



Republic of Albania  
Ministry of Environment,  
Forest & Water  
Administration



United Nations  
Development Programme

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# **KEY SOURCE ANALYSIS FROM FERMENTATION AND MANURE MANAGEMENT**

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**ALBANIA**

## **1. Key sources of regional significance: Enteric Fermentation**

### **1.1 Agriculture background**

The Agriculture sector has dominated the Albanian economy since many years. The specific weight of agriculture sector in the total GDP was 25.1% in 1990, approximately 52.3% in 1994 and still remained 45% till 2004. The income increase from the plants production, livestock, agro-industry, fishing and forestry remains the main alternative for the economic and social development of the country. Many factors condition the development of the agriculture sector. The most important are:

- Farms of minimal sizes and fragmented;
- Property problems over arable land;
- Very high prices of inputs and a unorganized and non-effective production and distribution system of agricultural production;
- Lack or insufficiency of agriculture crediting;
- Lack or insufficiency of agriculture mechanics.

The main emphasis still remains the production of cereals; however its structure has shifted towards supplying animal foodstuffs instead of human consumption. Rice cultivation and production after 1990 practically stopped and therefore there are no reported statistical data of cultivation for this crop. Heavily affected by the transition period were the so called industrial plants such as sugar beet, cotton, beans and sunflower seeds, whose production after 1990 was drastically reduced or stopped. Olives are considered a suitable product for export. There are around 6 million olive trees. From them, only 4 million are productive.

Livestock constitutes more than half of the total value of agricultural production. Although development of animal husbandry has not been encouraged, the number of cattle and of small ruminants has increased rapidly. The anticipated continuous increase can create problems for the environment in the future, because the density of livestock per acre of land is already very high. The high density of small ruminants in pastures and forests causes similar problems.

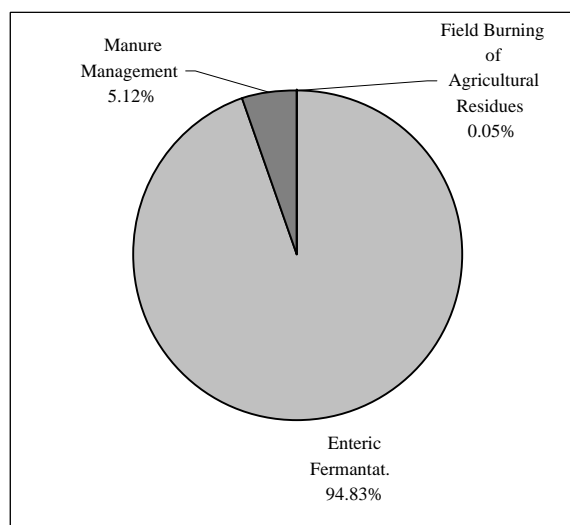
The Albanian agriculture will incur into new developments in the coming two decades. Such developments are expected to affect both the production structures and production modes. With most of agricultural activities shrinking, livestock breeding is still developing. Cattle number is increasing after a recession period during 1997-1998. The number of small ruminants is somewhat stable, whereas the poultry sector (principally laying hens) is on the rise.

### **1.2 Agriculture and Enteric Fermentation Activity Data**

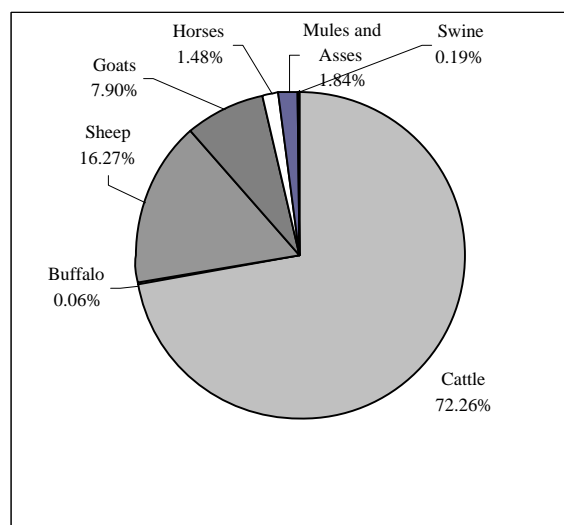
The conclusion withdrawn from the Inventory of GHG emissions for Albania, for the year 1994, performed under the First National Communication under the Climate Change Convention, is that the main key source is CH<sub>4</sub> emission from Enteric Fermentation with 22.49% of total GHG emissions.

From the other side, the contribution of agriculture sector is 26.59% in Global Warming Potential of Albania, from where the CH<sub>4</sub> emissions are the main contributors with 79.71 Gg or 77.74% of total CH<sub>4</sub> emissions from all sectors. CH<sub>4</sub> emissions come mainly from enteric fermentation (94.83%) and manure management (5.12%) as shown in figure 1.1. Cattle are the main contributor of CH<sub>4</sub> emissions from enteric fermentations (72.26%) followed by

sheep (16.27%) as shown in the figure 1.2. N<sub>2</sub>O emissions are mainly produced from the application of nitric fertilizers with 84.81%. The emissions of CH<sub>4</sub> and N<sub>2</sub>O are insignificant as a result of burning of agricultural residues.



**Figure 1.1.: CH<sub>4</sub> emission from agriculture sector [79.711 Gg], 1994**



**Figure 1.2.: CH<sub>4</sub> emission from Enteric Fermentation [54.619 Gg], 1994**

Let us analyze in detail the main factors related with activity data of key source from Enteric Fermentation for the year 1994. The main figure related with the Activity Data is the number of the animal population, and then the analyses have started from here.

Based in the IPCC figures for the year 1994, number of livestock is given in the following table 1.1 (taken from IPCC excel file). Three elements are very important:

- Number of Animals;
- Emissions Factor for Enteric Fermentation;
- Emissions Factor for Manure Management.

Table 1.1: Methane and nitrous oxide emissions from domestic livestock in 1994						
MODULE	AGRICULTURE					
SUBMODULE	METHANE AND NITROUS OXIDE EMISSIONS FROM DOMESTIC LIVESTOCK ENTERIC FERMENTATION AND MANURE MANAGEMENT					
WORKSHEET	4-1					
SHEET	1 OF 2 METHANE EMISSIONS FROM DOMESTIC LIVESTOCK ENTERIC FERMENTATION AND MANURE MANAGEMENT					
COUNTRY	ALBANIA					
YEAR	1994					
Livestock Type	STEP 1			STEP 2		STEP 3
	A Number of Animals (1000s)	B Emissions Factor for Enteric Fermentation (kg/head/yr)	C Emissions from Enteric Fermentation (t/yr)	D Emissions Factor for Manure Management (kg/head/yr)	E Emissions from Manure Management (t/yr)	F Total Annual Emissions from Domestic Livestock (Gg)
			C = (A x B)		E = (A x D)	F = (C + E)/1000
Dairy Cattle	451	81	36,531.00	5	2,255.00	38.79
Non-dairy	323	56	18,088.00	2	646.00	18.73

<b>Cattle</b>						
<b>Buffalo</b>	<b>0.8</b>	<b>55</b>	44.00	2	1.60	0.05
<b>Sheep</b>	<b>2460</b>	<b>5</b>	12,300.00	0.21	516.60	12.82
<b>Goats</b>	<b>1194</b>	<b>5</b>	5,970.00	0.22	262.68	6.23
<b>Camels</b>			0.00		0.00	0.00
<b>Horses</b>	<b>62</b>	<b>18</b>	1,116.00	2.2	136.40	1.25
<b>Mules &amp; Asses</b>	<b>139</b>	<b>10</b>	1,390.00	1.2	166.80	1.56
<b>Swine</b>	<b>98</b>	<b>1.5</b>	147.00	1	98.00	0.25
<b>Poultry</b>	<b>3642</b>	<b>0</b>	0.00		0.00	0.00
<b>Totals</b>			75,586.00		4,083.08	79.67

In order to reach the proper value we will use two registrations of livestock animal population: Registration of the year 1990 which has the time series of 1988-1990, and the Registration of 1996-2000 as shown in table 1.2.

Animals	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
cattle	430	400	378						456	433	488	623	703
cows	323	300	268						302	296	346	452	457
buffalo	1.01	0.93	0.88						0.74	0.71	0.69	0.66	0.64
sheep	1980	1920	1850						1910	1876	2012	2100	2150
goats	960	902	860						1045	1012	1067	1150	1213
Camels	0	0	0						0	0	0	0	0
Horses	123	116	110						74	70	65	60	55
Mules & Asses	143	134	124						125	121	145	160	164
Pigs	232	214	189						98	94	102	113	121
Poultry	2789	2634	2719						4108	4566	4862	5004	5115

Based on the above time series, the respective correlations have been found, from which, assuming a normal situation, we have calculated the respective figures for: dairy cattle, non-dairy cattle, buffalo, sheep, goats, horses, mules & asses, swine, poultry for the year 1994.

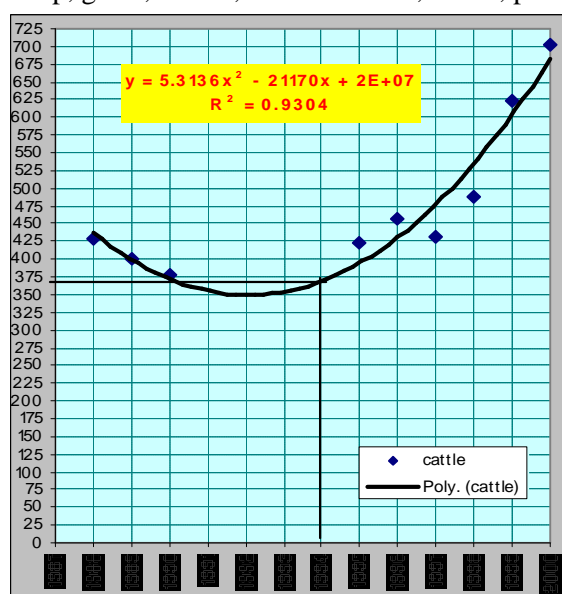


Figure 1.3.: Cattle population according two registrations: before 1990 and after 1995

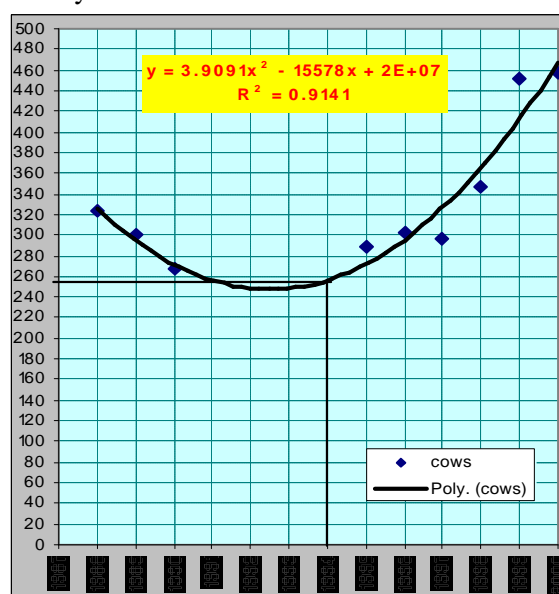


Figure 1.4.: Cows population according two registrations: before 1990 and after 1995

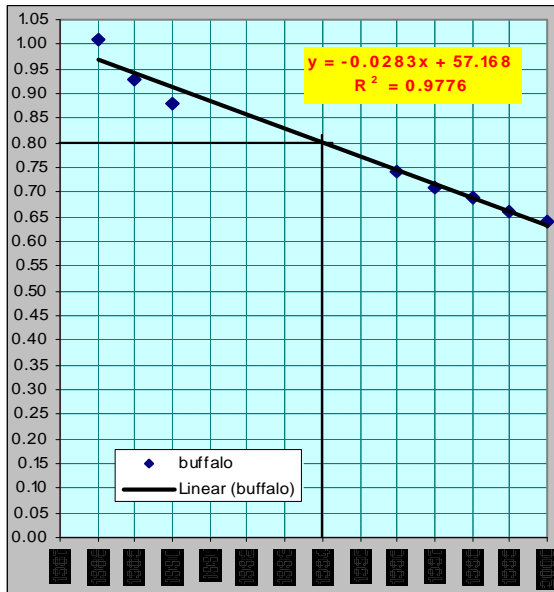


Figure 1.5.: Buffalo population according two registrations: before 1990 and after 1995

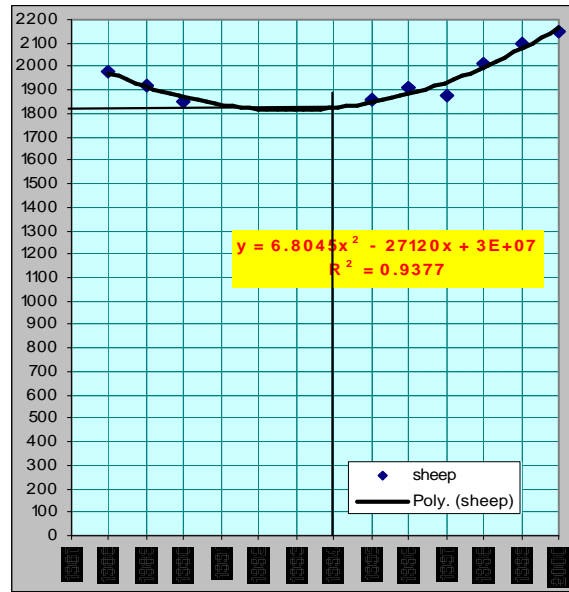


Figure 1.6.: Sheep population according two registrations: before 1990 and after 1995

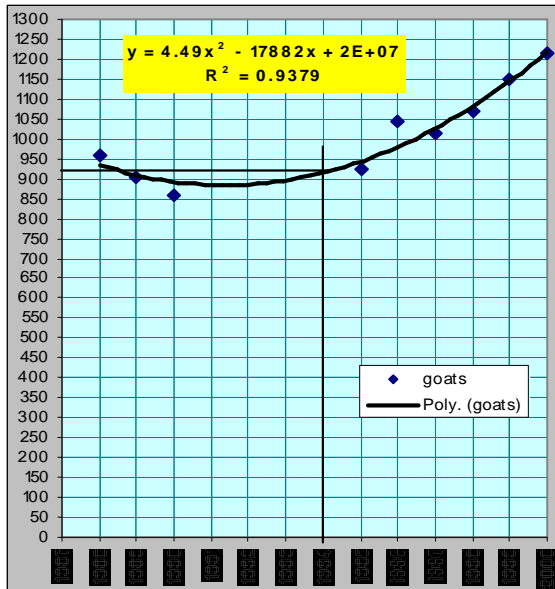


Figure 1.7.: Goats population according two registrations: before 1990 and after 1995

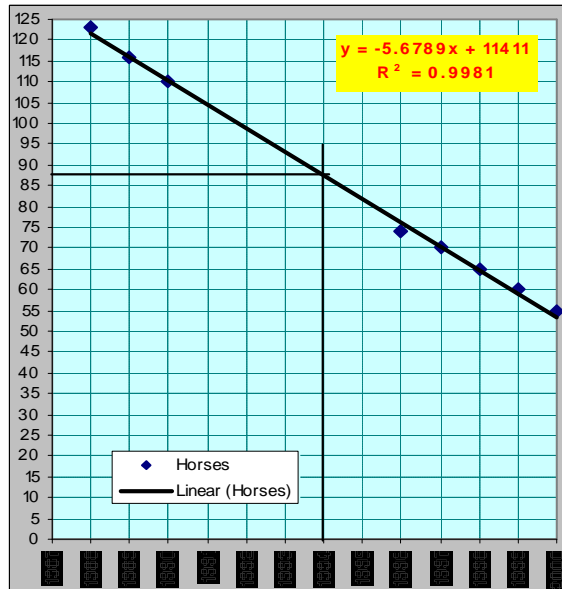


Figure 1.8.: Horses population according two registrations: before 1990 and after 1995

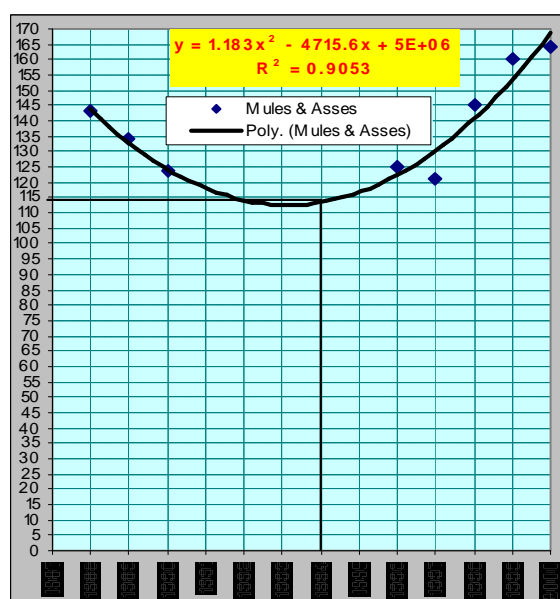


Figure 1.9.: Mules and Asses population according two reg.: before '90 and after 1995

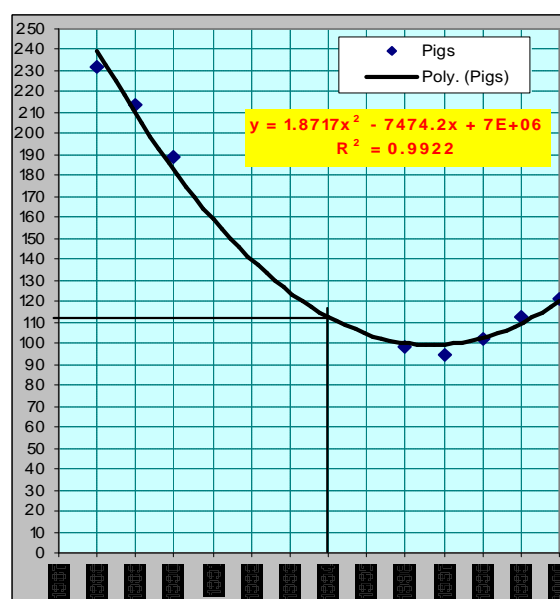


Figure 1.10.: Pigs population according two registrations: before 1990 and after 1995

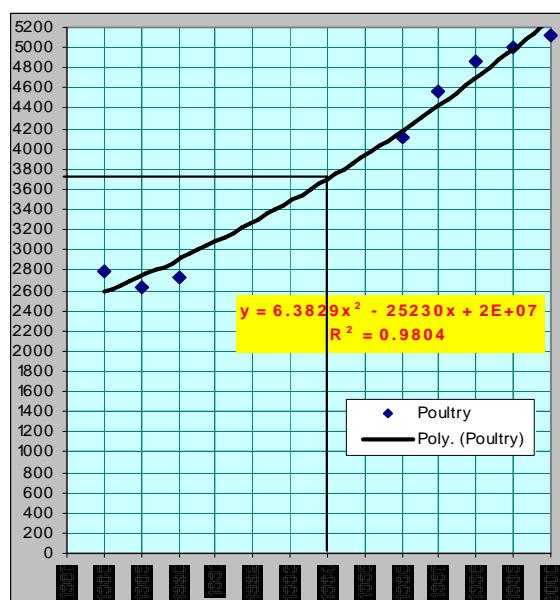


Figure 1.11.: Poultry population according two registrations: before 1990 and after 1995

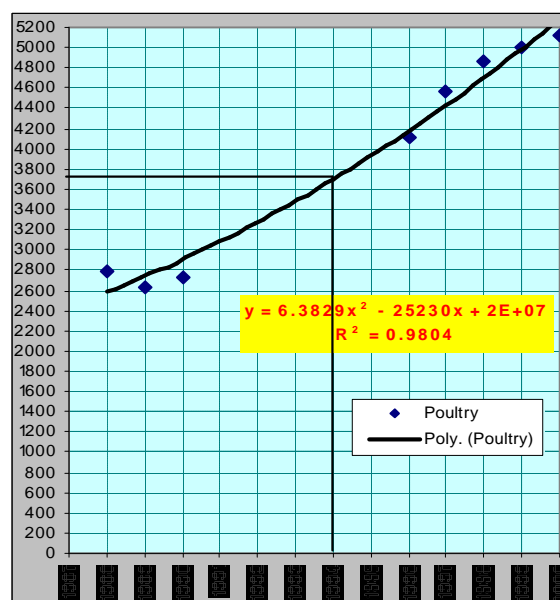


Figure 1.12.: Poultry population according two registrations: before 1990 and after 1995

Based on the above correlations (for all nine categories of animals), the new figures for animal population are shown in table 1.3:

Table 1.3: Recalculated animal populations (1000) for the year 1994			
animals	Population of animals for the year 1994 based on the values founded from the correlations on the year 2005	Population of animals for the year 1994 used in the IPCC methodology on the year 2000	difference
cattle	370	451	21.89%
cows	257	323	25.68%
buffalo	0.802	0.8	-0.25%
sheep	1820	2460	35.16%
goats	933	1194	27.97%
Camels	0	0	0
Horses	88	62	-29.55%

Mules & Asses	114	139	21.93%
Pigs	112	98	-12.50%
Poultry	3723	3642	-2.18%

The second important indicators are emission factor from enteric fermentations and manure management. Methane emission from enteric fermentation and from animal manure, as the principal methane contributor in the Albanian agriculture, has been estimated according to the IPCC (1996), as it was also discussed in details as above. Since measurement of gas emitted could not be conducted directly through the use of a facemask or respiratory chamber, the alternative method was to indirectly calculate the amount of gas produced through the use of the *emission factors*. The calculations were based on the following assumptions:

1. All dairy cattle are stall-fed while non-dairy cattle are allowed to graze in the open field. The feeds for all ruminants are assumed to attain 60% digestibility with 8% manure ash content;
2. Body weight and daily weight gain for different age groups of ruminants were derived from reports of Chatalakhana (1984);
3. An average milk yield of 8 liters/head/day with 3.8% is estimated for milk cows.

Due to the lack of changes in the cattle breeding patterns in Albania, the emission factors used for calculating the methane release will be the same. *Conversion factors* were used to estimate the amount of methane produced from animal manure. The average methane conversion factors (MCF) were established after assessing the manure management practices for each animal category in Albania. The size of dairy cows farms in Albania is small (on average 3-4 heads/farm). Therefore the use of liquid systems of manure management that generate high quantities of methane is almost inexistent. For this reason the MCF are the same to the ones selected before.

Based on both figures: number of respective animal population and specific emission factors we have now the possibility to find key source emission corrected by typing them in Module 4 of the IPCC excel sheets for the year 1994, as shown in the table 1.4.

Table 1.4: : Corrected methane and nitrous oxide emissions from domestic livestock in 1994						
MODULE	AGRICULTURE					
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			$C = (A \times B)$		$E = (A \times D)$	$F = (C + E)/1000$
Dairy Cattle	370	81	29,970.00	5	1,850.00	31.82
Non-dairy Cattle	257	56	14,392.00	2	514.00	14.91
Buffalo	0.802	55	44.11	2	1.60	0.05
Sheep	1820	5	9,100.00	0.21	382.20	9.48

Goats	933	5	4,665.00	0.22	205.26	4.87
Camels	0		0.00		0.00	0.00
Horses	88	18	1,584.00	2.2	193.60	1.78
Mules & Asses	114	10	1,140.00	1.2	136.80	1.28
Swine	112	1.5	168.00	1	112.00	0.28
Poultry	3723	0	0.00		0.00	0.00
<b>Totals</b>			<b>61,063.11</b>		<b>3,395.46</b>	<b>64.46</b>

Finally we got the following results:

<b>Table 1.5: CH<sub>4</sub> emissions from enteric fermentation and manure management as per categories of animals</b>				
Animals	Enteric Fermentation		Manure Management	
	1994 used	1994 corrected	1994 used	1994 corrected
Dairy Cattle	36.531	29.970	2.2550	1.8500
Non-dairy Cattle	18.088	14.392	0.6460	0.5140
Buffalo	0.044	0.044	0.0016	0.0016
Sheep	12.300	9.100	0.5166	0.3822
Goats	5.970	4.665	0.2627	0.2053
Camels	0.000	0.000	0.0000	0.0000
Horses	1.116	1.584	0.1364	0.1936
Mules & Asses	1.390	1.140	0.1668	0.1368
Swine	0.147	0.168	0.0980	0.1120
Poultry	0.000	0.000	0.0000	0.0000
<b>Total</b>	<b>75.586</b>	<b>61.063</b>	<b>4.0831</b>	<b>3.3955</b>

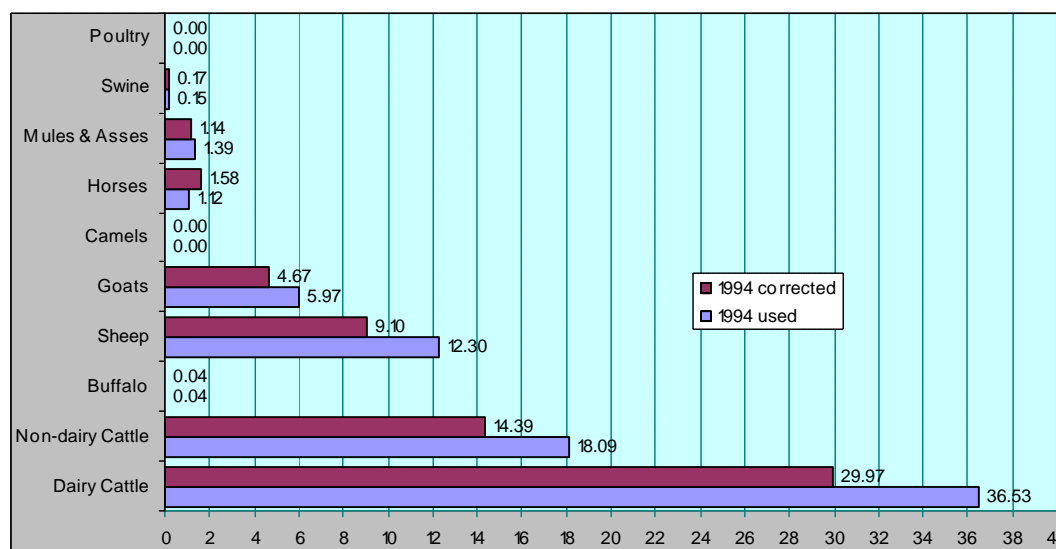


Figure 1.13: CH<sub>4</sub> emissions from enteric manure management [Gg/year]

<b>Table 1.6: CH<sub>4</sub> emissions from Enteric Fermentation and Manure Management from all categories of animals</b>		
	CH <sub>4</sub> from Enteric Fermentation and Manure Management prepared on 2000 for the year 1994	CH <sub>4</sub> from Enteric Fermentation and Manure Management prepared on 2005 for the year 1994
Gg/year for year 1994	79.6691	<b>64.4586</b>
Change between them, %	100%	80.91%

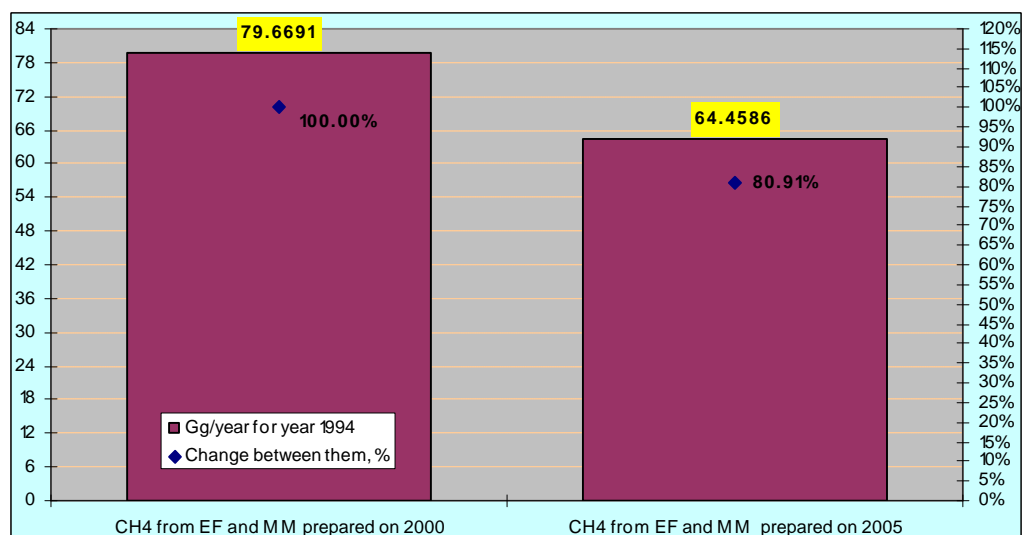


Figure 1.14.: CH<sub>4</sub> emissions from Enteric Fermentation and Manure Management

	N <sub>2</sub> O from Enteric Fermentation and Manure Management prepared on 2000 for the year 1994	N <sub>2</sub> O from Enteric Fermentation and Manure Management prepared on 2000 for the year 1994
Gg/year for year 1994	<b>0.00209</b>	<b>0.00176</b>
Change between them, %	100%	84.52%

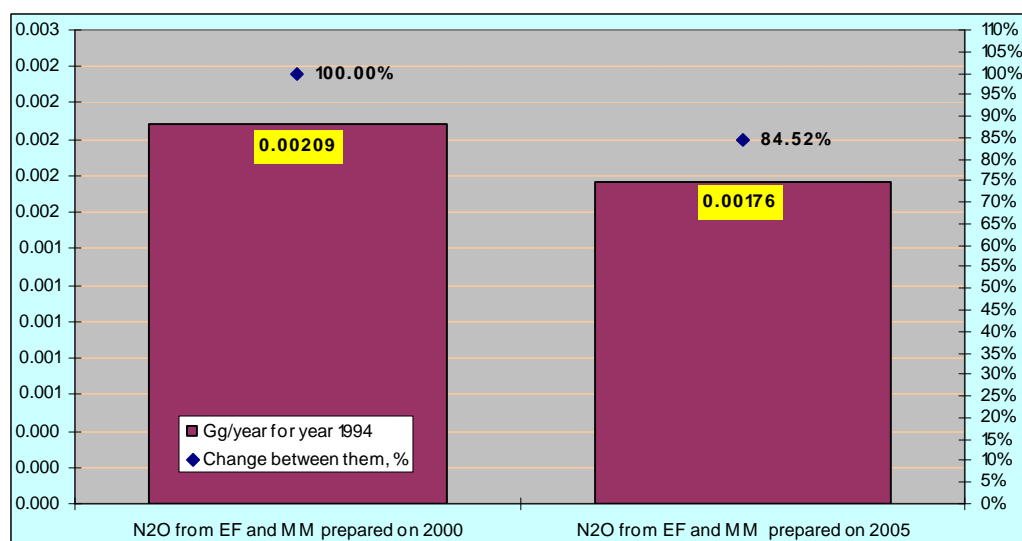
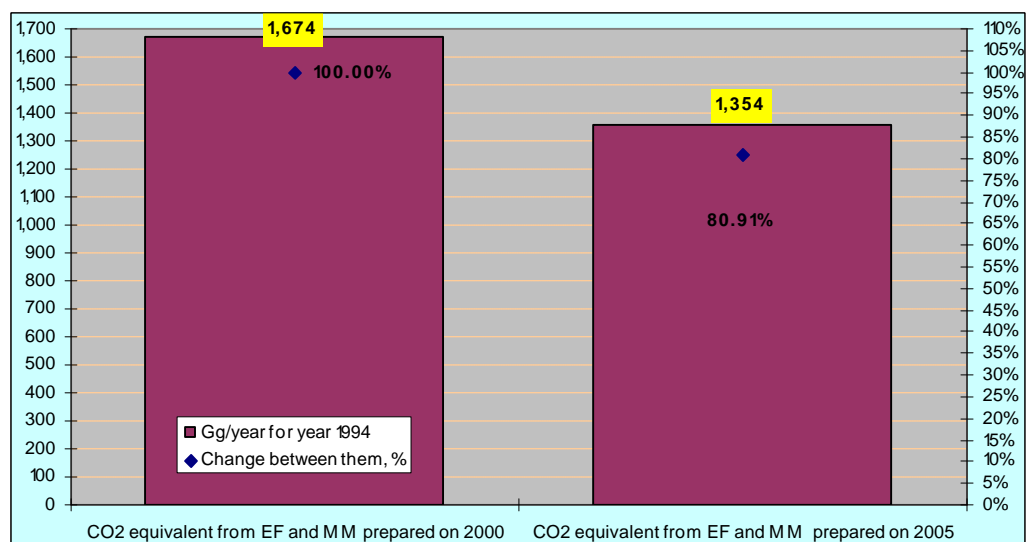


Figure 1.15.: N<sub>2</sub>O emissions from Enteric Fermentation and Manure Management

	CO <sub>2</sub> from Enteric Fermentation and Manure Management prepared on 2000 for the year 1994	CO <sub>2</sub> from Enteric Fermentation and Manure Management prepared on 2000 for the year 1994
Gg/year for year 1994	<b>1,674</b>	<b>1,354</b>
Change between them, %	100%	80.91%



**Figure 1.16.: CO<sub>2</sub> equivalent emissions from Enteric Fermentation and Manure Management**

**Final Conclusion is: Based on very detailed analysis described above CO<sub>2</sub> equivalent emissions from Enteric Fermentation and Manure Management calculated in the year 2000 for the year 1994 was 1674 Gg, while the same figure calculated in the year 2005 (as part of Key Source Analyze) is 1354 Gg or 19.09% lower.**