Herbivores, methane, mis-information and dangerous climate extremes.

By Walter Jehne

Things are not always what they are promoted to be by vested interests. Even valid scientific evidence presented in narrow or invalid contexts can mis-inform dangerously. So how can we ensure we get to consider all the evidence and contexts to let us objectively analyse each issue?

While science aims to present an objective analysis of the evidence to help us understand what governs each situation as well as the consequences of our actions within a systems context, we need to question if this is the only or correct context. If not it may give only a partial understanding of the system and the consequences from our actions and risks being dangerous or biased mis-information.

Getting this context and full understanding right is critical in areas like climate change where the evidence confirms it is abnormal, accelerating dangerously and may pose risks to humanity if not addressed urgently but where we lack a clear understanding of what to do to reverse its impacts.

It is also critical to help us understand the risks from the recent acceleration of methane emissions from industry, bio-systems and the over 20,000 billion tonnes in frozen ocean hydrates and tundras as climates warms abnormally. As abnormal mass methane emissions have triggered extinctions in the geological past, we need to understand the current risks and response options as a priority.

Given these recent abnormal releases of and rise in methane levels we need to urgently analyse;

1. **The verified evidence of what has, and is happening to global methane levels.**

2. **The claims about what has caused and the consequence of this rise in methane levels.**

3. **The veracity of and consequences from the proposed actions to hope to reduce them.**

4. **The natural processes that govern methane production, atmospheric levels and risks.**

5. **What we may have done to impair these processes to change these risks from methane.**

6. **How we may be able to restore these and thus limit risks from dangerous emissions.**

7. **If what we have been told about the methane crisis has considered this and if not why not.**

8. **What we must and can do instead to prevent the real risks from methane to our future.**

Only by critically evaluating all the scientific evidence relating to each of these questions can we understand what has happened to the natural processes that governed methane emissions and levels, their consequences and our options to avoid dangerous consequences, hopefully in time.

Only by such analyses can we understand the full context and natural processes and balances that govern the Earth's methane levels and avoid pending risks; including from over-reacting in naive, ineffective or counterproductive ways on simplistic assumptions, dogma and mis-information.

1. **The verified evidence of what has, and is happening to global methane levels.**

Throughout the Earth's existence methane gas has been produced and emitted into its atmosphere. While initial levels were substantial, since 4.2 billion years ago as water covered most of the Earth, sunlight has naturally photo-oxidised oxygen into ozone which then turns water vapour into vast quantities of hydroxyl ions (OH). These hydroxyl ions are highly reactive and can rapidly oxidise methane (CH4) into carbon dioxide (CO2) and water (H2O), to reduce methane in the atmosphere.

Volcanic and geological events over this period have triggered mass emissions of methane, resulting in climate extremes and the extinctions of much of life on land. In all cases the natural formation of hydroxyl ions has resulted in the rapid oxidation of these elevated methane, carbon monoxide and other volatile emissions and enabled new life to evolve and re-colonise in the impacted areas.

So much so that over recent geological time these hydroxyl ions have maintained methane levels at minimal background levels of some 700 parts per billion. This is despite the Earth's bio-systems emitting far more methane than at present from its then far more extensive natural wetlands, tundras and the bio-digestion of forest and grassland bio-mass by abundant termites and herbivores.

Then as now nature had the capacity to remove methane from the air to maintain low background levels despite much higher former emission levels. Consequently the recent rise in methane levels to some 1600 ppb in the 1990's and now 2400 ppb is abnormal and

indicates that the former natural processes that oxidised methane have been impaired, and needs to be understood, urgently.

Rather than focus on the symptom, the rise in methane levels or its source, why have the natural processes that previously oxidised this methane to sustain the stable low levels that humanity evolved in and relies on for its safe future, been impaired?

Have we impaired these processes and what must and can we do urgently to regenerate them? What is needed to ensure that we are not diverted from this imperative by biased mis-information that targets some natural sources of methane emissions and not the real issue, the actions need to restore the natural methane photo-oxidation processes and the former stable low methane levels?

While science has long confirmed the veracity of the natural photo-oxidation of water vapour into hydroxyl ions and its natural capacity to oxidize over 90% of the 600+ billion tonnes of methane as well as other volatile atmospheric pollutants being emitted globally each year, we need to better understand what governs these natural photo-oxidising processes and the sinks for methane. Whether and how we may have impaired them and what is needed to restore them urgently.

As in the case of climate change and our inducement of the Earth's abnormal greenhouse warming, it is essential that we focus on the cause of our impairment of the natural processes that previously regulated our safe climate rather than just its symptoms, the rise in CO2 and or methane levels and actions to slow down this symptom expression via emission reductions, but fail to address its cause.

As demonstrated by Charles Keeling 50 years ago, just as the rise in CO2 is caused by the imbalance between our total global emissions and natural draw down of CO2, the abnormal rise in methane levels is similarly caused by an imbalance between its emission and photo-oxidation processes, not the fact that herbivores, like all animals, emit some methane and thus need to be vilified based on a naive pseudo-scientific solution.

2. **The claims being made about the causes and consequence of the rise in methane levels.**

There is no question scientifically that ruminant herbivores that bio-digest grass, produce methane. Indeed cows, as do all living animals produce methane via their anaerobic digestion of their food.

However it does not follow logically that the digestive activity of those cows, herbivores or humans have caused the recent abnormal rise in methane levels or create a threat to our stable climate.

It does not follow that we can secure our safe climate by reducing these agents or their digestion.

Given the fact that the Earth sustained many times the current biomass of herbivores for millennia all of which were producing methane without raising the global methane levels above the natural minimal baseline of some 700 ppb, the issue clearly is not that 'animals emit methane' but what has happened to the natural processes and sinks that previously removed these emissions from the air?

Given that the emissions of methane by the current herbivores represents only a small fraction of the methane emissions from all natural sources, none of which raised methane levels abnormally, what basis is there for deeming this fraction to be the cause of and solution to the recent increase?

Given that we have had documented peer reviewed scientific evidence for over 50 years that natural processes have and still rapidly oxidise over 90% of the methane emitted from all global sources as well as much of the carbon monoxide and volatile pollutants, why have these claims ignored this?

Given that the abnormal recent rise in global methane levels signals that these natural regulatory processes of methane photo-oxidation have been impaired and that this creates a major risk to the future of humanity if not understood and addressed urgently, how can the continued simplistic naive assumptions and claims that 'cows are the cause' and their 'reduction is the solution' not risk impeding this critical understanding of this serious real risk and the urgent action to minimize it?

3. The veracity and consequences from the proposed actions to try to reduce them.

While reductions in the emission of methane from all sources will help lower the scale of their required removal process, such reductions cant compensate for the impairment of these removal processes. They may mask the seriousness of the problem and the need for urgent practical action to restore the natural removal processes to secure stable methane levels under all emission levels.

This is particularly the case where the targeted methane emission reductions involve only a small fraction of the total methane emissions, such as via the removal of herbivores digesting pastures, but ignore much larger sources of emissions from natural sources such as those from wetlands, termites and peats or man-made sources such as landfills, irrigated crops and fugitive emissions.

Given that the recent abnormal rises in global methane levels were associated with periods and regions where gas extraction and the expansion of fracking occurred, claims that the increase may be caused by cows whose numbers are well below former natural herbivore levels may be naive but also being used to cover up the far more direct and likely causal factors and solutions.

There is no question that confined factory farmed animals apart from raising animal rights issues also produce significant methane via both their digestion and effluents that are not able to be readily oxidised by hydroxyl ions produced by those systems. Claims that other herbivores naturally grazing pastures must be reduced to offset such emissions similarly have little logic or veracity.

Proposal to reduce the herbivores that ecologically graze and maintain natural grasslands may also have serious consequences and risks that must be considered in a total systemic context. Grasslands have evolved with and depend on their herbivores to regularly graze them and recycle excess grass into bio-fertilizers to help stimulate new ever more productive grass growth. Without their natural herbivore symbionts, grassland rapidly become overgrown, rank and dormant and major fire risks.

These inevitable fires will convert all the shoot bio-mass into CO2, carbon monoxide, poly-aromatic carbon volatiles and carbon particulates as well as oxidise much of the soil biology and carbon into such compounds and methane, often resulting in greater greenhouse warming than does grazing. This soil carbon oxidation often results in the loss of structure and water holding capacity in these soils as well as the volatilization and leaching of nutrients and risks of erosion.

The resultant loss of productivity and aridification of these soils can profoundly impair both the capacity of regenerating grasses on that soil to re-fix the carbon lost via burning as well as transpire the water vapour needed to produce the hydroxyl ions to naturally oxidize methane emissions. These compounding negative effects from removing natural grazing herbivores from grasslands in the naive dogma to reduce their digestive methane emissions are generally far more damaging to the health of these bio-systems and our stable climate than their beneficial net methane effects.

Clearly we should critically evaluate the net consequences from changing the ecology of natural bio-systems such as these grazing systems rather than make simplistic naive claims with unknown risks without understanding the processes and balances involved, or to advance other vested interests.

4. The natural processes that have regulated methane production, levels and risks.

As outlined in section 1 above methane is a common natural gas that is produced when the four bonds of a carbon atom reacts with hydrogen in oxygen deprived environments to form methane. Vast quantities are formed and emitted naturally from volcanoes, by combustion, from fossil carbon deposits and continually by microbes in swamps, soils and in the digestive tracts of animals where oxygen limits prevent the methane from being rapidly oxidised to stable carbon dioxide and water.

Methane is the major component in most coal and mineral gas and a valuable global source of fuel. Vast quantities are currently being extracted from coal seams, sediments, landfills and in industrial processes, often with high levels of associated fugitive emissions escaping into the atmosphere.

As outlined over 90% of the methane that is naturally emitted into the atmosphere was and still is rapidly oxidized to CO2 via the hydroxyl ions produced from the photo-oxidation of water vapour which enabled the atmosphere to sustain low baseline levels of some 700 ppb for millions of years. Most of the methane produced in soils and by soil organisms was similarly oxidised by microbial methanotrophs and emitted as CO2 that was then largely absorbed by plants to aid their growth.

Vast quantities of methane have also been produced by the anaerobic decomposition of carbon in organic sediments that have been washed out to sea or from submarine hydrothermal vents and now form over 10,000 billion tonnes of frozen methane hydrates in colder ocean regions. A further 5000 billion tonnes of methane may be released from the vast quantities of organic matter in the Earth's tundra and permafrost should they continue to melt as these regions warm exceptionally.

Given that methane levels can rise rapidly to dangerous levels in many regions particularly if these frozen hydrate and permafrost deposits warm and melt and that such toxic level pose extinction risks for life in large regions, humanity must prevent such risks for its own self interest and survival.

It can only do this if it prevents warming of the tundras and deep oceans at high latitudes containing these frozen methane stores. This may no longer be possible as the oceans are currently absorbing 93% of the additional heat being retained by the planet due to global warming and circulating this via currents that warm its deeper layers.

Accelerating quantities of methane are already bubbling up from melting hydrates in the arctic oceans and melting permafrosts and tundras in high latitudes. Both rates are and will accelerate unless we rapidly cool these deep frozen stores; but we don't know how we could do this.

Alternatively humanity must ensure that, as in nature, it can rapidly photo-oxidise the methane that will be released from this accelerated melting of these methane sinks into CO2 and fix this via plants. To do that it needs to re-create the extensive natural bio-systems able to sustain the generation of the vast quantities of hydroxyl ions needed to photo-oxidize these accelerating methane emissions.

All the evidence indicates that this is how nature limited methane concentrations following previous major geological emissions, limit their extinction impacts and return levels to natural low baselines.

Consequently rather than ignoring this natural methane reduction process so as to sustain the naive mis-information that 'cows are causing our abnormal methane rise', humanity may need to urgently face the reality of its real methane risk and imperative and the only way it can now address it.

5. What we may have done to impair these processes to create the methane rise.

Given that the natural hydroxyl ion producing processes had been able to oxidise even periodic high geological emissions of methane well above those now being added to the atmosphere by humans, it follows that our current abnormal rise in methane emissions is not just due to their emission but also a systemic impairment of the natural hydroxyl ion processes that formerly had oxidised them.

While there is no evidence that the abundant sunlight needed to photo-oxidize water vapour into the hydroxyl ions has diminished or changed, aspects of the complex atmospheric chemistry driving this reaction may have resulting in the impaired capacity to produce hydroxyl ions as previously.

In essence, in nature, ultra violet radiation in sunlight interacting with oxygen molecules (O_2) can induce them to form ozone (O_3) which can then split the water vapour molecule (H_2O) into two hydroxyl ions (2x OH). Each of these negatively charged hydroxyl ions can then act as free radicals in the atmosphere and can oxidize reduced gases such as methane (CH_4) and carbon monoxide (CO) into carbon dioxide (CO_2) and water (H_2O) both of which are stable.

However if there are excessive other abnormal pollutant gases and particulates in the air that also attract the ozone produced via photo-oxidation, such as dust, poly-aromatic hydrocarbons or nitrous oxides, these may limit the amount of ozone remaining and available to produce the hydroxyl ions.

Our agricultural management of our crops and landscapes now results in the emission into the air of not just abundant transpired water vapour as occurred naturally but also vastly increased quantities of dust aerosols , poly-aromatic hydrocarbons and particulates from fires and chemical volatiles from fuels, solvents and bio-cide as well as nitrous oxides from excess and inappropriate fertilizer use. These are known to interact with ozone and could readily have impaired hydroxyl ion formation.

While growing plants still transpire water vapour, our conversion of vast areas of natural perennial grasslands with deep roots able to sustain the longevity of green growth and thus transpiration into short lived annual crops may also have reduced the sustained transpiration of water into the air.

Together with the effect of our industrial cropping strategies in exposing bare soil and reducing the carbon content, structure, water holding capacity and stability of that soil to

wind erosion, these changes to the hydrological dynamics and longevity of these areas could readily impair the hydroxyl ion production capacity of the air above such industrial farmland relative to its former natural state.

If this is so the potential should also exist to help restore the former natural hydroxyl ion formation capacity of these landscapes via our restoration of more natural farming practices and in so doing help to restore their natural capacity to rapidly photo-oxidise the methane being emitted by them.

6. How we may be able to restore them and thus limit risks from dangerous emissions.

There is ample scientific evidence in regard to the cause and remediation of the ozone holes above both poles as well as the effect of pollutants in driving the dieback of many European forests that confirms the capacity of small quantities of pollutant aerosols to seriously impair the chemistry of key atmospheric processes and through that threaten the health and survival of bio-systems.

All the evidence indicates that similar agents and effects resulting from our expanded industrial farming practices may also be impairing the natural processes that formerly sustained atmospheric methane at minimal baseline levels but are now no longer able to offset modest extra emissions.

It follows that we should be able to restore these former natural levels of methane photo-oxidation and thus the safe baseline levels but only if we regenerate the soils, hydrology, protective cover and longevity of green growth of these landscapes and minimise the use of inputs that may impair these hydroxyl ion production and processes. The fact that local methane levels can vary significantly and are generally lower above regions with such natural farming practices and processes supports this.

Further practical studies are needed and could readily be undertaken to demonstrate and refine optimal ecological land restoration and management practices to not just lower methane levels but also regenerate the capacity of our restored rural landscapes to reduce, offset and buffer the risks from regions and industries with higher methane emissions but without this oxidation potential.

Given that humanity has now locked in major global warming impacts that are already triggering dangerous climate extremes that impede the capacity of our bio-systems to survive them and given the real risk that this warming may trigger the mass release of methane from frozen tundras and hydrates within decades, such practical studies to refine and demonstrate effective methane oxidation response capacities are of critical importance to impacted regions and all of humanity.

Such studies should involve refining ecological grazing strategies for extensive natural grasslands in cool high latitude and altitude habitats as well as coastal regions requiring minimal inputs that may be typical of those with closest proximity to areas of potential mass methane emissions. The studies should help refine practices that can maximize and sustain hydroxyl and photo-oxidation processes.

Suitable areas in southern South Island of New Zealand and Patagonia may be ideal for such studies and warrant priority funding support from global at risk public, private and philanthropic interests.

7. Why our conventional analysis of the methane crisis has not considered this.

Consistent with our wider global understanding of and response to our pending climate crises, vested interests and policy areas recognize that the challenge posed by the clear scientific evidence of the methane risks to the status quo is far too great for them individually or business as usual to acknowledge let alone respond to; instead excusing their non action by asking for more studies. Science has also failed by focusing on such studies and funding without adequately reinforcing the reality and risks all face but also the verified natural processes that can limit these strategic risks.

As a result as with climate change, they and the public have been focused on naive simplistic options to pretend to reduce the symptoms, the abnormal recent global rise in CO2 and methane levels, rather than understand and address the systemic imbalances that have caused these symptoms, even if they imply more fundamental changes to the status quo and its protected vested interests.

Without adequate strategic leadership from scientists or policy areas the public, that understands the importance and is highly committed to effective action to address it, has no comprehension of the wider natural systemic basis of the processes that created these symptoms or our potential to avoid these crises by regenerating the natural safe bio-systems that govern these processes.

The efforts of vested interests to focus public concern about methane on the emissions from cows and other groups like farmers less able to respond rather than themselves has been highly effective even if totally and knowingly mis-leading and counterproductive to an effective response. By co-opting groups like vegans to undertake much of the false advocacy they have not only limited costs but remained ‘non-involved’ while continuing their dominant emissions activities without scrutiny.

While this may help explain why after 50 years of scientific warnings and abundant verified science the public is still looking for leaders to do something, the reality of dangerous climate extremes is rapidly closing options to expediently ‘kick the can down the road’ based on scenarios for 2100. These climate realities now challenge the strategic self

interest, wellbeing and survival of nations as they realize they face major risks and impacts unless they adapt urgently via effective actions.

The above analysis and natural response options to the methane crisis, reflects such a realization. While there are verified effective natural solutions, leadership is needed to overcome the status quo inertia, impediments and mis-information that has protected the status quo, but is no longer viable.

8. What we must and can do to prevent the real risks from methane to our future.

Given that the risk to humanity and its future comes from a mass release of methane from the Earth's over 20,000 billion tonnes of frozen methane hydrates and tundras as the plant warms and given that this could happen unpredictably within decades in view of the already accelerating methane emissions as the poles warm, humanity only has one option to limit and survive this risk.

As nature has done repeatedly over the past 4 billion years, our only option is to hope the methane photo-oxidation capacity of the hydroxyl ions being produced as close as possible can convert most of this methane into CO2 fast enough to avoid the regional extinction of life and of this process.

Rather than hope we can significantly aid the capacity of these methane photo-oxidation processes by regenerating the healthy natural perennial grasslands and forests that can sustain the fluxes of transpired water into the air to optimize these photo-oxidation processes. Similarly we can refine land management practices for such grasslands and forests that minimize the impairment of these photo-oxidation processes as is evident from some of our high input industrial farming practices.

To optimize our understanding, refinement and capacity to regenerate, extend and sustain these processes and bio-systems practical demonstration and monitoring trials should be established in suitable typical locations with adequate global funding given the strategic global interests involved.

Most of all political leadership needs to be given not just for these practical trials and capabilities but to communicating this larger strategic imperative, narrative and last chance natural solution to the risk of a potential existential extinction event within decades from a mass methane emission.

This leadership can best come from a nation and community that has skin in the game by being subject to naive mis-information that 'cows are causing the abnormal rise in methane emissions' but with no vested interests to protect. A nation with the potential to gain significant economic and strategic advantages by leading globally in refining and providing the means for others to regenerate the health of soils, bio-systems and the atmosphere and

through that limit methane risks and help secure a safe climate and future for all of humanity.

Next step actions

Given their significant natural grazing ecologies and economies, both Australia and New Zealand are uniquely placed to lead globally to re-define this methane problem and their methane accounting based on this valid scientific understanding of both the emission sources and photo-oxidation sinks. Leading farmers and innovation catalysts are available in both nations and collectively to do this.

The above discussion paper and policy synopsis has been prepared to frame both this challenge and its solution. We welcome critical analysis and debate on its evidence base and suggestions. Ideally these inputs could be integrated and progressed via a think tank of invited lead participants to detail strategic, policy and practical priorities and implementation actions to catalyse the needed changes.

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