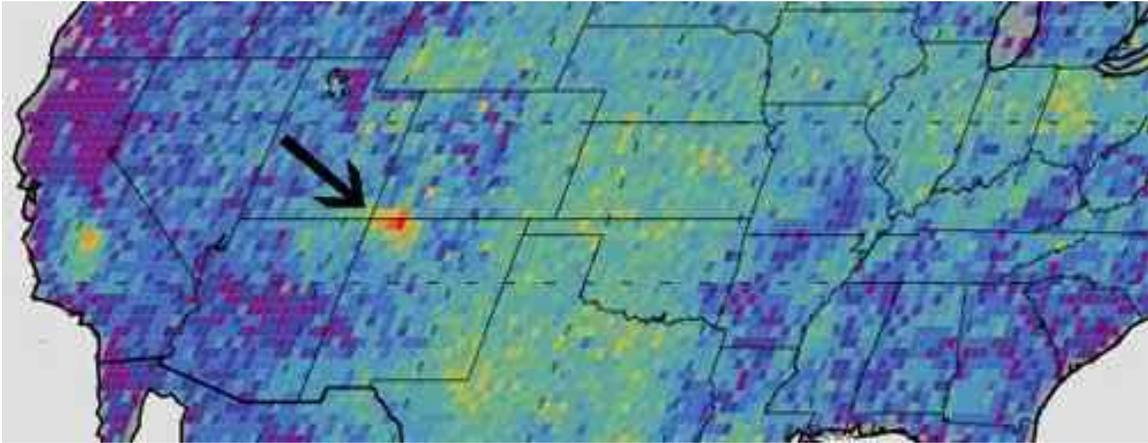


A Message for Climate Change “Denialists”



This recent satellite image of the methane cloud hovering over the Four Corners region serves as a stark reminder of one of the lesser-known contributors to climate change and, until recently, one of the least understood.

Methane is a primary component of natural gas that escapes from oil and gas industry drilling and other leaky pipes. Methane contributes to global warming when it absorbs the sun's heat. About 25 percent of human-caused global warming is from methane emissions and while methane does not remain in the atmosphere as long as carbon, in the first two decades of its release, methane is 84 times more potent than carbon dioxide.

Part of the confusion over the implications of methane comes from the historical fact that the earth has always undergone warming and cooling cycles. Relying on the scientifically well-documented natural variations in climate warming – not to be confused with weather – many Americans acknowledge increased temperatures, yet a significant number deny that it is caused by human activity.

What this ill-informed thinking ignores about global warming is agriculture. Although the climate change-causing implications of methane are associated with the industrial era, agriculture caused warming before the Industrial Revolution is often ignored.

Ice cores show that ice ages caused by natural declines in greenhouse gasses have occurred roughly every 10,000 years, but the advent of human agriculture 10,000 years ago changed that. The “(e)arth should have undergone a large natural cooling during the last several thousand years, and (it would have) had it not been for the greenhouse-gas releases from early human activities.”

Methane (CH₄)

The aspect of climate change seldom mentioned is the preindustrial spike of methane (CH₄). The natural process for producing methane is vegetation growth, death and decay. In addition to the anthropogenic (human-caused) increase of carbon (CO₂) that spiked with the Industrial Revolution some 200 years ago, there was a human caused increase in CH₄ about 5,000 years ago. Until then, methane concentrations in the atmosphere had followed natural variations over the previous hundreds of thousands of years.

Once the natural sources of this sudden increase of methane were ruled out (the tropical and boreal wetlands) the human cause became apparent. In *Plows, Plagues & Petroleum*, retired professor of Environmental Sciences at the University of Virginia William Ruddiman lays out the details of how humans took control of methane production and concludes “(t)he continued growth in the size of the methane anomaly (5,000 years ago) is consistent with the history of irrigation and population growth in Southeast Asia.”

The planetary transition from the hunting-fishing-gathering lifeway to agriculture originated independently in several regions some 12,000 years ago, permanent settlements first appeared 10,500 years ago, followed by the domestication of goats, sheep, pigs and cattle 9,500 years ago. This fundamental change to a

place-based way of life dramatically increased human population that eventually led to an abrupt methane uptick or anomaly 5,000 years ago corresponding with the innovation of irrigation-based agriculture.

The initial, new methane-generating activity was the diversion of river water to irrigate rice, followed by the advent of canals to irrigate croplands as never before. This created artificial wetlands from which the natural process of methane production spiked: vegetation (both rice and weeds) growth, death, drying and decay.

Irrigation agriculture fostered an increase in the other methane producing activities: livestock emissions (burps, belches and flatulence), biomass burning to clear agricultural fields and human waste. Although an effort to parse precise “blame” among these various activities is like unscrambling an egg, the base cause of this methane spike is the abrupt and rapid expansion of human irrigation-based agriculture and the increase in human population that accompanied it.

Carbon (CO₂)

Ruddiman found similar evidence of preindustrial era atmospheric carbon increase attributed to humans, in his words, “taking control” of CO₂. Natural variations in methane are controlled mainly by growth and shrinkage of wetlands. It is relatively easy to measure, while the carbon system is far more complex due to the ubiquity of CO₂. Carbon exists in almost every part of the climate system: air, vegetation and oceans. Although allocation among causes is again uncertain, the ice core evidence that disclosed the record of methane also held the history of natural CO₂ cycles, “four major cycles, each marked by a slow erratic drift to lower CO₂ concentrations, and then rapid shifts to higher values every 100,000 years.”

As with the preindustrial era methane anomaly, human activity had implications for carbon. About 8,000 years ago forest clearing for agriculture caused a slow rise that continued until CO₂ spiked

in the industrial era. Stone Age humans began clearing forest using axes and sticks in Europe, China and the Indus River Valley 9,500 to 8,000 years ago, followed with increased efficiency in the Bronze Age and Iron Age with metal tools, plows and domesticated animals for a far more extensive clearance of forests.

Domesday Survey

The Domesday Survey commissioned by William the Conqueror in 1089 found that 85 percent of England was deforested. Calculations based on population growth and other factors detailed in Michael Williams' book, *Deforesting the Earth*, posits a massive preindustrial deforestation - "human forest footprint" – bolstered by the burning of peat in Europe and coal in China of about 40 parts per million (ppm). This number is based on a projected natural value of 240-245 ppm some 5,000 years ago to the level of 280-285 ppm reached just before the industrial era.

(H)uman activities linked to farming had taken control of the trends of two major greenhouse gasses thousands of years ago, forcing their concentrations to rise when nature would have driven them lower. The net impact of humans through time was a long slow rise in greenhouse-gas concentrations prior to the industrial era, and then much more rapid increases during the last 200 years of industrialization.

Accompanying agriculture, the population explosion and deforestation initiated this unending increase in atmospheric carbon from 245 CO₂ parts per million to 285 ppm by the start of the Industrial Revolution. Now the concentration of CO₂ in the atmosphere is 400 ppm or 50 ppm above the 350 ppm maximum

that scientists deem safe for human survival and another 50 ppm short of the threshold that international climate negotiators have identified as providing a 50 percent chance of avoiding the impacts of catastrophic, irreversible climate change. The methane anomaly resulting from irrigation agriculture jumped 25 times from 10 ppm 5000 years ago to 250 ppm reached even before the industrial era.

The fault in the thinking of “denialists” when they rely on the incontrovertible scientific evidence of natural variation is refusing to acknowledge the measurable changes brought on by agriculture, forest clearing for CO₂ and irrigation for CH₄. These preindustrial era carbon and methane increases prevented natural cooling and likely avoided a naturally occurring ice age that otherwise would have arrived around the time of Christ.

This approaches the bizarre, but the most untenable aspect of the denialists assertion that natural variations are currently at play – and warming is not caused by human activity - is the current level of CO₂ in the atmosphere at 115 CO₂ ppm (400 less 285 = 115, but there are those who claim the difference is 150 ppm) above the count at the beginning of the Industrial Revolution.

In view of the current climate change crisis and looming devastation, what’s so worrisome about this phenomenon of climate change denial is that the refusal to acknowledge the science is not so much a function of ignorance or not being well read, rather it reflects a political ideology or religious faith that is often beyond the reach of logic or science.

Sources:

“(e)arth should have undergone...” William F. Ruddiman,
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“(t)he continued growth...” Ruddiman, p. 80

“four major cycles...” Ruddiman, p. 84

“human forest footprint” Ruddiman, p. 91

“(H)uman activities...” Ruddiman, p. 95

