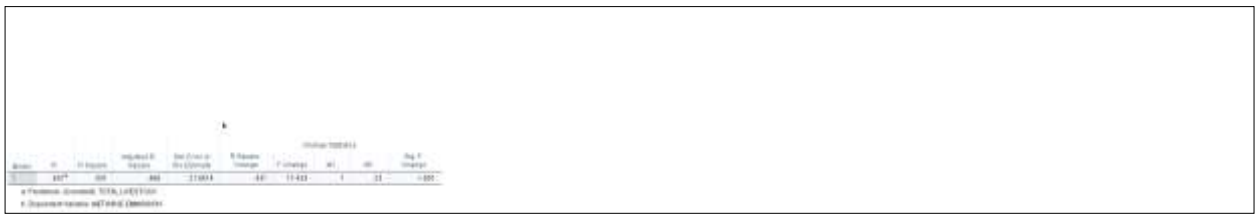
I) Figure-1 shows the district wise methane emission in Assam, 2001. Nagaon experiences highest emission of methane followed by Darrang with more than 8 $Ggyr^{-1}$. Sonitpur, Barpeta and Kamrup emitted methane equal to 8 $Ggyr^{-1}$. While North Cachar Hills emitted the least amount of methane (below 1 $Ggyr^{-1}$). Remaining districts of Assam emitted methane from 2 $Ggyr^{-1}$ to 6 $Ggyr^{-1}$. It is theoretically observed that districts having more than 8 $Ggyr^{-1}$ methane emissions are associated either with high livestock population, Coal mining area, increasing built up area with encroachment of low lying areas, etc.

II) Figure-2 shows the district wise livestock population in Assam, 2001. Nagaon ranks first in livestock population followed by Sonitpur. Point to be noted here is that Nagaon also exhibits highest emission of methane, so also Sonitpur does. Kamrup district shows third highest rank in livestock population.



North Cachar Hill district holds least rank in livestock population and also emits least methane gas. Remaining districts of Assam produces livestock between 5 lakhs to 20 lakhs. It is evident that there is relationship between livestock and methane emission.

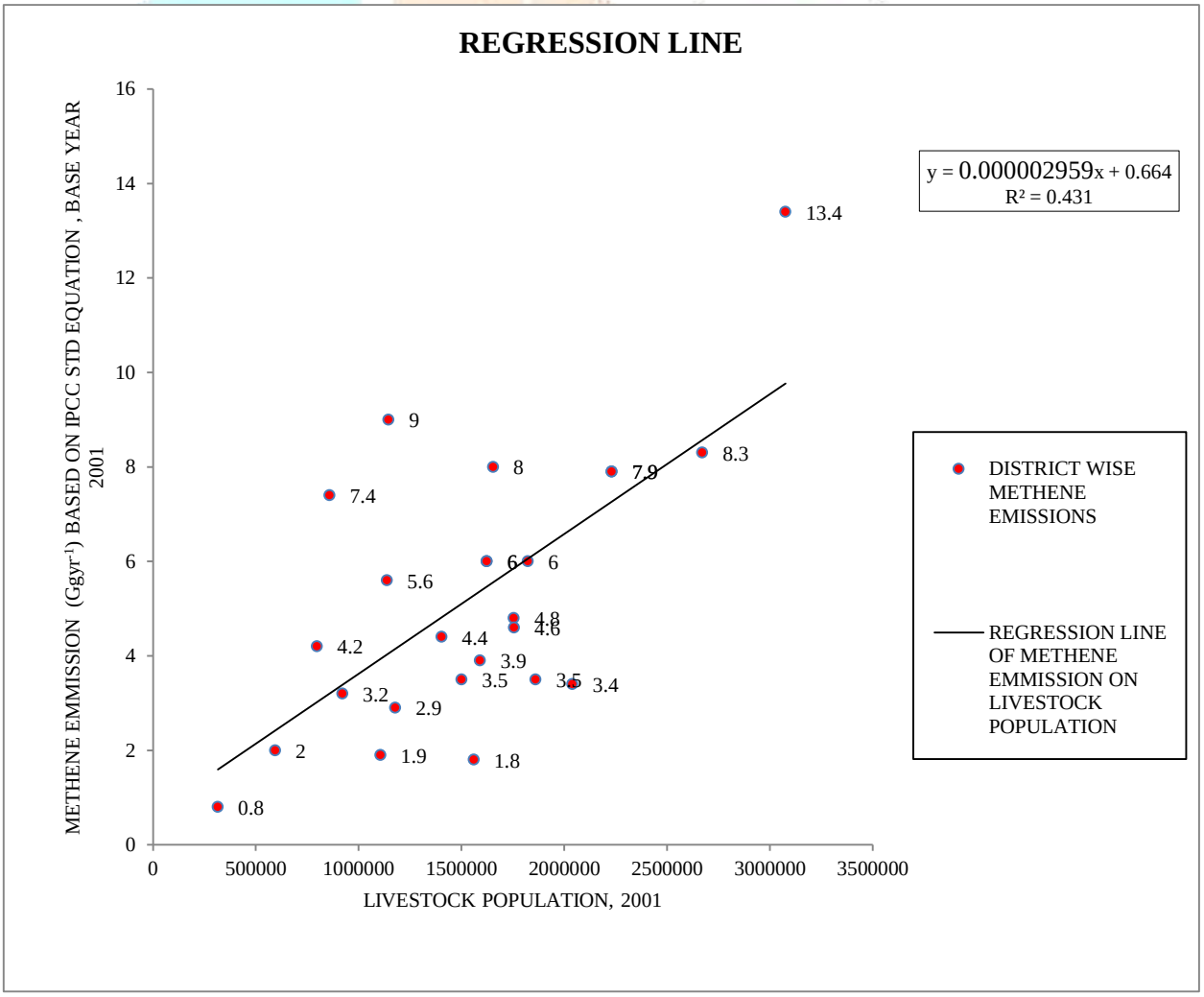
III) Table-b shows that the Correlation between Livestock population (X) and Methane emission (Y) is positive and the value of 'r' is 0.657. The value of R^2 states that 43.1% of variation in Y is explained by X variable. The remaining variation in Y, i.e. 56.9% would be explained by other independent



variable(s) . Here, F-test shows significance at 1% level of significance.

IV) The Coefficients table shows that the value of slope (b) is 0.000002959 and intercept is 0.665. The t-value is significant at 1% level of significance and the standard error is 1.175. Value of tolerance is unity as it is a bi-variate relationship.

V) The regression line shows that one unit change in Livestock population increases 0.000002959 $Ggyr^{-1}$ methane emissions. This linear relation is highly applied in the cases of Dhubri (Y= 6), Goalpara (Y= 3.2), Sonitpur (Y= 8.3), Cachar (Y= 4.4) and Hailakandi (Y= 2) only. Although Nagaon (Y= 13.4) has highest emissions of methane as per observation, it is not due to the large numbers of livestock population. Remaining districts of Assam shows less linear relation between methane emissions and livestock population.



CONCLUSION

Effective and desired relationship can be achieved if independent and dependent variables are selected on basis of ground reality check. Theoretical or arbitrary selection of variables very often is unable to draw any concrete inferences. The problem stated here is a universal one. In this paper, there is a scope of adding more independent variables to predict the dependent variable, or identifying principal component(s) from sets of variables selected for the purpose.

NO CONFLICT OF INTEREST: There is no conflict of interest in terms of funding and collected data.

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2002	CH4 EMMISSION (Ggyr-1) BASED ON IPCC STD EQUATION , BASE YEAR 2001		
	Districts	METHANE EMMISSION	TOTAL LIVESTOCK
0	BARPETA	8	1654297
1	BONGAIGAON	4.2	797340
2	CACHAR	4.4	1403479
3	DARRANG	9	1145875
4	DHEMAJI	1.8	1559889
5	DHUBRI	6	1823357
8	DIBRUGARH	3.4	2039290
9	GOALPARA	3.2	921735
10	GOLAGHAT	4.8	1755256
11	HAILAKANDI	2	595523
12	JORHAT	4.6	1756126
13	KAMRUP	7.9	2231220
26	KAMRUP	7.9	2231220
14	KARBI ANGLONG	6	1623839
15	KARBI ANGLONG	6	1623839
16	KARIMGANJ	2.9	1178985
17	KOKRAJHAR	3.9	1590931
18	LAKHIMPUR	3.5	1861145
19	MORIGAON	5.6	1137842
22	N. C. HILLS	0.8	315180
20	NAGAON	13.4	3076004
21	NALBARI	7.4	858662
24	SHONITPUR	8.3	2671446
23	SIBSAGAR	3.5	1500938
25	TINSUKIA	1.9	1106161

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