

The Role of Ruminants on Environmental Pollution and Possible Solution to Reduce Global Warming

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Abstract: The aim of the work was to shed light on the responsibility of ruminants to inject methane (CH_4) into the atmosphere and to highlight how about 70% of livestock and almost all small ruminants live in areas of the planet, usually the poorest, where it is not possible to produce food for the man. According to many authors, ruminant breeding is one of the main causes of deforestation and global warming observed in recent years and 11%-12% of world population's malnutrition depends mainly on the increase in ruminant rearing that is also responsible for the poor efficiency in producing nutrients. A further objective is to highlight those factors that, for various reasons, are ignored. Ruminants have contributed both to the work, still used in many areas (just think of the hilly fields of rice in Asia), both with the supply of noble proteins to be one of the main factors that allowed the evolution of human species. Just think that where (Europe, Asia minor, Indian sub-continent) milk was used for feeding children, the numerical increase in human population was faster than the areas where its use was unknown (Americas and Australia). The most fertile soils, like the Great Plains of the United States, are those that in the past were populated by ruminants like the bison. Some scientists argue that humans are a species that is supposed to eat fruit physiologically. They ignore that *Homo habilis* has evolved since he became omnivorous. Many primates complement their diet with small mammals, crabs, crustaceans, molluscs, amphibians, worms and even fish trapped in some ponds during the low tide period. They ignore or want to ignore that primitive man chose the flesh driven by instinct because they needed vitamin B12. Regarding deforestation, many of the areas currently used as pastures have been obtained by burning forests, but it is not sufficiently stressed that all areas used today by man come from forest areas and that every year millions of hectares of forests are destroyed due to accidental fires or are caused by pyromaniacs. As for the production of CH_4 , although the ruminants produce physiologically CH_4 , it is also true that the increase in CH_4 in the atmosphere is preceded by the increase in heat, the main cause of which is the increase in carbon dioxide (CO_2). The presence of this gas in the atmosphere is due to the use of fossil fuels, namely oil, coal and natural gas, whose emissions are due to the multinational companies that manage the production of energy. It is likely that the demonization of ruminants serves to focus attention on a problem that is solvable by improving cattle rearing techniques and the rational use of manure. The purpose of this demonization is also to allocate the breeding areas to the seed multinationals. It is likely that the objective is to minimize the real problem of global warming, which derives from the misuse of the energy resources of the subsoil that derive from the accumulation over the millennia of different sources of carbon that are released daily in the atmosphere.

Key words: Ruminants, deforestation, methane, global warming, primates, endangered species, water consumption, human undernutrition.

1. Introduction

The increase in population will require new cultivated land and/or a further increase in yields, partly because the developing countries have adopted the Western food style: as happened in China between 1980 and 2012, where the consumption of meat has increased from 20 kg/capita to 59 kg/capita [1].

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Developing countries, pursuing a status symbol, increase the consumption of products derived from animals. Animalists and scientists [2] point out that the consumption of products of animal origin is a non-secondary cause of global warming (GW). The main culprits are the ruminants that produce methane (CH_4) that is found in the atmosphere.

Currently, around 11%-12% of the population (particularly Asia and sub-Saharan Africa) is undernourished; however, this value was 18% in 1990.

One third of the food produced (1.3 billion tons) is ruined due to inefficient distribution logistics. It is not to be excluded that without this waste the undernourished population would not exist.

It is estimated that in the European Union (EU) every year, around 88 million tons of food are wasted at all stages of the food chain, of which 14% is attributed to collective catering; the estimated cost to dispose of food products in landfills amounts to around 143 billion euros [3].

The food crisis of recent times has been determined by the speculation on foodstuffs and by the hoarding of lands (the hoarding of land for 20 million hectares) in the South of the world, in Africa but also in Asia; not secondary factor was the use of plant resources both for the production of agro-fuels and the hoarding of food products by the developed countries and large state-owned companies that have created a joint venture between public and private [1, 4]. The lands have been subtracted to nomadic or sedentary populations that have owned them for generations but cannot prove their ownership. In the developing countries, in fact, there is no guarantee of land rights but informal and traditional rules, recognized locally but not by international agreements. History teaches that less than 100 years ago colonialists, instead of renting those surfaces, decimated the populations that owned them. Today, due to the speed that characterizes the dissemination of news, the bloody suppression of the populations is more difficult, and the appropriation of the territories has been legalized by different methods (land grabbing) that lead to the same result.

While the news travels fast, the rules change and it is not possible to exclude that even scientists convince the public opinion that the meat of ruminants is harmful to replace the pastures with new forms of economic colonialism.

2. CH₄ in the Atmosphere and Role of Ruminants

Looking at the intergovernmental panel on climate

change (IPCC) report, the value data of CH₄ in the atmosphere (ppb), it is easily verified that the increase of CH₄ in the atmosphere from 1979 up to 2014 (Fig. 1) has followed that of the number of standardized ruminants (SR) that corresponds to one cattle/buffalo/camel or eight sheep/goats or five camelids.

It is also easily verified that the increase of CH₄ in the atmosphere from 1979 up to 2002 is higher than the number of SR. After 2002, the opposite is true. A further proof of the spurious association between CH₄ in the atmosphere and the number of SR raised on the planet is given by the following observation. If the CH₄ value in the atmosphere is divided by the SR number, it is easy to see that the CH₄ produced by ruminants after 2002 decreases from 1.031 ppb/SR to 0.937 ppb/SR (Fig. 2) while the digestive physiology of ruminants not been modified. Indirectly, this evidence shows that there are other sources that emit CH₄ in the atmosphere that after 2002 have become more active. It should be emphasized that the number of ruminants (especially wild) increased progressively from the Miocene (20 million years ago) while the increase of CH₄ in the atmosphere was recorded only after the start of the industrial era.

The sources that determine the presence of CH₄ in the atmosphere are only partially known.

For example, recently, scientists have shown that clams and worms in the Baltic release more greenhouse gases than 20,000 dairy cows [4]. The figure above represents 10% of the entire population of Welsh dairy cows and 1% of the entire population of dairy cows in the United Kingdom.

The results, which were published in Scientific Reports, indicate a hitherto neglected source of greenhouse gases in the sea and could have a profound impact on decision makers. Co-author of the study, Dr. Ernest Chi Fru, from the School of Earth and Ocean Sciences of the University of Cardiff, said "What baffles is that the Baltic Sea makes up only about 0.1% of the Earth's oceans, which implies that globally,

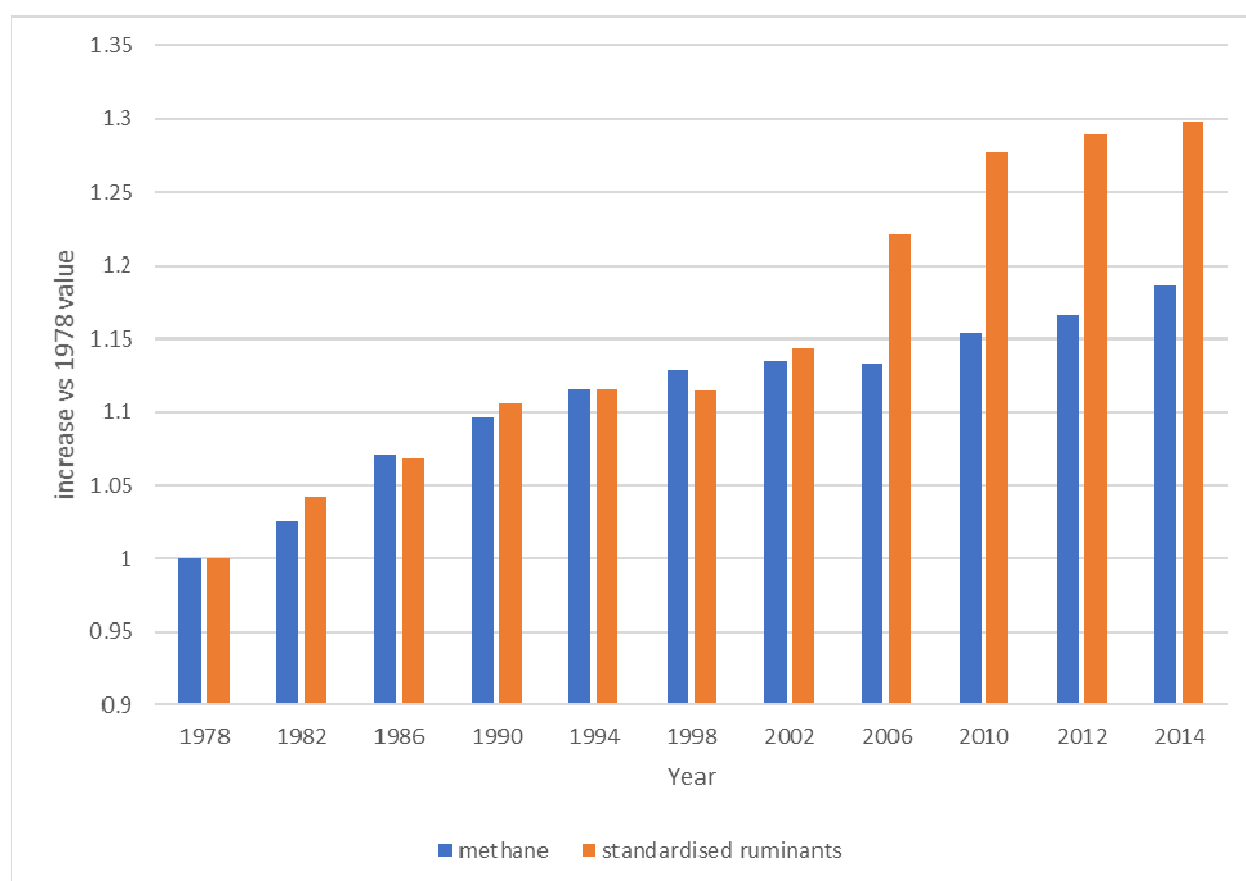


Fig. 1 The increase (1979-2014) of standardized ruminants (SR) and methane compared with 1978 values (= 1).

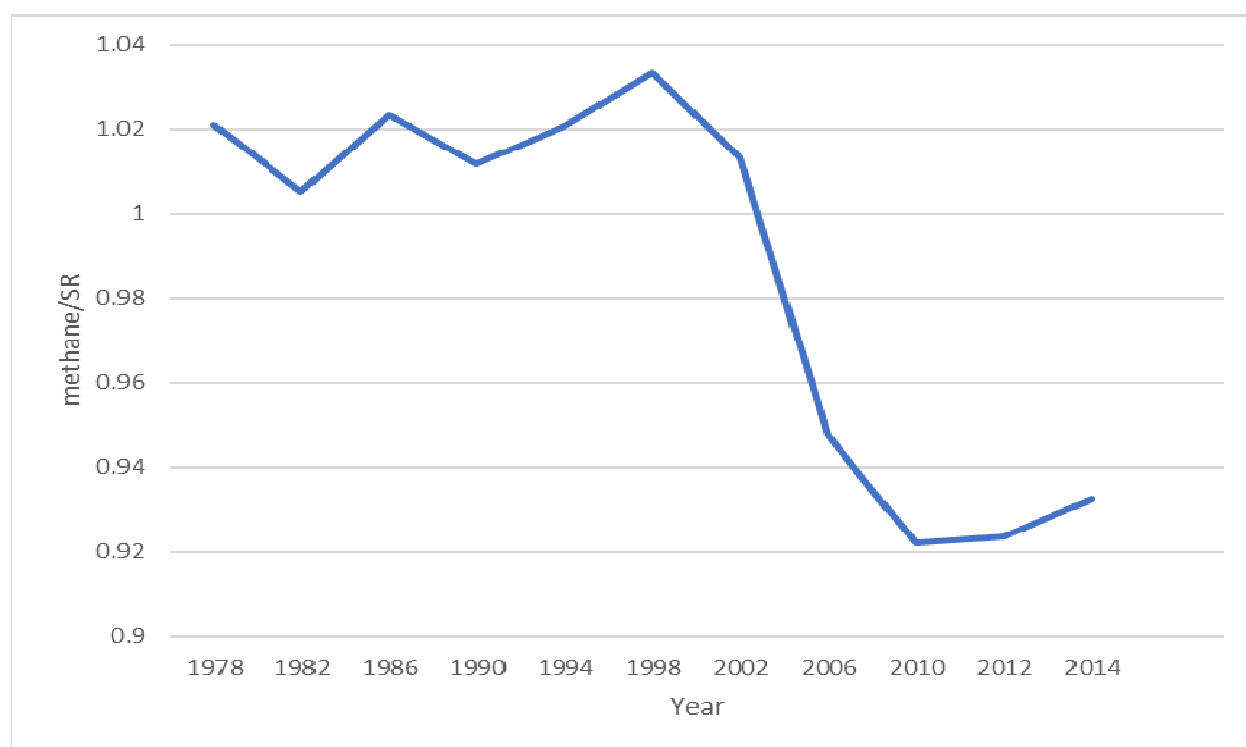


Fig. 2 Methane (ppb) input in atmosphere (IPCC) between 1979 and 2014 per SR (methane/SR).

apparently harmless bivalve animals at the bottom of the world's oceans may actually contribute to amount of greenhouse gases that are not found" [4]. The team analyzed both the direct and indirect contribution on CH₄ and nitrous oxide production in the sea. The results showed that sediments containing clams and worms increased CH₄ production by a factor of eight compared to completely bare sediments.

To be recalled here is that CH₄, responsible for 18% of the greenhouse effect, is derived from the decomposition of solid urban waste in landfills and from digestion of anaerobic biomass (both of these causes are difficult to quantify). CH₄ also derives from marshes (23%), fossil fuel extraction (20%), digestive processes of ruminants (17%) and rice cultivation (12%-18%) [5, 6]. It is known that the oxygen-free mud on the bottom of the marshes has always hosted methane-producing bacteria, also called wetland gas. To these sources, it is necessary to add the emissions of oil activities and the considerable losses stemming from gas pipelines. The concentration in the atmosphere of 700 ppb estimated between the years 1,000 and 1,750 has increased to 1,750 ppb in 2000 (+150%).

Furthermore, to extract coal from mines, to reduce the risk of explosion, CH₄ is extracted and introduced into the atmosphere before, during and after the start of the extraction process.

Between 1979 and 2014, according to FAO [7], SR increased from one billion and 539 million heads (cattle = 1,217 million) to one billion and 974 million heads (cattle = 1,494 million), they grew by 28%, while rice production rose from 375 million tons to 741 million tons and the increase was 197%. If CH₄ sources (ruminant digestive processes = 17%, rice fields = 12%) are considered, why scientists and press predominantly demonize the ruminants? It cannot be excluded that they protect the interests of multinationals who produce seeds. The increase of CH₄ in the atmosphere, as well as that of CO₂, has been recorded especially since the advent of

industrial era (end of XVIII century-beginning of XIX century) when the number of domestic ruminants in the planet was certainly lower than at present but the number of wild ruminants was absolutely higher. In USA, for example, 89.3 million of bovine are currently bred but it is known that in 1870, were present 60 million of bison (the estimates of the number of the Eurasian bison are unavailable) together with a high number of wild ruminants like [8] elk, deer and bighorn (the number of bighorn is estimated at least two million, in fact this wild sheep is part of the Native American mythology).

Kristensen *et al.* [2] report that according to Hristov [8], wild ruminant emissions in the past would be almost identical to those observed today by CH₄ emissions from wild animals and animals raised in the United States.

Since that time, CH₄ in the atmosphere has increased 2.5 times. The increase in CO₂ and CH₄ occurs after the temperature is increased and not vice versa [9]. The atmospheric CO₂ concentration increased by 18% compared to the pre-industrial period (from 270 ppb to 319 ppb in 2005) because the carbon, stored in the subsoil for millions of years, was used for energy purposes releasing CO₂ into the atmosphere, right in the period in which the number of forests on the planet has decreased. CO₂ is one of the main causes of GW which accelerates the melting of permafrost (20% of the world's land surface) from which large quantities of CH₄ are released thanks to the action of methanogenic bacteria [10-13].

The CH₄ is trapped beneath the permanent permafrost, which serves as a waterproof cover under which large amounts of CH₄ gas are found, accumulated over the millennia. In Siberia it is possible to observe CH₄ bubbles under the permafrost, thanks to which the tundra trembles and explodes.

The newspaper named "Siberian Times" [10] reports that Alexander Sokolov, head of the

Ecological Research and Development Center of the Institute of Plant and Animal Ecology of the Ural Department of the Russian Academy of Sciences in Labytnangi, discovered 15 flickering areas below the grass. CH₄ and CO₂ came out when these areas were drilled, even if it was not known in which concentrations.

The reason why Siberia meadows become similar to those of a water mattress is not yet clear. It is possible that the abnormal heat that is also affecting the Russian Arctic, causing colossal fires throughout Siberia, is causing the permafrost to thaw, which releases the gas trapped in the ground for thousands of years.

In Eastern Siberia, obviously on the continental shelf in a vast territory of about two million square kilometers, between 2003 and 2008, it was established that the surface waters are now almost completely saturated with CH₄. From such waters exits a quantity of CH₄ equal to about 1.85 ppm, which is the same quantity emitted by all the oceans of the planet. According to Steven Goddard the release of CH₄ by the Siberian Arctic permafrost is about eight million tons per year; this quantity is really ridiculous if compared to the 80 million tons per year produced by the flatulent emissions of cattle animals raised in the United States [11].

It should be remembered, however, that in the past, when the permafrost did not dissolve, the presence of CH₄ in the atmosphere was lower despite [2, 8] that the CH₄ emissions of wild ruminants, in quantity, were not very different from those today they are recorded by adding together the production of CH₄ produced by domestic and wild ruminants.

The permafrost contains large amounts of CH₄, one of the four greenhouse gases contributing to GW, 25 times higher than that of CO₂.

The heat melts the permafrost which in turn frees the CH₄ in the atmosphere, which heats the temperature even more.

The discovery of numerous giant CH₄ bubbles [12,

13] in the Siberian peninsulas of Yamal and Gydan has recently been reported. These bubbles, with the melting of the permafrost produced by climate change, are ready to surface and explode on the surface. The indigenous Yakut already [13-15] in 2014 had noticed that some areas of land suddenly became mobile, just as if under the ground there were huge inflatable balls, tens or hundreds of meters wide. They called them “bulgunyakh” in the local dialect. But they are also referred to as “pingos” or simply “flickering tundra”. When the permafrost layer is punctured, these pockets of pressurized gas explode releasing the CH₄ that was trapped there.

In 2016 the first scientific publications on this phenomenon appeared. Eco Watch [14], site of environmental news, reports that the climatologists Alexander Sokolov and Dorothee Ehrich measured that, after the explosion, the local atmosphere contained a thousand times more CH₄ than that normally present, while the concentration of CO₂ has risen to 25 times the normal. The explosions produce a ball of fire and are audible even a hundred miles away, causing the formation of craters of tens or hundreds of meters in diameter immediately renamed by the locals “the gates of the underworld”.

A study by the University of Colorado estimates that by 2100 permafrost [16] more than 205 billion tons of CO₂ will be released. But also CH₄ is one of the main greenhouse gases and is responsible for about 8% of natural atmospheric heating (CO₂ affects about 15%-20%). However, CH₄ is 30 times more efficient than CO₂ in reflecting and retaining heat. However, it must also be said that atmospheric CH₄ comes mainly from wetlands, paddy fields, fermentation of manure and agricultural biomass. Among the sources of minor importance is the extraction and distribution of natural gas, together with the extraction of coal and termite metabolism (the termites can evacuate up to 5 L of CH₄ per minute).

3. Increase in the Earth Temperature

Summer of 2016 was particularly hot in Siberia, even reaching 35 °C in the Yamal Peninsula [14]. What is worse is that the summer of 2016 is the 14th hottest month ever recorded. This not only caused the expansion of existing lakes and the formation of new basins of fresh water, but also changed the biological balance of the tundra. To these phenomena is now added the outcrop and explosion of the pockets of natural gas that until now had been trapped under the layer of frozen ground. A few weeks ago, the census of giant bubbles discovered in Siberia reached 7,000. Still relatively little to decisively influence the ecosystem of the tundra, but it is not known which surprises are still hidden in the Siberian subsoil. Now even from the distant tundra comes the confirmation that to effectively combat climate change, a coordinated world intervention is needed [17, 18]. CH₄ has a half-life of 10 years and its release is aggravated by the CO₂ that has a half-life of 100 years. Despite this evidence, 483 coal-burning power plants have been planned between 2009 and 2019 and 710 more will be built between 2020 and 2030 (about a third in China).

Coal is used to produce about 40% of the electricity needs worldwide [19, 20]. In many countries this figure is much higher: Poland relies on coal for over 94% of its electricity, South Africa for 92%, China for 77% and Australia for 76%. China, India and the United States use about two-thirds of the world's most polluting fuel.

Between 2002 and 2012, world coal consumption doubled [19]. The Asian countries have led the growth: China, Japan, South Korea and India. The data for 2017 indicate that India and the United States have also increased coal production. The biggest change was in the United States, where the extraction recorded a +19% in the first five months of the year.

However, China has decided to stop the construction of 104 new coal-fired plants. By 2020, China plans to install 130 thermal power plants using

new energy, in particular solar and wind energy. For this purpose, China has allocated some 360 billion euros which should also lead to the creation of 13 million jobs. By 2020, 27% of energy production will come from renewables, while 55% will still be fueled by coal.

Recently the Pope [21] stressed that technology based on fossil fuels, very polluting, in particular coal, but also on oil and, to a lesser extent, on gas, should gradually be replaced by renewable energy.

4. Possible Solution to Decrease CH₄ Emission

It has been estimated that the human population present in urban areas would pass from 28% to 70% from 1950 to 2050 [1], and that 57% of the cattle population bred in Africa and Asia mainly due to the traction, will be replaced by mechanical tools. To support current production, instead of 1.5 billion cattle will be enough about 900 million cattle, which, being more productive, will be fed with diets less rich in fodder and therefore will produce less CH₄. In addition to the digestive processes of ruminants, even the manure stored for 3-4 months, before being used agronomically, contributes to the release of CH₄ into the atmosphere.

The daily introduction of manure and sewage in biogas plants leads, instead, to the production of clean CH₄. Of the same opinion is Devivo [22].

It should be emphasized that the daily introduction of manure and sewage (connected to confined farms) in biogas plants (in Italy in 2018 almost 2,000 biogas plants are operational, of which 80% in the agricultural sector) leads to the production of CH₄ and therefore of clean energy. Biogas plants produce biomethane. Biomethane is the result of a biogas redevelopment process which in turn is obtained by the anaerobic digestion of agro-industrial biomass, as agricultural by-products, zootechnical waste, with the addition of integration crops, organic fraction of municipal waste coming from separate collection. A

part of the CH₄ in the atmosphere, difficult to quantify, comes from landfills; the introduction into the biogas plants of the organic fraction of municipal waste would also reduce the introduction of CH₄ into the atmosphere. With the use of this technique also the faeces of ruminants would not be responsible for the pollution but would contribute to the production of clean energy. The use of this technique on a buffalo farm equivalent of 2,500 adults provides electricity to 300 families. If all the Italian farms of cattle and buffalo were equipped with biogas plants, 3.6% of the polluting energy (fossil fuels) would be saved.

As for Italy [23], the current biogas plants (two thousand) would provide an electric power of about 1,400 MW, equivalent to a biomethane production of 2.8 billion cubic meters per year. Potentially, according to recent estimates, this quantity could produce up to 8.5 billion cubic meters of biomethane for 2030, equal to about 12%-13% of the current annual demand for natural gas. Moreover, thanks to the biogas-biomethane chain, positive impacts on employment were achieved: 6.7 employees per MW installed, i.e., “the sector with the highest employment intensity among renewable”, favoring “the creation of over 12 thousand jobs”.

The number of biogas plants in Europe rose from 16,834 to 17,376 in 2015 (+3%). Some countries have seen considerable growth, for example the United Kingdom (77 new plants, +17%), Belgium (20 new plants, +11%) and the Netherlands (16 new plants, +6%). With regard to biogas production, national associations and third-party observers quantify the total amount of electricity produced from biogas in 60.6 TWh, a number that corresponds to the annual consumption of 13.9 million European households.

The heat produced by the biogas can also be used to dry the forage, such as alfalfa, even when it rains at an early vegetative stage and with a moisture content above 30% and with a protein content > 20% and a low percentage of lignin. The use of this alfalfa involves saving 0.5 kg of soybean meal/head/day and

almost 1 kg of cornmeal that can be used for human consumption. The lower use of soy/corn reduces the use of transport and therefore the emission of CO₂ and consequently the release of gas into the atmosphere. Contrary to what is generally claimed, soy is used to provide oil to men (olive oil produced in the world only meets 4% of the consumption of lipids) and the extraction flour is given to the animals!

5. The Role of Ruminants on Deforestation

Even if deforestation has slowed, the GW continues to worsen. In the past, industrialized countries have deforested both Europe and other countries and today are asking developing countries to restore forests. In Italy, entire forests have supplied timber for the construction of the Roman fleet.

During the first Punic War more than 1,000 ships were created, of which over 70% went to peak. Deprived of forest cover, the slopes of the mountains collapsed more easily; the climate was warmer and drier: the waters of the Tiber river in winter were frozen. The regime of the Apennine rivers became torrential, with long summer droughts and sudden and ruinous autumn floods. The frequent floods caused by the rivers have led to the spread of swampy areas and to the general warming of the climate and have favored the spread of the anopheles' mosquito [24, 25]. The land between the two rivers, rich in forests, became largely an arid desert. A small public bath in old Rome needed more than 100 tons of wood a year to reach the desired temperatures.

Ireland in the first half of the 19th century was deforested to promote economic development. Ireland needed fuel for the operation of ironworks and deforested areas for sheep breeding and for the wool industry. Both wool and iron brought wealth that was invested in new ironworks and livestock. But these required works, which is why the population increase was encouraged. To nurture the rapidly growing population, potato monoculture has been encouraged and widespread, being a high-yield culture and

particularly suited to countries with little sun. It is known that monocultures are fragile cultures. With the “potato blight”, the disease of 1845 began the disaster.

In UK the forest that in the past concerned the whole Sherwood county (the Robin Hood’s Sherwood Forest) today is reduced to 423 ha, the pau Brazil (*Caesalpinia echinata*) of Atlantic mata (between the seventeenth and eighteenth centuries) was reduced in powder by colonialists to produce a precious staining. It is also reminded that the deforestation of *Sequoia sempervirens* in the mountains at the western borders of Sierra Nevada was interrupted by the government of the United States only in 1968.

In Italy, for example, Sila forest (73.695 ha) was destroyed in the past by the Romans, as previously mentioned, for the construction of the roman fleet and by the Americans as compensation for war damages (Second World War).

Today developed countries should increase the wooded area and Latin American countries should be forced to place trees on grazing areas (wooded pastures). Recently it has been shown that the activity of unused parts of fodder (hard parts and roots) of the rotary grasslands in Brazil (1 head/ha), the CO₂ produced by the organic part of the plants compensate that produced by the cattle [26-28].

Between 2000 and 2007 in Brazil, 154,312 km² have been deforested, almost seven million hectares have been used in Africa for cocoa cultivation; millions of hectares of forest have been destroyed for the cultivation of *Jatropha* and other essences useful for the functioning of biofuel plants. For the production of palm oil in Malaysia, 4.5 million hectares of forest were used, and several hectares were destroyed for the collection of fine woods. It is little known, for example, that in Tanzania, an emir fenced 400,000 ha for exclusive hunting rights, protecting them with armed troops from the Masai who used them as pasture. The pasture is considered unused land and therefore rented by the governors to the highest bidder. Above all Africa is a marvelous

reserve and object of hoarding the earth. African rainforests destroyed by humans have negatively affected biodiversity (the gorilla is now considered endangered).

Since all countries have deforested their land over the centuries, reforestation work should primarily affect countries that have remained with a forest area of less than [29] compared to the world average (32%). In Europe, these countries are, for example, Ireland (10.8%), the Netherlands (11.1%), the United Kingdom (12.9%), Denmark (14.2%), Turkey (15%), Belgium (22.5%), Hungary (22.8%), Albania (28.2%), Romania (29.2%), France (30.6%), Poland (30.7%), Greece (31%), Serbia (31.1%), Italy (31.2%) and Switzerland (31.5%). It is not logical that the countries that have deforested their territory in the past today are asking others to stop using forest areas. If the 95 countries with less than 32% of the forest area managed to have at least 32% of the areas covered by forests, the world average value of the areas covered by forests would rise to 42% and the problem of deforestation would be greatly attenuated.

The problem of deforestation is identified with what happened and happens in the Amazon, but not everyone knows that the greatest deforestation has occurred around the Tar Sands of Canada, around Fort Mc Murray. In this area the trees are cut down to get bitumen and the forest is not replanted. Even in other places, forests have been lost—in British Columbia, Ontario, Quebec. The queen of deforestation is, however, Alberta, where the tar sands have turned the boreal forest into a land of oil and not into pastures.

While it is true that the countries where forests exist are guilty of deforestation, it is also true that countries requiring products from deforested areas are guilty.

Between 1990 and 2008, European consumption caused the demolition of forests in various parts of the world for an extension of at least nine million hectares (an area comparable to that of Ireland).

In the last 18 years, 33% of crops and 8% of livestock produced by deforestation have been

exported mainly from developing countries. Of these, Europe imported and consumed 36%, while in the same period the most limited consumption in the United States and Canada caused the “only” reduction of 1.9 million hectares of forests; while those of East Asia (including China and Japan) contributed to the reduction of 4.5 million hectares. The increase in consumption of crops such as soybean (86 million hectares are used for the cultivation of soy), palm oil and related products, as well as meat consumption, are the main cause of deforestation in tropical areas and the European Commission, Member States and the European Parliament in the light of these results, said Dante Caserta, president of World Wide Fund for Nature Italy, must act immediately. The European countries that import these products should rebuild their forest surfaces or contribute to their recovery in the exporting countries. It is useful to reiterate that, contrary to what is generally stated, soy is not produced for animal feed but is used, like palm oil, to provide oil to men (olive oil only satisfies 4% of consumption) and the extraction flour is given to the animals! In most cases, areas intended for grazing are those that cannot be used for more profitable agricultural production.

The deforestation of the Amazon rain forest is seen as a resource for grazing livestock, for precious woods, for living space and for agricultural space (in particular for soybeans) and for road works (e.g., highways and motorways). Adam David [30] reports that according to a 2009 report by Greenpeace, the Brazilian beef industry, supported by international meat consumption, was responsible for around 80% of all deforestation in the region and around 14% of deforestation total annual, becoming the main responsible for deforestation in the world. Adam David [30] also reports that according to a 2006 report by the Food and Agriculture Organization of the United Nations, 70% of the Amazon forests and 91% of the deforested areas since 1970 are used for grazing of livestock. Currently, trees are used to obtain

precious woods: Is it responsible for deforestation who sells or who buys? “Eleven EU countries imported approximately 10 million cubic meters of *Handroanthus impetiginosus* (IPE) and *Handroanthus serratifolia* [31] from the risk areas between March 2016 and September 2017.”

There is no shortage of virtuous examples. Beijing, for example, one of the most polluted cities, has implemented the largest reforestation plan in its history since 2012 and today the forests cover more than 25% of the urban surface, marking an increase of 42% [32].

In Brazil, it is mandatory to allocate 20% of the cultivated areas (sugarcane, soybean, oranges, etc.) to the growth of the arboreal species belonging to the original forest.

In Portugal, the green energy produced has exceeded consumption: 103.6% of consumption. Among the sources, hydroelectric and wind energy met 55% and 42% of the needs, respectively. Overall, the “green” energies prevented the release into the atmosphere of 1.8 million tons of CO₂ into the atmosphere until March 2018. Renewable sources could be able to fully meet the needs of mainland Portugal.

6. Ruminant Breeding with Intensive or Extended System

Despite the unique nutritional qualities of milk and meat provided by ruminants, especially when grazing, some scientists continue to recommend chicken meat, which grows 50 times in 45 d and that of pork, which has doubled the daily weight gain in the last 40 years.

Between 1979 and 2014, consumption of ruminant meat rose by 140% [7]. On the total meat consumption, however, the percentage of pork remained unchanged, while that of poultry increased by 17% and that of ruminants decreased by 13%. If meat is harmful to human health, since the consumption of ruminant meat has decreased, the harm to human health should result from excessive

consumption of meat in general or probably from the increase in consumption of poultry meat.

It should be remembered, for example, that cow's milk in cold areas, including Northern Italy, especially in winter, when no plant foods were available, was used to combat scurvy and pellagra.

When man has increased his stature, his needs have changed profoundly and without the provision of animal food or it would have been lower or in extreme cases the species would not have reached the third millennium. The needs of the same macro elements such as Ca and P cannot be met by a plant-based diet. The Ca requirements are met by 769 g of milk or about 100 g of cheese; in the case of a vegetable diet 719 g of cabbage, 2 kg of broccoli or 600 g of beans are needed, these quantities are difficult to digest.

7. Water Consumption for Agricultural Products

It is emphasized that 15,000 L water are needed to produce 1 kg of beef, but at the same time it is not known that for a cup of coffee it takes 140 L water and to produce a can of coke, which is one of the causes of diabetes and obesity, 200 L are needed.

In this regard, it should be noted that between 1960 and 2014 [7] the consumption of meat and milk (beef + buffalo) increased only in Asia (+230% and +170%, meat and milk, respectively), Latin America (+15% and +68%, meat and milk, respectively) and in Oceania (+38% and +15%, meat and milk, respectively). In Africa, only milk consumption has increased (+16%). What happened in Europe and in Italy after the Second World War is happening today in the developing countries. The increase in the consumption of food of animal origin represents the search for a social symbol. The consumption of food of animal origin is destined to decrease in the developing countries, as happened in the industrialized countries.

This phenomenon has occurred in industrialized countries most likely because European cattle breeds

provide hypertrophic muscle masses without flavor, especially if hormones are used to stimulate daily weight gain. Furthermore, globalization has made known new eating habits.

In this way, the nutritional characteristics of the meat obtained with breeds characterized by hypertrophic muscular masses and with hormonal treatments are increasingly dissimilar to those of ruminants bred freely (optimal ratio $\omega 3/\omega 6$, higher presence of conjugated linoleic acid and unsaturated fatty acids).

If this is the future, it cannot be ruled out that the consumer prefers the less expensive meat of chicken and pork and that the consumption of beef is replaced, especially in countries that do not have culinary traditions, from that of worms and crickets.

The demonization concerns red meat, but not chicken meat, although broilers between hatching and slaughter grow almost 50 times in 45 d and therefore more rapidly than a neoplastic mass. The poultry and pig farming industry belong to a lobby while that of ruminants, especially that of small ruminants, is not defended by the media.

With intensive breeding to obtain 1 kg of beef, 14-20 kg of dry matter, consisting of fodder and 9-13 kg of corn + soy are needed. It is important to emphasize that intensely bred cattle represent less than 28% of the world's cattle. The other cattle and two billion and 200 million small ruminants use pastures in areas not suitable for intensive agricultural processes.

Especially in areas where the availability of water is not constant, agricultural production is not possible because, when there is no water, it is not possible to move plants in places where water resources exist. In these areas, instead, the ruminants are transferred where it is possible to satisfy the nutritional needs as it happened for the man before the birth of agriculture: the man has pursued the seasons to find food. In many areas, domestic and wild ruminants move in search of grazing. Ruminants, therefore, in many areas produce

food where it is impossible to practice any form of agriculture. Many areas have become fertile thanks to livestock debris and only later have been used for more productive crops. Among all it is known that the plains of the United States made fertile by the faeces of millions of bison. The assertion that ruminants occupy areas that could be destined for the production of food of plant origin, therefore, is not always sustainable.

It is not of secondary importance to take into consideration what livestock has represented in human history and in particular in the evolution of the technologies of dairy products that represent one of the most interesting cultural expressions that characterize a people.

8. Why Some Scientists Want to Convince Man to Eat Only Fruits

Many scientists sustain that man is a species that physiologically should eat fruit. It is known that *Homo habilis* evolved becoming omnivorous at least from 1.8 to 2.5 million years ago. It dates to that time the discovery, 2.5 million years old, of cuts on bones of animals. Between 1.8-2.5 million years and 600-350,000 years ago the volume (cm³) of the human brain increased from 510-600 cm³ to over 1,500 cm³. During this period, it is assumed that hunting began and, therefore, the consumption of meat. These activities took place in groups and generated the first social relationships and the evolution of the use of the word.

Despite this, animal rights activists and some scientists tend to convince public opinion that humans are a species that physiologically should eat fruit, such as primates, close relatives of the human species. Chimpanzees are known to hunt other small monkeys (*Ptilocolobus temminckii* and *Colobus guereza*) and supplement their diet with small mammals. The captured and killed prey is distributed to all members of the hunting group. The behavior of Orange Bonobo is similar to that of the chimpanzee. Another example

is *Macaca irus* living in the Indonesian coastal regions. It feeds on fruit, leaves and shoots, crabs and all sorts of crustaceans, mollusks, amphibians, worms and finally fish trapped in some ponds during the low tide period. *Homo sapiens*, like the last native peoples, chose instinctive-driven food and ate meat because he needed vitamin B12, which, unlike herbivores, man is unable to synthesize and is present only in products of animal origin. The problems arising from population growth must aim at the search for intelligent solutions. Currently this problem is addressed by trying not to harm economic interests; this strategy does not always provide correct solutions. To support the current demand, instead of 1.5 billion heads of cattle, about 900 million heads are enough, which will be more efficient because they will be fed with diets with less fodder and will produce less CH₄, but unfortunately will provide foods with inferior nutraceutical characteristics.

In short, if it is true that once the development of the body is completed, it is possible to live only with plant foods, it is also true that an optimal plant diet should be characterized by the same varieties of plant essences that can now only be found in inhabited areas from monkeys. Many of these foods, particularly fruit, would probably not be appreciated by the modern man who over the years has selected varieties with a higher content of fructose and sucrose, while in the past it was richer in fructose and glucose, and therefore it was less sweet and, today, would be appreciated only by the wild relatives closest to the human species. Trying to describe an ideal diet model for *Homo sapiens* is an arduous task, especially for the various discoveries of the last decades, which have shown that a man is able to successfully adapt to many diets and, due to genetic variability of the human species, strict homologation would be very difficult [33].

9. Conclusions

The increase in consumption of animal proteins will occur due to the increase in the world human

population and will aggravate the GW. According to the press, the main culprits of the GW are the ruminants that produce CH_4 that is released into the atmosphere. After 2002, the increase in CH_4 in the atmosphere was higher than the increase in ruminants. This evidence shows that CH_4 sources are only partially known and that the increase of CH_4 in the atmosphere and the increase in the number of ruminants is a spurious association. Suffice it to say that the number of ruminants (especially wild) increased progressively from the Miocene (20 million years ago) while the increase in CH_4 in the atmosphere was recorded only after the start of the industrial era. Other sources that emit CH_4 are likely to have become more active.

Atmospheric CO_2 concentration increased by 18% compared to the pre-industrial period because carbon, stored in the subsoil for millions of years, was used for energy purposes by releasing CO_2 into the atmosphere that underlies GW.

Thanks to GW, the melting of permafrost is increased from which large amounts of CH_4 are released so that in Siberia it is possible to observe the CH_4 bubbles under the permafrost.

The digestive processes of ruminants and the manure stored for 3-4 months, before being used agronomically, would therefore be only partially influential on GW. In this regard, the daily introduction of manure and sewage in biogas plants leads, instead, to the production of clean CH_4 .

As regards deforestation, it should be recalled that in the past the industrialized countries have deforested their territory and today are asking developing countries to restore forests. The solution of the problem of deforestation will occur if the developed countries increase the wooded area and the developing countries will plant trees on the pastures (wooded pastures). Reforestation should mainly affect countries that have remained with a forest area lower than the world average (32%).

The demonization of food provided by ruminants,

despite the unique nutritional qualities of milk and meat, especially when ruminants graze, drives some scientists to recommend chicken meat, which remember grows 50 times in 45 d (and therefore grows faster than a mass neoplastic). Between 1979 and 2014 on total meat consumption, the percentage of pork remained unchanged, that of poultry increased by 17% and that of ruminants decreased by 13%. This decline in industrialized countries has occurred because in many cases cattle breeds provide tasteless hypertrophic muscle masses that favor the consumption of cheaper meat (chicken and pork) and, especially in countries that do not have culinary traditions, this favors the consumption of worms and crickets. The poultry and pig breeding industries are pressing, while that of ruminants, particularly which of small ruminants, are not defended by the media. If meat is harmful to human health, since the consumption of ruminant meat has decreased, harm to human health should result from overconsumption of meat in general or most likely from the increase in consumption of poultry meat.

The press stresses how much water is needed to produce 1 kg of meat with intensively bred livestock representing less than 28% of the world's population, while other ruminants use pastures in areas not suitable for intensive agricultural processes, especially if the availability of water is not constant. In these areas, unlike what can be done for edible plants, when water is lacking, ruminants are transferred where their water needs can be met. The press does not emphasize how much water is needed for a cup of coffee or a can of Coca-Cola. It is not taken into account that the consumption of meat and milk has increased in Asia, Latin America, Oceania, whereas in Africa only milk consumption has increased.

The percentage of undernourished population has decreased from 18% to about 11%-12% and if a third of the food produced remains unused due to inefficient distribution logistics, most likely without this waste the undernourished population would be considerably

lower than the current one.

Lastly, it is not of secondary importance to consider what livestock has represented in man's evolutionary history. One example is the creation of dairy products, one of the most interesting cultural expressions of a people.

It is not possible to ignore that *Homo habilis* has evolved since he became omnivorous and that many primates complete their diet with proteins of animal origin. Furthermore, primitive man chose instinct-driven meat because he needed vitamin B12.

In short, if it is true that once the development of the body is completed, it is possible to live only with plant foods, it is also true that an optimal plant diet should be characterized by the same variety of plant essences that can now be found only in areas inhabited by relatives closer to man.

Many of these foods, particularly fruit, would probably not be appreciated by the modern man who over the years has selected varieties with a higher content of fructose and sucrose, while in the past it was richer in fructose and glucose, and therefore it was less sweet and, today, it would only be appreciated by wild relatives.

An ideal diet model for *Homo sapiens* is difficult to hypothesize because man is able to successfully adapt to many diets and, due to the genetic variability of the species, strict homologation would be very difficult.

The problems arising from population growth must aim at finding intelligent solutions without favoring solutions that try not to damage economic interests.

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