WILL A PLANT BASED DIET DESTROY THE WORLD?



Since the 1950s, agricultural projects have grown exponentially. Chemical fertilizers, pesticides and irrigation are now commonplace in industrial farming; enormous tracts of land from a few hundred to hundreds of thousands acres can be seen blanketed with one type crop after another. It is clear that this form of production has become deeply dependent on petroleum-based energy sources for its success.

Industrial crops may conjure images of seemingly endless rows of corn and soybeans in the Midwest, but that's only part of a bigger picture: most US-grown produce - from apples to zucchini – is now produced with industrialized techniques. This has caused an artificial disconnect between animals & plants; traditionally they'd feed into each other within nature's balanced system, but this arrangement has been replaced by soils increasingly deficient on one end, while animal waste becomes dangerously excessive at the other... all thanks to commercial agriculture.

While vegans are being distracted in thinking the cow is the big culprit, they are forgetting to look under the hood of how these precious plants are being produced and the devastation that is resulting from the practices of industrialized farming.

It's an unsustainable way of life that takes its toll on our planet; it uses up precious resources like fuel and water, pollutes the environment with various toxins creating drastic ecological damage and affects all living creatures worldwide in a major way.

The Impact of Synthetic Fertilizer Use

Every plant needs nitrogen to survive, but it does more than just sustain life. It's also an essential part of the chlorophyll molecule that helps capture sunlight energy for photosynthesis and drives growth in a big way - resulting in better yields! In addition, this crucial nutrient is even found within roots where proteins and enzymes aid water and nutrient absorption so plants can reach their full potential.

Without nitrogen, life as we know it would not exist! Though the gas is all around us in the atmosphere, plants and animals need a reactive form of this vital element to survive. Luckily, Mother Nature has some nifty ways of providing us with nitrogen: bacteria found in the roots of legumes like peas and beans "fix" atmospheric nitrogen into nutrients that other plants can use! Before 1913

though, we had to rely on gathering bird droppings or spreading manure/crop residues...to fertilize the land with a usable form of nitrogen. In 1913 German scientists changed everything with their discovery of how to synthesize ammonia from air...opening up an entirely new way for farming communities to access important nitrogen elements needed by crops.

Increased access to nitrogen fertilizer in the early 20th century has been a real game-changer for agriculture, allowing crop yields and global population numbers to soar. Without it, studies suggest only 3.5 billion people would remain on earth today - that's more than half of what is projected by 2050!

Fertilizers and waste from confined animal operations contain nitrogen, which is great for plants – in moderation. Too much of it though can spell disaster! When too much nitrogen makes its way into lakes and rivers from farmland runoff, algae blooms come out in full force — creating what they call a 'dead zone', where no plant or animals life have any hope of surviving. Sadly swimming & other recreational activities are rarely allowed near these polluted bodies anymore – what a bummer!

Dead zones have become an alarming environmental problem in US water bodies. In 2015, the dead zone in the Gulf of Mexico was a huge 5,000 square miles - roughly equivalent to Connecticut and Rhode Island combined! While synthetic nitrogen fertilizer is great for growing crops, it does come with an unwelcome side-effect: contributing about 13 percent GHG emissions worldwide; mainly nitrous oxide which traps heat like crazy.

So why do crops need the application of nitrogen?

The verdict is in: nearly a third of nitrogen fertilizer applied to Australian crops doesn't make it all the way through. A recent comprehensive study found that an average of 28% (ranging from 0 to 94%), was unaccounted for at harvest time.

There are a range of potential loss pathways. Volatilisation, leaching and runoff - you can measure these directly. Denitrification? Well, it's a bit more complicated than that - usually deduced by seeing what nitrogen gets lost to the other pathways then calculating how much is left over.

Runoff/Erosion

Ploughing land is a staple in farming across the globe, turning over soil to aerate and warm it before planting crops. Though beneficial for growing food, this method of tillage can leave topsoil vulnerable to erosion – one of the most serious environmental problems worldwide that jeopardizes food production and agricultural livelihoods around the world, particularly in developing countries where populations are dense and resources scarce. This type of tilling has serious consequences on global sustainability!

In the late 70s, Palouse farming was in a dire state. Shockingly, an entire 10% of farmland had lost 100% of its topsoil due to erosion; and a further 60%, between 25-75%. Unfortunately that's not all - it also caused more pollutants like sediment, fertilizers & pesticides flowing into our waters.

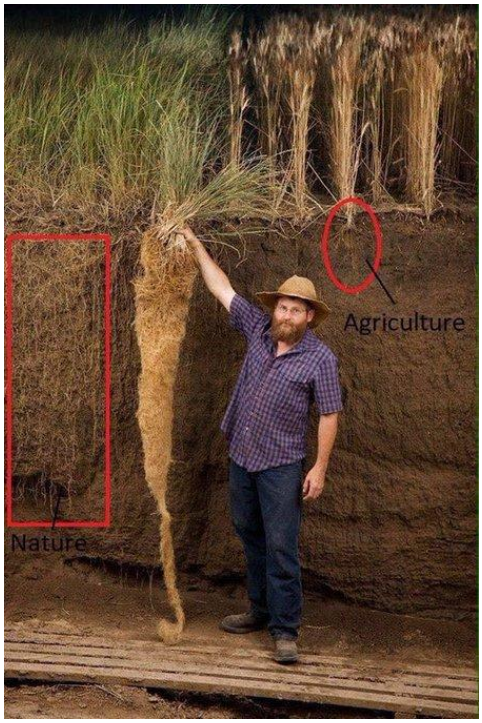
Erosion caused by water and wind can cause serious, irreversible damage to the environment. Not only does it steal away much-needed organic matter from soil surfaces but also has been found in various Australian studies to take with it substantial amounts of nitrogen - a vital resource for maintaining healthy ecosystems. Despite its potentially massive impacts, there's still little research into this destructive force - leaving us all wondering how large a role erosion plays in pollution problems today.

In studies across Australia measuring runoff and erosions effects, researchers have uncovered potential for significant nitrogen loss along this pathway.

Wind erosion can be particularly detrimental to cultivated barren soils. An Australian study revealed that dust particles with a diameter of less than 90µm removed 16 times more nitrogen from the land they were derived from. This means 0.17% of those tiny little specks are full of elemental N! So though it may seem like blowing in the wind, it's actually a much larger effort taking place beneath our feet (Leys and McTainsh 1994).

In Central Queensland, an example of how to minimize erosion caused by water was studied. Results showed that keeping ground cover high and soil structure intact as well as creating contours and vegetated waterways to control water flow kept the sediment loss rate down - 1.2 tonnes per hectare under zero tillage compared to a whopping 4 tonne for conventional tillage practices!

Despite the benefits of no-till agricultural practices, a whopping 8 kg Nitrogen/ha was still lost from soil in southern Qld annually. That's two thirds of all its nitrogen and 20% of the total fertiliser used! What's more astonishing is that bare summer fallowed ground led to 61 tonnes per hectare being moved each year – an incredible number reduced down to 2.1 t/ha under zero tillage farming (Freebairn & Wockner 1986).



Jerry Glover, a soil scientist, shows off a perennial wheatgrass plant's long roots, which grow deeper than annual plants' roots, improving soil structure and reducing erosion. Jim Richardson/National Geographic Creative

Biodiversity loss from Urea and Herbicides

Urea is the most popular fertilizer used around the globe and it's not hard to see why - its easy transportability has made it king of fertilizers! In fact, 80% of total nitrogen fertilizer applications in 2014 were urea-based according to reports by the UN Food & Agriculture Organization in 2017. It looks like that number isn't budging any time soon either!

With the increasing global demand for nitrogen fertilizers at a rate of approximately 160,000 metric tons per year, it's important to understand how different types of soil respond when nitrates like urea are added. (FAO,2015). Recent studies have highlighted that this can lead to intermediate N substrates such as NO2- and NH3 accumulating in a way which can be toxic or inhibitory towards

various organisms - worryingly, these include both AOBs (ammonia oxidizing bacteria) and NOBs (Nitrite Oxidising Bacteria) (Venterea et al., 2015; Breuillin-Sessoms et al., 2017)..

Weeding

If you've ever had to weed a garden, then you know it can be time-consuming and exhausting work. Now imagine having to do this for an entire hectare of land! It's laborious – but necessary in order to reduce the risk of crop damage caused by weeds.

Hand weeding by traditional hoes is an incredibly labor-intensive job - one person can spend 140 hours to complete just 1 hectare of land. Luckily, with each successive round of weeding that number drops significantly: after 3 passes it's down to only 65 hrs/hectare! To ensure healthy crops and avoid the spread of weeds, farmers must time their weedings carefully.

There are two ways of controlling weeds: mechanically or chemically.

The chemical cost of weeds are estimated to cost Australian agriculture AU$2.5–4.5 billion per annum. For winter cropping systems alone the cost is $1.3 billion, equivalent to ~20% of the gross value of the Australian wheat crop.

The overuse of herbicides and pesticides will cause for the soil to lose it's fertility.

In greenhouse studies, glyphosate application has been found to affect microbial composition and enzymatic activity in plant rhizospheres (i.e. in the soil adhered to plant roots) as well as in bulk soil[25,26,27,28]. Disrupting effects of glyphosate on earthworms[29] and their interactions with symbiotic mycorrhizal fungi[30,31] have also been reported.

Moreover, the presence of excess chemicals will increase the alkalinity or acidity of soil thus degrading the soil quality. This will in turn cause soil erosion.

Australia's northern grain region is facing an alarming increase in herbicide resistance, with 14 weeds already confirmed as herbicides and more at risk of developing susceptibility. Especially problematic are the Group M (glyphosate) resistant weeds popping up on farms located within NSW'S Liverpool Plains area - namely annual ryegrass, barnyard grass, liverseed grass, common sowthistle and wild oat. This presents a huge challenge to both growers and agronomists who must now grapple with how best to tackle these steadfast weeds.

What are some solutions?

The problems we face with industrial agriculture are systemic across all forms of food production where we have turned paddocks into factories in selecting for a single product using a single objective to the exclusion of all other parts in the system. These other parts form the foundation and the balance that is needed in order to make it a sustainable operation.

Some possible solutions that seek to restore the symbiotic relationship across the system are emerging, of which include;

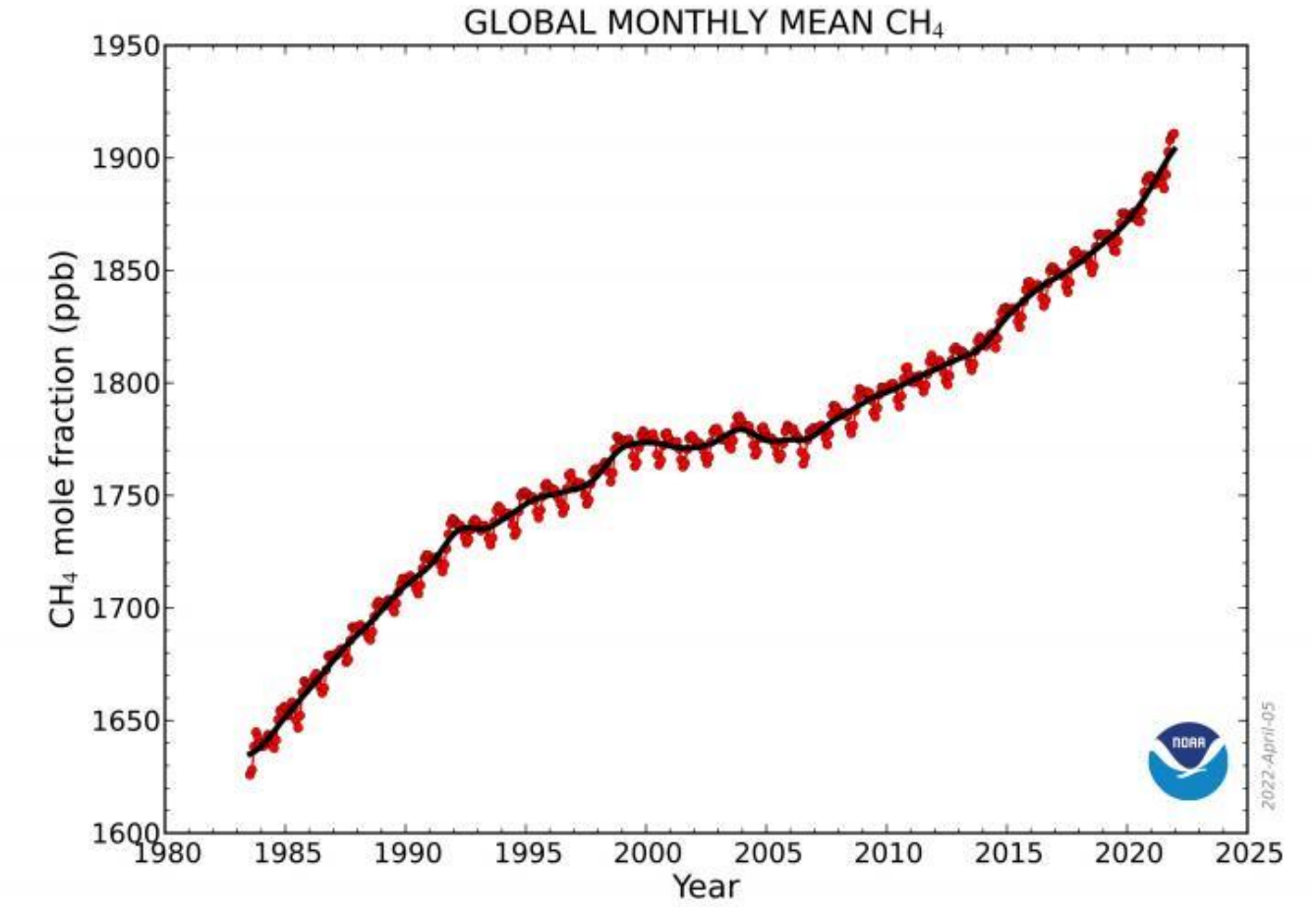
1. Agroforestry: A land use management system that combines trees, crops, and livestock in a mutually beneficial relationship.
2. Permaculture: A holistic approach to farming that mimics natural ecosystems and emphasizes soil health, water management, and biodiversity.
3. Organic farming: A method that relies on natural fertilizers, pest control, and soil management practices to produce food without synthetic chemicals.

4. Urban agriculture: The practice of growing food in urban areas using rooftop gardens, community gardens, and vertical farming.
5. Conservation agriculture: A farming method that prioritizes soil health, minimizes tillage, and uses cover crops to maintain soil fertility and reduce erosion.
6. Community Supported Agriculture (CSA): A model in which consumers purchase shares of a farm's crops and receive a weekly delivery of fresh produce.
7. Farmers Markets: Keeping the footprint small by bringing local produce into a more mainstream way of shopping for fresh food grown locally.
8. Aquaponics: A closed-loop system that combines fish farming and plant cultivation to produce food in a sustainable and efficient manner.
9. Holistic management: A holistic approach to land management that considers the economic, social, and environmental impacts of farming practices.

So is the cow really the problem?

The world cattle population recorded by the USDA first reached 1 billion in 1975. In 2021 it still remains steady at around 1 billion.

Global methane levels recorded the largest annual increase ever observed in 2021 and since 1983 the methane level was 1635 ppb and in 2022 it is now1900 ppb.



Frank Mitloehner, a professor from University of California who studies animal agriculture and its relationship to air quality and the climate explains the unique cycle of methane produced from cows and other ruminant animals.

He states that '*..as part of the **biogenic carbon cycle**, plants absorb carbon dioxide out of the atmosphere, and through the process of photosynthesis, they harness the energy of the sun to produce carbohydrates such as cellulose. Cellulose is a key feed ingredient for cattle and other ruminant animals. They are able to break it down in their rumens, taking the carbon that makes up the cellulose they consume and emitting a portion as methane….After about 12 years, the methane is converted back into carbon dioxide through hydroxyl oxidation – a chemical reaction in the atmosphere…..That carbon is the same carbon that was in the air prior to being consumed by an animal which is then sequestered back into the plants and the cycle continues….* ***It is recycled carbon. As long as herd emissions remain constant for more than 12 years, no additional methane – or warming – is being added to the atmosphere in the biogenic carbon cycle.***

This is not a single species problem, it's a whole systemic problem that needs to be redesigned and reengineered to work with the environment instead of working in spite of it.

This was beautifully articulated by a farmer in response to an invitation to attend an Australian Landcare workshop that was being offered in the local rural community.

A friend came to stay with us and he told us about his friend who made the remark, '*This Landcare better be the answer to everything. I'm sick of trying to keep things allive that want to die and killing things that want to live*'. We all laughed and laughed, how crude but true that really was. I still get a giggle out of it whenever I think about that.

Ultimately I think we keep distracting ourselves from the real problem, by making the type of food we eat a moral, social or environmental issue. It's the way they are grown that is the real issue at play here. We need to hold all of our agricultural systems accountable to the degradation they cause to our environment and seek to produce our food so that it remains in a balanced symbiotic relationship with all the other elements that are involved with the process.

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Resources:

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