Animal Agriculture is the Leading Cause of Climate Change

A Climate Healers Position Paper

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ABSTRACT

this paper, we present the results of a Global Sensitivity Analysis (GSA) proving that animal agricu
sponsible for at least 87% of greenhouse gas emissions annually. The burning of fossil fuels is cur
rbon dioxide (CO_2) emissions. However, climate change is caused by cumulative human-made gr
st current CO_2 emissions alone. While humans have been burning fossil fuels for a little over 200
imal agriculture for well over 8,000 years. For the GSA analysis, we use factual data from the Fifth
tergovernmental Panel on Climate Change (IPCC) and other peer-reviewed scientific sources. We
ased economy first and that blindly eliminating fossil fuel usage first will accelerate the warming o
missions from animal agriculture alone cause more incremental global warming than the annual C
ombined. We further show that the transition to a global plant-based economy has the potential to
generating soils and vegetation, returning atmospheric greenhouse gas levels to the “safe zone” o
quivalent, while restoring the biodiversity of the planet and healing its climate. This paper clearly i
overnment institutions, corporations and news media, who vastly underestimate the role of anima
ssil fuel use, need to urgently change their priorities in order to be effective.

1. Introduction

he burning of fossil fuels is undoubtedly the leading source of human-made Carbon diOxide (CO_2
uman-made greenhouse gas in terms of its radiative forcing, which is the average energy trapped
ea of the Earth’s surface, typically measured relative to the base year 1750. In the absence of acti

eenhouse gas as it persists in the atmosphere for tens of thousands of years. The Fifth Assessme anel on Climate Change (IPCC) estimates the mean radiative forcing of human-made CO_2 to be 1.6 owerful human-made greenhouse gas, methane, with a mean radiative forcing of 0.97 W/m^2, ling ears before it reacts with oxygen free radicals and also converts into CO_2. As such, it is tempting to duction of fossil fuel burning to minimize future human-made CO_2 emissions is the best strategy ientific community, government institutions, corporations and news media have adopted this stra nquestioningly accepted the United Nations (UN) Food and Agricultural Organization (FAO)'s estim griculture industry sector is a mere 14.5% of global human-made greenhouse gas emissions, whic urning over dealing with the animal agriculture sector.

 this paper, we will show that this strategy of focusing exclusively on the reduction of fossil fuel bu the point of no return. Using a Global Sensitivity Analysis (GSA) method, we will show that the UN animal agriculture is incorrect and that the correct estimate is at least 51% as calculated by Good e tightened to at least 87% of global greenhouse gas emissions. Therefore, animal agriculture is th

urthermore, we will show that a global transition to a plant-based economy has the potential to se generating soils and vegetation, returning atmospheric greenhouse gas levels to the "safe zone" c quivalent (CO_2e), while restoring the biodiversity of the planet and healing its climate.

he organization of this paper is as follows:

 Section 2, we will examine how waste "exhaust" from human activities changes the Earth's climat eenhouse gases, which heat up the Earth's atmosphere or aerosols, which are atmospheric partic he main human-made greenhouse gases are CO_2 and methane, which are both carbon-based gas ulphates, which are primarily produced when we burn coal and oil.

Section 3, we will examine how the carbon cycle of the planet has been impacted by two main hu
earing or land use change, primarily for agriculture, and fossil fuel burning.

Section 4, we will examine current agricultural land use and biomass flows to establish that anim
nd clearing, causing climate change. Next, we will compare Local Sensitivity Analysis (LSA) vs. Glob
uman activities causing climate change: animal agriculture and fossil fuel burning. While LSA is use
riations in the current emissions scenario, it can lead to inaccurate results when extrapolated out
nalyzing a global change directly and will lead to more accurate results for that change. Using the
e UN FAO's 14.5% estimate on the greenhouse gas emissions contribution of the animal agricultu
nhang estimate of 51% is truly just a lower bound on the greenhouse gas emissions contribution o
ghten this lower bound using the Carbon Opportunity Cost (COC) estimates of Searchinger et. al. a
nnual greenhouse gas emissions contribution of animal agriculture is at least 87%[4].

Section 5, we will estimate the CO2 sequestration potential and the resultant climate mitigation t
ant-based economy.

nally, we have included an Appendix detailing the four major miscalculations in the IPCC reports, w
ange impact of animal agriculture.

what follows, for the sake of simplicity, we have used the specified statistical mean or the midpoi
CC reports and other peer-reviewed sources. Our conclusions do not change if we include the unc
ut we will likely lose clarity in our presentation.

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2. HOW HUMANS CHANGE CLIMATE

Climate Healers Position Paper

most everything humans do changes the Earth's climate. The waste "exhaust" from human activit
erefore, the question is not whether humans change the Earth's climate, but how much and in w

rs, burn coal and natural gas for electricity and consume animal products, the exhaust gases and
rth. Exhaust gases such as CO2, methane and nitrous oxide (N2O) heat the Earth. Exhaust particl

he UN IPCC has quantified the impact of each of these exhaust gases and particles in terms of rad
at existed in the year 1750 as the base year (see FIg. 2.1)[1]. CO2 is the main human-made exhau
rovide an additional 1.68 W/m2 of heating power relative to its atmospheric concentration in 175
O2 in the atmosphere since 1750 is like adding a 1.68 Watt continuous heater on every square me

he next most significant human-made exhaust gas is methane, which has the chemical formula C
diative forcing of 0.97 W/m2 and it lingers in the atmosphere for an average half-life of 8.4 years
so converts into CO2. The number one cause of methane emissions is animal agriculture, which c
diative forcing of methane (0.97 W/m2) is less than that of CO2 (1.68 W/m2), the annual emission
et radiative forcing, and therefore climate change, than the annual emissions of CO2.

he annual emissions of methane from 2011-2016 was 0.363 Gt, on average[6].

he amount of methane that has accumulated in the atmosphere since 1750 until 2011 is 1.1ppm,

herefore, to a first order approximation, our annual emissions of methane is contributing 0.97×0.

contrast, the annual emissions of CO2 from 2011 to 2016 was 39 Gt, on average[6].

he amount of CO2 that has accumulated in the atmosphere since 1750 until 2011 is 110ppm, whic

herefore, to a first order approximation, our annual emissions of CO2 is contributing 1.68×39/859

urthermore, since just 45% of the annual CO2 emissions remains airborne due to uptake from lan
om our annual CO2 emissions that is truly contributing to atmospheric heating is 0.45×0.076 = 0.0
ontribution (please see Appendix for more detailed discussions).

is important to point out that the IPCC has consistently undercounted the impact of our annual m
00 year period, even as it warns humanity that catastrophic climate change is imminent within the

CC is obscuring the safest engineering process for powering down the two major engines of plan
presented by animal agriculture and the Burning Machine (BM) represented by fossil fuel burnin
orrectly, we will likely cause various climate tipping points to be breached unnecessarily as we rais
ocess itself.

the latest report issued in August 2019[6], the IPCC is still using a Global Warming Potential (GWF
O2 equivalent (CO2e). Global Warming Potential (GWP) converts the radiative forcing impact over
lated to the reference gas, CO2. For methane, the GWP over a 100 year time horizon, excluding cl
is 34. The GWP of methane over a 10 year time horizon, including cloud effects, is 130[10].

we used GWP of 130 for methane, then the annual emissions of methane would be 0.363 x 130 =
missions of CO2 (39 Gt CO2).

nce just 45% of the annual CO2 emissions remains airborne[29] each year, the comparison of me
45 x 39 = 17.6 Gt CO2.

herefore, the climate change impact of our annual CO2 emissions (17.6 Gt CO2) is about one-third
6.9 Gt CO2e), just as we calculated above.

deed, the impact of methane from animal agriculture alone is **37% of 46.9 Gt CO2e**, which works

his exceeds the impact of all fossil fuel based CO2 emissions, which is **87% of 17.6 Gt Co2**, which v

or reference, please see Table on Page 9 of the latest IPCC report[6].

he third most significant human-made exhaust particles are sulphate aerosols, created mainly du
ASA,

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*he sulfate aerosols absorb no sunlight but they reflect it, thereby reducing the amount of sunlight reach
elieved to survive in the atmosphere for about 3-5 days.*

he sulfate aerosols also enter clouds where they cause the number of cloud droplets to increase but ma
ake the clouds reflect more sunlight than they would without the presence of the sulfate aerosols. Pollu
modify the low-lying clouds above them. These changes in the cloud droplets, due to the sulfate aeroso
eather satellites as a track through a layer of clouds. In addition to making the clouds more reflective, it
olluted clouds to last longer and reflect more sunlight than non-polluted clouds."

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g 2.1 shows the radiative forcing contributions of the major greenhouse gases and aerosols that h
750. Fig 2.2 shows a map of the world depicting fires seen from space by the NASA MODIS Satellite
ash-and-burn fires are a significant reason why grazing lands, which constitute 37% of the ice-free
nd carbon.

he radiative cooling effect of human-made sulphate aerosols together with their cloud adjustmen

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Fig. 2.1. Anthropogenic Radiative Forcing from various greenhouse gases and aerosols, broken in
effects such as sulphate aerosols and changes in surface albedo and 3) Other Heating Effects suc
Values sourced from IPCC AR5 WG1 Chapter 8.

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ig 2.2 NASA MODIS Satellite map of fires that occurred in a 10-day period in May 2019. Most of th
for animal agriculture.

O2 is absorbed by trees and plants during photosynthesis and it is stored away permanently in ve
owever, in the absence of active reforestation efforts, CO2 is a long-lived greenhouse gas that ling
ears. At present, about 85% of human-made CO2 emissions are from burning fossil fuels, i.e., coal
ainly from burning down forests to clear land, i.e., land-use changes[8].

owever, since CO2 is a long-lived greenhouse gas, it is the cumulative emissions of CO2 over time
missions alone. In 1850, land use changes were the main source of human-made CO2 emissions,
tegrating the annual CO2 emissions components over time, we see in Fig. 2.4 that between 1850
se changes is second only to that from coal burning. Besides, land use changes have been occurri
urning only started in the industrial era, around 200 years ago. Since the long-range time constan
rder of tens of thousands of years, it is relevant to consider the cumulative CO2 emissions from la
al. has estimated the CO2 emissions due to land use changes in the pre-industrial era to be 1250
000 years ago to 2011, CO2 emissions from land-use changes is 1850 Gt CO2, which exceeds the C
ombined of 1200 Gt CO2. Therefore, land use changes are the leading cause of human-made CO2
urning.

Fig. 2.3. Annual anthropogenic CO2 emissions from Land Use Change + Coal + Oil + Gas + Ceme
Change component dominated in 1850 while the fossil fuel component

Fig. 2.4. Cumulative CO2 emissions from Land Use Change, Coal, Oil, Gas and Cement productio
Land Use Change contribution prior to 1850 to be 343GtC or 1

summary, of the top three human-made exhaust gases and particles impacting climate change,

Land use changes, primarily for agriculture, is the leading cause of CO2 emissions, a global heati

Animal agriculture is the leading cause of methane emissions, the global heating component con
nnual basis; and

Fossil fuel burning is the leading cause of sulphate emissions, a global cooling component.

ith the exception of sulphate aerosols, which are mainly a byproduct of fossil fuel combustion, th
nange – CO2 and methane – are molecular forms of carbon. Therefore, let us now take a closer loo
mposition of the planet.

3. HOW HUMANS CHANGED CARBON

arbon is stored on land in vegetation and soils. Roughly half the weight of a tree is carbon. Half th
bove ground and therefore, the above ground weight of a tree is a good measure of the amount o
ontains three times as much carbon as the vegetation it holds. Soil carbon excludes carbon stored

arbon is stored deep underground in the form of fossil fuels. It is also stored under permafrost la
ozen and preserved at the dawn of the ice ages 3 million years ago.

arbon is stored in the ocean in surface, intermediate and deep sea sediments. It is also stored in t
und in the atmosphere, primarily as CO2, methane, organic carbon and black carbon.

g. 3.1. Carbon storage in permafrost, land, ocean, fossil reserves and the atmosphere in 1750 (in
activities.

Fig. 3.2. The distribution of carbon on land is highly uneven. The density of carbon is highest in fo

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or at least 8000 years, humans have been displacing carbon by clearing land for agriculture and by splaced carbon has returned back to land, while some has dissolved into the ocean and 240 GtC c greenhouse gases causing climate change. It is estimated that in the pre-industrial era, humans c is barely made a dent in the atmospheric CO2 levels as most of it returned back to land in the for oss that grew in the Arctic tundra on boggy ground. Since then, humans have combusted 365 GtC splaced 164 GtC from vegetation and soil on land. Of that total of 529 GtC of carbon, 45% or 240 C ethane, etc., in the atmosphere, while 155 GtC has dissolved into the ocean and 134 GtC has retu

umans have cut down about 46% of the trees on land since the dawn of civilization[12]. This corre egetation and soils and sending it up into the air. While the pre-industrial clearing of land was com e industrial-era clearing has been mostly compensated with additional storage in forests due to t nd clearing in the industrial era was accompanied by fossil fuel burning, it raised the atmospheric ore efficient photosynthesis. Therefore, even though the cleared land is storing very little carbon ave a greater density of carbon than in pre-industrial times, which partially offsets the carbon lost

t present, 2470 GtC is stored in 130 Million square kilometers (Mkm2) of the ice-free land area of t 19,000 tons per sq. km (t/km2). According to the IPCC Land Use Block diagram (see Fig. 11.9, pag azing land for animal agriculture[14]. The Integrated Science Assessment Model (ISAM) at the Uni currently storing 53 GtC, for an average of 1,150 t/km2, or just 6% of the global average[15]. This Fig 3.2, which shows vast swathes of the planet with low carbon density corresponding to where

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4. SENSITIVITY ANALYSIS FOR HUMAN AC CLIMATE CHANGE

the previous sections, we have established that land clearing, primarily for Agriculture, and fossil using climate change. In this section, we will compare the climate change impact of eliminating fo imal agriculture, a sub-sector of agriculture.

the dawn of the Agricultural revolution, 10,000 years ago, human biomass was negligible compar rge wild animals that are greater than 44kg in average weight. At that time, humans could afford t imal foods (see Fig. 4.1)[16]. However, in the industrial era, by 1970, human biomass alone was e ,000 years ago. In addition, humans were now farming animals whose total biomass was roughly nsuming three times as much food as all humans, in terms of dry weight. As far as the planet was esenting the profile of a biomass that was triple the biomass of all the megafauna from 10K years d declined by 60%.

st forward another 40 years and by 2010, human biomass had doubled from 1970 levels. Our far od (in terms of dry weight) as all humans thereby presenting the profile of a biomass that is NINE ,000 years ago[14], even though their actual biomass is only four times the biomass of all large w ecause we have genetically selected our farmed animals for freakish characteristics which makes t one would indicate. For example, the average white rhinoceros weighs 5100 lbs and eats 120 lbs o eighs 1700 lbs and eats 140-150 lbs of feed a day.

e biomass of wild animals had declined by 52% from 1970 levels and therefore down by 81% from wild animals was also accelerating exponentially to be 58% from 1970 levels by 2012[18] and 60% human land clearing for agriculture, since 80% of mass extinction is due to habitat loss[20].

terms of dry matter biomass, our "livestock" or farmed animals consume more than 80% of the f ovide just 15% of the food (including "seafood") that humans consume (see Fig. 4.2)[14]. Therefor e eat, in terms of dry weight. Poore and Nemecek have calculated that plant-based foods provide e consume[21]. Therefore, it is not too far-fetched to ask the question, how much can we mitigate riculture sector altogether and relied entirely on plant-based foods and products? Indeed, this is iminating fossil fuel burning altogether. Of course, this would require us to not use animal produc

EGAN" lifestyle, since at present, the animal agriculture industry is providing 190 million tons of "f
illion tons of "other raw materials" such as skin, blood and bones. If we only change our diets, but
oducts, the industry is perfectly capable of raising animals just to produce the "other raw materia
a dent in our environmental impact.

ig. 4.1. The biomass of wild animals, humans and farmed animals over time. Human biomass was
years ago. Today, this biomass ratio is inverted and biomass levels a

ig. 4.2. Biomass flows, in Gigatons of dry matter biomass per year, through the Animal Agriculture
4.5 times as much food as all humans. Source IPCC AR5 WG3 Chapter 1

its Fifth Assessment Report, the UN IPCC had calculated that the "Agriculture, Forestry and Land
O2e or 24% of the global greenhouse gas emissions by industry sector, including indirect emission
ee Fig. 4.3)[1]. Since animal agriculture is a sub-sector under AFOLU, its contribution must be stric
as calculated to produce 32 Gt of CO_2 or 65% of the total greenhouse gas emissions (49 Gt CO_2e)
at eliminating fossil fuel burning is a more effective climate mitigation strategy than eliminating t

owever, this is like inferring the Earth is flat based on local, line-of-sight observations. Such "Local
isleading. Firstly, the above comparison is based on current emissions and not on cumulative em
ppropriate for measuring climate change impact. Secondly, the IPCC is using a 100 year time fram
ethane, which undercounts its more relevant 10-year impact by nearly a factor of 5. Thirdly, it is n
erosol cooling effects that need to be taken into account for comparing climate change impact. Fo

mission to one sector alone. Therefore, if a truck is transporting agricultural products, its emission
ctor and not to the AFOLU sector. Finally, the UN IPCC is relying on the UN Food and Agricultural
O has publicly partnered with the International Meat Secretariat and the International Dairy Fede
lease see Appendix below for a detailed analysis of the IPCC's miscalculations). How reliable can t
dustry interests? Indeed, here's a timeline of events debunking the FAO's reports:

IMELINE OF EVENTS:

005 – Alan Calverd, an independent physicist, published an estimate of GHG emissions from "Lives
tal. "Livestock" breathing is a proxy for the avoided carbon sequestration while consuming anima

006 – FAO published Livestock's Long Shadow (LLS) calculating lifecycle emissions from the "Livest
ss than the breathing contribution alone[5].

009 – Goodland and Anhang, two Environmental Assessment (EA) specialists with the World Bank,
rors in LLS and calculating lifecycle emissions of the "Livestock" sector to be 32.6 Gt CO2e or 51%
tual emissions of 21.1 Gt CO2e plus avoided carbon sequestration of 11.5 Gt CO2e (see Table 4.1
imal agriculture is eliminated[3]. The latter is their estimate of the "Carbon Opportunity Cost (CO
Searchinger et al. In the former, Goodland and Anhang used a 20-year timeframe for averaging t
meframe used in the FAO's analysis[4].

011 – FAO scientists published critique of Goodland and Anhang's estimate in Animal Feed Science

012 – Goodland and Anhang published refutation in AFST Journal and reiterated their estimate. FA
espite AFST Editor's invitation[24].

013 – FAO publicly partnered with International Meat Secretariat and the International Dairy Feder
ecycle emissions of the "Livestock" sector to be 7.1 Gt CO2e or 14.5% of total, without addressing
hang's report or in the ensuing peer-reviewed debate[2].

herefore, relying on the FAO's analysis is like relying on a Philip Morris scientific paper that extols t
ghts[25]. Or the Philip Morris study conducted by Arthur D. Little which found that smokers' early
e costs of health-care and lost tax revenue from early death. In its lifecycle analysis of animal agri
nimal agriculture, i.e., the carbon sequestration that will occur annually if the products of animal a
ternatives, to be precisely ZERO. This is incorrect, since animal agriculture is using 37% of the lanc
is grazing land is storing just 2% of the land carbon[15]. This shows that there is a tremendous de
pportunity to redress the carbon imbalance between land and the atmosphere. Indeed, it appears
nstly undercounted the COC of animal agriculture since they only included CO2 stored in above gr
soil. Searchinger et al. calculate the COC to be an average of 5 tons of CO2 per person per year, w
uman population of 6.9 billion in 2010[4]. Therefore, the true lifecycle emissions of animal agricult
e total. The detailed calculations are shown in Table 4.1 below:

Fig. 4.3. Global emissions by economic sector according to the UN IPCC AR5. Agriculture, FOrestry
total, but this fraction doesn't include indirect emissions from transport, in

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contrast to "Local Sensitivity Analysis," a "Global Sensitivity Analysis" works by considering the tho
diative forcing change in the two scenarios:

Clean Energy Economy: if we eliminate fossil fuel burning and replace it with clean energy sour
Plant Based Economy: if we eliminate the animal agriculture sector and replace it with plant-ba

the Clean Energy Economy scenario, we assume that all energy sources have been transitioned t
ontinuing to burn down forests to grow more animal foods as before. Therefore, land use change
mosphere. The CO2 component of the radiative forcing would continue to increase but at a slowe
urning coal and oil, sulphate aerosols would disappear within 3-5 days, which means that the net

ue to this component. Finally, Other Heating Effects would remain the same so that the net radiat
e present 2.29 W/m2, exacerbating numerous catastrophic climate feedback loops.

the Plant Based Economy scenario, we assume that all animal products have been replaced with
griculture has been eliminated, but we continue to burn fossil fuels as necessary. From Fig. 4.2, we
od and product requirements from the cropland output alone, freeing up the grazing land for ref
azing land will begin sequestering 34.5 Gt CO2 per year, reducing CO2 levels in the atmosphere. I
urning would disappear as we reduce our need for transporting vast amounts of food to animals,
eir carcasses, treating diseased people, etc. About 40% of the methane in the atmosphere would
rcing by 0.4 W/m2. Therefore, we can expect the net radiative forcing to decrease to 1.3-1.7 W/m
s the net radiative forcing decreases, we can start gradually switching out the fossil fuel infrastruc
xacerbating catastrophic climate feedback loops.

he choice between these two scenarios should now be obvious. This shows that animal agricultur

s the detailed calculations in Fig 4.4a show, a total shutdown of the Burning machine in the Clean
crease in radiative forcing of 0.901 W/m2 annually. In contrast, Fig 4.4b shows that a total shutd
conomy scenario would result in a net **decrease** in radiative forcing of 0.104 W/m2 annually.

Fig 4.4a: Detailed calculations on the annual change in radiative forcing if the Burning machine is
while neglecting the impact of other minor greenhouse

Fig 4.4b: Detailed calculations on the annual change in radiative forcing if the Killing machine is sh
changes, while neglecting the impact of other minor greenho

nerefore, the optimum strategy to shut down these two machines without increasing the net radia
achine as soon as possible and then shut down 0.104/0.901 = 11.5% of the Burning machine ever

5. CO2 SEQUESTRATION POTENTIAL IN A ECONOMY

t present, grazing lands store just 6% of the carbon per unit area when compared to the average f oster paper presented at the AGU Fall Meeting in 2015, we reported that 41% of this grazing land turn the original forests on that land, the carbon storage on land would increase by 265 GtC from onducted using 2014 HYDE land use data, assuming that grazing land is reverted to native biomes

g. 5.1. The Lifestyle Carbon Dividend analysis showing that a global transition to a plant-based ec grazing land.

5. CONCLUSIONS

this paper, we established that animal agriculture is the leading cause of climate change account

missions. We also illustrated the need to properly sequence the shutdown process for the killing m
achine (fossil fuel burning) so that we don't increase the radiative forcing unnecessarily. Fortunat
e killing machine and the burning machine with the attendant global transition to a plant-based e
assroots action, with or without the active cooperation of governments, scientific institutions, co

APPENDIX: FOUR MISCALCULATIONS IN U

this appendix, we identify four miscalculations in the United Nations (UN) Intergovernmental Pan
use a systematic under-estimation of the impact of animal agriculture on climate change. For refe
of the 2019 IPCC Special Report on Climate Change and Land[6], since it was published after the
tastrophic climate change by 2030, 11 short years from now[7].

e two biggest greenhouse gas contributors to climate change are carbon dioxide (CO2) and meth
atural gas, produce CO2 when burned. Animal agriculture produces methane gas through farm an
ublic to focus on fossil fuels rather than animal agriculture, even though methane causes more gl
ere's how:

Fig. A.1. A comparison of how the IPCC calculates annual greenhouse gas emissions (see Table SP
the reality of how the same annual greenhouse gas emissions impa

The IPCC uses total CO2 emissions instead of airborne fraction (45%)

he IPCC counts all human CO_2 emissions as contributing to climate change even though less than
arming gas on an annual basis. That miscalculation means fossil fuels are being blamed for more
nimal agriculture is not getting the attention it warrants.

Table SPM1, page 9, of its Special Report[6], the IPCC counts 39.1 Giga tons (Gt) as the average ar
ational Oceanic and Atmospheric Administration (NOAA) Mauna Loa data reveals that between Ja
mosphere increased by 2.24 ppm per year[27].

ach ppm of CO_2 in the atmosphere corresponds to 7.81 Gt CO_2[28].

herefore, 2.24 ppm of CO_2 corresponds to 17.6 Gt CO_2, which is only 45% of the average annual e

ansen et al report that this "airborne fraction" has been decreasing since 2000 even though the ra
ontradicts the IPCC's implicit assumption that the airborne fraction is entirely due to land/ocean u

he fact is that human CO_2 emissions is occurring on top of a natural photosynthesis and respiratio
ience to simply assume that this natural cycle is "perfectly" balanced. This leads one to question h
alanced? Or is it 99.9% balanced?

he IPCC is also simply averaging the CO_2 impulse response from different climate models instead
sponses are so dramatically different.

he lack of inquiry by the IPCC into potential imbalances in the natural CO_2 cycle and the poor met
mospheric CO_2 impulse response shows that the IPCC is not too concerned about accuracy in its
ounting the impact of fossil fuels and under counting the impact of animal agriculture.

The IPCC measures the impact of methane over a 100 year timeframe, thereby dilu ecade

Table SPM1, page 9, of its Special Report[6], the IPCC counts the average annual emissions of me
me frame, excluding climate carbon feedbacks, this works out to an equivalent CO_2 emissions of 1
WP) of 28. This is the value shown in Table SPM1.

he IPCC underestimates the impact of methane gas by using a timeframe of 100 years. This ignore
O2 with a half-life of 8.4 years. By stretching methane's impact over an entire century, the IPCC is
oes on an annual basis, compared to C02. This is like eating a whole cake in one day, each and eve
ould have on our body as if we ate it over the course of a year.

owever, over a 10 year time frame, including cloud effects, the GWP of methane is 130, which mea
O2e[10].

ease see Fig A.1 for the dramatic impact that the first two miscalculations have on the annual gre
ethane and how it changes the framing of climate change.

Fig. A.2. How the ice-free land area of the planet is distributed for different uses. Please note that
Grazing occurs on 37% of the land area. *Data Source:* 2019 IPCC Special Report. *Figure co*

The IPCC does not consider the opportunity cost of land use for Animal Agriculture

ost forests are destroyed to create animal grazing land. When forests vanish, so does the ability o
ees absorb carbon dioxide and the trees are gone. So, the cooling opportunity is lost. Over time, t
ause of climate change. Currently, 37% of the ice-free land area of the planet is used for animal gr
rbon on land (see Fig A.2). Yet, the IPCC does not consider the opportunity cost of this land use fo

. The IPCC uses raw data from the Animal Agriculture industry

he IPCC uses raw data from the animal agriculture industry through the United Nations Food and

eutral sources. This is like getting our data from the tobacco industry to determine cigarettes impa
artnership with the International Meat Secretariat, International Dairy Federation and the Internat
romotion organizations. Members of the UN FAO are co-authors of IPCC reports, thereby eliminat
ientific deliberations on the impact of animal agriculture.

REFERENCES

] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D.
ephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Clima
ontribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on
attner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)], 2014, Ca
ngdom and New York, NY, USA.

] Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G
A global assessment of emissions and mitigation opportunities. Food and Agriculture Organizatio

] Goodland, R. and Anhang, J. M., Livestock and Climate Change: What if the Key Actors in Climate
atch, November-December 2009, Worldwatch Institute, Washington DC, USA, pp. 10-19.

] Searchinger, T.D., Wirsenius, S., Beringer, T., Dumas, P., Assessing the Efficiency of Changes in La
ol 564, December 2018 pp. 249-253.

] United Nations Food and Agricultural Organization, Livestock's Long Shadow, Environmental Issu
gricultural Organization, Rome, Italy, 2006.

] IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Ma
uxes in Terrestrial Ecosystems, UN Intergovernmental Panel on Climate Change, Aug 2019.

] IPCC Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by
imate Change, Oct 2018.

] Carbon Dioxide Information Analysis Center (CDIAC), Lawrence Berkeley Laboratory, 2017.

] Kaplan et. al. Holocene carbon emissions as a result of anthropogenic land cover change, The H

0] Shindell, D.T., G. Faluvegi, D.M. Koch, G.A. Schmidt, N. Unger, and S.E. Bauer, 2009: Improved a
cience, 326, pp. 716-718.

1] Ciais, P., C. Sabine, G. Bala, L. Bopp, V. Brovkin, J. Canadell, A. Chhabra, R. DeFries, J. Galloway, M
ao and P. Thornton, 2013: Carbon and Other Biogeochemical Cycles. In: Climate Change 2013: The
roup I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker

Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. 2014, Cambridge University Press, Car
SA.
2] Crowther, T.W., et. al., Mapping Tree Density at a Global Scale, Nature 525, Sep 2015, pp. 201-2
3] Zhu, Z., et. al., Greening of the Earth and its Drivers, Nature Climate Change 6, Apr 2016, pp. 79
4] Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E.A. Elsiddig, H. Haberl, R. Harper, J. H
avindranath, C.W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling, and F. Tubiello, 2014: Agric
imate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth A
anel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Sey
ckemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)],
nited Kingdom and New York, NY, USA.

5] Rao, S., Jain, A. K., Shu, S., The Lifestyle Carbon Dividend: Assessment of the Carbon Sequestrat
everted to Native Forests, AGU Fall Meeting 2015.
6] Barnosky, A., Megafauna Biomass Tradeoff as a Driver of Quaternary and Future Extinctions, P
7] World Wildlife Fund Living Planet Report 2014.
8] World Wildlife Fund Living Planet Report 2016.
9] World Wildlife Fund Living Planet Report 2018.
0] E. O. Wilson, The Creation: An Appeal to Save Life on Earth, W. W. Norton and Company, 2007.
1] Poore, J. and Nemecek, T., Reducing Food's Environmental Impacts Through Producers and Co
. 987-992.
2] Calverd, A., A Radical Approach to Kyoto, Physics World, Vol 18, No 7, Jul 2005.
3] Herrero, M., Gerber, P., Vellinga, T., Garnett, T., Leip, A., Opio, C., Westhoek, H.J. Thornton, P.K.,
oussana, J.-F., Steinfeld, H., McAllister, T.A. 2011. Livestock and greenhouse gas emissions: The imp
eed Sci. Technol. 166-167: pp. 779-782.
4] Goodland, R. and Anhang, J. 2012. Livestock and greenhouse gas emissions: The importance of
nim. Feed Sci. Technol. 166–167, 779–782.] Anim. Feed Sci. Technol. vol 172, issues 3-4, pp. 252-2
5] Mendes, P., Kapur, S., Wang, J., Feng, S., Roething, H., A Randomized, Controlled Exposure Stud
garettes Switching to Marlboro Lights or Marlboro Ultra Lights, Regulatory Toxicology and Pharm
6] Goldewijk, K., Beusen, A., Van Drecht, G. and De Vos, M., 2010: "The HYDE 3.1 spatially explicit d
ange over the past 12,000 years," Global Ecology and Biogeography, 2010, vol. 20, issue 1, pp. 73-
7] CO2 Monthly Data from NOAA Mauna Loa observatory, accessed from co2.earth/monthly-co2.
8] Conversion table accessed from https://cdiac.ess-dive.lbl.gov/pns/convert.html#3.
9] J. Hansen, P. Karecha, M. Sato, "Climate Forcing Growth Rates: Doubling Down On Our Faustiar
 1, 2013. https://iopscience.iop.org/article/10.1088/1748-9326/8/1/011006/meta
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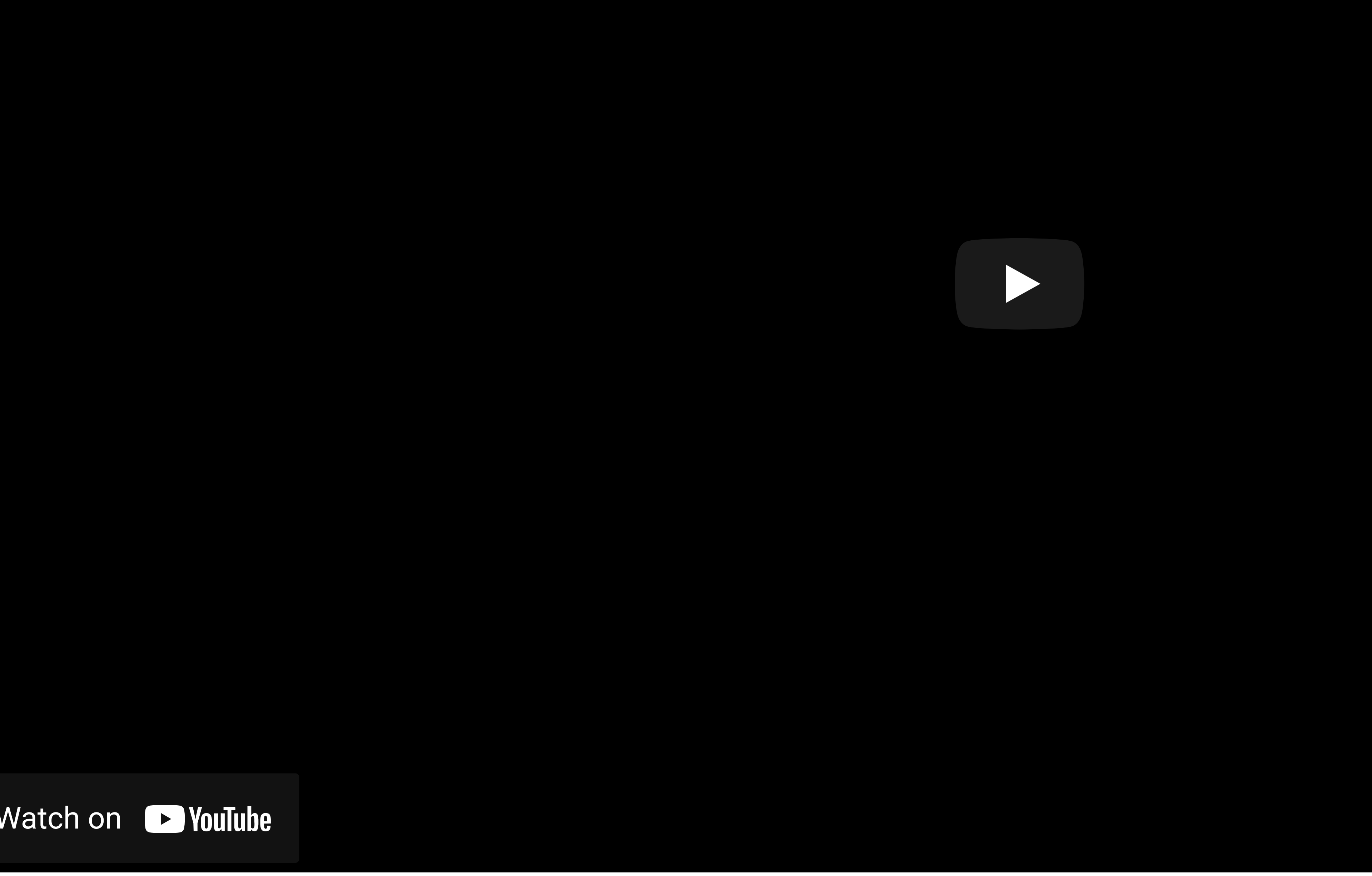

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