



Neem

'The Tree of the 21st Century'

- United Nations

2020

*The **BEST** way to
PREDICT the **FUTURE**
is to **CREATE IT.***



Anthony J. Archer
Chairman and CEO

A Message

from the

Primal Group's Chairman and CEO

Mankind is in a period of transition, where the old ways of doing things are being replaced by new, more evolved and higher conscious processes. This is the case across every industry, from manufacturing, technology, agriculture and beyond. The reason for this is very simplistic yet profound - mankind is built for survival. Our subconscious recognizes patterns and dangers even before our conscious mind.

We are driven by instincts that date back to primitive man. These primordial changes were explained succinctly by a paraphrase of Charles Darwin's *Origin of the Species*:

"It is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is best able to adapt and adjust to the changing environment in which it finds itself".¹

In a world of shared common interests, such as survival, that requires the participation of others, none can ignore the issues that are currently being faced. Change is needed. A behavioral shift is underway, one that blends doing good with doing good business. We live in an exciting time, where the boundaries between business and higher purpose are being torn down, where the environment and others are taken into account greater than ever before. It is imperative that we not only appreciate, but also participate in this process. Those who stubbornly refuse to join the revolutionary shift in practices will regress, while those best able to adapt and innovate change will receive the greatest rewards.

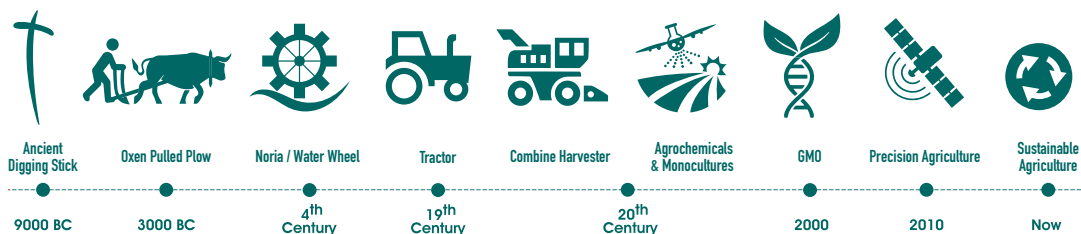
Today, for the first time in history, social responsibility and sustainability are being demanded from the ground up, rather than from the top down. This is a huge adjustment in human behavior and represents a great opportunity to make the world a better place, secure our survival and build wealth; all of which are essential ingredients to continued success.

An entrepreneurial approach to this is critically important, since it is business and commerce that rapidly changes technologies, habits, and perception. We have the capacity to create a remarkably different economy; one that can restore ecosystems, reduce carbon in the atmosphere and protect the environment, while bringing forth innovation, prosperity, employment and security.

My passion is to create real value, by challenging the status quo while contributing to a new era of sustainability that has far reaching benefits for all. Not only must our company be non-destructive and profitable, but also inherently restorative to the world. By helping to repair the damage of the synthetically-based agricultural revolution of the past, we will ensure ourselves a new, ecologically sustainable and viable future.

The Green Revolution is dead, long live the Green Revolution!

Anthony J. Archer



¹Leon C. Megginson (1963)

Table of Contents

About Us **3**

A Primal World..... **4**

- » A Haunting Challenge4

- » The Green Revolution.....5

Protecting Crops..... **6**

- » The Necessity for Pesticides6

- » The Dangers of Synthetic Pesticides7

- » A New Horizon for Sustainable Pesticide Use9

Boosting Yields..... **10**

- » The Necessity for Fertilizers 10

- » Fertilizer Use is Inevitable, the Dangers are Not 11

Safeguarding Health..... **12**

- » The Necessity of Antibiotics.....12

- » The Dangers of Overuse.....13

- » Managing the Rise of Antibiotic Resistance14

The Threat of Compound Growth **17**

- » Global Population Still Rising Fast17

- » Nearly One-Third of the Globe Go to Bed Hungry Every Night19

- » A Wasteful Society Unwilling to Change.....20

- » Crop Yields in Decline.....22

- » Avoiding the Malthusian Catastrophe22

Nature’s Solution **24**

- » Neem - A Key Player in Solving Global Issues.....24

- » Neem’s Role in Sustainable Agriculture26

- » Neem Crop Care - Environmentally Friendly and Cost Effective.....27

- » An Effective Pesticide, Yet Kind to the Planet28

- » Benefits of Using Neem as a Fertilizer29

The Rising Demand for Organics..... **31**

- » Organic Food is the Only Sustainable Option31

- » A Favorable Regulatory Environment32

- » Reasons to Go Organic34

Neem’s Role in Healthy Living **36**

- » Why Neem is a Key Solution - Effective & Low Cost.....38

- » Neem’s Future Uses in Medicine.....39

- » Uses in the Personal and Health Care Markets.....40

- » Prospects in Cosmetics, Skincare & Oral Hygiene41

- » A Powerful All-Natural Solution for the Growing Pet Care Market.....43

- » A Leader in Carbon Offsetting.....44

- » One of the Most Resilient Timbers on the Planet45

Neem - Ahead of the Curve..... **46**

We Participate in the UN Global Compact..... **47**

Final Thoughts From Our Chairman & CEO.. **48**

- » If Neem Has Such Wonderful Potential, Why Hasn’t it Been Utilized Until Now?.....48

Bibliography..... **50**

About Us

Evolving a Sustainable Future

The Primal Group is dedicated to establishing itself as a lead organization, driving change to create a more tenable future for our planet by ensuring environmental protection, social responsibility and value-creation, for generations to come.

A world beset with new challenges requires innovative thinking and a more imaginative approach. Sustainable businesses will be the only survivors in a world with rising environmental challenges, public awareness and accountability.

Primal

- *The very first, **original***
- *Primary in its **priority***
- *Primitive in its **simplicity***
- *Pristine in its **purity***
- *Paramount in its **importance***

Alternative investment specialists in emerging markets, the Primal Group focuses on the solutions needed to sustain a global population racing away to over 10 billion by 2050. By focusing on the *Primal* needs of man, our aim is to provide a lower risk profile offering better rewards than traditional asset classes.

In a world demanding and deserving of higher social responsibility, sustainable business will ensure a more conscious and profitable future for us all.

Welcome to Our World.



A Primal World

The Neem tree is integral to the survival and prosperity of mankind and is set to change from an under-developed gift of nature to a powerful and globally utilized resource. Before demonstrating the benefits of the neem tree, this brochure will expand upon the challenges being faced and the insufficiencies of current solutions to the physiological needs of the earth's growing population. These sections are not a litany of disastrous environmental practices; they are necessary prefaces to the required solutions. We will display the threats that our unsustainable habits have created, and finally, the safety and rewards set for those that allocate time and resources to the sustainable solution - Neem.

A Haunting Challenge

Producing enough food has haunted mankind since time immemorial. With so few breakthroughs to increase yields, the food needs of growing populations were historically met simply by the expansion of the cultivated area. As the most fertile land was quickly utilized, further expansion meant bringing lower-yielding land into cultivation. **By the 19th century, pessimism regarding the possibility of feeding our ever-increasing populations was on the rise.** The task appeared even more intimidating as advances in medicine and public health led to **longer life expectancies and more children being born.**

Perhaps the most prominent authority at the time was **Thomas Robert Malthus**, an English cleric and scholar (1766-1834). Wielding great influence in the areas of political economy and demography, **he influenced many prominent academics and scientists over the following century, including Charles Darwin, John Maynard Keynes, Karl Marx, Mao Zedong and many more.** His seminal work, 'An Essay on the Principle of Population', was published in 1798. At the time of writing, during the dawn of the Industrial revolution, the world's population was 1 billion, a net increase of 700 million on Year 1 AD.²

Against the prevailing opinion, which predicted that society would continue to improve, **Malthus pointed out that fast accelerating population growth would use up all available resources, and end progress towards this expected utopia.** A greatly increased population would eventually be affected by famine and disease, leading to what is widely known as a **Malthusian Catastrophe.** Explaining this, he wrote:

"Famine seems to be the last, the most dreadful resource of nature. The power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world."³

Since Malthus warned of the dangers resulting from fast rising population growth, including the likely depletion of food and other resources, **population**

has expanded to 7.8 billion in 2020. Our increasing population is also aging, with 15% of all humans who have ever existed and over 50% who have reached the age of 65 currently alive.

Yet, Man's resilience and ingenuity overcame Malthus' predictions, at least until now, by what is now known as the Green Revolution.

Over **50%** of all humans that have reached **65** years old are **currently alive**

United Nations Population Division (2015)

Man's resilience and ingenuity overcame Malthus' prediction, at least until now, by what is known as the Green Revolution

International Food Policy Research Institute (2012)

²Optimum Population Trust (2010) ³Malthus T.R. (1798)

The Green Revolution



In the 20th Century, massive investments in modern scientific research for agriculture led to dramatic yield breakthroughs in the industrial countries.

*It took almost **1,000** years for wheat yields to increase from 0.5 to 2 metric tons per hectare, but only **40** years to climb from 2 to 6 metric tons per hectare.*

Norman Borlaug was awarded a Nobel Peace Prize in 1970 for crossing Japanese and Mexican wheat varieties at the International Center for Maize and Wheat Improvement (CIMMYT) in Mexico City.

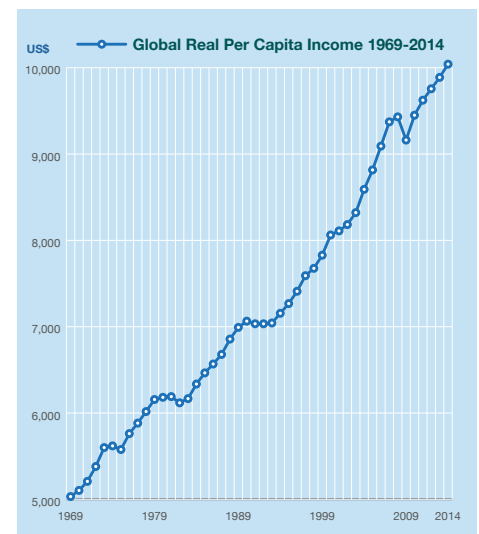
Improved agronomy and **the development of synthetic fertilizers and pesticides** fueled these advances. Most industrial countries achieved **sustained food surpluses by the second half of the century and eliminated the threat of starvation.**

The Green Revolution led to sizable increases in returns to land, hence raising farmers' incomes. Moreover, with greater income to spend, new needs for farm inputs, milling and marketing services, farmers led a general increase in demand for goods and services. This stimulated the rural non-farming economy, while generating significant new income and employment of its own. Real per capita incomes almost doubled in Asia between 1970 and 1995, poverty declined from nearly three out of every five Asians in 1975 to less than one in three by 1995. **The absolute number of poor people fell from 1.15 billion in 1975 to 825 million in 1995 despite a 60 percent increase in population.** In India, the percentage of the rural population living below the poverty line fluctuated between 50 and 65 percent before the mid 1960s, but then steadily declined to approximately one third of the rural population by 1993. Much of these declines are attributed to agricultural growth.⁴

The three key aspects of the Green Revolution of the 1960s were:

- **Research and Development**
- **Synthetic Pesticides**
- **Synthetic Fertilizers**

A great success at meeting a major threat to the survival of the global population of the time, **the Green Revolution greatly increased food productivity and decreased poverty levels across the globe.** However, at what cost and are the devastating effects permanent?



Source: World Bank (2015)

Protecting Crops

Pesticides are substances used to prevent, repel and deter pests. Crucial for optimal plant development, they protect plants from being damaged by weeds, insects, fungi and microorganisms such as bacteria and viruses.

The Necessity for Pesticides

The benefits of pesticides to mankind and the environment are: increased crop and livestock yields, improved food safety, human health, quality of life and longevity, and reduced drudgery, energy use and environmental degradation.

20-40% of the world's potential crop production is already lost annually because of the effects of weeds, pests and disease

production. **If pesticides were abolished, the lives saved would be severely outnumbered by the lives lost by a factor of 1,000 due to inferior diets.**⁵ Secondary penalties would be massive environmental damage due to the land needs of less productive farming, and a crippling financial cost.

Crop losses would be doubled if existing pesticide use were abandoned

Pesticides also contribute to enhanced human health by preventing disease outbreaks through the protection of private, public and commercial properties from infestation. They are even used to sanitize our drinking and recreational water, and ensure wider selections and lower prices for food and clothing.

There are two distinct forms of pesticides: synthetic, man-made, chemical pesticides and the natural, organic solutions that already exist, but are under utilized.

Even though the global population has nearly doubled over the past 40 years, per calorie consumption in the developing world has only increased by 33%

Pesticide use is essential for the survival of the human race. The unrelenting demand for food from the current global population (which is still growing vigorously) means that we simply cannot allow pests to impact levels of food

In addition to increasing crop yields, pesticides used in stored products can also prolong the viable life of produce, prevent huge post-harvest losses from pests and diseases and protect food so that it is safe to eat.



Pesticides Support Abundant Food; The Alternative is Unthinkable

⁵The New York Times (2008)

The Dangers of Synthetic Pesticides

A synthetic pesticide is a poisonous chemical or mixture that is used to prevent, repel or kill insects, weeds and fungi. While these synthetic pesticides can aid farmers in preventing crop losses caused by pests, the negative effects on human health and the environment can be catastrophic.

Each year, an estimated 450 million kg (1 billion lbs) of pesticides are applied in the US⁶, with a total of 17,000 different pesticide products sold on the market. However, **98 percent of sprayed pesticides and 95 percent of herbicides come into contact with a destination other than the targeted one.**⁷

Human & Environmental Impact of Synthetic Pesticide Use

According to the Centers for Disease Control and Prevention (CDC), more than 90 percent of Americans have pesticides or their by products in their bodies.⁸

In the US, the total estimated environmental and social costs from pesticides exceeded US\$9.6 billion in 2014.⁹

Pesticides can enter the body through inhalation, by consumption of treated food and water, and through direct contact with the skin. **There are up to 3 million cases of serious pesticide poisoning**

documented each year, responsible for up to 250,000 deaths.¹⁰ The World Health Organization (WHO) believes that acute pesticide poisoning is significantly under-reported in developing countries with as many as **25 million cases¹¹ of mild chemical pesticide poisoning left unreported**, which may also cause long-term damage. The situation continues to deteriorate globally; in the US, the Environmental Protection Agency (EPA) **estimated a \$2 billion cost to clear up waters polluted with pesticides.**¹² In China, the largest lakes and reservoirs are so polluted that they are unfit for human consumption. **Pesticides have been widely linked to a range of human health hazards** which can vary from short-term impacts such as headaches, nausea and skin and eye irritation, to chronic impacts **like cancer, nerve and blood disorders, birth defects and hormone irregularity.** Some health effects may occur years after even minimal exposure.

The European Food Safety Authority (EFSA) warned of the significant association between exposure to pesticides and the following health issues:

- **Liver Cancer**
- **Breast Cancer**
- **Type II Diabetes**
- **Leukemia**
- **Parkinson's Disease**

According to Beyond Pesticides (formerly the National Coalition Against the Misuse of Pesticides), **of the 30 most commonly used lawn pesticides in the United States, 13 are probable carcinogens, another 13 are linked with birth defects, 21 affect the reproductive system, 15 cause neurotoxicity, 26 cause liver or kidney damage, 27 are sensitizers and/or irritants and 11 have the potential to disrupt the endocrine system.**¹³ The Agency for Toxic Substances and Disease Registry found that **children who lived in homes where adults used pesticides were twice as likely to develop brain cancer** compared to those who lived in homes where no pesticides were used.¹⁴

Health Risks Associated with Synthetic Pesticides

Because pesticides end up virtually everywhere instead of remaining on crops, their existence in our environment has been linked to the following health problems:



Skin, Eye, and Lung Irritation



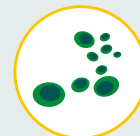
Hormone Disruption



Brain and Nervous System Toxicity



Cancer



Blood Disorders



Nerve Disorders



Birth Defects / Toxicity to a Fetus

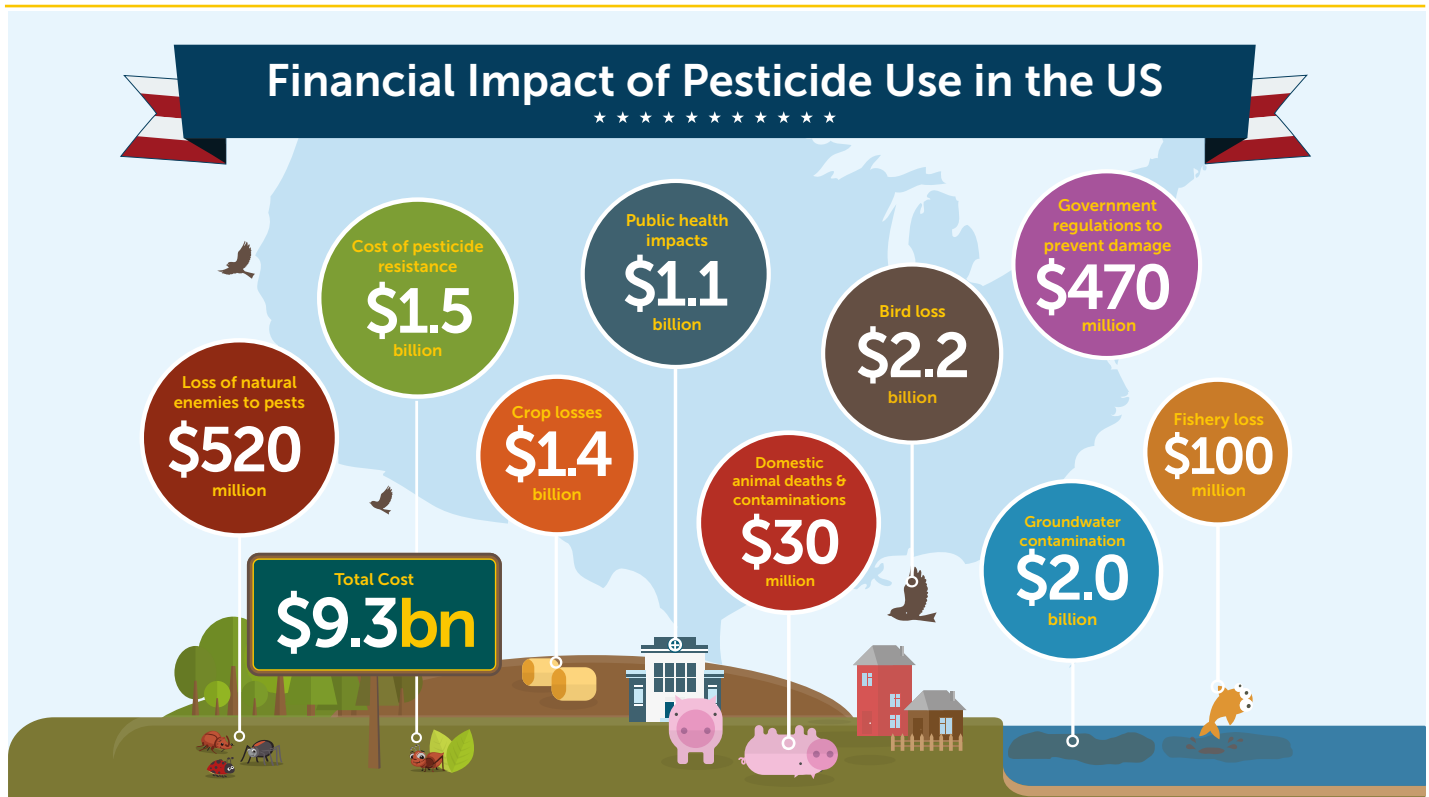


Reproduction Effects

Children living in areas with heavy pesticide use had strikingly impaired hand-eye coordination, decreased physical stamina, short-term memory impairment, and trouble drawing

The Natural Resource Defense Council (2014)

Source: Environmental Protection Agency (2014)



Source: Pimentel, D. & Peshin, R. (2014)

Environmental Contamination

Synthetic pesticides travel outside their intended area of use and contaminate the air, soil and water. **95 percent of agricultural areas in the US rely on groundwater for their needs, and half of the population uses groundwater for drinking and other household purposes.**¹⁵ Since it takes decades for synthetic pesticide contamination to become apparent, **contaminated water is invariably used for human consumption.** Synthetic pesticides can also cause plant destruction, **reduce oxygen levels in water and kill marine life.** They have even been linked to a range of physiological and behavioral changes in birds, including the abandonment of nests and an increased failure to avoid predators.¹⁶

Harmful to Soil

Many synthetic pesticides contain persistent soil contaminants that can survive for decades and have an adverse effect on soil conservation. They **reduce the level of vegetative cover on the**

ground, which eventually promotes soil erosion. This in turn weakens the soil, making it unsuitable for future growth and possibly resulting in the collapse of that particular ecosystem. The use of synthetics can also kill the beneficial populations of soil microorganisms such as fungi and bacteria, and have a long-

term negative effect on the soil.¹⁷

Reduces Biodiversity

Synthetic pesticides disturb the nervous systems of animals, which can interfere with their ability to survive and reproduce.¹⁸

Key Pesticides and Associated Dangers		
Atrazine	Metam Sodium	Glyphosate
One of most widely used pesticides in the US, Atrazine is used to treat corn, sugarcane pineapples and other crops. In 2003, it was banned by the European Union	A soil fumigant, metam sodium is the third most commonly used agricultural pesticide in the US used for carrots, potatoes, strawberries and others	Known commercially as RoundUp, glyphosate is the world's most widely produced herbicide and is commonly used in urban as well as agricultural areas
Atrazine disrupts hormones by altering male reproductive tissues when exposed during development	Metam sodium reduces the effectiveness of the human immune system cells and causes damage to the liver and lungs	The WHO classified glyphosate as 'probably carcinogenic in humans'. Monsanto is currently mired in litigation brought by tens of thousands of cancer patients who claim exposure to Monsanto's Roundup weed killer caused them to develop non-Hodgkin lymphoma.

¹⁵US Geological Survey (2015) ¹⁶Natural Resources Defense Council (2014) ¹⁷Toxics Action Center (2012) ¹⁸Nature (2013)



A New Horizon for Sustainable Pesticide Use

The level of future chemical pesticide use will be driven by four considerations; firstly its **cost** – simply the financial outlay for businesses in using effective synthetic pesticides. Secondly, an assessment of the **dangers** their use poses, both to consumers and the environment. If we accept that little in life is truly ‘risk free’, then the decision is a simple one; are they risks worth taking? Does exposing farmers or consumers to the increased risk of cancer (or for a non-comprehensive consideration - infertility, sterility, respiratory illnesses, organ failure or birth defects in expectant mothers) outweigh the problems that result from not providing enough food? The third factor is the **alternative** and organic options that are making their way to the market. The fourth, and final, consideration embraces the **long-term sustainability** of the products used and their impact on the environment and on our health.

Norman Borlaug, the Nobel Prize winning scientist, got it right. The driving force behind the Green Revolution in the 1960s, and his response to critics who latterly focused on the costs and dangers associated with large quantities of pesticides, which necessitated large quantities of fossil fuels was the following:

“ (they) are elitists. They have never experienced the physical sensation of hunger...if they lived just one month amid the misery of the developing world, as I have for fifty years, they’d be crying out for tractors and fertilizers and irrigation canals...”

Yet nearly half a century after the start of this approach, a new assessment of the high quantities of pesticides would perhaps be less expansive and one doesn’t need to be an environmental activist to be aware of the dangers of chemical pesticides. Corporations are aware as well; Monsanto is the manufacturer of ‘Roundup’, a controversial herbicide with glyphosphate, an active ingredient linked to a wide range of diseases in the West such as autism, cancer, Parkinson’s disease as well as a range of allergies.¹⁹ Yet the company, which is also the manufacturer of a range of genetically modified crops, describes itself as a ‘sustainable agricultural company’. **Society knows there is a need for change, though this has not yet been backed by sufficient action, however the reasons for change are becoming irresistible.**

While scientific research, along with regulatory and consumer pressures, can get rid of the most dangerous chemical pesticides, the new synthetic applications, while slightly safer, still suffer from many of the same issues of the past. These include the **lingering effects of residue exposure as well as the inevitability of bugs building up resistance to the type of pesticide, which requires either higher doses or a move to alternatives.**

The North American crop protection chemicals market has been estimated at \$14.1 billion in 2017²⁰, but, as shown on the previous page, the social and environment costs of chemical pesticides are too drastic. However, as the US follows Europe in their hope to fast track a range of environmentally friendly pesticides, the bulk of pesticide use in the US will remain synthetically derived. This can only change with persistent pressure from consumers, a force that has gained momentum recently. This calls for sufficient volumes of viable alternatives, enough to adjust the current state of affairs.

¹⁹Massachusetts Institute of Technology (2013) ²⁰Modor Intelligence (2019)

Boosting Yields

A fertilizer is any material of natural or synthetic origin that is applied to soils or plant tissues to supply nutrients, such as nitrogen, phosphorous and potash – all of which are essential for plant growth and acquiring optimum yields.

The Necessity for Fertilizers

The benefits of fertilizers to mankind and the environment are: increased crop and livestock yields, improved food safety, human health, quality of life and longevity, and reduced drudgery, energy use and environmental degradation. **Fertilizers, like pesticides, are essential to the survival of the human race.** Without fertilizers, farmers would have to continually clear new areas of land and only farm each piece of land for a short time before moving on. This method harms the environment and wastes the earth's resources as the land quickly becomes unproductive, leaving the surface barren and vulnerable to erosion. This is unsustainable, as land is a finite resource and under greater pressure to perform than ever before.

There are two distinct forms of fertilizer: Man-made, synthetic (chemical) fertilizers and the natural, organic solutions that already exist but are currently under-utilized.

Synthetic Fertilizers - A Danger to Society?

Even though synthetic fertilizers have historically proven to be effective, many have caused a variety of environmental and agricultural issues including water pollution, lower crop yields and increased public health risks. The associated costs across Europe are estimated at \$79 billion every year.²¹

Excess synthetic fertilizer use and runoff may cause oxygen starvation in waterways, which threatens animal and plant health. **In Europe, at least 10 million people are at risk of consuming drinking water contaminated with nitrate concentrations above recommended levels.** Nitrates are known to cause toxic algal blooms and **dead zones in oceans**, evident in the North,

Adriatic and Baltic seas. **There are over 400 oceanic dead zones worldwide**, ranging from areas as small as a square kilometer and the largest covering 70,000 square kilometers.²² In the forests, atmospheric nitrogen deposition has caused at least 10% loss of plant diversity over two-thirds of Europe.²³

Harmful Effects

Increases Pollution Synthetic fertilizers can flow into lakes and rivers, altering the ratio of nutrients in the water and severely affecting both the ecosystem and human health. For example, in the United States, **nitrogen compounds from synthetic fertilizers used in midwestern farms have traveled down the Mississippi to the Gulf of Mexico and created a large 'dead-zone' where aquatic life can no longer survive.**²⁴

Lowers Crop Yields The excessive use of synthetic fertilizers has increased yields in the short term, but the process is finite and the yields for many crops are now falling. **Nitrogen rich synthetic fertilizer acidifies the soil over time, depleting its nutrients and killing the organisms present that are beneficial for plant growth.**²⁵

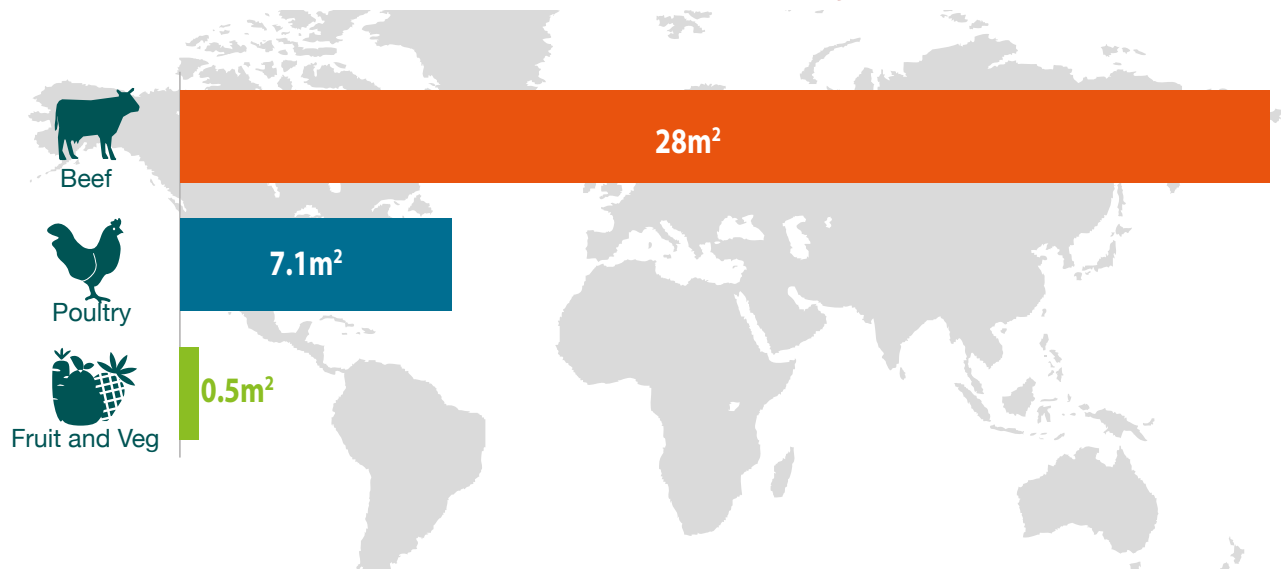
Damages Public Health The nitrogen in synthetic fertilizers can cause serious harm to humans, as the nitrates present can pollute drinking water, which in turns becomes a danger to infants. **Infants under the age of 6 months are highly susceptible to methemoglobinemia – a disease that is caused exclusively by nitrates**, and is characterized by an inability of red blood cells to release oxygen to the tissue cells, leading to oxygen hypoxia.²⁶

*World fertilizer consumption reached **186.9 million tons** in 2014. Alongside this demand, the global fertilizer market saw total revenues of **\$175.2bn** in 2013 and is forecast to reach a value of **\$194bn** in 2018 at a CAGR of **2.1%***

International Fertilizer Industry Association (2013)

What You Eat Could Cost the Earth

Land needed per kilo of produce per year



Source: Netherlands Environmental Assessment Agency (2012)

Fertilizer Use is Inevitable, the Dangers are Not

The invention of nitrogen-based fertilizers in the early twentieth century was likely the single most important obstacle in the way of Malthus's prediction that growing population numbers would eventually overwhelm the human race's ability to feed itself. Yet, the terrible irony is that the main cereal crops we rely on such as corn, wheat and rice are the most nitrogen hungry of all plants. Without the addition of copious nitrogen, photosynthesis can't take place, proteins aren't created and plants don't grow. **Half of the nitrogen found in our muscle and organ tissue originates from fertilizer factories.**

Yet inevitably, there is a cost associated with this nitrogen-assisted bounty. In the three decades leading up to 1995 for example, fertilizer production in China quadrupled and usage leapt on farmland.²⁷ Globally, the 'carrying capacity' of the world's soils has increased from 1.9 people per hectare of farmland to 4.3 with the latter figure reaching 10 people in China.²⁸ Worldwide, the result has been a litany of environment deterioration

that impacts our planet and human existence. Nitrogen washed off fields ends up either in the water or the air, while some is eaten by livestock and humans. **Vivid photographs of bright green algae blooms and oxygen depleted dead zones are a stark casualty of man's craving for more food** and ever increasing levels of productivity. Subsidies encourage the overuse of chemical fertilizers, but end up degenerating the soil, requiring the application of more and more fertilizer, and so it continues.

There is also evidence of a positive relationship between synthetic fertilizer use and the spread of pest insect populations. Analysis shows that the increase in populations of major insect pests across Asia is linked to synthetic pesticide use. Crop pathogens such as fungi, bacteria, and viruses are more harmful when excessive nitrogen fertilizer is applied. Cropland in China exposed to disease and pests increased by 50% to 345 million hectares (Mha) in the mid-2000s.²⁹

Moves to improve Nitrogen Use Efficiency (NUE) on the land would include better land management practices, but uptake is often feeble in the face of a range of factors – including technical and socioeconomic. Often farmers are unwilling to cut back for the simplest of reasons, the fear of a loss of crop yield. Short of turning off the taps, which is an unrealistic prospect, a tougher farm regulatory environment, better education and improved training would help. **Studies have shown that better management of nitrogen on farms could cut nitrous oxide emissions into the environment by one-quarter with no impact to farm output.** The adjustment for farming would have to be as profound as that underway for controlling emissions in the power sector. Another option would be to breed crops more efficient at absorbing nitrogen in fields, or to encourage more diverse crop rotation. Research is underway for methods to 'fix' the nitrogen issue. There is plenty in the atmosphere, but it doesn't grow into plant friendly ammonia in an oxygen rich environment.

²⁷National Geographic (2013) ²⁸Yale: Environment 360 (2009) ²⁹Nature (2010)

Safeguarding Health

Antibiotics are medications used in the treatment and prevention of bacterial infections. Discovered less than a century ago, antibiotics are essential to the survival of the human race, making it possible to treat many diseases previously regarded as fatal. Used appropriately, they also enable farmers to treat livestock, helping to secure the world's food chain.

The Necessity of Antibiotics

As with pesticides and fertilizers, there are a range of benefits associated with antibiotics for both mankind and the environment. These include improved livestock yields, higher levels of food safety, improved human health and increased quality of life. Preventing antibiotic resistance will increase longevity, reduce drudgery and energy usage while benefiting the environment.

Antibiotic resistance is the ability of bacteria or other microorganisms to resist the effects of an antibiotic that was once effective. As microbes are constantly evolving and adapting to new environments, antibiotics become increasingly ineffective, making it harder to eliminate infections from the body.

The overuse of antibiotics through over-prescription to humans and livestock is also causing antibiotic resistance, threatening the effective prevention and treatment of an ever-increasing range of infections caused by bacteria.

According to the US Centers for Disease Control and Prevention (CDC), **a 'post-antibiotic era' is becoming a 'growing epidemic' costing the US \$55 billion every year, with severe implications for human health.**³⁰ The CDC believes that half of the antibiotics prescribed to humans are neither necessary, nor prescribed properly. Between 2009 and 2015, antibiotic use increased by 26%. Of that increase, **95% of the antibiotics are used in both animals and humans to treat diseases.** The global use of antibiotics in agriculture is also expected to see a 67% rise by 2030.³¹

The use (and overuse) of antibiotics in livestock is something that mirrors issues with mankind's overconsumption of antibiotics, but the statistics are starker. **80% of antibiotics purchased in the US are for livestock,** with a similarly high percentage of usage deemed unnecessary.³²

The fast diminishing effectiveness of antibiotics is an imminent threat to mankind, and the majority of livestock cases can be traced back to the issuance of antibiotics without any veterinary supervision.

*Antibiotic resistance will be the cause of **10 million deaths per year** by 2050*

Review on Antimicrobial Resistance (2014)

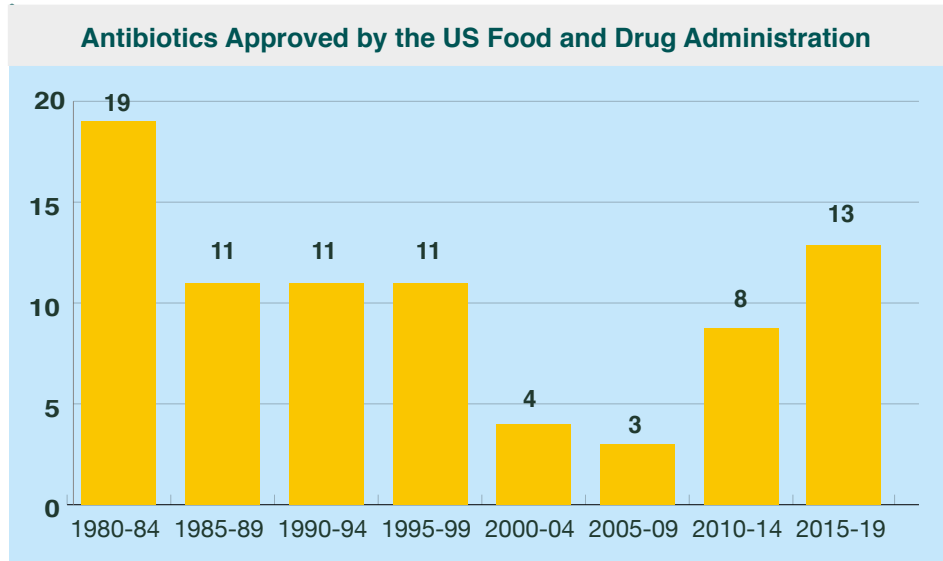
*No new class of antibiotics has been discovered since the **1980s***

World Economic Forum (2013)

The Dangers of Overuse

Resistance to antibiotics spreads quickly between humans, animals and crops. **When humans consume livestock containing antibiotics, ingest crops grown using contaminated manure or come into contact with antibiotic-resistant bacteria in humans, the resistance is easily passed on, resulting in a vicious cycle.** This situation has been acknowledged since the 1970s, but it took until 2013 for legislation forcing farmers to seek a prescription before using antibiotics on their livestock to pass. Introduced in stages, this policy became binding in 2016.

- **The Green Revolution was a turning point in modern agriculture that saw a drastic increase in global production through a series of research, developmental and technological innovations, saving an estimated 1 billion people from starvation.**
- **Poverty decreased as farmers' incomes rose, leading to an increased demand for goods and services.**

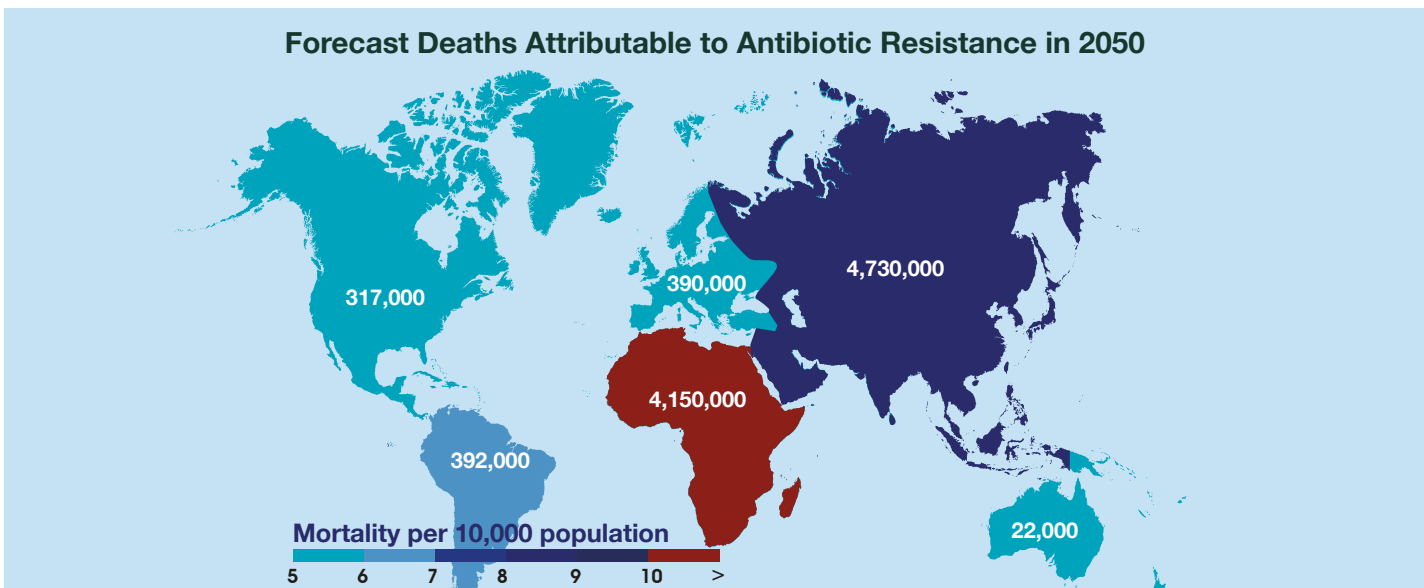


Source: US Food and Drug Administration (2019)

- **Conventional farming techniques use excessive amounts of water, energy and chemicals, often with little regard to any long-term adverse effects.**

with irrigation systems pumping water from reservoirs faster than they are being recharged. Additionally, toxic herbicides and insecticides are accumulating in the ground and surface waters, synthetic fertilizers are disrupting ecosystems and medically important antibiotics are entering our food chain.

The environmental costs of conventional farming techniques are now mounting



Source: Review on Antimicrobial Resistance (2014)



Worse than ever, *Staphylococcus aureus* microbes are resistant to the drug methicillin, shown being attacked by an immune cell (green) in this micrograph, and are becoming more prevalent and resistant to antibiotics.

Managing the Rise of Antibiotic Resistance

“...the problem (of antibiotic resistance) is so serious that it threatens the achievements of modern medicine. A post-antibiotic era – in which common infections and minor injuries can kill – is a very real possibility for the 21st century” - World Health Organization, 2014

It's a numbers game, pure and simple. According to Forbes, **it costs \$5 billion to research and develop drugs, which includes the time spent on extensive trials as well as dealing with the regulatory hurdles. Yet with 80% of drugs failing to make it to market, pharmaceutical companies take fewer risks and make more profit on drugs that won't lose effectiveness such as antidepressants, statins or anti-inflammatories.** The result is that between 2008-2012, only two systemic antibacterial agents were approved by the FDA for use on humans. Previously, between 1983 - 1987, there were 16 approvals. By 2013, a mere 5% of US drugs in development were antibiotics.³³ The level of antibiotic overuse across society is staggering. According to the WHO, 50% of the antibiotics prescribed to humans are unnecessary, while the equivalent figure in agriculture is 80%.³⁴ Some antibiotics introduced in the 1980s were successful in controlling any bacterial resistance; yet these same antibiotics have been ineffective in more than half of the patients to whom they were administered. All of this has occurred

in a span of only 30 years.

In the graphic words of the UK's Chief Medical Officer in 2013, the result could lead to “a 19th century environment where infections kill us as a result of routine operations.” **Without effective human antibiotics, operations that relied on suppressing the immune system or accessing the bloodstream such as trauma surgery, cancer treatments or heart or lung surgery, would become sources of danger.** Non-functioning antibiotics for livestock will have an equally dramatic impact. As most livestock are reared using antibiotics both to protect and fatten them, a systematic drop off in antibiotic effectiveness will impact the supply of livestock and the result will be food shortages and inevitably higher prices.

Both the US government and the private sector are working simultaneously to head off some of the worst consequences of antibiotic overuse, which reinforces the seriousness of the situation. In December 2016, it became illegal to use medically important antibiotics for production

purposes and a veterinarian's approval is now required to administer medication for therapeutic uses. This is a significant change from decades-old policies.

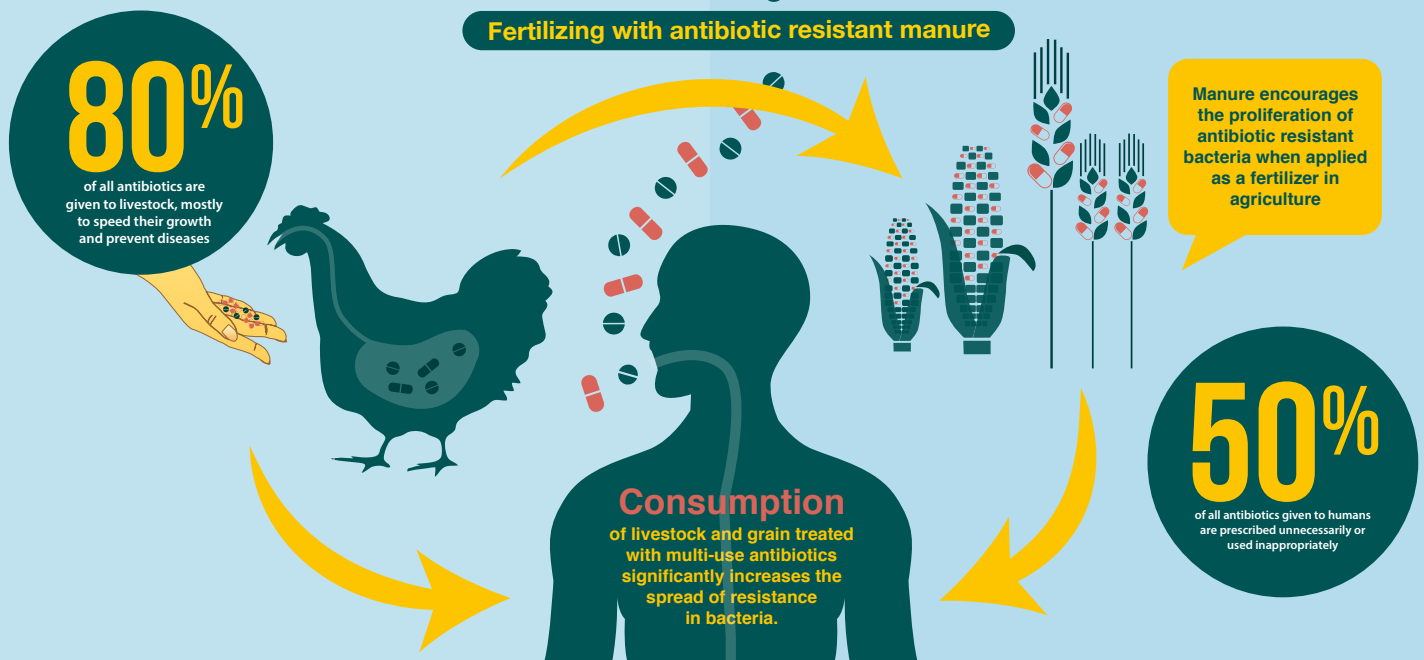
Meanwhile, in response to pressure from consumers, who are increasingly interested in the provenance and production conditions of their food, the largest food processing restaurants and retail companies in the US will phase out meat, eggs and other foods with productions adulterated with antibiotics. This has been described as a ‘game-changer’ by industry watchers. During the first half of 2015, in rapid succession, McDonald's – the world's largest restaurant chain, Costco, the world's third largest retailer and Tyson Foods, the largest poultry producer in the US, all announced plans to eliminate livestock raised with shared-use (between animals and humans) antibiotics. Today, Tyson Foods is the world's largest producer of “No Antibiotics Ever” chicken, and McDonald's and Costco are in the early stages of implementing policies to eliminate antibiotics important to human medicine in its poultry and beef supply.

³³Alliance for the Prudent Use of Antibiotics (2012) ³⁴Centers for Disease Control and Prevention (2013)

ANTIBIOTIC RESISTANCE

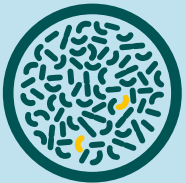
Will Kill More People Than Cancer and Diabetes Combined By 2050

How Resistance Develops and Spreads

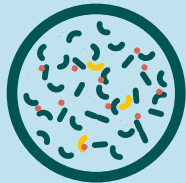


- 1 Antibiotics can be given to livestock in their feed or sprayed on them, to be ingested when the animals groom themselves
- 2 Superbugs can be passed to humans in many ways

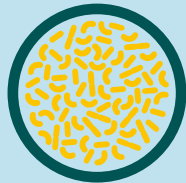
- 2 The bacteria causing an infection are usually not resistant to drugs



When an human or animal has a bacteria infection, some of this bacteria might be resistant



The antibiotic will kill all the non-resistant bacteria, leaving the resistant ones



The resistant bacteria can then flourish and replicate



A person goes to hospital and is infected by bacteria resistant to antibiotics from another patient

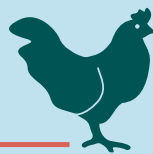


A person is prescribed with antibiotics. This can breed bacteria resistant to antibiotics

ANTIBIOTICS AS GROWTH PROMOTERS

They help chickens grow bigger, making the meat...

In 1960, it took **63** days to grow a **1.5kg** broiler

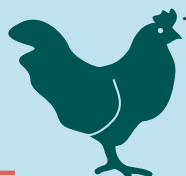


\$1.47

per kg

...cheaper for the consumer

In 2011, it took **47** days to grow a **2.1kg** broiler



\$0.58

per kg



Fertilizing food crops with antibiotic resistant manure can spread antibiotic resistance to humans when eating these crops or through drinking contaminated water



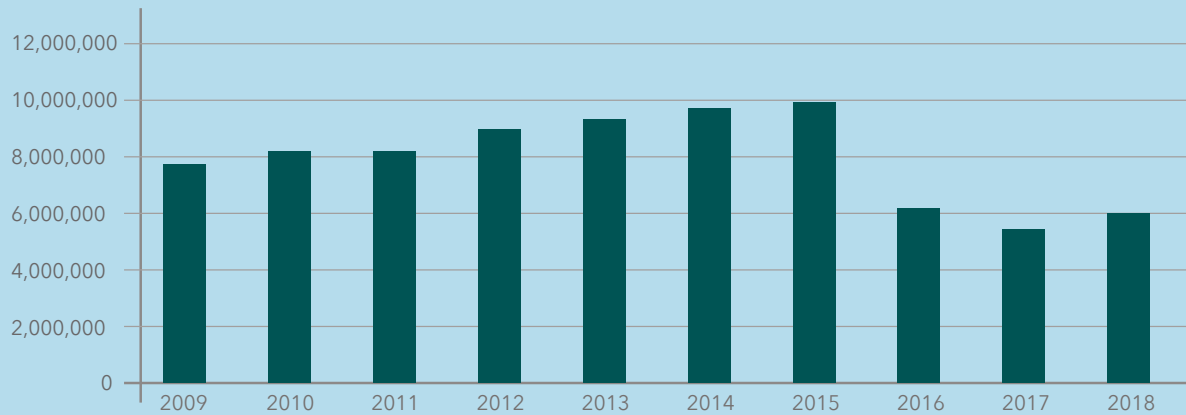
Animals are fed with unnecessary antibiotics which can breed resistant bacteria and can then be passed on to humans via food or runoff to the environment

558,000

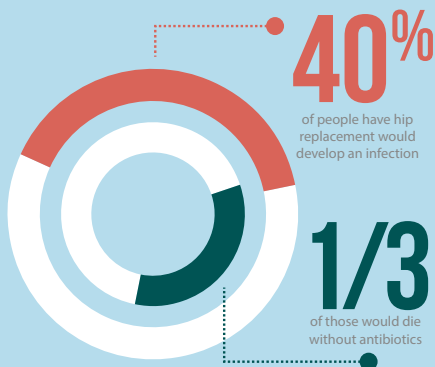
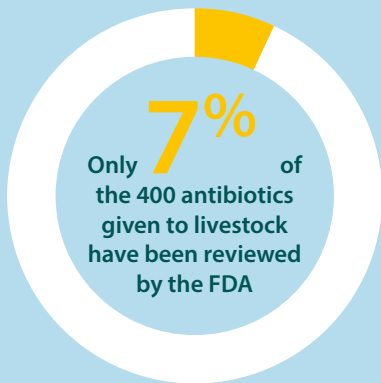
people are estimated to have developed multi-drug or rifampicin-resistant tuberculosis in 2017.



Sales of Medically Important Antimicrobials for Use in Food-Producing Animals



How Resistance Impacts Our Society



Antibiotic resistant infections are responsible for:

\$20 bn **\$35** bn **\$8** mn

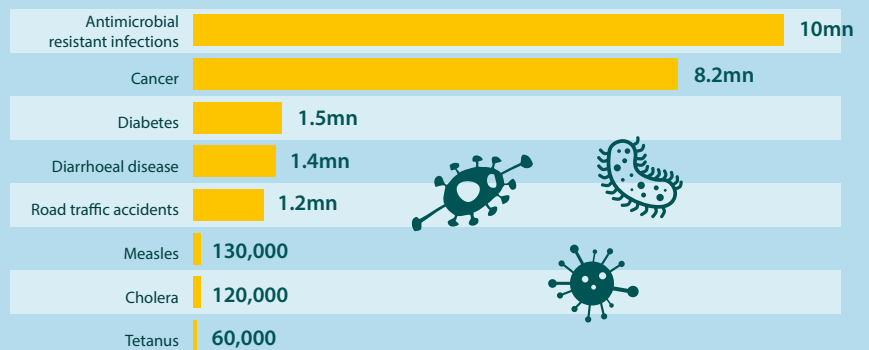
in health care costs

in lost productivity

additional hospital stays

Deaths from Drug-resistant Infections Set to Skyrocket

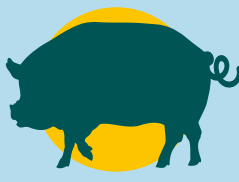
Deaths from antimicrobial resistant infections and other causes by 2050



What are the Retail Giants Doing About it?



McDonald's ceased using chickens reared with dual use antibiotics and plans to reduce the use of antibiotics in its beef supply



Walmart has asked suppliers to publicly disclose their progress in stopping antibiotic use for promoting growth in livestock



Costco will eliminate antibiotics important to human medicine in its poultry and beef supply

The Threat of Compound Growth

The Green Revolution saved millions of lives from starvation and poverty, but compounding growth had a severe impact on population numbers, ironically making it more difficult to reach the goal of cheap food for all, the reason for its very existence.

Global Population Still Rising Fast

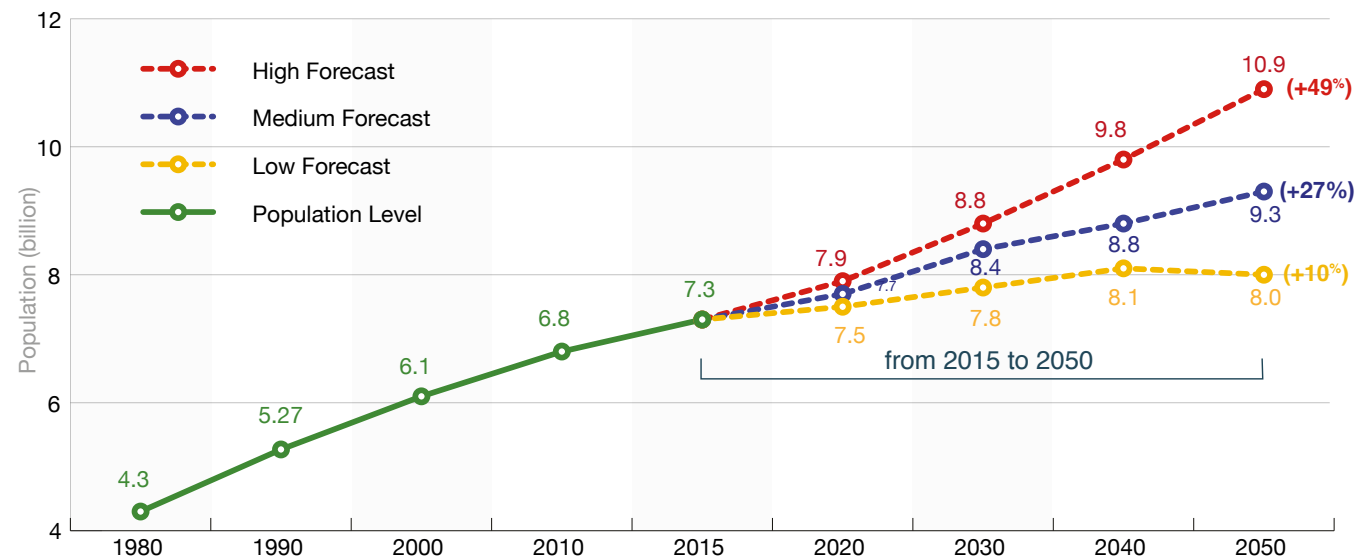
According to a recent study undertaken by the UN and the University of Washington, the chances of the global population reaching 11 billion by the end of this century have been estimated at 70%, with an 80% chance of the number being in the range of 9.6 billion to 12.3 billion.³⁵

Currently, **14% of all humans who have ever existed are alive.** The world's population finally reached 1 billion at the beginning of the 19th century. Only 200 years later, humanity hit the 6 billion mark and it only took 12 years to reach 7 billion.³⁶

“Compound interest is the eighth wonder of the world. He who understands it, earns it, he who doesn't, pays it”

Albert Einstein

UN Population Growth Estimates: High, Medium and Low Variants

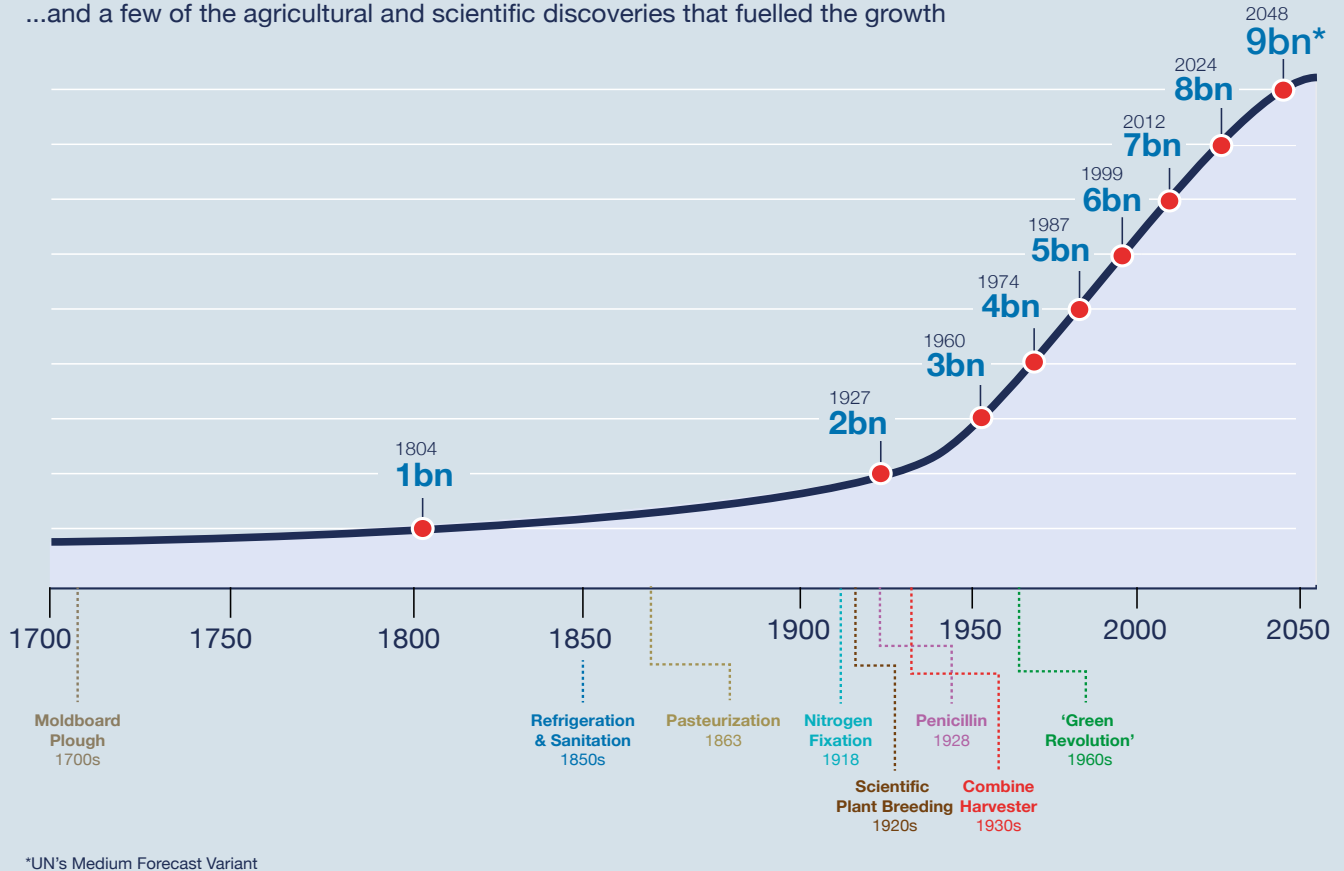


Source: United Nations (2014)

³⁵UN and the University of Washington (2014) ³⁶Population Institute (2011)

Expansion in the world's population over the past 300 years

...and a few of the agricultural and scientific discoveries that fueled the growth



Source: The Atlantic Magazine (2013)

Such aggressive growth estimates rudely overturn the consensus built up over the past two decades, which had assumed the global population would peak mid-century at 9 billion.

With the number of people on earth increasing by a further 50% from current levels within the lifetime of most children alive today, change is essential

Many resources, such as oil, water and farmland, are already under pressure due to the extreme levels of usage imposed, while pollution levels and the earth's temperature continue to rise.

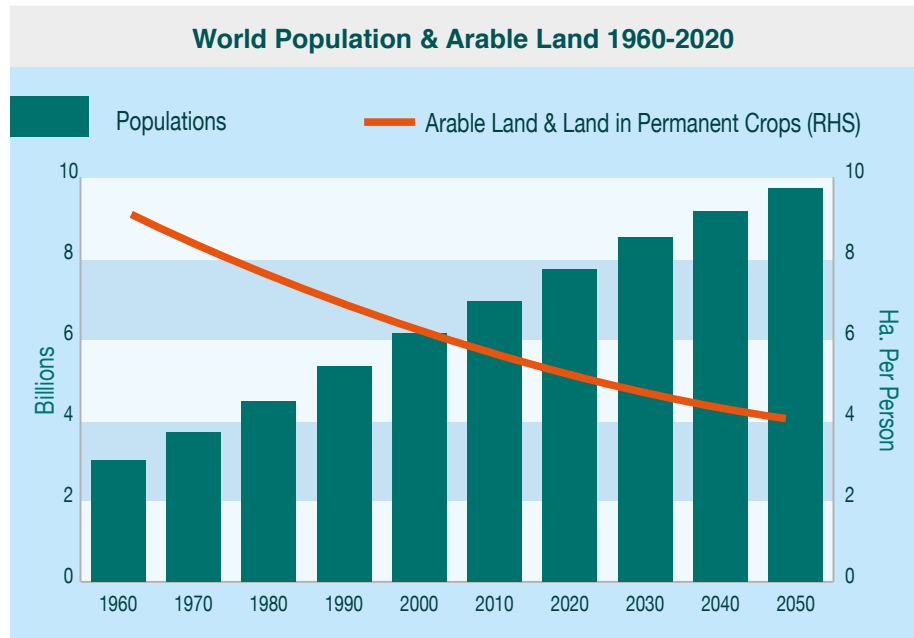
Developed countries face the prospects of caring for increasing numbers of retiring and long-living baby-boomers at a time of slower economic growth, raising concerns over funding. Population migration, from the countryside to the cities and across borders, is increasing the economic and social tensions in host or targeted countries. It paints a bleak vision of the future. Malthus foresaw an impending catastrophe, whereby geometrically growing populations would outstrip arithmetically expanding food production.

The end result would be the breakdown of society and the return to a feudal, subsistence existence.

Yet, it never came to pass. The dawning of the Industrial Revolution meant that Malthus' predictions were quickly overtaken by the productivity and technological advances that occurred during the 19th and 20th century, which accelerated after World War II. **A stream of inventions, none of which Malthus could have imagined (and some of which are represented in the chart above) opened the way for food production to outpace the exponential growth in demand.**

Nearly One-Third of the Globe Go to Bed Hungry Every Night

Malthus' ideas are returning to discussion for the same compelling reasons that his original work first provoked attention and controversy. Worldwide, one-third of all food produced annually for human consumption (1.3 billion tons) goes to waste; yet almost a third of the world's population, equivalent to 2 billion people, go to bed hungry every night. 1.2 billion people do not have access to the UN's daily prescribed 5-13 gallons of fresh water.³⁷ This dystopian vision arises in spite of the tremendous economic wealth that has been generated over the past sixty years. Even as farmers and scientists devised ways to enhance arable productivity, more than half of the world's annual cereal crop production is never used.³⁸



Source: GS & PA Research, Food & Agricultural Organization (2012)

The Hunger Trigger

The number of hungry people now exceeds the total number on earth when Malthus was warning of the consequences of food running out. And though society has not yet broken down as a result of a food supply imbalance, it has been the trigger for significant events. One of the major reasons for the twenty-first century's first resource-based conflict, the 2012 Arab Spring, was the price of bread. In the space of one month in mid-2012, the global price of wheat jumped by 65%. The escalating price of bread in the Middle East, where it is an essential everyday foodstuff, added fuel to the long lasting discontent and contributed towards the toppling of governments in Egypt, Libya and Tunisia.

“The food price spike was the final nail in the coffin for regimes that were failing to deliver on their side of the social contract,”

- Professor Jane Harrigan, Department of Economics at the London School of Oriental and African Studies

A Wasteful Society Unwilling to Change

Some observers make the point that because enough food is grown globally, it is only a question of better 'downstream' management to iron out the anomalies and eradicate hunger. By cutting down on wastage and inefficiencies from food storage and distribution, food availability will increase and 'hey presto' the problem would be solved. If only it were that easy. In Southeast-Asia it is estimated that losses from rice harvests range from 37% to 80% of production. Even in China, the world's second largest economy, annual losses from rice harvests are estimated at 45% of production, and in Vietnam the figure is 80%. Some of the culprits have been identified as:

- **Inefficient harvesting**
- **Inadequate local transportation**
- **Poor infrastructure covering storage and handling**

Yet we would argue that whether or not food wastage rates can be reduced, this would simply affect the periphery and not alter the basic premise. People will continue to go hungry in key areas around the world. The Food and Agriculture Organization (FAO) notes that the number of upward revisions to populations in sub-Saharan Africa, '...does not augur well for the food security prospects of the region and the world'.

But, hunger isn't prevalent in only developing countries, though localized

constraints do play a part in creating bottlenecks. For example, it is estimated that 40% of all food grown in the US is uneaten. That such waste occurs in the richest nation on earth is no surprise. What is surprising is that in spite of this, one in six Americans still 'lack a secure supply of food to their tables'.³⁹ If the US can't get it right, will others?

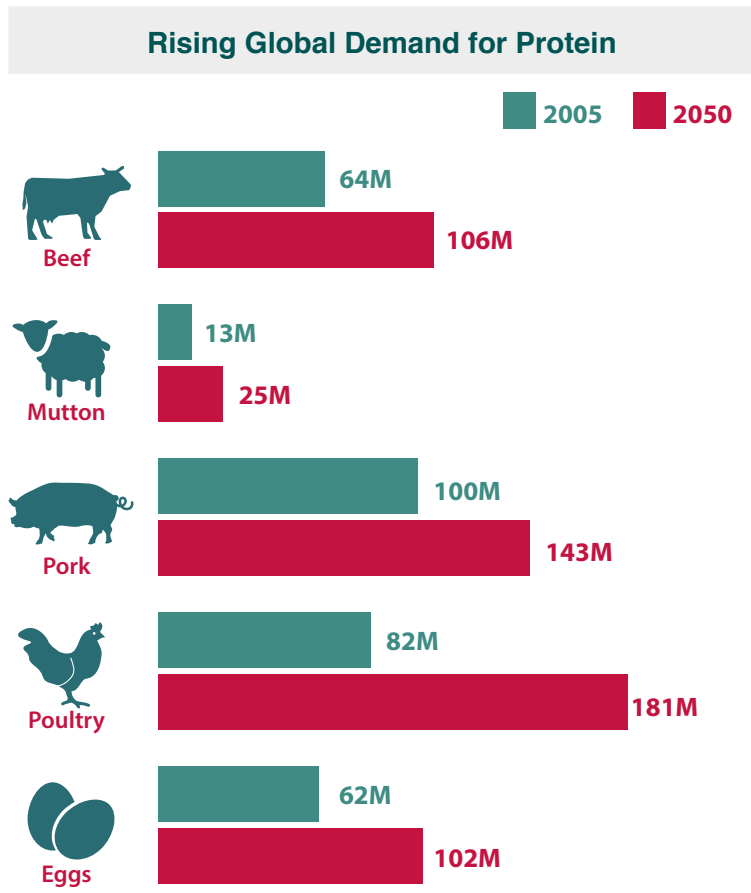
There are two additional factors inexorably

because it weighs more on the ability of developing countries, many of which are already highly dependent on agriculture, to grow more food in increasingly hostile climates. The global annual temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880 and over twice that rate (+0.18°C / +0.32°F) since 1981. The five warmest years in the 1880–2019 record have all occurred since 2015.⁴⁰ It has to be remembered

that calculating averages necessarily covers a range of both much higher and lower temperatures; both extremes are negative to food production. **The FAO estimates that by 2050, 70% more food will need to be grown globally just to keep pace with population growth.** Higher temperatures and more extreme localized weather will add pressure and likely ensure this figure is a minimum threshold that needs to be applied.

Another factor to consider is migration and the rising proportion of workforces moving from the countryside into cities, at a practical level weighing on the ability to produce enough food. Urban city populations are forecast to rise from an estimated 54% of populations to 66% by 2050.⁴¹ **As people who used to work on farms leave for cities in search of better prospects, the result will be a**

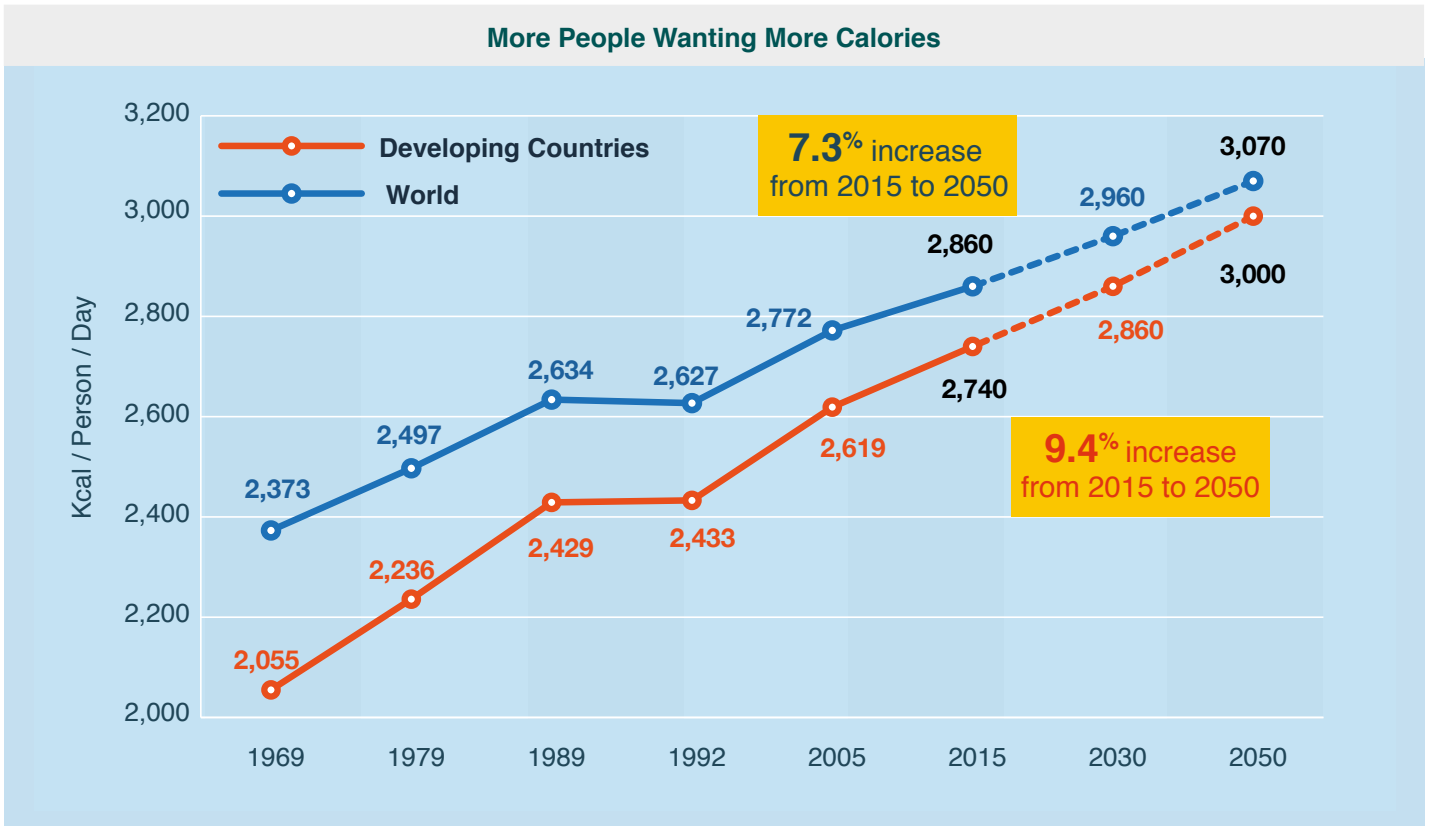
rationalization of the centers of food production, raising different issues of food security. Having enough people growing sufficient food where it is needed, and logistic infrastructure in place to ensure it is not wasted, are key.



Source: UN Food and Agricultural Organization (2005)

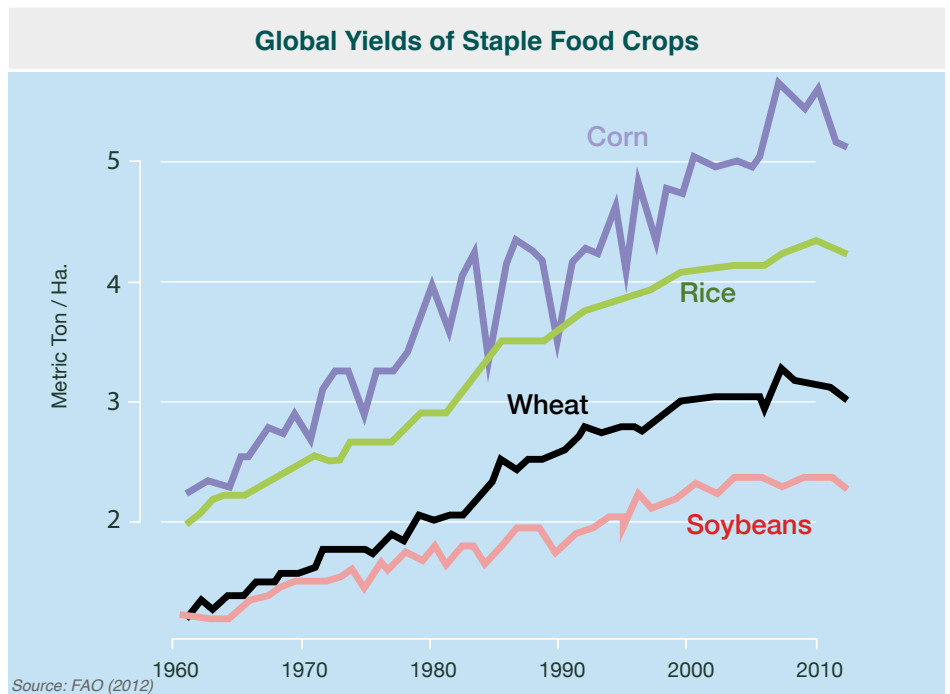
leading the world down the path that Malthus warned of unless we make fundamental changes. The first is the effect of a warmer climate whether man-made, cyclical or otherwise. This is impacting the chances of achieving food security

³⁹National Resources Defence Council (2012) ⁴⁰NOAA National Centers for Environmental Information (2019) ⁴¹United Nations Population Division (2014)



Malthus - Partially Right and Increasingly Relevant

If the global population keeps rising sharply in areas where food production is most vulnerable, **does that mean that Malthus will eventually be proved right? Will the world run short of food, causing famines, the ultimate Malthusian catastrophe?** Perhaps not at a global level, but regionally this may certainly be the case. The short term outlook is probably worse than it appears. **Corrective measures must be put in place now, due to the lead times involved.** If delayed, the time-scale necessary to register and implement the adjustments will result in conditions deteriorating before they improve.



Crop Yields in Decline

Our future world may be characterized by a (warmer) planet, where fewer crops can only be grown in a more restricted number of regions and where the extraction of resources from the planet becomes increasingly difficult and expensive. Unless moves are made to explore sustainability, living within our means may be having to make do with less. How much less remains to be seen, but consider the issues that have to be

contended with: **farmland availability is shrinking**, much of it to make way for the expanding urban populations. **Crop yields are no longer increasing from the 'Green Revolution' of the 1960s and 1970s.** However, this memory brings with it many negative impacts that are just beginning to be understood. **Water resources are under pressure and soil quality continues to deteriorate.** A new, kinder and more efficient way of producing

food must be implemented in order to avoid some of the worst aspects of Malthus' predictions occurring this century.

A growing global population means the demand for protein rich diets is adding further pressure on the earth's natural resources, compounding the challenge mankind faces.

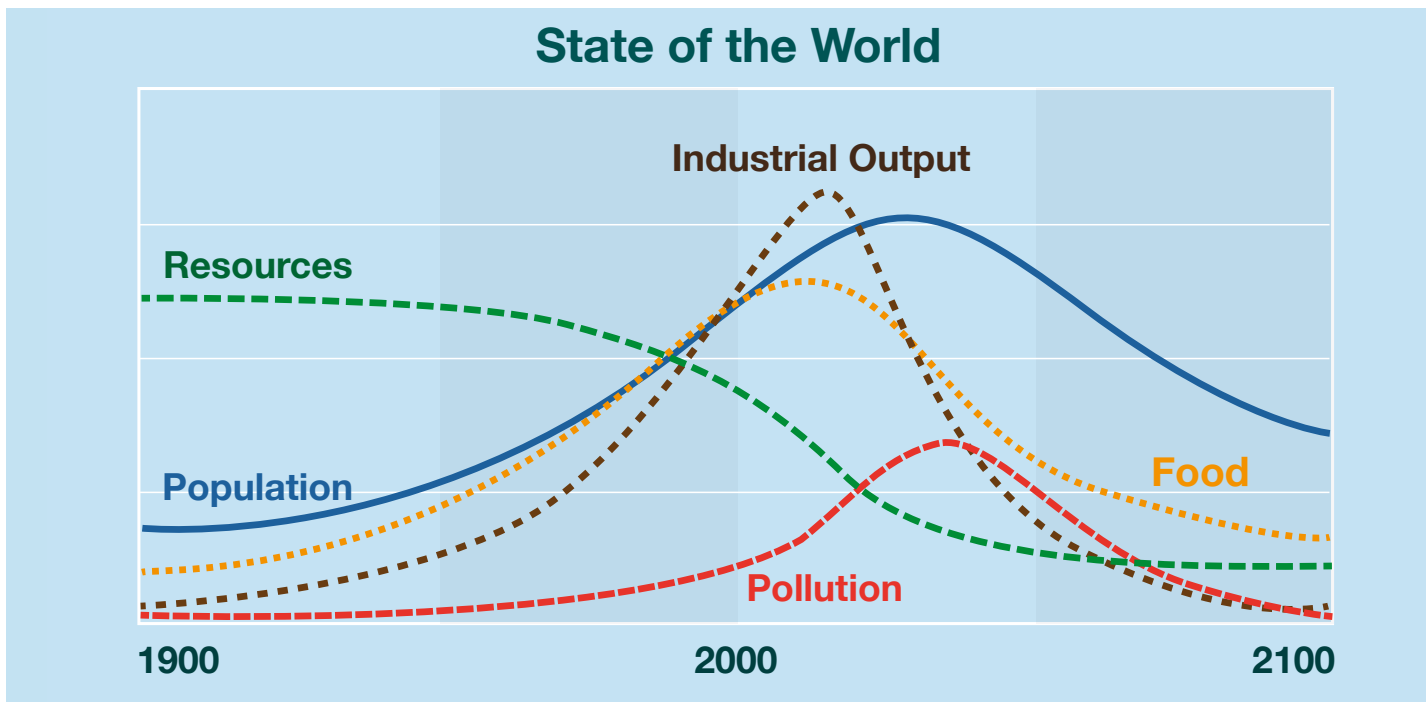
Avoiding the Malthusian Catastrophe

So far, synthetic pesticides, chemical fertilizers and antibiotics have played a monumental role in avoiding the doom-laden future Malthus foresaw. Yet the dangers he set out still exist. Mankind has overcome his prediction to date, but at great cost, and in a form that is simply not sustainable for future generations. **Mankind can no longer afford to pollute the water, damage the soil,**

or compromise our immune systems by overusing antibiotics. It is time to readdress the concerns of Thomas Malthus. The fundamental issues he raised still exist, and must be tackled in an enduring manner. The ersatz approach has compounded the potential catastrophe. **In order for mankind to avoid famine and disease on an even greater scale than the Malthusian prediction, much**

innovation and changing of practices are clearly needed. A new approach must be taken, as the old way of doing things is unsustainable.

The Green Revolution is dead, long live the Green Revolution.



The Green Revolution is Dead, Long Live the Green Revolution!



THE GREEN
REVOLUTION
IS DEAD

LONG LIVE THE NEW
GREEN REVOLUTION

Nature's Solution

Neem - A Key Player in Solving Global Issues

The first “Green Revolution” was flawed, it was not working...it was unsustainable. **We must move on to another, superior agricultural revolution and get it right this time!**

In order to be truly committed to a way of doing no harm while solving mankind's need for survival, we need a viable solution, and this solution must then be cultivated, scaled up and embraced. Having a zero footprint and eliminating further harm is not enough, a restorative approach must also be undertaken.

In India, the Neem tree is a renowned, highly regarded organic pesticide, fertilizer and medicinal plant, yet the majority of the world is unfamiliar with neem. With the evolution of man and awareness of our environment and the need for sustainability, **neem is starting to gain recognition and is set for a remarkable rise.**

The neem tree (*Azadirachta Indica*) has been dubbed “**tree of the 21st century,**” **by the United Nations.** Neem has the qualities essential to conquer some of

mankind's greatest threats. **It possesses the ability to overcome the challenges restrained by the original Green Revolution,** only without the hazardous side effects caused by the inadequate practices and synthetic chemical compounds, all the while, restoring the environment.

An evergreen tree and part of the same family as Mahogany, neem is indigenous to Southeast Asia. Neem is fast growing, rising by 2.6 feet (80cm) a year, it can reach up to 100 feet (30 meters) when fully grown. Able to withstand drought, its wide canopy forms a rounded crown of leaves that produce delicate white flowers and small green fruit shaped like an olive. In the West, scientific interest in the tree started as recently as the 1950s, much of it centered on the oil from the fruit, which contains multiple insect repellency and fertilizer properties. **Azadirachtin, the key active ingredient in the oil, has such a complex chemical structure that it took 20 years to synthesize in the laboratory. It is this complexity that provides much of neem's potency and unique flexibility.**

A tree that was virtually ignored by Western researchers until the late 1950s, neem has such a complex chemical composition that it took scientists 20 years to synthesize its key active ingredient - Azadirachtin

*The neem tree (*Azadirachta Indica*) has been dubbed “The tree of the 21st century” by the United Nations*



The Life of Neem

Named 'Arista' in Sanskrit - meaning 'perfect, complete and imperishable'



Leaves

Containing most active ingredients found in the seeds but in a much lower concentration, the leaves are considered the most versatile part of the tree. Now used as a pesticide, fertilizer and animal feed, the leaves were originally used as a medicinal tea in Indonesia



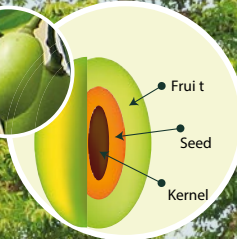
Flowers

The flowers are the part of the tree with fewer uses, however, given the flowers' sweet, honey-like smell, the flowers are used in aromatherapy for a calming and restorative effect



Twigs

Whilst used in commercial toothpastes and mouthwashes, twigs have most widely been used as brushes for generations in India



Fruit

Seed

Kernel

Oil

Extracted from the kernels inside the seeds, where a single seed may contain up to 50% oil by weight, the oil is recognized and valued as a safe and effective bio-pesticide for organic farming. The oil has also been widely studied due to its medicinal properties and is also used in a variety of cosmetic products such as creams, soaps and shampoos



Bark

Neem bark contains spermicidal properties and research is undergoing to approve its potential use as a sexual contraceptive for both women and men



Cake

After the seeds have been pressed for oil, the resulting by-product is the neem cake. Neem cake is used across the agriculture sector as an effective pesticide, fertilizer and anti-bacterial, anti-fungal organic alternative to antibiotics in livestock



Roots

The roots of a neem tree also have different medicinal properties due to being antiseptic, antibacterial, anti fungal and germicidal. They are also used as a pesticide and to control fleas and ticks on pets



Pesticide

Neem-based organic pesticides are effective against 600 insect species. As a fertilizer, neem also reduces soil alkalinity and ensures optimum fertility



Medicine

All parts of the neem tree can be used for the treatment of inflammation, infection, fever and skin diseases



Cosmetics

Containing a high level of antioxidants, neem is used in organic soaps, shampoos and hydrating creams



Cattle feed

Neem is used as an organic and nutritional supplement that is effective against internal nematodes



Fertilizer

Neem improves the nutritional value of the soil while protecting plant roots from pests and diseases



Timber

Derived from the mahogany family, Neem is an extremely durable wood ideal as a construction material

Neem's Role in Sustainable Agriculture

Neem's Three Main Uses in Agriculture

1

Organic & Sustainable Pesticide

2

Organic & Sustainable Fertilizer

3

Organic & Sustainable Alternative to Antibiotics for Livestock

The Sustainable Solution to Crop Protection

Neem derived bio-chemicals contain different limonoids, mainly azadirachtins, nimbin, nimbidin and nimbolides. Many have shown anti-feedancy, fecundity suppression, ovicidal and larvicidal activity, growth regulation and repellence against around 600 different insect species. The table below shows some examples of the different groups of pests neem is effective against:

Pests	Level of Control	Recommended Neem Formulation
Beetle larvae, butterfly and moth caterpillars	Very Good	Aqueous neem extracts
Stalk borers	Very Good	Aqueous neem extracts, neem cake, neem powder
True bugs, plant and leaf hoppers, grasshoppers	Very Good	Neem oil, neem kernel extracts
Adult beetles	Good	Aqueous neem extracts, neem cake powder, leaves, neem oil
Aphids and whiteflies	Good	Neem oil
Plant parasitic nematodes	Good	Neem cake and Neem leaves

Source: HDRA – The Organic Organization (2015)

Neem provides an inexpensive and non-toxic alternative to a number of synthetic pesticides.

Neem-based pesticides have a great number of **benefits** both to the environment and human health:

- **Effectiveness & Persistency**
Neem extracts do not kill pests immediately, but changes the feeding or life cycle of the insect until it is no longer able to live or reproduce.
- **Environmentally Friendly**
Neem based pesticides are entirely biodegradable, leaving no residue on the land. The degradation of Azadirachtin occurs due to the effects of UV light, temperature, pH and microbial activity, and therefore will not lead to an accumulation. According to the US National Pesticide Information Center (NPIC), neem-based pesticides are practically non-toxic to birds, mammals, plants and pollinators.
- **Increases Nutritional Value**
Organic foods contain between 20-40 percent higher levels of nutrients, including vitamin C, zinc and iron that are very important to maintain a healthy body. They also contain up to 60 percent more antioxidants than non-organically grown foodstuffs, which helps to prevent and repair damage to the body's tissues from free radicals.⁴²
- **Immune to Resistance**
As opposed to synthetic pesticides, neem-based pesticides have multiple modes of action against insects, and therefore rarely induce resistance. Neem acts on the insect's hormonal system, not on the digestive or nervous systems, which makes it very difficult for future generations of insects to develop any resistance.
- **Cost Effective**
Including application costs, as shown in the table to the right, neem-based pesticides are cost effective when compared to traditional synthetic pesticides.

⁴²British Journal of Nutrition (2014)

Neem Crop Care - Environmentally Friendly and Cost Effective

A Comparison with Synthetic Pesticides Currently on the Market

	Glyphosphate	Atrazine	Metam Sodium	Pure Neem Oil	Trilogy	Azamax
Description	Broad-spectrum herbicide known commercially as RoundUp	One of most widely used pesticides in the US but banned in EU	The 3rd most used agricultural pesticide in the US	Neem oil is a naturally occurring pesticide found in seeds of the neem tree	Insect growth regulator and feeding inhibitor effective throughout the larval and pupae stages of insect development	Effective on all larval and pupae stages of insect development by repelling and deterring feeding in insects
Environmental Impact	The WHO classified glyphosphate as 'probably carcinogenic in humans'	Disrupts hormones by altering male reproductive tissues	Reduces the effectiveness of immune system cells and causes damage to the liver and lungs	Organic and environmentally friendly with no hazardous side effects	Approved for organic production by the USDA	Approved for organic production by the USDA
Active Ingredient Dosage (Liters/hectare)	2	7.20	600 - 800	5.0 - 7.0	2.30	0.40 – 1.20
Cost per liter (US\$)	8.50	3.50	1.79	15	8.40	130
Application Cost per hectare (US\$)	30	30	570	30	30	30
Application Guidelines	Application by ground spraying contractor (4x per season)	Application by ground spraying contractor (4x per season)	One application every 3 years through fumigation system	Application by ground spraying contractor (4x per annum)	Application by ground spraying contractor (4x per annum)	Application by ground spraying contractor (6x per annum)
Total Annual Cost per hectare (US\$)	188	220.80	548 - 667.30	195 - 225	197.28	232 - 336

Source: The Primal Group (2020)

The global bio-pesticide market reached \$3.147 billion in 2018.⁴³ Forecasts place the bio-pesticide market value at \$14.94 billion in 2028, with a CAGR of 15.11%. Bioinsecticides currently account for the largest revenue share of 50.34% in the overall market by type segment, while biofungicides are anticipated to be the fastest growing when compared to other types of biopesticides.⁴⁴ The global organic fertilizers market is anticipated to reach US\$6.3 billion by the end of 2024 from US\$3.1 billion in 2016.⁴⁵

Disclaimer

The information contained within this table has been collected from sources (including third party content providers) that The Primal Group believe to be reliable. The pricing contained in this chart has been prepared on the basis of reasonable endeavors and constitutes The Primal Group's judgment on the date of preparation, and may be subject to change without notice. The Primal Group bears no obligation to update this table on the basis of subsequent information or in light of specific events.

All major assumptions have been sourced from the Atrazine Product Guide, Monsanto Product Guide, Metam Sodium Product Guide, Trilogy Product Guide, Neemix Product Guide, Ultra Bio-Logics Inc.,

⁴³Modor Intelligence (2019) ⁴⁴Inkwood Research (2020) ⁴⁵Research Nester (2019)

An Effective Pesticide, Yet Kind to the Planet

- **Non Poisonous**
- **Non Toxic**
- **No Human Health Risk**
- **Organic**
- **Non Harmful to Soil (Neem is nourishing to soil)**
- **Does Not Reduce Biodiversity (non-harmful to pollinators like bees)**
- **Positive Environmental and Social Financial Impact**
- **Sustainable Legislation Compliance**

Pesticides are often **applied** via one of the following **processes**:

Seed Treatments

Pesticides are applied to the seed prior to planting, in the form of a coating that protects against soil-borne risks to the plant. These coatings can also provide supplemental chemicals and nutrients designed to encourage plant growth.

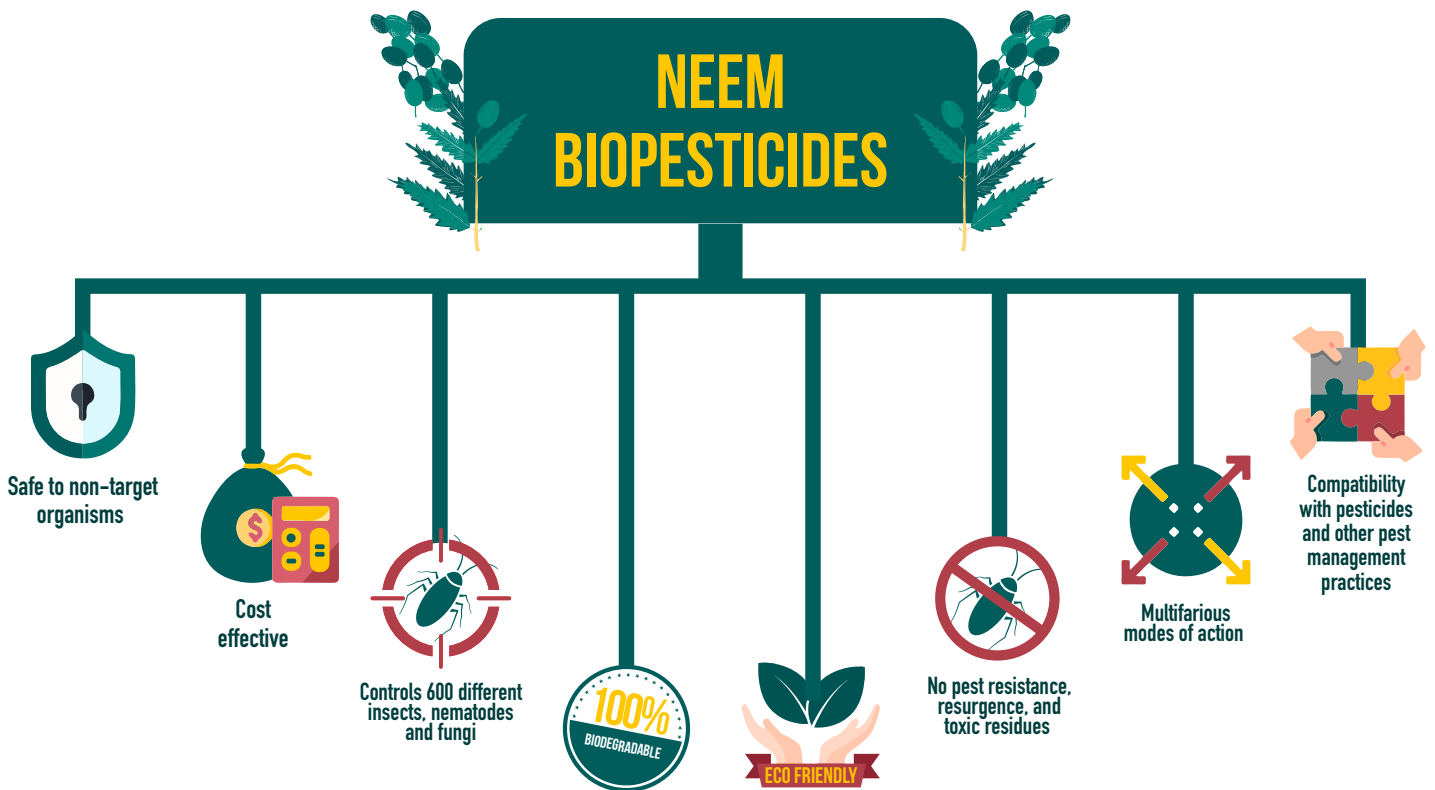
Spray Application

The most common form of pesticide application is mechanical spraying. Hydraulic sprayers convert a pesticide formulation into droplets that can be distributed by air or land.

Fumigation

Gaseous chemicals lethal to pests, fumigants are widely used when no other form of control is feasible. The process is highly effective, but excessive applications are resulting in concerns that will increasingly restrict their future use.

Multiple Advantages to the Use of Neem as a Pesticide



Benefits of Using Neem as a Fertilizer

Neem Cake - A Byproduct that Nourishes Soil and Stimulates Growth

Neem cake, the byproduct obtained by pressing the leftover material in the neem oil extraction process, acts as an organic fertilizer with pesticidal properties. It is entirely natural, reduces the alkalinity in the soil and is compatible with soil microbes, thereby ensuring optimum fertility.

The neem seeds that have gone through the oil extraction process do not go to waste as the residue still contains vital nutrients necessary for plant development that filtrate back into the land to nourish plants and crops.

Improving the organic content in the soil while protecting plant roots from soil dwelling pests, diseases and nematodes, the cake also benefits soil texture and increases water retention. **Filled with nutritional value, neem cake has more nitrogen, phosphorous, potassium, calcium and magnesium than ordinary farmyard manure.** This product is commonly used to fertilize a wide variety of crops.

- **Improves Soil Health**

Using neem as an organic fertilizer increases airflow through the soil, allowing plant roots to breathe, helps the soil retain moisture, and increases soil workability.

- **Environmentally Friendly**

Organic fertilizers are healthier for the ecosystem because they must first break down before releasing their nutrients, ensuring that no runoff occurs.

- **Hydraulic Conductivity**

Organic matter supplied by organic fertilizers improves water flow in soils and provides a food source for soil micro-organisms which contribute to macro-pores formation.

Neem as a Fertilizer

- **Non Pollutant**
- **Non Toxic**
- **No Human Health Risk**
- **No Environmental Contamination**
- **Nourishes Soil**
- **Does Not Reduce Biodiversity**
- **Positive Environmental & Social Financial Impact**



Synthetic vs Organic Crop Care

The Reported Dangers of Synthetics and Benefits of Organics

The Synthetic Option



HAZARDOUS

Travels outside the intended area of use and contaminates the air, soil and water



STALLS LONG TERM GROWTH

Synthetic fertilizers acidify the soil over time and deplete its nutrients



REDUCES BIODIVERSITY

Synthetic pesticides damage the nervous systems of animals and compromise their ability to survive and reproduce



HARMS PUBLIC HEALTH

In extreme cases, the nitrates in synthetic fertilizers have prevented oxygen use in infants



DAMAGES SOIL

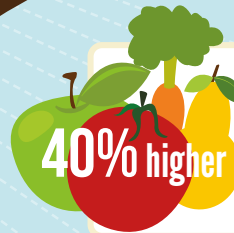
Reduces the amount of vegetative cover on the ground, promoting soil erosion

The Neem Way



SAFER

Entirely biodegradable, no hazardous residue is left on land or water



MORE NUTRITIOUS

Organically grown food contains up to 40% higher levels of nutrients



COST EFFECTIVE

Comparable pricing to their synthetic alternatives



HIGHLY EFFECTIVE

Neem-based pesticides provide multiple protective layers against pests



IMPROVES SOIL

Neem cake enriches the soil by increasing airflow and water retention while reducing the growth of pests and bacteria

The Rising Demand for Organics

Organic food is defined by the United States Department of Agriculture (USDA) as any crops produced without the use of synthetic pesticides or fertilizers and any animal derived food that are given no antibiotics or growth hormones. In other words, it is food produced using environmentally and animal friendly farming methods. To be labeled organic at least 95 percent of the ingredients must come from organically produced plants and animals.

Organic Food is the Only Sustainable Option

Organic food is the only sustainable solution in feeding an ever increasing population. Anything other than organic risks causing further stress on our environment.

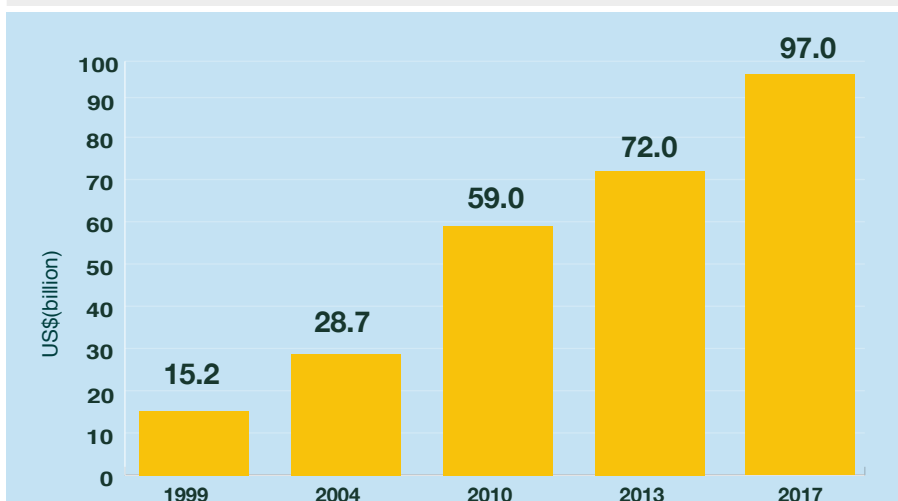
In 2017, North America was the leading consumer of organics, with the region's organic food market valued at 48.7 billion US dollars. North America and Europe comprise almost 90 percent of global revenues. In Asia, the third largest market

for organic products, a transition is taking place whereby countries are moving from an export to domestic focus, with most developments now occurring in the Chinese and Indian markets.⁴⁶

Organic fruits and vegetables emerged as the leading sector, forecasted to grow at a CAGR of over 14% from 2018 to 2025. Pushed by increasing consumer awareness of the health benefits of organics and the increasing threat of

antibiotic resistance, the meat, fish & poultry are forecasted to witness the highest CAGR and account for over 7% by 2025.⁴⁷

Growth of the Global Market for Organic Food & Drink 1999 - 2017



Source: Source: FiBL-IFOAM (2019)

The global market for organic foods and beverages is expected to increase to **US\$ 679.81** billion by 2027, growing at a CAGR of **17.05%** up from US\$ 165.52 billion in 2018.

Absolute Market Insights (2019)

A Favorable Regulatory Environment

A classification supplied by the lead global agency on the matter, the US Dept. of Agriculture, and followed by many other bodies around the world, describes organics as any crops produced without the use of synthetic pesticides or fertilizers and any animal derived food that are given no antibiotics or growth hormones.

Making agriculture greener and more efficient will be aided by new legislation supporting the use of natural resources that safeguard biodiversity and ensure a sustainable food chain. **As consumers become more educated and aware of agriculture's more dangerous traditions, pressure is placed on producers and their governments to change archaic policies** in favor of organics, further expediting the industry's transition to safer and sustainable

Organic food is produced using farming methods that protect the environment and ensure a sustainable future for our world's growing population

practices.

Environmental concerns, in particular the need to protect groundwater quality, underpins much of the legislative action. All pesticides in the US have to be registered with the Environmental Protection Agency (EPA) and some, classified 'Restricted Use', can only be used or supervised by a Certified Applicator. The EPA also regulates any pesticides imported for use in the US.

The two key pieces of US federal legislation are:

1. FIFRA, providing federal control over pesticides

2. FFDCA, specifying the levels of pesticides and chemicals in food

Before any new pesticides can be made available in the US, they are tested by the EPA to ensure they can be used with a reasonable certainty of no harm to human health or risks to the environment. To certify pesticides, the EPA requires more than 100 scientific studies and tests from applicants regarding the effect on crops, health and the environment. Additionally, the EPA sets tolerance levels, which determine the maximum pesticide residue levels that can remain in or on foods.

Fertilizers comprising nitrogen, phosphorus and potassium provide nutrients necessary for plant growth. Materials applied with the goal of enhancing the soil are called soil amendments. Unlike pesticides, fertilizers can be derived from previously unused materials and waste materials, like sewage and various industrial waste products. **Overuse of fertilizers can therefore result in groundwater and surface water contamination.**

Legislation covering fertilizer made from sewage is extensively covered by the Clean Water Act (CWA) and is subject to concentration limits for a variety of metals including cadmium, copper, lead, mercury and zinc.

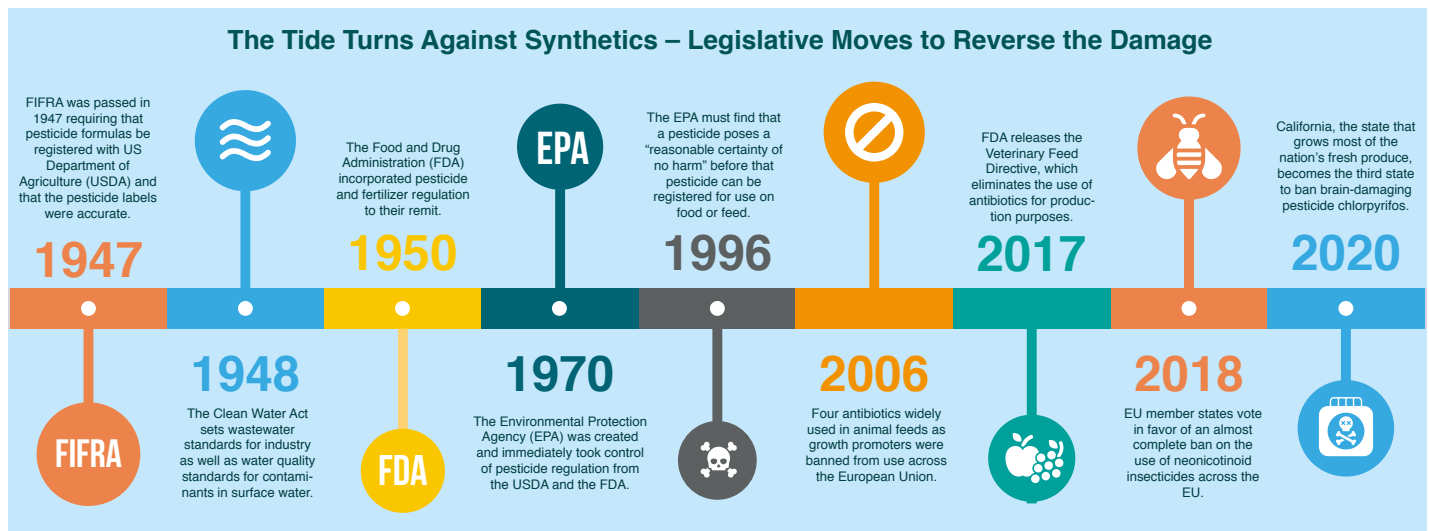
A long-standing piece of legislation, the CWA was first enacted in 1948 but reorganized and expanded in 1972. It sets wastewater standards for industry as well as water quality standards for contaminants in surface water. The CWA makes it illegal to discharge pollutants into navigable waters without a permit. Wastewater management is undertaken by the NPDES Program, which ensures compliance monitoring at the state level.

The EU, keen to promote a greater degree of responsibility with its Common Agricultural Policy, at 40% the largest component of its overall budget, provides a layer of financial support to farmers who enhance sustainability in their management of natural resources. Acknowledging the importance of agricultural practices that benefit the environment and climate, it provides 'Green' payments that will help to maintain an 'ecological focus area' on farms, such as encouraging the use of bio-fertilizers. Organic fertilizers are also promoted in developing markets such as India, with the introduction of the 'National Project on Development and Use of Biofertilizers'. China has also been promoting the use of organics by providing companies manufacturing organic products with tax exemptions.

Synthetic pesticide use in the developed economies of North America and Europe is expected to decrease, driven by restrictions on the use of certain crop protection chemicals.

In 2018, EU member states voted in favor of an almost complete ban on the use of neonicotinoid insecticides across the EU, representing a major extension of existing restrictions, in place since 2013. Scientific studies have long linked neonicotinoids to "Colony Collapse Disorder", a phenomenon that occurs when the majority of worker bees in a colony disappear, leading to the death of the entire bee colony and significant economic losses given agricultural crops' dependence on bee pollination.⁴⁸

In 2019, the US Environmental Protection Agency (EPA) banned 12 neonicotinoids. While this ban represents a win for environmentalists, it still leaves 47 neonicotinoid-based products on the US market.⁴⁹



Source: The Primal Group (2020)

Another highly toxic pesticide to have been banned is chlorpyrifos. In 2018, after realizing that the hefty weight of scientific evidence was not enough to convince the EPA to prohibit chlorpyrifos, Hawaii residents joined together to pass their own statewide ban. New York shortly followed and California - the state that grows most of the nation's fresh produce – became the third state to ban the brain-damaging pesticide in 2020.⁵⁰

Increasing consumer awareness about synthetics and their consequences on human health has led to a number of court cases against big agrochemical corporations. One of the best-known companies currently under public scrutiny is undeniably Monsanto, which brought glyphosate-based herbicides to the market in the 1970s and was acquired by German chemicals giant Bayer in 2018.

Monsanto is currently mired in litigation brought by tens of thousands of cancer patients who claim exposure to Monsanto's Roundup weed killer caused them to develop non-Hodgkin lymphoma. The first trial against Monsanto ended in August 2018 with a unanimous jury verdict of \$289 million for a California school district groundskeeper. The second case to go to trial ended with a \$80 million verdict and the third case to go to trial against Monsanto resulted in a \$2 billion verdict on behalf of an elderly couple who both developed cancer after exposure to

Roundup.⁵¹

The number of health concerns related to exposure to Roundup has even led to the state of California adopting the International Agency for Research on Cancer's classification of glyphosate as a carcinogenic in March 2017, despite the EPA maintaining its position that glyphosate poses no significant cancer risks to the general public. The state proceeded to add glyphosate to its list of chemicals known to cause cancer in July 2017.⁵²

Antibiotic resistance is another issue that is increasingly being addressed not only by companies that are adopting policies to reduce antibiotic use but also by government agencies which are leading critical activities to combat antibiotic resistance domestically and globally. Yet the number of people facing antibiotic resistance in the United States is still too high, with 2.8 million antibiotic-resistant infections occurring in the United States each year, resulting in more than 35,000 deaths.⁵³

Antibiotic use by humans and for animals is regulated by the FDA. Since 2003, the FDA has been evaluating the potential human health impact of using antibiotics in food producing animals and has taken important steps toward fundamental change in how medically important

antibiotics can be legally used in feed or water for food-producing animals. In 2017, the FDA released the Veterinary Feed Directive, which eliminates the use of antibiotics for production purposes (i.e., growth promotion and feed efficiency) and brings their remaining therapeutic uses in feed and water under the supervision of licensed veterinarians.⁵⁴

Years ahead of legislation in the US, four antibiotics widely used in animal feeds as growth promoters had already been banned across the European Union in 2006. In 2018, the European Parliament approved new legislation, which will become law by 2022, completely banning the use of human reserve antibiotics in veterinary medicine and the use of unprescribed animal antimicrobials.⁵⁵

A strong body of opinion believes that organic farming has a positive effect on the quality of food we eat, on our health, and that is beneficial to the environment. Preventing potential health hazards imposed by synthetic pesticides and fertilizers, while providing better living conditions to animals, organic farming has a positive effect on land productivity and global health. This will be the major drive for an increase in agricultural legislation, as an informed public demands a more natural, healthy and sustainable global food system.

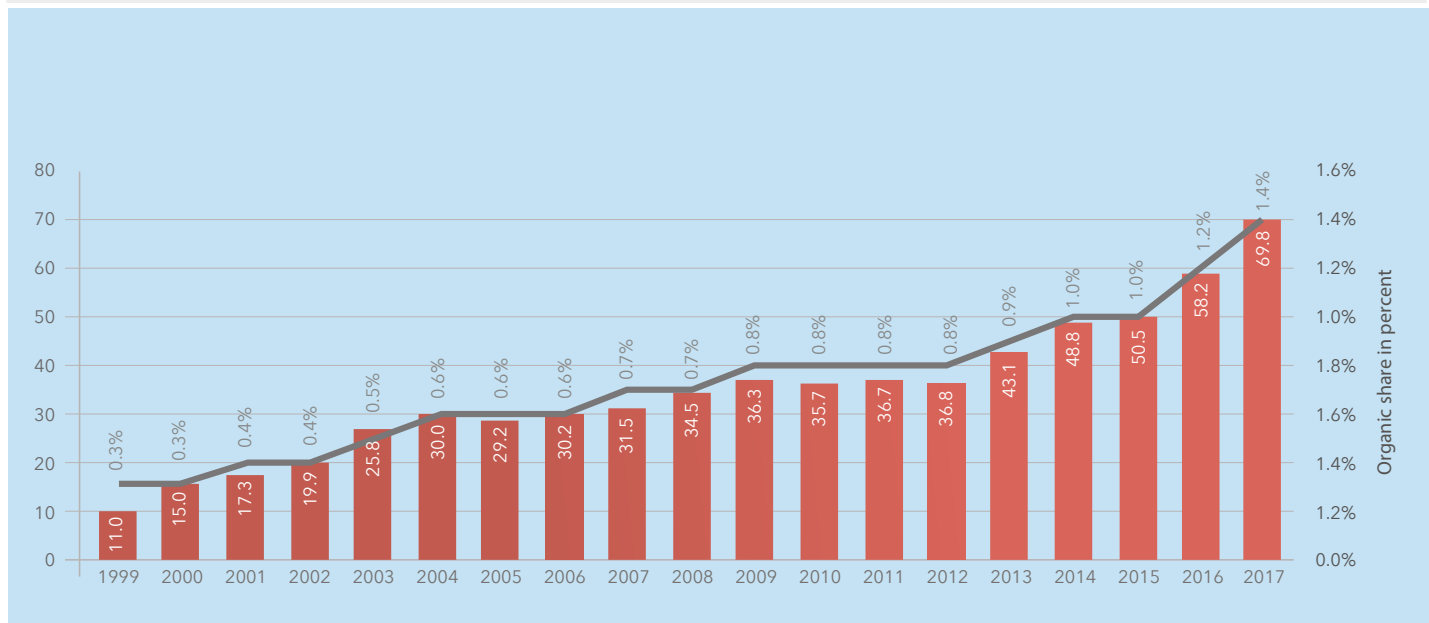
⁵⁰Foodprint (2019) ⁵¹Baum Hedlund Law (2020) ⁵²JD Supra LLC (2019) ⁵³Centers for Disease Control and Prevention (2019) ⁵⁴Food and Drug Administration (2019) ⁵⁵The Guardian (2018)

Reasons to Go Organic

Organic farming has a positive effect on the quality of food we eat, on health as well as being beneficial to the environment:

- Contain between 20-40 percent higher levels of nutrients including vitamin C, zinc and iron
- Approx. 60 percent more antioxidants than non-organic food
- Provide better living conditions to animals
- Not using unnecessary antibiotics and growth hormones, avoids antibiotic resistance
- Prevents potential health hazards imposed by synthetic pesticides and fertilizers including cancer, nerve and blood disorders and others.
- Will have a positive short-term and long-term effect on land productivity and condition – global arable land degradation is reduced
- Eating and producing organically does not reduce biodiversity, destroy habitats or threaten endangered species

Growth of Organic Agricultural Land 1999 - 2017



Source: FiBL-IFOAM-SOEL (2019)

The Organics Market

Global Organics Market

Since 1999, organic sales soared by

538%



Forecast CAGR of 17.05% to 2027

\$72bn

2013

\$165.5bn

2018

\$679.8bn

2027

There are **69.8mn** hectares of organic agricultural land, which has been increasing at **11%** a year since 1999

It represents **<1.4%** share of total farmland worldwide



USA
40.01

Germany
10.04



France
7.92



China
7.64



Italy
3.14



Canada
3.00



Switzerland
2.43



Sweden
2.37



UK
2.31



Spain
1.90



The Top Ten Markets For Organic Food and Beverages (€bn, 2017)

North America

3.2mn

hectares organic farmland

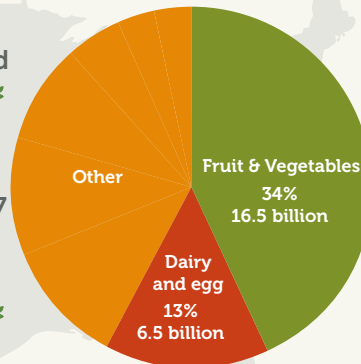


Organic sales reached

\$48.7bn in 2017
accounting for **5.5%** of
total food sales in the U.S.



Organic Market Share in the US

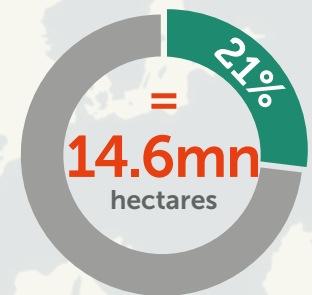


Europe

The **2nd** most important market for organics. Valued at **\$39.6bn** in 2017.

Largest concentration of organic food retailers in the world.

Global Organic Farmland



■ Europe ■ rest of the world

Latin America

Contains **8 million** hectares of organic farmland

Brazil is the largest organic products market in Latin America



Pão de Açúcar

is the leading Brazillian retailer for organics

China

China's organic food market is expected to grow to over **\$13bn** by the end of the year **2024**.

Certified organic products share of the nation's total food sales



Australia

With **35.67 million** hectares of organic farmland,

51% of the world's total

Neem's Role in Healthy Living

<p>4 Organic Disease Prevention</p>	<p>5 Medicinal Potential</p>	<p>6 Personal Healthcare</p>
--	-------------------------------------	-------------------------------------

The past two decades have seen over 2,000 research papers written on the benefits and uses of neem in healthcare. Neem is set to make the leap to usage in mainstream conventional medicines. As society looks for alternative, non-synthetic care, the plant is a viable option as a natural prevention and cure for a variety of health issues.

Mosquitoes - The World's Most Dangerous Animals

"It is impossible to calculate the harm that malaria has done to the world"

Bill Gates

Malaria is a killer responsible for an estimated 405,000 deaths worldwide in 2018

World Health Organization (WHO)

Malaria - The Human and Financial Cost

Malaria, one of the diseases spread by mosquitoes, is a killer responsible for an estimated 405,000 deaths worldwide in 2018. According to the WHO, there were 228 million cases of malaria globally in 2018. Though 3.4 billion people in 92 countries are at risk, Africa is the continent most vulnerable to the disease. 94% of malaria-related deaths occur on the African continent. Children are the most vulnerable to the disease, accounting for 67% of all malaria deaths worldwide.⁵⁶

There is also a substantial direct and indirect financial cost associated with malaria estimated at \$12 billion annually in just Africa, according to the CDC in 2014⁵⁷ (though it is interesting to note that \$12

billion is the same sum utilized by UNICEF in 2004, suggesting one of the figures is likely to prove highly conservative).

For governments, the costs include building, setting up and running health facilities, spraying, productivity and financial consequences of lost work days, and opportunities forgone for economic ventures and tourism.

Since 2007, philanthropist Bill Gates has made it his goal to eradicate malaria worldwide, a target he believes will be achieved during his lifetime. \$2.9 billion has been spent so far by the Gates Foundation on combatting malaria.

⁵⁶World Health Organization (2019) ⁵⁷Center for Disease Control and Prevention (2014)



The Tiger Mosquito can transmit more than 20 different diseases such as malaria, dengue, chikungunya, zika, and yellow fever.

The problems faced in fighting malaria can be divided into three:

- **A lack of funding**
- **Poverty, a key factor in malaria prevention and treatment**
- **Parasite resistance to antimalarial medicines and mosquito resistance to insecticides.**

What happens in the fight against malaria over the coming decades will dictate whether it can be eradicated or if conditions will deteriorate.

Successes...

There have been many victories in the fight against malaria. The incidence rate of malaria declined globally between 2010 and 2018, from 71 to 57 cases per 1000 population at risk.⁵⁸ It is impressive when one considers that **no vaccine exists against malaria**, so all of this has been achieved through preventative measures such as the elimination of mosquitoes, prophylaxis, and bite protection.

Threats...

Yet the fight against malaria characterizes many of the successes (and threats) confronting mankind's efforts to make the world a safer and healthier place. Consider the following issues:

The use of 'harsh' but effective pesticides such as Dichlorodiphenyltrichloroethane (DDT) to treat the disease has, with the value of hindsight, proved counter-productive. DDT's potency and effectiveness since its invention in the 1940s meant it was used extensively in the agricultural sector throughout the 1950s and 1960s. Sentiment towards it changed rapidly due to concerns about its effect on human health, the environment and wildlife, causing DDT to be banned worldwide by the early 1990s. Despite being banned across the US in 1972, adults in America were consuming an average of 0.8 micrograms of DDT daily between 1986 - 1991. DDT is highly resistant to metabolism, and thus remains stored in body tissue, exposing the body to this toxic chemical. Oral exposure in animals has been associated with liver cancer and pre-term birth. Additionally, the EPA has determined that DDT is a 'probable' human carcinogen.⁵⁹ It is also associated with neurological effects such as reduced motor skills and a decrease in verbal, memory, quantitative and perceptual performance skills in preschoolers. When exposed to higher levels of DDT, immediate neurotoxic effects such as tremors, seizures and vomiting occur.⁶⁰

However, nature has begun to fight back against DDT and other similar synthetic pesticides.

According to the 2019 World Malaria Report, there is growing parasite resistance to antimalarial medicines and mosquito resistance to insecticides that, if left unaddressed, could reduce the efficacy of currently available interventions and threaten malaria control and elimination efforts.⁶¹

To those assessing the concerns associated with antibiotic overuse, the dangers are eerily familiar. A common mosquito across five countries in the Greater Mekong sub-region of Southeast Asia is now resistant to most available antimalarial medicines. Between 2010 and 2018, 73 countries confirmed mosquito resistance to at least one insecticide. The number of countries that reported insecticide resistance to all four main insecticide classes used to date increased from 22 to 26.⁶² **Stimulated by a warming climate and wetter summers, the highly invasive and adaptable Asian Tiger Mosquito is spreading across parts of the globe previously considered malaria free, including across Europe. For example, malaria has been reported in Greece since 2011.**

The Tiger Mosquito presents a real challenge, acting as an effective conduit to humans for a further assortment of viruses including yellow fever, encephalitis and dengue, which together affect up to 100 million people every year.

Current Expenditure on Malaria Funding is Insufficient

In spite of the severity of malaria, it is no surprise to learn that global funding to control the disease is lower than estimated needs. According to the WHO, US\$ 2.7 billion was invested in malaria control and elimination efforts globally in 2018. The amount invested fell short of the US\$ 5 billion estimated to be required globally to stay on track towards the WHO's morbidity milestones. In a much more febrile financial climate, funding is significantly difficult to come by.⁶³

"We need extra resources. We can go a long way with what we have now, but we won't reach our global targets. We also need new, transformative tools for transmission reduction, improved diagnosis and improved case management. We are dealing with a very hard enemy."

Dr Pedro Alonso, Director, WHO Global Malaria Programme, 73rd United Nations General Assembly (2018)

Why Neem is a Key Solution - Effective & Low Cost

Naturally extracted as well as being a powerful, effective pesticide, neem has evolved from being a 'traditional' medicine to the subject of studies demonstrating its effectiveness in the reduction of malaria transmission. **A study co-authored by MIT and detailed in the Malaria Journal shows how neem seeds, dried, ground into a coarse powder and then sprinkled onto known mosquito larvae breeding grounds, resulted in 49% fewer adult females.**⁶⁴ As the study pointed out, targeting the larval phase of mosquitoes has three distinct strengths:

- **It is proven to work**
- **Low cost**
- **There is minimal environmental impact**

As the study pointed out, to be useful in the fight against malaria, the solutions must be both low cost and sustainable.

A number of recent field tests illustrate the success that neem has in the effective treatment of malaria. As Bill Gates noted, **"the cost of controlling it endlessly is not sustainable"**.

Low cost methods of eradication will be needed and independent trials do show Neem's effectiveness.

Mosquitoes are one of the deadliest animals in the world, with their ability to carry and spread disease to humans causing millions of deaths every year. Zika, dengue, chikungunya, and yellow fever, for example, are all transmitted to humans by the *Aedes aegypti* mosquito. More than half of the world's population live in areas where this mosquito species is present. The worldwide incidence of dengue has risen 30-fold in the past 30 years, and more countries are reporting their first outbreaks of the disease, making sustained mosquito control efforts more important than ever in order to prevent outbreaks from these diseases.⁶⁵



Neem Extract Can Be Used to Tackle Malaria

⁶³World Health Organization (2019) ⁶⁴Malaria Journal (2014) ⁶⁵World Health Organization (2020)

Neem's Future Uses in Medicine

Innovation is necessary in medicine to treat the variety of diseases that affect us every day, and renowned institutions such as the Mayo Clinic, Oxford University and the Massachusetts Institute of Technology are currently investigating the extensive health benefits of neem.

With over 200 compounds found to be effective against inflammation, infection, fever, skin disease and dental illness, neem is a clinically proven antimicrobial that is active against a variety of viruses

Neem does not disrupt the body's natural ecology, and unlike synthetic antibiotics, **fights bacteria without resulting in increasing levels of resistance over time.** Neem oil is an all-natural anti-fungal and anti-bacterial that is effective at **killing off bad bacteria without eliminating the good bacteria** the body needs to stay healthy.

Reducing Insulin Requirements for Diabetics

One person dies from diabetes every seven seconds. 387 million people are living with the illness today, with an increase of 205 million expected by 2035. Diabetes expenditure reaches \$825 billion globally, making the illness responsible for \$1 out of every \$9 spent on healthcare.⁶⁶

Neem delays the coagulation of blood, which calms erratic heart beats, hence, reducing potential heart disease and high blood pressure. For non-ketonic and insulin-sensitive diabetic patients, neem leaf extracts can reduce their insulin requirements by 30-50%.⁶⁷

Showing Clear Antiretroviral Activity

In 2018, 37.9 million people were living with HIV around the globe. 770,000 people died from HIV-related causes and 1.7 million people were newly infected. Although the number of new HIV infections has dropped by 37% since 2000, it is still prevalent in developing regions such as Africa, where two thirds of all people living with HIV live.⁶⁸

Neem leaves show clear antiretroviral activity in humans suffering with AIDS. Exhibiting significant improvements in CD4T cell levels, reduced levels of anemia and an average weight gain of six pounds, the examined HIV/AIDS patients in several clinical trials across Africa showed recovery and did not experience any adverse effects from the treatment.⁶⁹

The US National Institute of Health confirmed that neem extracts have been able to kill the AIDS virus.⁷⁰ Patents have been granted for these specific extracts as an alternative natural AIDS treatment.⁷¹

Sensitizing Cancerous Cells to Radiotherapy

Cancer is the cause of one in every eight deaths worldwide and is rapidly becoming a global pandemic. The cancer burden is expected to increase to 21.7 million cases and 13 million deaths per year in 2030.

Various compounds found in neem bark, leaves, seeds and seed oil have been used to combat cancerous cells with no registered side effects. Instead of targeting the cancer cells directly, the protein – Neem Leaf Glycoprotein (NLGP) – modulates cells that are responsible for providing immunity to the body present within the tumor environment and its peripheral system. Neem extracts have also been shown to sensitize cancer cells to immunotherapy and radiotherapy, and enhance the efficacy of chemotherapeutic agents. In-vitro studies by the Memorial Sloan Kettering Cancer Center have also demonstrated neem's ability to inhibit cancer cell growth.⁷²

The Department of Biochemistry and Microbiology from Rochester's Mayo Clinic has been researching neem since 2013, and are currently engaged in preclinical evaluation of neem's ability to inhibit prostate cancer tumor growth.

Uses in the Personal and Health Care Markets



Neem has proven its potential to aid mankind both in providing sustainable and safe agricultural practices as well as potential in the treatment of many diseases ranging from HIV to cancer. The phenomenal ability of this truly astonishing tree does not stop there, with major players in the personal care industry utilizing neem in their organic product lines.

Demand for organic cosmetics is increasing globally and the trend is developing towards multi-beneficial natural products, which is creating another high potential growing market. Utilized in various personal care and cosmetic products, neem offers a variety of health and lifestyle benefits with low to non-existent side effects.

Consumer concerns in the West, and also the emergent middle-class segments across the developing world, including China and India, about how cosmetics and personal products are formulated and manufactured continue to grow. The result is driving superior expansion in the organic personal care market, expected to reach US\$ 25.11 billion by 2025, at a CAGR of 9.4%.⁷³ The initial range of basic organic products is now becoming

more sophisticated and innovative with commensurately higher price points.

Neem has a substantive, high-end contribution to make in a variety of personal care and health areas, and it will be aided by a more favorable regulatory environment making it easier and cheaper to bring organic products to market. In 2018, the United States Department of Agriculture allocated \$1.87 billion for The Organic Environmental Quality Incentives Program (EQIP), which provides financial and technical assistance to organic farmers and to growers transitioning to organic production systems.

*The organic personal care market was estimated at USD **13.33 bn** in 2018 and is projected to reach US **\$25.11bn** by **2025**, at a CAGR of **9.4%***

Grand View Research (2019)

⁷³Grand View Research (2019)

Prospects in Cosmetics, Skincare & Oral Hygiene

Protecting and Rejuvenating Skin



Skin ageing depends on a variety of factors, including lifestyle, diet and genetics, though one factor remains consistent – the impact of drier and less elastic skin on our appearance.

With over 600 million people aged 65 or older alive today, and that figure forecast to double in the next 25 years, rising demand for skin care products will be a major catalyst for the \$123.8 billion industry⁷⁴, which is projected to reach \$183.03 billion by 2025 expanding at CAGR of 4.5%.⁷⁵

Neem contains four times the level of antioxidants that are found in cranberries, blueberries and artichokes, thoroughly limiting the production of skin-damaging free radicals. The high Vitamin E, fatty acid and emollient content of its oil improves elasticity and reduces wrinkles while moisturizing the skin.⁷⁶

Known for removing impurities and tightening pores, neem-based skin care products are now offered by cosmetic brands such as L'Oreal, Garnier, Avon, Shiseido and Dr. Hauschka, which highlights the very tangible potential of neem within the skin care industry.

Relieving the Symptoms of Acne



Acne Vulgaris (acne) is the most common skin disease in the world; it affects 80% of people aged between 11 to 30 years old⁷⁷ and the global market for acne related products will reach \$7.35 billion by 2025.⁷⁸

There is no cure for acne, **but quercetin, an antibacterial and anti-inflammatory compound found in neem oil, has been found to relieve its symptoms by reducing the level of bacteria in the skin while soothing redness and inflammation.** This was demonstrated in a clinical trial by the Reddy Memorial College of Pharmacy in India and published in the Journal of Acute Diseases (2013).

Many synthetic treatments for acne have been found to have adverse side effects. Roche's Accutane, a once popular 'miracle cure', was withdrawn from sale in the US as it was associated with causing birth defects, miscarriages and mental health issues. One of the many advantages of neem is that as an organic and non-toxic alternative, the treatment is not harmful to humans and has no adverse side-effects.

Relieving the Symptoms of Eczema



Atopic Dermatitis (eczema) is a recurring, non-infectious and inflammatory skin condition that affects 1 in 10 people in the world today.⁷⁹ The eczema therapeutics market is poised to grow by \$3.6 billion during 2020-2024 at a CAGR of over 9%.⁸⁰

Characterized by rashes appearing all over the body, eczema starts in childhood and can often resurface later on in life. Neem, with its antiseptic properties and high Vitamin E content, restores the skin's protective barrier and effectively soothes the symptoms of eczema.

In a scholarly review conducted by the Kolkata Institute of Chemical Biology and published in June 2002 by 'Current Science', **neem oil was shown to have a wide spectrum of antibacterial action against 14 different strains of pathogenic bacteria.**

Reducing Dandruff



In the US alone, 50 million people suffer from dandruff and a further 97% of the population are expected to have the condition at some point in their lives. Nearly \$300 million is spent every year on various treatment products.⁸¹

Neem oil helps to maintain the scalp's natural pH level of 4.5-5.5, serving as a protective mechanism by inhibiting the incidence of dandruff while also reducing its severity. Clear relief after applying a neem remedy was demonstrated in a clinical trial published in the African Journal of Biotechnology (2006).

Strengthening Hair and Stimulating Growth



Valued at \$ 87.73 billion in 2018⁸², the global hair care market is projected to grow at a CAGR of 3.68% over the forecast period of 2018-2024.⁸³

Hair loss affects two-thirds of men by the time they reach 35 years old, and by age 50, the proportion increases to 85%.⁸⁴ Factors responsible range from genetics to stress, while the inevitability of the aging process will also see the quality of hair deteriorate over time.

Neem oil, when applied to the scalp, improves blood circulation and boosts the immune system. Proven to reduce hair loss, neem also enhances the rate of hair growth.⁸⁵ The linoleic, oleic and stearic acids in neem nourish and condition hair to restore its natural texture.

Head Lice



Pediculus capitis, also known as Head Lice, are highly contagious⁸⁶, infesting up to 12 million children in the US every year and hundreds of millions worldwide.

Neem offers a healthy and effective alternative to synthetic treatments that are often toxic and can prove ineffective if the lice have developed resistance. Eradicating lice during all stages of the life cycle, while decreasing their appetite to the point of starvation, neem oil acts as a prophylactic agent, effectively preventing the spread of infestation.⁸⁷

Licener, an anti-lice shampoo based on neem seed extracts, successfully eliminated head lice infestation after a single use in a clinical study by the US National Institute of Health in 2012.

Safeguarding Oral Hygiene



Oral hygiene, which primarily comprises toothpastes, toothbrushes and mouthwashes, is one of the categories with the largest potential in the personal care sector. Globally, the oral care market reached \$44.5 billion in 2019 and is expected to reach \$53.3 billion by 2025 at a CAGR of 3%.⁸⁸

Neem bark, the active ingredient used in a variety of toothpaste and mouthwash products plays a vital role in preventing gum disease, reducing plaque and eliminating bacteria.

Neem's antibacterial properties stop bacteria from sticking to teeth and turning into plaque, while also preventing and treating gingivitis. Minimizing the amount of bacteria in the mouth with neem also helps prevent cavities and eliminates bad breath.

⁸¹Manual, F. and Ranganathan, S. (2011) ⁸²Statista (2019) ⁸³Infinium (2018) ⁸⁴American Hair Loss Association (2015) ⁸⁵Puri, H.S (2005) ⁸⁶Centers for Disease Control and Prevention (2012) ⁸⁷Livestrong (2014) ⁸⁸Research and Markets (2019)

Neem's Additional Roles

7

Organic
Pet Care

8

Carbon
Reduction

9

Resilient
Timber

A Powerful All-Natural Solution for the Growing Pet Care Market

Over two-thirds of American households own at least one pet. The US pet care market was valued at **\$72.14bn**, in 2018. Globally, the market was valued at \$190.1 and is expected to reach **\$269.9 bn** by 2025 at a CAGR of **5.2%**

Global Market Insights (2019)

Pet ownership in the US has increased from 56% of households in 1988 to 68% in 2018 – with a total of 89.9 million homes owning one or more pets.⁸⁹ Coinciding with increasing numbers of baby boomers reaching retirement, a large segment of the population are buying pets for companionship. Further catalysts for rising pet ownership are high divorce rates and young people marrying later, so there are more single-member households in the US than ever before.

Throughout Asia there are even higher levels of demand for pet care products. China has one of the world's lowest birth rates, and an increasing number of middle class couples are spending their time and money on pets rather than children. Ownership rates are expected to rise rapidly across China, where the total number of pet dogs and cats currently exceeds 90 million. The market

is estimated to show the fastest growth at 14% over the 2019-2025 period.⁹⁰

Even at times of financial difficulty, 81% of pet owners spend the same amount or more on their companions⁹¹, proving the industry is effectively recession-proof and that pet care products see consistently high demand regardless of fluctuations in price.

Neem oil's antifungal and antiseptic properties are utilized in many pet care products. Ranging from shampoos, creams and wipes, these products repel fleas and ticks, heal ringworm, soothe infections, treat mites and mange and reduce itchiness.⁹²

A Leader in Carbon Offsetting

Climate Change is a complicated situation and certainly not one that can be contributed to a single cause or a simple solution, but there is a generally accepted consensus that the burning of fossil fuels and the subsequent production of greenhouse gases (GHGs) is one contributing factor behind the earth's warming temperatures. **That humanity has caused a substantial rise in atmospheric carbon-dioxide levels over the past centuries, thereby contributing to global warming, is beyond debate for most, including the United Nations and the vast majority of its members.**

The pressure for governments and industries to mitigate this result of economic growth and industrialization has been enshrined in climate protocols. These acknowledge the need for highly populated, emerging economies like China, India and Brazil to fast track growth while accepting that a major cost component, to be shared globally, is GHG.

Businesses (and households) can compensate for the release of GHG by funding emission reduction projects that will:

- **Replace the use of fossil fuels with renewable energy**
- **Reduce the use of fossil fuels with energy efficiency**
- **Capture and store already released carbon in trees or plants**

Benchmarking the Impact of Climate Change

For the first time, legally binding targets were set for 37 industrialized countries to cut GHG emissions by at least 5% below 1990 levels during the period 2008-2012 in the first commitment of the Kyoto Protocol of 1997. The second commitment, based on revised targets,

began in January 2013 and will end in 2020. The goal is to keep global temperature rises to 2 degrees Celsius above the pre-industrial age global mean. Failure to keep within these limits could see global mean temperatures rise by 3-4 degrees Celsius. To achieve the set targets, both compliance and voluntary carbon markets were established. Two aspects underpin the compliance section of the market:

- **Emissions Trading, which is the transfer of any surplus climate change credit allowance from one industrialized country to another**
- **Carbon polluters can take part in projects in developing countries to offset exceeding their allowance or as an alternative to reducing their domestic emissions**

Both countries and organizations can buy or sell carbon credits from other countries and organizations.

A carbon credit is the unit of measurement that represents the removal of one ton of carbon dioxide equivalent from the atmosphere. Both countries and organizations can buy or sell carbon credits from other countries and organizations. For companies, the voluntary aspect to carbon credits will be driven by a multitude of factors including **peer pressure, corporate social responsibility, shareholder/stakeholder demand and the less altruistic but equally valid one of being regarded as "responsible"**.

Neem as a Greenhouse Gas Offset Solution

A number of features make neem attractive for corporations or investors looking to set up plantations as a direct or offset method

of GHG reduction. By utilizing available atmospheric CO² in photosynthesis, tree plantations provide a simple and effective natural 'sink' for manmade pollutant activities. **As long-term entrapment is key, so neem's longevity is key.**

For those examining the benefits of plantations, neem trees tick off many of the boxes for driving sustainability. **It has a high rate of photosynthesis and liberates more oxygen than many other tree species**, being able to 'fix' more than 14 μmol of CO² m⁻¹ sec⁻¹. **The tree can also live for up to 200 years.**

A hardy, drought resistant tree with thick foliage, a single trunk, very high leaf surface area and a wide canopy, neem provides a good platform for maximum CO² fixation, able to provide a shield against other pollution components, particularly SO². On a practical, day-to-day level, **neem trees can tolerate high levels of carbon dioxide and sulphur dioxide, both emissions that are prevalent in cities with high levels of traffic.**

Urban Pollution

In Bangalore, one of India's fastest growing cities, studies show that streets with suitable tree coverage, such as neem, have lower average temperatures, humidity and pollution. Afternoon ambient temperatures of 30°C can be lowered by as much as 19% (5.6°C), while road surface temperatures can be reduced by 2.75°C and SO² levels by as much as 65%. Suspended particulates, comprising particles that may be as small as 2.5 micrometers and made up of hundreds of different chemicals including SO² and NO² emitted from cars, had very high levels on the city's exposed roads. 50% of these had particulate levels twice the permissible limits. In contrast, 80% of streets with trees had particulate levels within prescribed limits.

Rising Demand For Forest Carbon Offsets

As a result of international negotiations and domestic policies on how to address climate change, citizens and companies have forged ahead to protect their forests by valuing the carbon stored within forests and natural landscapes. In 2016, NGO Forest Trends tracked over \$662 million that went towards purchasing carbon offsets produced by 150 projects that are restoring or protecting forests. These 150 forest carbon projects alone cover 12 million hectares of land, and it is estimated that over 1,500 projects exist worldwide. Since 2009 a cumulative \$2.8 billion have gone into improving, maintaining, or restoring forests' ability to store carbon.⁹³

Range of Organic Carbon Sequestration by Tree		
Common Name	Species	Organic Carbon Sequestration (ton/tree/yr)
Moringa	<i>Moringa oleifera</i>	15.78
Neem	<i>Azadirachta indica</i>	12.27
Royal Poinciana	<i>Delonix regia</i>	12.25
Copperpod	<i>Peltophorum pteocarpum</i>	9.58
Acacia	<i>Acacia nilotica</i>	9.25
Indian Rosewood	<i>Dalbergia sissoo</i>	7.21
Palash	<i>Butea monosperma</i>	3.55
Lebbek Tree	<i>Albizia lebbek</i>	2.42
Nagpur Teak	<i>Tectona grandis</i>	1.92
Lemon Eucalyptus	<i>Eucalyptus citriodora</i>	1.81

Source: North Maharashtra University, India (2014)

"Healthy forests are a key defense against the natural and socio-economic impacts of climate change"

Forest Trends' Ecosystem Marketplace (2013)

One of the Most Resilient Timbers on the Planet

Neem is derived from the same plant family as the mahogany tree, making it an extremely durable wood and one of the most hardwearing and resilient timbers available on the planet. **A durable, termite resistant, relatively heavy timber**, neem wood is also utilized in building construction, agricultural implements, tool handles, fence posts and furniture.

Neem trees can yield harvests of around 12.5m³ (40 tons) of high quality compact wood per hectare, which will meet the

growing demand for light-coloured neem wood utilized for household furniture.

Globally, all managed forests generate approximately \$100 billion in wood removals and \$18.5 billion in other forest products per annum, which is fueled by over \$64 billion in investments.⁹⁴ The annual global exports for primary and secondary wood products that originate from tropical forests, such as the Brazilian Amazon, have seen average revenue of \$20 billion in the past five years up until 2015.⁹⁵

Neem exists in 80 countries around the world, consisting of 91 million trees.⁹⁶ India is the main producer of neem, with 16% of the world's total growing inside its borders.⁹⁷ Outside South Asia, the commercial cultivation of this valuable tree is limited, but coverage has spread across lowland regions of Africa, the Middle East, the Americas, Australia and the South Pacific. **Production patterns are expected to change, with Brazil⁹⁸ and China⁹⁹ set to establish themselves as major competitors and leading producers of neem in the future.**

Neem - Ahead of the Curve

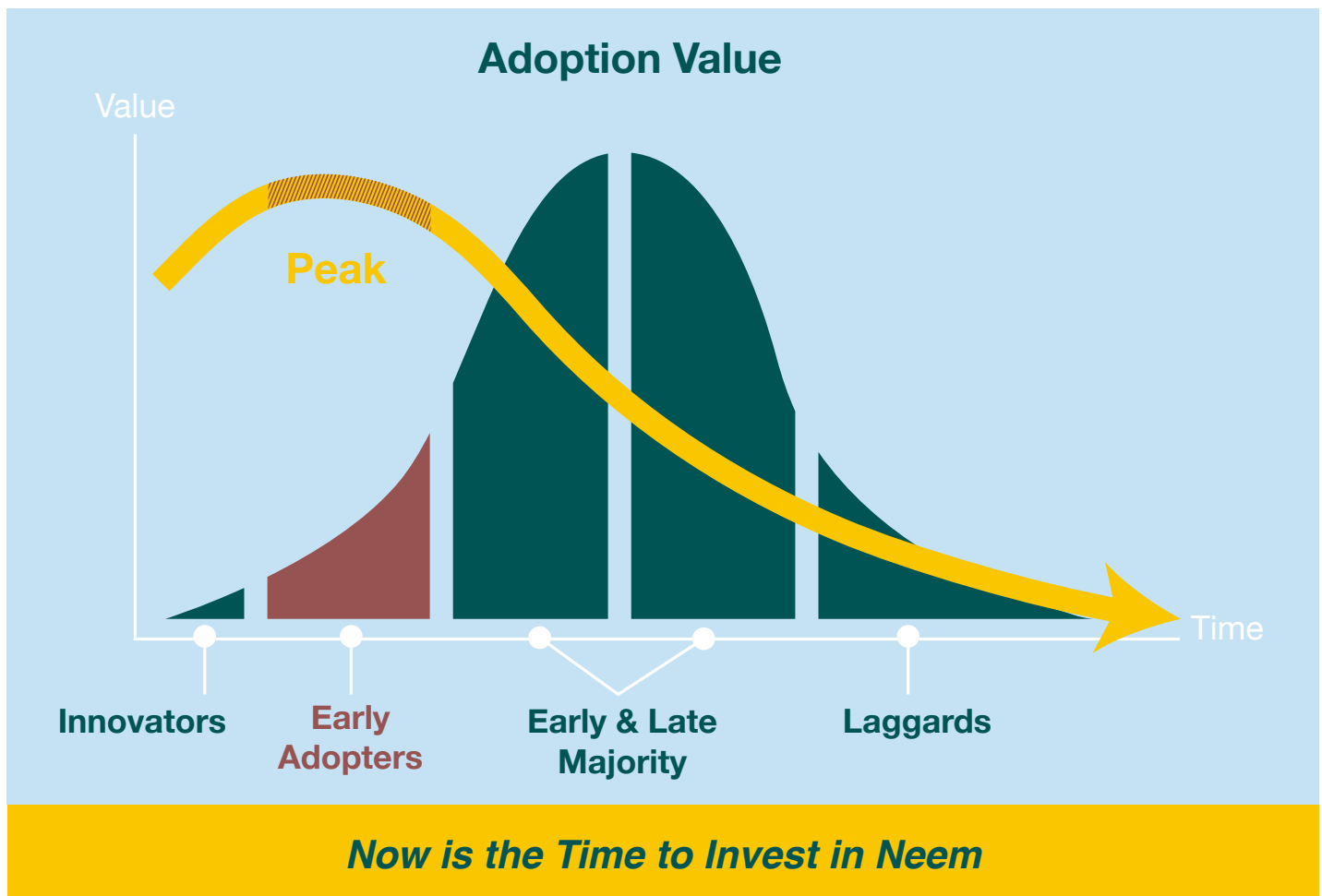
Investors in neem-related products are those who appreciate the opportunity of being ahead of the curve. As an Early Adopter, investors will be in the very best position to catalyze a revolutionary transformation across these sectors, while at the same time maximizing returns in a sustainable and socially responsible manner.

A bell curve tracks best how new products and ideas spread through the marketplace. The curve begins with innovators, then moves rapidly to early adopters, who enjoy the maximum value from a new product's introduction, before spreading across the rest of society, eventually reaching the laggards, by which time commoditization and ubiquity will nullify much of the value the product started with.

The idea of a diffusion curve (originated by Geoff Moore) shows how a successful business innovation travels from left to right over time and affects ever more consumers until it finally reaches everyone. The X-axis shows the different groups an idea encounters over time, while the Y-axis shows the number of people in each group.

The greatest value accrues at the beginning of the peak. Innovators often spend considerable time and financial resources in getting their idea beyond the concept stage. By that point they often don't have the necessary capital to take the next step, allowing them to benefit from their hard work and make the transition to success. This is where early adopters get involved. By providing support in whatever form required, and often based on their experience at this stage of proceedings, early adopters can help to bring the product or innovation to market.

Being 'ahead of the curve' rewards early adopters. It allows them to participate once the concept has been proved, on what are usually highly attractive terms, way ahead of the majority of their peers or the population at large. Yet the value peak only starts near its apex, underplaying how long it took to reach that position and showing how the period of maximum value is relatively short compared to that of the tail.



We Participate in the UN Global Compact

As an organization that focuses on ethical and sustainable projects, Primal Group gladly supports the United Nations (UN) chartered principles on human rights, labor, environment and anti-corruption.

We are part of a fast growing network of businesses and other stakeholders seeking to build prosperous and thriving societies around the world. With more than 8,343 participating companies from 135 countries, as well as over 3,000 non-business participants (as of January 2016), the Global Compact has emerged as a truly global initiative with a strong presence in both developing and developed nations.

By promoting sustainable development, employing sound corporate citizenship and building a set of values based on universally accepted principles, we are

shaping the environment that is critical for business and society to thrive.

As participants of the UN Global compact, we gladly endorse the ten principles and affirm our commitment to implementing and upholding them in all aspects of our business and across all of our spheres of influence. We ensure that the Global Compact is a fundamental part of the strategy, culture and daily operations of Primal Group, and we continue to engage in collaborative projects that advance the broader development objectives of the United Nations.

We continually strive to generate sustainable value that will help shape the environment that is crucial for life and business to thrive.



We, as approved, active participants, abide, support and promote:

The Universal Principles of the Global Compact

1. *To support and respect the protection of internationally proclaimed human rights.*
2. *To ensure that we are not complicit in human rights abuses.*
3. *To uphold the freedom of association and the effective recognition of the right to collective bargaining.*
4. *To uphold the elimination of all forms of forced and compulsory labor.*
5. *To uphold the effective abolition of child labor.*
6. *To uphold the elimination of discrimination in respect of employment and occupation.*
7. *To support a precautionary approach to environmental challenges.*
8. *To undertake initiatives to promote greater environmental responsibility.*
9. *To encourage the development and diffusion of environmentally friendly technologies.*
10. *To work against corruption in all its forms, including extortion and bribery.*

Final Thoughts From Our Chairman & CEO

If Neem Has Such Wonderful Potential, Why Hasn't it Been Utilized Until Now?

The Green Revolution of the 1960s was a turning point in modern agriculture that **heralded a drastic increase in global production through a series of research, development and technological innovations, saving one billion people from starvation.** Although these developments enabled our rising population to thrive well into a new millennium, **farming techniques now rely on an unsustainable amount of water, energy and agrochemicals,** often with little regard to any long-term adverse affects to our environment. The environmental cost of conventional farming techniques is now mounting, with **irrigation systems pumping water from reservoirs faster than they are being recharged, toxic herbicides and insecticides accumulating in ground and surface waters and chemical fertilizers disrupting ecosystems and contaminating our food chain.** The major agricultural corporations responsible for such drastic innovation made the choice to develop synthetic, man-made compounds that mimicked nature and the many beneficial plants and trees that already exist. Their decision was rooted in a sole obligation to create profit for shareholders, without a full understanding of their products' impact to society or

the environment. By creating a product that did not exist naturally, and was not produced by any other party, they were able to inflate value. In comparison to natural products, man-made products suffer from less competition, are not dependent on outside cooperation to achieve success, and don't need to compete with what nature provides. In essence, **man-made products can be monopolized, whereas natural products cannot. Corporations were therefore unconcerned, ignorant of and oblivious to the medium to long-term damages caused by synthetic pesticides and synthetic fertilizers.**

Since the late 19th century, the United States Supreme Court has ruled that corporations are in fact 'persons'. This has initiated a major conflict. We, as humans, naturally incorporate moral considerations into our decision-making processes that corporate 'persons' need not take into account. **If a corporation's sole purpose is to generate profit for its shareholders, those employed by a corporation inherit that very same obligation.** This created an unfortunate situation whereby even moral beings employed by a corporation put **profit before morality,** ensuring that

the corporation became, in essence, a psychopath, obsessed with a sole purpose: to generate profit, no matter the price.

Historical Psychopathic Nature of Corporations

- ☑ *Callous disregard for the feelings of others*
- ☑ *Incapacity to maintain enduring relationships*
- ☑ *Reckless disregard for the safety of others*
- ☑ *Deceitfulness: repeated lying and conniving others for profit*
- ☑ *Incapacity to experience guilt*
- ☑ *Failure to conform to social norms with respect to lawful behaviors*

The Corporation: The Pathologica Pursuit of Profit and Power - Professor Joel Bakan 2015

Jan
2020

Global Digital Snapshot

A snapshot of the world's key digital statistical indicators

Total
Population



7.68
Billion

Active
Internet Users



4.54
Billion

Active Social
Media Accounts



3.8
Billion

Unique
Mobile Users



4.18
Billion

Active Mobile
Social Accounts



3.75
Billion

Statista (2020)

Fortunately, since the turn of the century, **internet use has catapulted from non-existence 30 years ago to just over 4.5 billion active users worldwide today. With 300 billion emails sent, 8.4 billion YouTube videos watched and 5 billion Google searches conducted every single day, we are now living in a society that is ever more informed, educated and empowered than ever before.**

Society is no longer prepared to allow corporations to make profit at any price. The corporate structure of the past made it impossible for even well meaning company directors to consider moral obligations, as they were obliged to carry out their one objective. Now though, the captains of industry have been empowered to a higher level of morality. **By demanding corporations to become socially responsible, the consumer is setting the parameters of how providers must behave.**

Company directors across the globe are starting to make high moral, socially responsible and sustainable decisions that they were previously not able to. In fact, it is now **imperative that they do so in order for their corporations to survive.** An alignment of interests between the corporation and society is finally arriving. **Companies that fail to do good**

business will do no business at all.

Hence, moral behavior is now becoming an obligation of corporations in order to generate greater profit.

We have evolved to appreciate that existence is interdependent, that we must work together, create mutually beneficial systems of practice that build prosperity for all. **Profit at any price is no longer the acceptable norm.** If there is a more cost effective and sustainable way, it must be taken. **The public is no longer accepting the psychopathic nature of corporate "persons". There is a moral code of conduct that must be adhered to. Investing in products such as neem is not about simple diversification, comparable to traditional past investments. It is about investing in mankind's future, understanding the movement, the culture shift, being part of the solution and profiting from it.**

Profit is essential in order for something to become part of our lives, and for it to last.

Creating benefits for people and the planet is the most challenging frontier

for entrepreneurs. As governments step back from providing basic services, and as the need to tackle our local and global issues continues to grow, we have an opportunity to invent, respond to the needs of mankind and truly make change. We can change our practices, create sustainability and create a more prosperous world for all. I encourage as many as possible to add a new dimension to their lives, their business and their investments. **By adding sustainability now, we are acting ahead of the curve, the most advantageous position to be in.**

"The great thing is that, with technology, we've also become far more aware not just of what is happening in our own neighborhood, but of what is happening on the other side of the world. This technology has also smashed through the top-down approach and shifted the power to the people."

Sir Richard Branson

Bibliography

- Absolute Market Insights. Organic Food And Beverages Market 2019-2027 (2019)
- Agency for Toxic Substances & Disease Registry. Public Health Statement for DDT, DDE, and DDD (2002)
- Agency for Toxic Substances and Disease Registry. Prenatal Exposure to Pesticides and Childhood Brain Cancer (2009)
- Alliance for the Prudent Use of Antibiotics. New Antibiotic Development: Barriers and Opportunities (2012)
- Allianz SE. The Fifty Greatest Breakthroughs Since the Wheel (2013)
- American Hair Loss Association. Hair Loss (2015)
- American Veterinary Medical Association. US Pet Ownership Statistics (2012)
- Anyaehe, Ugochukwu. Medicinal Properties of Fractionated Neem Leaf Extract (2009)
- APPA. 2019-2020 National Pet Owners Survey (2019)
- ASD Reports. Eczema Therapeutics Market is Forecast to Show Significant Growth to 2018 (2012)
- Baum Hedlund Law. Monsanto Roundup Trial Schedule (2020)
- BBC. EU Member States Support Near-Total Neonicotinoids Ban (2018)
- BCC Research. The Pet Industry: Food, Accessories, Health Products & Services (2015)
- Beyond Pesticides. Health Effects of 30 Commonly Used Lawn Pesticides (2013)
- British Journal of Nutrition. Higher Antioxidant Concentrations and Less Pesticide Residues in Organically Grown Crops (2014)
- Business Insider. The US Just Banned 12 Pesticides That Are Like Nicotine for Bees. Here's How Dangerous They Are (2019)
- Carbon Disclosure Project. Global Forest Report (2014)
- Centers for Disease Control and Prevention. Antibiotic Resistance Threats in the United States (2013)
- Centers for Disease Control and Prevention. Antibiotic Resistance Threats in the United States 2019 (2019)
- Center for Disease Control and Prevention. Impact of Malaria (2014)
- Centers for Disease Control and Prevention. Head Lice – Epidemiology & Risk Factors (2012)
- Centers for Disease Control and Prevention. Fourth National Report on Human Exposure to Environmental Chemicals (2015)
- Coherent Market Insights. Skin Care Products Market Size, Share & Trends Analysis Report, By Product, By Region And Segment Forecasts, 2019 – 2025 (2019)
- Dhaliwal, G. S., R. Arora and O. Koul. Neem Research in Asian Continent: Present Status and Future Outlook (2004)
- Environmental Protection Agency. Nitrates and Nitrites – Toxicity and Exposure Assessment for Children's Health (2012)
- Environmental Protection Agency. Pesticides Health and Safety (2014)
- European Nitrogen Assessment. Sources, Effects and Policy Perspectives (2012).
- Federation of American Societies for Experimental Biology. Seeking HIV Treatment Clues in the Neem Tree (2012)
- Filho, Wilson. The Neem Project (2005)
- FiBL & IFOAM. The World of Organic Agriculture (2019)
- Franchise. Pet Care Industry Analysis (2015)
- Future Market Insights. Oral Care Market (2014)
- Foodprint. California May Be Next to Ban Dangerous Chlorpyrifos (2019)
- Food and Drug Administration. Fact Sheet: Veterinary Feed Directive Final Rule and Next Steps (2019)
- Forest Trends. State of Forest Carbon Finance 2017 (2017)
- Global Data. Acne – Drug Pipeline Analysis and Market Forecasts to 2016 (2010)
- Global Market Insights. Pet Care Market Size By Type, Pet Care Products, Services, By Animal, By Distribution Channel, Industry Analysis Report, Regional Outlook, Application Potential, Price Trends, Competitive Market Share & Forecast, 2019 – 2025 (2019)
- Grand View Research. Organics Market (2013)
- Grand View Research. Organic Foods And Beverages Market Analysis By Product (Fruits & Vegetables, Meat, Fish & Poultry, Dairy Products, Frozen & Processed Food), Organic Beverages (Non-Dairy, Coffee & Tea, Beer & Wine), And Segment Forecasts, 2018 – 2025 (2019)
- Grand View Research. Organic Personal Care Market Size, Share & Trends Analysis Report By Application (Cosmetics, Skin, Oral, Hair Care), By Region, And Segment Forecasts, 2019 – 2025 (2019)
- GS & PA Research, Food & Agricultural Organization. World Population & Arable Land, 1960-2020 (2012)
- HDRA – The Organic Organization. The Neem Tree (2015)
- Infinium. Hair Care Market (Product - Shampoos, Styling Gels, Hair Spray, Hair Oil, Conditioners and Colorants; Distribution Channel - Pharmacies, E-Commerce, Specialty Stores, Direct Selling, Salons and Hypermarkets & Retail Chains): Global Industry Analysis, Trends, Size, Share and Forecasts to 2024 (2018)
- Inkwood Research. Global Biopesticides Market Forecast 2020-2028 (2020).
- International Diabetes Foundation. Diabetes – Facts and Figures (2015)
- International Fertilizer Industry Association. Fertilizer Outlook 2013 – 2017 (2013)
- International Food Policy Research Institute. 'Green Revolution – Cure or Blessing?' (2012)

International Food Policy Research Institute. Green Revolution: Cure or Blessing? (2012)	Natural Resources Defense Council. Food Farm Animals and Drugs (2015)	Trends Analysis Report, By Product, By Region And Segment Forecasts, 2019 – 2025 (2019)
International Institute for Applied Systems and Analysis. Fertilizer Nutrient Imbalance to Limit Food Production (2014)	Natural Resources Defense Council. Pesticides – What You Need to Know (2014)	Review on Antimicrobial Resistance. Tackling a Crisis for the Health and Wealth of Nations (2014)
JD Supra LLC. EPA versus the State of California: An Important Glyphosate Update (2019)	Nature. Pesticides Spark Broad Biodiversity Loss (2013)	Research and Markets. Oral Care/Oral Hygiene Market by Product (Toothbrush (Manual, Electric, Battery-Powered), Toothpaste, Mouthwash, Dental Floss, Teeth Whitening), Distribution Channel (Consumer Store, Retail Pharmacy, e-commerce), Region - Global Forecast to 2025 (2019)
Leon C. Megginson. 'Lessons from Europe for American Business,' Southwestern Social Science Quarterly (1963)	Nature. The Impacts of Climate Change on Water Resources and Agriculture in China (2010)	
Livestrong. Neem Bark Benefits (2015)	Neem Tree Farms. Pet Care (2015)	Research Nester. Organic Fertilizers Market: Global Demand Analysis & Opportunity Outlook 2024 (2019)
Livestrong. Does Neem Benefit Your Skin? (2014)	Netherlands Environmental Assessment Agency. The Price of Protein (2014)	Smithsonian. Oceanic Dead Are Getting Worse (2014)
Livestrong. Neem Oil for Head Lice (2014)	Nicoletti, M., P. Del Serrone and K. Murugan. Current Mosquito-Borne Disease Emergencies in Italy and Climate Changes – The Neem Opportunity (2015)	Stephanie Seneff. Information on Glyphosate (RoundUp) (2015)
Malaria Journal. Efficacy of Local Neem Extracts for Sustainable Malaria Vector Control (2008)		
Malaria Journal. Funding for Malaria Control, 2006 – 2010 (2014)	NOAA National Centers for Environmental Information. Global Climate Report - Annual 2019 (2019)	Statista. Acne Treatment Market Size Worldwide 2016 and 2025 (2019)
Malthus T.R. 'An Essay on the Principle of Population' (1798)	Optimum Population Trust. Too many people: Earth's population problem (2010)	Statista. Size of the Global Hair Care Market from 2012 to 2025 (2019)
Manual, F. and Ranganathan, S. A New Postulate on Two Stages of Dandruff: A Clinical Perspective (2011)	Organic Monitor. The Global Market for Organic Food & Drink (2010)	Statista. Worldwide Digital Population as of January 2020 (2020)
Massachusetts Institute of Technology. Glyphosate – Pathways to Modern Diseases (2013)	Organic Authority. Invisible Monsters – 5 of the Most Common Pesticides (2011)	Stephanie Seneff. Massachusetts Institute of Technology (2014)
Memorial Sloan Kettering Cancer Center. Integrative Medicine – Neem (2014)	Pesticide Action Network North America. 'Pesticides 101 – A Primer' (2015)	Technavio. Eczema Therapeutics Market by Indication and Geography - Forecast and Analysis 2020-2024 (2019)
Michael CR Alavanja. 'Pesticide Use and Exposure Extensive Worldwide,' Reviews on Environmental Health (2009)	Pesticide Action Network, Pesticides in Our Bodies (2015)	The Guardian. Neem – Nature's Pharmacy (2002)
Modor Intelligence. Crop Protection Chemicals (Pesticides) Market - North America Industry Growth, Trends and Forecasts (2020 - 2025) (2019)	Pesticide Action Network. The DDT Story (2013)	The Guardian. European Parliament Approves Curbs on Use of Antibiotics on Farm Animals (2018)
National Geographic. Fertilized World – A Mixed Blessing (2013)	Pimentel, D. & Peshin, R. Integrated Pest Management: Pesticide Problems (2014)	The New York Times. Strategic Spending on Organic Foods (2008)
National Institute of Arthritis. Musculoskeletal and Skin Diseases, What is Acne? (2014)	Pimentel, D. & Peshin, R. Integrated Pest Management: Innovation-Development Process (2009)	Time Magazine. This Year's Gulf of Mexico's Dead Zone Could be the Biggest on Record (2013)
National Institute of Arthritis. Musculoskeletal and Skin Diseases, What is Acne? (2014)	Population Institute. From 6 Billion to 7 Billion – How Population Growth is Changing and Challenging Our World (2011)	Tiwari, Ruchi. Neem and its Potential for Safeguarding Health of Animals and Humans (2014)
National Resources Defense Council. Issue Paper 12-06-B (2012)	Princeton Environmental Institute. Global Livestock Antibiotic Use (2015)	Toxics Actions Center. The Problem With Pesticides (2012)
Natural Environment Research Council. Excessive Nitrogen Harms the Economy and the Environment (2011)	Puri, H.S. Neem: The Divine Tree (2005)	Transparency Market Research. Global Scenario, Trends, Industry Analysis, Size, Share and Forecast 2011 – 2017 (2014)
	Reportbuyer. Skin Care Products Market Size, Share &	UK National Audit Office. Malaria Press Release (2013)

- UN and the University of Washington. World Population Stabilization Unlikely This Century (2014)
- UN Food and Agricultural Organization. Agriculture Towards 2050 (2012)
- UN Food and Agricultural Organization. ESA Working Paper No. 12-03 (2005)
- UN Food and Agricultural Organization. Food Loss and Food Waste (2015)
- United Nations Environment Programme, Food Waste Facts (2014)
- United Nations Environmental Programme. The UN's Tree of the 21st Century (2012).
- United Nations Forum on Forests. Changing Futures, Social Choices and Forest Contributions (2013)
- United Nations Population Division. World Population Prospects (2015)
- United Nations Population Division. World Urbanization Prospects (2014)
- US Geological Survey. Pesticides in Groundwater (2015)
- Wegener, M. and Tinghui, Xin. Potential Benefits of Establishing A Neem Industry in China (2003)
- World Bank. Per Capita GDP (Current US\$) (2015)
- World Economic Forum, The Dangers of Hubris on Human Health (2013)
- World Health Organization, The Impact of Pesticides on Health (2004)
- World Health Organization. 10 Facts on HIV/AIDS (2014)
- World Health Organization. World Malaria Report: Factsheet (2019)
- World Health Organization. Mosquito-Borne Diseases (2020)
- World Health Organization. HIV/AIDS Key Facts (2019)
- World Health Organization. World Malaria Report 2019 (2019)
- World Watch Institute. Beef is Much More Water Intensive than Many Staple Foods (2014)
- Yale Environment 360. The Nitrogen Fix: Breaking a Costly Addiction (2009)
-

*In a world **DESPERATELY** needing
SUSTAINABLE solutions,
the **ONUS** is upon **US** to **MAKE HISTORY**,
or we will be **VILIFIED** by it.*

Tomorrow's Child

by Glenn Thomas

*Without a name; an unseen face
and knowing not your time nor place
Tomorrow's Child, though yet unborn,
I met you first last Tuesday morn.
A wise friend introduced us two,
and through his shining point of view
I saw a day that you would see;
a day for you, but not for me
Knowing you has changed my thinking,
for I never had an inkling
That perhaps the things I do
might someday, somehow, threaten you
Tomorrow's Child, my daughter-son
I'm afraid I've just begun
To think of you and of your good,
Though always having known I should.
Begin I will to weigh the cost
of what I squander; what is lost
If ever I forget that you
will someday come to live here too.*

In memory of Ray Anderson (Interface)

July 28th 1934 – August 8th 2011

Disclaimer

This report has been prepared by The Primal Group, herein referred to as "Primal Group". The information contained within this document has been provided as a general commentary solely for the intended recipient and is for information purposes only. This document does not constitute legal, tax, accounting, investment and/or other professional commentary and/or advice. This material is for your information and is not intended as an offer, or a solicitation of an offer, to buy or sell any investment or other specific product. All information and opinions as well as any prices indicated are current as of the date of this report, and are subject to change without notice. The information has been collected from sources (including third party content providers) that Primal Group believe to be reliable and all reasonable care has been taken to ensure that the information contained is not untrue or misleading, although Primal Group will not vouch for its accuracy or validity. To the extent that the content may include statements about future events, such statements are derived from Primal Group's analysis and are subject to a number of risks, uncertainties and market behaviors, and should not be taken as reason for, or advice for, financial decision-making.

This document has been prepared on the basis of reasonable endeavors and constitutes Primal Group's judgment on the date of preparation, and may be subject to change without notice. Primal Group bears no obligation to update this document on the basis of subsequent information or in light of specific events.

All materials on this report, including the information, design, graphics and photographs are the copyright of © Primal Group 2020. The unauthorized use and/or duplication of this material without express and written permission from Primal Group are strictly prohibited.

The information contained herein has been prepared without taking into account the investment objectives, financial situation or needs of any particular person, organization or entity. Primal Group accepts no liability for loss arising from use of this material. Primal Group is not responsible for the redistribution of our information by third party aggregators. Those unsure of an investment's suitability for their circumstances should always seek professional advice.

Copyright © Primal Group 2020. All rights reserved.



✉ info@primalgroup.com

🌐 primalgroup.com