



 agripower®

**This crop feeds  
more than half the  
world's people.  
It also accounts for  
50% of crop GHG's.**

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**21st century farmers the world over, big and small, are at the forefront of change and challenges: making a living, feeding our world and being a friend to planet Earth.**

# Agripower

Agripower Australia Limited (Agripower) produces the world's leading silicon fertiliser, **Agrisilica®**. Containing exceptionally high concentrations of **Plant Available Silicon (PAS)**, **Agrisilica®** is now being exported internationally.

Agripower owns the world's largest resource of plant available silicon or 'PAS' - arguably the most exciting development to fertilisers in decades. With around 2 billion tonnes of 'amorphous silica' - the source of PAS, the resource has a life expectancy of 200 years. Agripower is the only bulk producer of commercially available PAS worldwide.

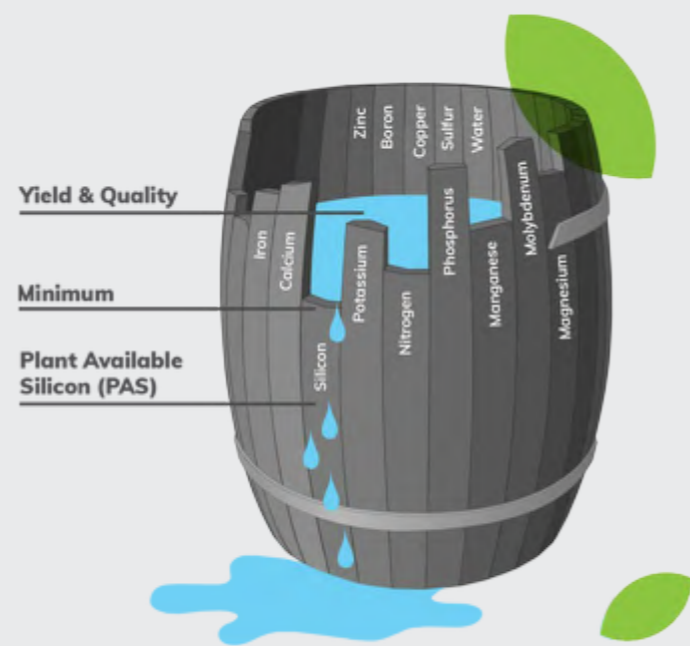
In August 2020, the Association of American Plant Food Control Officials (AAPFCO) classified uncalcined amorphous silica (Agrisilica®) as a beneficial substance. This remarkable resource gives growers access to a nutrient now recognised and proven in trials around the world as a significant game-changer in agriculture's quest for sustainable food security.

Agripower is pioneering new approaches to fertiliser management by demonstrating to farmers how they can better optimise direct and indirect multiplier outcomes by using Agrisilica®.

Agrisilica® has numerous unique benefits and actions. It is not an 'alternative' to NPK, MAP, DAP etc, rather it is complementary, increasing their outcomes by enhancing their uptake. This boosts their intended benefits, mitigates environmental issues and finally, adds its own benefits as you will discover.

The aggregated outcomes are more crops, better crops, safer crops and more grower income, all achieved more sustainably.

AAPFCO's recognition is significant as it reinforces agriculture's 'Law of the Minimum' whereby crop yield and quality are determined by the nutrient or resource in **least supply**. In other words, crop yield and quality will be diminished if any beneficial nutrient is limited. The issues up till now have been firstly, that the removal of naturally occurring PAS has outstripped what has been replenished and secondly, obtaining commercial quantities of supplementary sources of PAS.



# Climate Smart Agriculture (CSA) and Agrisilica®.

Agrisilica® is a natural fertiliser that can shift thinking and practices, leading to sustainable intensification of agriculture and CSA's '3 Pillars'.

Climate Smart Agriculture (CSA), developed by the UN's Food & Agriculture Organisation (FAO), was established as a set of guiding strategies for transforming and reorienting the way we farm in the face of climate change. CSA's '3 Pillars' are:

1. Increasing productivity and incomes, often referred to as 'sustainable intensification' of agriculture;
2. Resilience to climate change through adaptation; and
3. Reducing, mitigating and/or removing where possible, harmful greenhouse gas emissions and environmental pollution.

CSA calls on stakeholders at all levels - local, national and international - to participate by identifying, embracing and championing strategies and solutions that fit with each farming community or region's situation. Agrisilica® links directly and pertinently a number of listed practices, including:

**1: Crop production** which seeks to combine traditional knowledge with new technology to produce more from the same area of land, conserve resources and enhance ecosystem services, reduce greenhouse gas emissions and negative environmental impacts, reduce soil compaction and increase carbon sequestration.

**2: Land and water management** which looks to the restoration of degraded lands, increasing soil carbon and sequestration, enhancing soil nutrients and water retention capacity, and reducing deforestation to make way for agriculture. Put simply, more efficient use of precious resources: land and water.

Global population growth and trends are driving demand for food security and food safety. Shrinking amounts of arable land, crop losses from stress, the need to reduce Heavy Metals uptake and pesticide toxicity, improved shelf-life and mitigating agriculture's environmental impact are all challenges facing farmers world-wide.

Headquartered in Sydney with operations in Queensland, Australia, Agripower's plant currently produces 250,000tpa. In late 2019 the Queensland State Government announced that Agripower's proposed \$663 million rail and plant expansion project was awarded 'Prescribed Project' status. Creating 450 jobs during construction and 500 full time positions on completion of Stage 1, it will add a further 2,000 jobs by the time the project is fully realised in 5-7 years. The end result for Agripower will be 10Mtpa production capacity with optimised transport and global export facilities.



# The most significant breakthrough in fertilisers in 90 years: Agrisilica®

Agrisilica® is a GHG emissions-free, non-synthetic, non-toxic and environmentally safe natural fertiliser delivering ‘plant available silicon’ known as PAS.

There are extraordinary benefits to be gained from PAS, for farmers, consumers and our environment. Some benefits are immediate and direct.

PAS is no ordinary nutrient. The science is compelling and because PAS is derived from a natural resource, it is all the more exceptional. From a sustainability perspective, it is even more valuable.

Farming occurs the world over - in both developed and still developing nations. Farmers everywhere face the same issues and imperatives. Modern farming practices over the last 100 years have produced more food but there have been side-effects. Now there is a nutrient that will naturally offer many positive benefits and deliver many healing, mitigating and remediating outcomes to agriculture's past, present and future footprint.

Agrisilica®'s range includes fertilisers and soil amendments for use in field crops, tree crops (e.g. fruits, nuts) and vegetables, horticulture, amenity horticulture, lawns, turf, playing fields and golf courses.

- Agrisilica® comes in chip, powder, liquid and notably granular form, the latter blending easily with existing granulated fertilisers.
- Agrisilica® complements traditional fertilisers (NPK, MAP, DAP etc), enhancing and optimising outcomes.
- Agrisilica® is a natural water retention agent with high Water Holding - 55%\* (i.e., 100kg holds 155kg of water), of which 90% w/w is Plant Available Water. Soil moisture is increased, making water more available to plants as they need it.
- Agrisilica® has a high Cation Exchange Capacity (>30 cmol kg<sup>-1</sup>)
- Agrisilica® is certified for use in organic farming, reinforcing its quality and safety.



# Powered by Agrisilica®

Agrisilica® is well proven over some 600 independently conducted trials, across 46 crops, in 14 countries, over the past 7 years. It can be used as a stand-alone input or blended with traditional granular fertilisers.

## Grower Benefits - Crops

- increased yield over same area (by as much as 120% for some crops)
- reduces need to clear more land
- increased root mass up to 200%
- increased crop quality: improved appearance, weight, size, taste
- increased crop durability: crop better handles harvesting, storage and transport, and has longer shelf life
- increased crop resilience reducing pest-herb- fungicides usage as plant cell strength and natural defense systems are optimised to better resist abiotic and biotic stresses e.g.:  
**Abiotic Stresses** - drought, temperature extremes, Heavy Metals uptake, nutrient imbalance, salinity and poor soils  
**Biotic Stresses** - bacterial attack, viral attack, fungal attack and insect attack
- improves soil condition and health:
  1. improves cation exchange capacity (CEC) enabling higher retention and uptake of nutrients and water
  2. retains more water/moisture without waterlogging
  3. boosts organic soil carbon and humic acid
  4. improves soil oxygen/aeration and texture/structure
  5. increases soil biodiversity

## Grower Benefits - Improved Revenue

- more income via more crop to market
- better crop quality commands better prices
- can reduce overheads by:
  1. reducing water consumption
  2. reducing pesticide/fungicide usage
- reduces nutrient losses which can cost farmers up to 25% annual income
- improves farmer income security

## Consumer Benefits

- increased food safety / less Heavy Metals uptake e.g. cadmium and arsenic
- less pesticide / fungicide usage
- increased taste and nutritional value

## Benefits all round:

- reduces water consumption
- reduced soil erosion and exhaustion
- 100% natural, non-toxic, non-calcined
- does not pollute ground water, rivers or marine environments and is not harmful to fish
- lower carbon footprint
- increases and replenishes soil carbon
- 100% safe for pollinators (i.e. bees)
- a fertiliser that enhances results while mitigating environmental impact



# Soil carbon - what is it, can we renew it? It's not magic, it's basic science and PAS.

Soil as a carbon warehouse and weapon in the climate fight has become the 'holy grail' achieving mythic status: everyone wants it, it seems elusive and is undoubtedly valuable.

The importance of soil carbon for sustaining Earth's life support systems is becoming more apparent as the world's population heads towards 10 billion by 2050. Soil carbon is affected by soil type and structure, climate, fertiliser management and tillage practices.

For a clearer understanding the page opposite illustrates how PAS can renew and restore soil carbon while at the same time, reduce Carbon dioxide (CO<sub>2</sub>), a major greenhouse gas. The process is logically simple:

1. Get more plants to absorb more CO<sub>2</sub> through increased photosynthesis.
2. While it lives, the plant will increase soil carbon via natural plant debris, roots and root exudation.
3. When the plant dies or the crop is harvested, plant residue returns to the soil, further increasing soil carbon levels.

## Agrisilica® increases soil carbon by:

- increasing plant and root mass
- increasing plant photosynthesis (CO<sub>2</sub> absorption)
- **increasing carbon sequestration for potentially thousands of years via PAS-generated Phytolith-occluded carbon which is highly stable and resistant to decomposition and therefore important to long-term global carbon sequestration.**



**"If we treat soil carbon as a renewable source, we change the dynamics."**

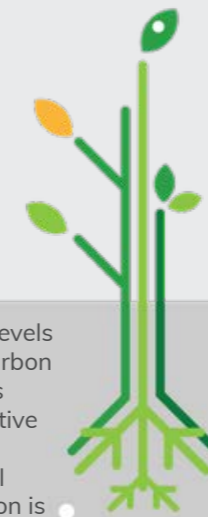
Thomas J Goreau | Biogeochemist and expert on carbon and nitrogen cycles

# Agrisilica® creates Soil Carbon Renewal & Reduces GHG CO<sub>2</sub>

## Plant A

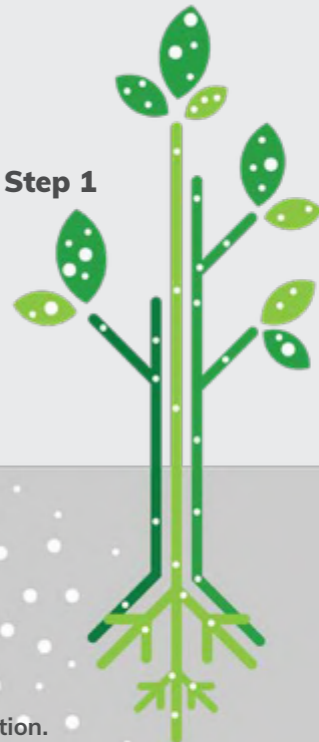
Relies only on what PAS may be naturally available in soil.

**Sand is crystalline silicon. It does not provide PAS.**



Most soils contain low levels of PAS. Crops return Carbon to the soil through roots and recycling of vegetative matter, however there is often a net loss of soil Carbon and more Carbon is exported off farm as produce and losses from soil erosion leading to: **Soil carbon being reduced.**

## Plant B - Step 1



PAS is applied via Agrisilica®. Taken up by the plant, PAS lodges in all parts of the crop. The crop is now PAS-nutrient rich.

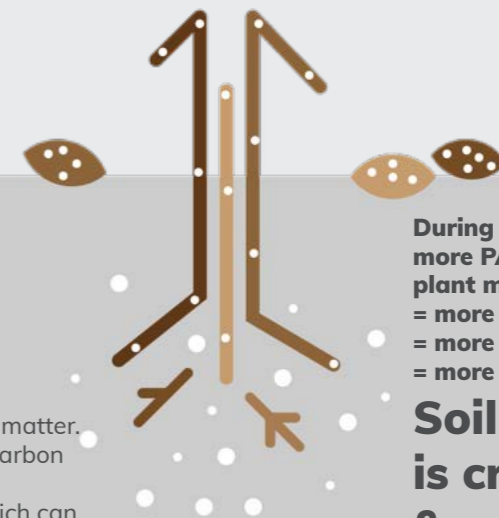
## PAS boosts PHOTOSYNTHESIS

- meaning: More CO<sub>2</sub> is absorbed = GHG reduction.
- Plant mass is greater = more CO<sub>2</sub> absorbed.
- More, clean O<sub>2</sub> is released
- So, where has all the Carbon gone? It has been sequestered in the plant by 'plant phytoliths', which require PAS.

## Plant B – Step 2, After life

**SILICON PHYTOLITHS**  
PAS - absorbed by crops during lifetime, become rigid silicon forms called phytoliths. Phytoliths capture and store Carbon.

Plants and crops return Carbon to the soil as roots and vegetative matter. The more PAS a crop takes up, the more Carbon the crop sequesters. It stores this Carbon in PAS Phytoliths which can store Carbon for thousands of years.



During the plant's lifetime, the more PAS a plant is given, the more plant mass is created, which means: = more Carbon is stored in the plant = more Carbon goes back into the soil = more soil Carbon

**Soil carbon is created & renewed.**



**Who relies on their crops? Do they have access to better ways of farming for better outcomes? How will the next generation farm?**

# The UN SDG's and why they matter.

In September 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development that includes 17 Sustainable Development Goals (SDGs).

“The strong connection between inclusive economic growth, especially in rural areas, and rapid reduction of poverty was simply not apparent in the empirical record in the early 1980s. The East Asian Miracle (World Bank 1993) did not appear for another decade. This rapid growth validated the central theme of the ‘macro’-food policy perspective – poverty cannot be reduced without greater economic productivity of unskilled, especially rural, labour. That theme remains powerfully relevant even as the sources of such productivity increases are increasingly elusive.”<sup>1</sup>

The last part of the last sentence above is particularly critical. Farming is hard work. For farmers in developing countries, particularly small-holders, it is even more challenging with their limited resources - finance, water, poor soils and crop stress losses. 75% of the world's population who are food-insecure, rely on agriculture and natural resources for their livelihoods. The following pages will examine critical issues for farmers and all who rely on them, including our planet. The interconnected effects of sustainable agriculture cannot be overstated. The UN's 17 SDG's emphasise an holistic approach to achieving sustainable development for all.

Agrisilica® has a role to play in shaping new conversations, and practices around the future of farming. Agripower believes the benefits of Agrisilica® can contribute directly and/or indirectly to Goals 1, 2, 3, 6, 8, 9, 11, 12, 13, 14 and 15 of the UN SDG's.

## **Food and agriculture are key to achieving the United Nations entire set of SDGs.**

*FAO, 2030 Agenda, 2015*

1. No Poverty
2. Zero Hunger
3. Good Health & Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water & Sanitation
7. Affordable & Clean Energy
8. Decent Work & Economic Growth
9. Industry, Innovation & Infrastructure
10. Reduced Inequalities
11. Sustainable Cities & Communities
12. Responsible Consumption & Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice & Strong Institutions
17. Partnerships for the Goals

<sup>1</sup> C. Peter Timmer, Professor Emeritus, Thomas D. Cabot Professor of Development Studies, Harvard University in 'Managing Structural Transformation: A Political Economy Approach' 2015. key advisors for the World Development Report 2008: Agriculture for Development. He currently serves as an advisor to the Bill and Melinda Gates Foundation on agricultural development and food security issues.



# Agriculture faces 6 key problems:

1. Food Security
2. Crop Loss
3. Soil Health
4. Ecosystem Damage
5. Toxicity
6. GHG Emissions

**To feed around 10 billion by 2050 we need somewhere between 51-110% more food and fodder.**

- Agriculture is estimated to be the direct driver for around 80% of deforestation worldwide.<sup>1</sup>
- Biodiversity for food and agriculture is indispensable to food security, sustainable development and the supply of many vital ecosystem services.<sup>2</sup>
- 70% of global water consumption is used for farming.<sup>3</sup>
- 78% of global ocean and freshwater pollution is caused by agriculture.<sup>4</sup>
- Food is responsible for approximately 26% of global GHG emissions.<sup>5</sup>
- In 2017, agriculture accounted for 42% of total CH<sub>4</sub> and 75% of total N<sub>2</sub>O emissions.<sup>6</sup>
- About 51–82% crop yield in world agriculture is lost annually due to abiotic stress.<sup>7</sup>
- 75% of the world's soils are degraded.<sup>8</sup>
- An average 200,000 people die annually from toxic exposure to pesticides.<sup>9</sup>
- Agriculture is the largest contributor of non-CO<sub>2</sub> GHG's at 56%<sup>10</sup>

**Fertiliser Management is fundamental to the each of the six key problems facing the agriculture.**

Recognising the many issues and competing criteria around sustainable food production, the FAO has developed a Code of Conduct for the Sustainable Use and Management of Fertilisers which came into being in 2019.

If crop production collapses the outcomes predicted include mass migration in the hundreds of millions and starvation. We need sustainable intensification of agriculture to deliver food security. The challenge is meeting the needs of the present without compromising the ability of future generations to meet their needs.

Many of us take food for granted, yet according to the FAO the combined levels of moderate and severe food insecurity brings the estimated current total to 26.4% or about 2 billion people.

**Every person on the planet relies on agriculture one way or another. Long term stewardship of natural and human resources are just as importance as short-term gains.**

**Agriculture is necessary. Now we need to address its impact.**



How does he safeguard the next crop, food for his table, secure his income?

Economic growth must be inclusive to provide sustainable jobs and promote equality.

The food and agriculture sector offer key solutions for development and is central for hunger and poverty eradication.

Sustained & inclusive economic growth can drive progress, create decent jobs for all and improve living standards.

Investments in infrastructure are crucial to achieving sustainable development.

A future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.



# Problem #1 Food security

## Solution: Increase crop yield, quality, resilience and grower income, sustainably.

Agriculture stimulates economic development and resilience beyond its own sector, benefitting growers, communities, regions and nations.

**The UN has noted, historically almost no country has reduced poverty and achieved growth without first increasing agricultural productivity.**

Many communities depend on income from agriculture to sustain them. Many are farming land that is naturally poor. If crops fail due the outcome is a lack of food supply and income.

**Agripower's Agrisilica® contributes to CSA's 3 Pillars, and directly and indirectly support Goals 1, 8, 9 & 11 of the UN by:**

- Increasing yield - farmers gain more crop tonnage per same land area.
- Increasing income - farmers get more crop to market, netting more profit;
- Increasing crop quality (size, weight, shelf-life and appearance) achieving better prices for premium quality crops;
- Reducing crop losses from abiotic and biotic stress by naturally increasing crop resilience and boosting defense systems;
- Being 100% naturally derived and non-toxic it will not harm: roots or leaves (does not burn); soil biodiversity or vital ecology systems; water resources including potable water; or livestock;

- Being approved for organic farming input;
- Reducing pesticide usage;
- Reducing chemical run-off and leaching of costly fertilisers into their waterways. Nitrogen loss can cost farmers up to 25% of their annual income<sup>1</sup>;
- Delivering farmers value for money: farmer gets '4 products in 1' as Agrisilica®:
  1. delivers its own 'fertiliser'actions
  2. boosts uptake and performance of traditional fertilisers
  3. reduces pesticide usage / costs
  4. reduces irrigation usage / costs

**Through education at every level on Agrisilica®'s benefits, we can provide a significant game-changer to agriculture globally. Farmers can now work with a fertiliser and revised management programmes to deliver improved outcomes, leading to increased financial resilience and its multiplier effects on communities, regional, even national economic growth, while contributing to Climate Smart Agriculture and the UN SDG's - sustainable intensification of agriculture.**

<sup>1</sup>Nitrogen pollution: the forgotten element of climate change, The Conversation, Dec 5, 2016

Economic growth must be inclusive to provide sustainable jobs and promote equality.



**Drought, pests or frost, the outcome's the same. No crop, no income. No food.**

The food and agriculture sector offer key solutions for development and is central for hunger and poverty eradication.



## **Problem #2 Crop loss**

### **Solution: Increase crop resilience to biotic/abiotic stressors for better crop productivity, better grower economic resilience.**

51-82% of crops are lost annually around the world due to crop 'stress'. Conversely, we need to find 70-110% more food to feed 10 billion people by 2050. Fixing annual crop loss would go a long way to closing the food gap.

Abiotic stress such as climatic conditions, nutrient deficiencies or toxicity, and biotic stress such as pests and pathogens, can wipe out a year's income and anticipated food supplies.

The UN has set a 2030 target of doubling agricultural productivity and incomes of small-scale producers. How is all that going to happen while protecting ecosystems, adapting to climate change and extreme conditions and somehow progressively improve land and soil quality?

The UN also sees mitigation of extreme food price volatility caused by crop losses, as an essential to achieving zero hunger.

Educating fertiliser producers, distributors, agronomists, governments and growers around the world on the potential of Agrisilica® in relation to the UN's goals is part of what we do at Agripower.

**Agripower's direct and indirect benefits and contributions to UN Goals # 1 & 2 by applying Agrisilica® include:**

- Increased strength of plant's epidermal layer makes plant more insect resistant
- Increased plant cell strength from root to leaf improves photosynthesis and water and nutrient use within the plant
- Increased temperature tolerance via lower transpiration rates (less water loss)
- Increased cell strength reduces lodging
- Reduced sodium uptake (salinity stress)
- Increased cation exchange capacity (CEC) enabling higher retention and uptake of nutrients (NPK) and water
- All this means: higher and healthier yields, more crop to market, more income stability / economic resilience and... safer food for consumption.





**It takes 3,000 years to make 1mm of fertile soil. We can't wait that long.**

Economic growth must be inclusive to provide sustainable jobs and promote equality.

Responsible Consumption and Production

Sustainably manage forests, combat desertification, halt and remediate land degradation and halt further biodiversity loss.



## **Problem #3 Soil health**

# **Solution: Increase soil health, water holding capability & soil carbon.**

75% of the world's soils are degraded. 24 billion tonnes of fertile soil are lost annually by deforestation and tillage and ~70% of original stored soil carbon has been lost.

95% of the world's soil will be degraded by 2050 if we don't change the way we farm. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) more than 75% of the Earth's land areas have lost some or most of their functions, undermining the well-being of the 3.2 billion people that rely on them to produce food crops, provide clean water, control flooding and more. These once-productive lands have either become deserts, are polluted, or have been deforested and converted for unsustainable agricultural production. This is a major contributor to increased conflict and mass human migration, and left unchecked, could force as many as 700 million to migrate by 2050. Soil is a finite resource and when exposed (e.g. deforestation, erosion, tillage) it oxidizes, essentially burning soil carbon.

According to Rattan Lal, Director of Ohio State University's Carbon Management and Sequestration Centre, restoring degraded soils can add 1-3 billion tons of carbon annually, equivalent to roughly 3.5-11 billion tons of CO<sub>2</sub> emissions.

### **How Agrisilica can renew soil carbon.**

Agrisilica® creates and increases soil carbon because it is high in PAS. See page 11 which explains the process.

### **Agrisilica®'s unique soil benefits boost CSA pillars & support SDG's 1, 12 & 15:**

- Increases 'silicon phytolith' production
- Optimises plant intake of CO<sub>2</sub> which
  1. reduces atmospheric CO<sub>2</sub>
  2. increases plant growth
  3. increases plant storage of carbon
- Improves soil texture and structure
- Improves soil porosity
- Increases water retention and transmission
- Increases aeration (oxygenation)
- Increases CEC (cation exchange capacity)
- Increases nutrient reserves and
- Improves elemental balance
- Increases soil biodiversity
- Increases organic soil pool
- Increases microbial biomass
- Decreases soil pests and pathogens
- Increases soil carbon sequestration

Careful management of this essential global resource is a key feature of a sustainable future.

Sustainably manage forests, combat desertification, halt and remediate land degradation and halt further biodiversity loss.

**Of 28,000 species on the IUCN\* Red List threatened with extinction, agriculture is listed as a threat to 24,000 of them.**

## **Problem #4 Ecosystem damage. Solution: A fertiliser that does no harm, only helps.**

78% of global ocean and freshwater pollution is caused by agriculture while pollinators, such as bees, are essential to successful farming. Our capacity to produce food is being undermined by our failure to protect biodiversity.

**Scientists have identified 415 dead zones worldwide, 213 areas of concern and only 13 coastal systems in recovery.<sup>1</sup>**

Toxicity and pollution from agriculture can directly impact life on land and below water. Dead zones are caused by too many nutrients in water systems and oceans. Agriculture is not the sole contributor to water pollution, but it is one of the largest. Ecosystems are fragile as we have seen here in Australia in the Great Barrier Reef, with the 'crown-of-thorns' starfish.

**Pollinators affect 35% of global agricultural land, supporting the production of 87 leading food crops worldwide.<sup>2</sup>**

The protection of bees and pollinators is essential to successful and sustainable agriculture. Introducing and using innovative practices that integrate local and scientific knowledge can help. Climate change, chemicals, monocultures, pests, disease and changes in land use can all impact these fragile but essential 'agri-helpers'.

**Agrisilica® directly contributes to the CSA pillars & support SDG's 14 & 15 by:**

- Reducing chemical fertiliser leaching and run-off by optimising their uptake by plants, Agrisilica® inhibits and/or mitigates water and marine system pollution and damage, e.g. eutrophication and acidification.
- Optimising plant and soil health and their natural defenses against pest and pathogen attack means a reduction in the use of toxic pest- herb and fungicides, e.g. trials in July 2020 Agrisilica® reduced Pink Stem Borer damage to rice to 12.47%, whereas the chemical pesticide could only reduce damage to 19.95%.
- Acting mechanically (as opposed to chemically), Agrisilica® reduces pest burdens while remaining 100% safe to pollinators and all air-borne and land life, and to freshwater and marine life;
- Delivering yield increases on the same amount of land, negating need for deforestation and ecosystem destruction;
- Increasing soil health and condition rejuvenation which promotes healthy soil biodiversity and above and below ground ecosystem activity.

<sup>1</sup>National Geographic, Resource Library|Encyclopedic Entry

<sup>2</sup>FAO, Why Bees Matter, 2018



**You'd like to know the food she's eating is safe.**

Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Ensuring availability and sustainable management of water and sanitation for all

Responsible Consumption and Production

Careful management of this essential global resource is a key feature of a sustainable future.



# Problem #5 Toxicity.

## Solution: A fertiliser that also mitigates and reduces agri-toxicity.

The UN estimates an average 200,000 people die annually from exposure to pesticides. Cadmium and Arsenic are in our food chain, notably cereals and vegetables.

Heavy Metal contamination is one of the most pressing concerns in the debate about food security and safety globally. A number of fertilisers have been identified as a major source of Cadmium contamination of soil. Arsenic in groundwater resources is well documented. The worst affected region is Bangladesh where an estimated 30 million people rely on contaminated groundwater for drinking and irrigation. There is a clear link between water pollution and food chain cross-contamination<sup>1</sup>. Arsenic in irrigation water reduces crop yields long term whilst contaminating crops such as rice, food staple to more than 50% of the world's population.

The WHO estimates 4.9 million deaths annually are attributable to environmental exposure and inappropriate management of selected chemicals such as pesticides in agriculture. Pesticide suicides are now a major clinical and public health problem mostly in poor rural regions. It is said that if they had not been introduced into rural communities for agricultural use, pesticide suicides would not have occurred and that preventing these deaths should be a global public health priority.

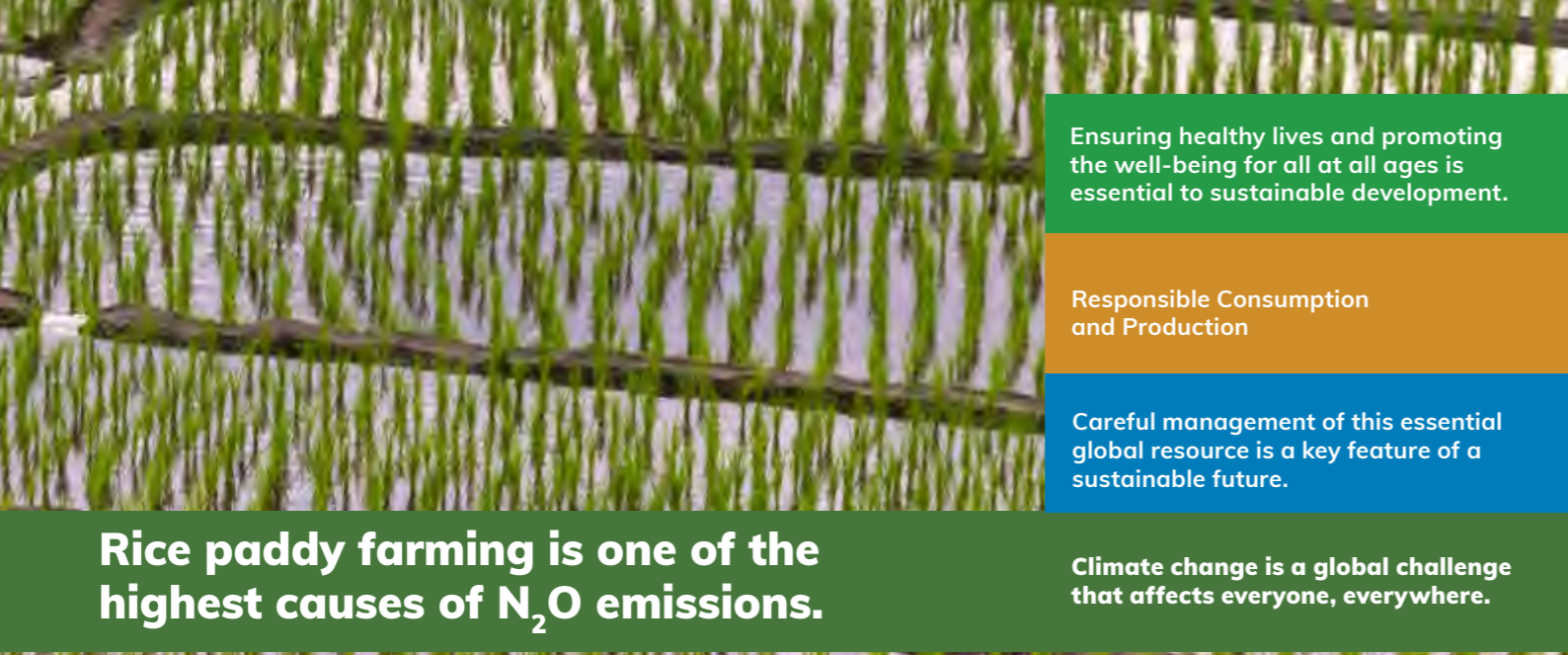
Agriculture is a main source of Heavy Metals in our foods. Sources include chemical fertilisers, liming, sewage, manure, fungicides

& pesticides. Human health impacts include respiratory, skin conditions, cancers, bone fractures, cardiovascular issues, kidney failure, neurological impairment (including neo & post-natal), even death. Toxicity contaminates our soils, drinking water, inland water systems, oceans and our food basket.

**Agrisilica® with its high PAS content can reduce toxicity in soils, water resources and food chains, contributing to the CSA pillars and UN SDG's 3, 6, 12 & 14 by:**

- PAS reduces plant uptake of certain Heavy Metals by causing 'immobilisation'
- PAS stimulates antioxidant enzyme production in plants, reducing or eliminating Heavy Metals damage to plants
- PAS reduces the translocation of some Heavy Metals from roots to shoots
- PAS can reduce chemical pesticide usage, reducing soil and ground-water contamination, and crop uptake
- PAS reduces fertiliser leaching and run-off entering water sources and marine systems which impact water safety and ocean acidification and eutrophication
- PAS trials reveal reductions in Arsenic (As) and Cadmium (Cd) levels in the edible parts of potatoes, wheat, onion and carrots by up to 40%<sup>2</sup>.

<sup>1</sup>Ebbs and others 2006. <sup>2</sup>Greger and Landbert (2015).



Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Responsible Consumption and Production

Careful management of this essential global resource is a key feature of a sustainable future.

Climate change is a global challenge that affects everyone, everywhere.

**Rice paddy farming is one of the highest causes of N<sub>2</sub>O emissions.**



# Problem #6 Emissions.

## Solution: Using a fertiliser proven to reduce emissions notably N<sub>2</sub>O and CO<sub>2</sub>.

Agriculture is the largest contributor of non-CO<sub>2</sub> GHG's at 56%<sup>1</sup>. With a lifespan of 114 years, Nitrous Oxide (N<sub>2</sub>O) is 300 times more potent than CO<sub>2</sub>. Nitrogen (N) is essential to agriculture and food security. The challenge is considerable.

**Climate change is a global challenge that affects everyone, everywhere.**

With a global population projected at 9+ billion by 2050, agriculture's challenge is adapting to meet demand while protecting resources. The UN calls for education, mitigation, adaptation and impact reduction. Let's consider a few facts in relation to Greenhouse Gases (GHGs) and agriculture:

- Of global anthropogenic emissions in 2005, agriculture accounted for about 60% of N<sub>2</sub>O and about 50% of CH<sub>4</sub>, and projected to increase 35-60% by 2030 (FAO, 2003)<sup>2</sup>;
- More than 50% of applied Nitrogen is lost via leaching, volatilization and run-off. Nitrogen losses can cost farmers up to 25% of their annual income<sup>3</sup>;
- Sugar production (~176.5mmt p/a) is one of agriculture's highest emitters of CH<sub>4</sub> and N<sub>2</sub>O and a major contributor to eutrophication;
- Rice production (staple diet to 50%+ of the world's population) produces 50% of crop GHGs. 20 years of rice production GHG's could equate to 1,200 coal plant emissions.<sup>4</sup>

For citations 1-5 see back cover.

**Agrisilica®, by reducing greenhouse gas emissions, supports CSA pillars and the 13th UN SDG:**

Agrisilica® & N<sub>2</sub>O

- increases nitrogen fixation in legumes
- reduces nitrogen volatilization
- increases soil nitrogen mineralisation
- promotes ammonium assimilation
- increases nitrogen denitrification
- reduces nitrogen leaching and run-off by up to 40%

Agrisilica® & CO<sub>2</sub>

- increases plant photosynthesis activity which increases CO<sub>2</sub> absorption and carbon capture
- increases soil organic carbon content
- increases carbon sequestration for potentially thousands of years via PAS-based Phytolith-occluded carbon which is highly stable and resistant to decomposition, thereby being important to long-term global carbon sequestration<sup>5</sup>.

Citations Page 15:

<sup>1</sup>Wageningen University & Research Centre, 2012. <sup>2</sup>The State of the World's Biodiversity for Food and Agriculture, FAO 2019.  
<sup>3</sup>Tariq Khokhar, Global Data Editor & Senior Data Scientist, World Bank, 2017. <sup>4</sup>Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987-992.  
<sup>5</sup>Hannah Ritchie, Our World in Data, 2019  
<sup>6</sup>FAO, Environmental Statistics, 2017. <sup>7</sup>Suarau O. Oshunsanya Nkem J. NwosuYong Li - Abiotic Stress in Agricultural Crops Under Climatic Conditions, 2019. <sup>8</sup>Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). <sup>9</sup>Hilal Elver and Baskut Tuncak, special rapporteurs to the U.N. on food and toxins respectively, United Nations Report 2017. <sup>10</sup>Smith, P. et al. Chapter 11 - Agriculture, forestry and other land use (AFOLU) In *Climate Change 2014: Mitigation of Climate Change*, IPCC Working Group III Contribution to AR5 (Cambridge University Press, 2014).

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<sup>1</sup>Smith, P. et al. Chapter 11 - Agriculture, forestry and other land use (AFOLU) In *Climate Change 2014: Mitigation of Climate Change*, IPCC Working Group III Contribution to AR5 (Cambridge University Press, 2014).  
<sup>2</sup>Smith, P., D. Martino, Z.Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sorotenko, 2007: Agriculture, In *Climate Change 2007: Mitigation*, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. <sup>3</sup>Nitrogen pollution: the forgotten element of climate change, *The Conversation*, Dec 5, 2016. <sup>4</sup>Bloomberg Quint June 2019. <sup>5</sup>Parr and Sullivan, 2005; Song et al., 2012a.

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