

GreenSTEM Technology Corp

We use Science to Restore, Preserve and Protect
the Health and Beauty of our Land

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www.greenstem.ca

Who We Are



**Saskatoon scientists and business-people
Green Stem Technology Corp formed in *May 2018***

**Michael Cavanaugh - 25 yr business, YXE
Dr Susan Kaminskyj - 23 yr professor, UofS
Dr Zakia Boubakir - 9 yr NRC and UofS**

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What We Do

- ▶ Agriculture →
 - ▶ We generate *stress-resistant* plants by helping them form symbioses (metabolic partnerships) with certain rare microbes.
 - ▶ Stresses include dryness, salt, low NPK, petrochemicals, synthetic pesticides.
 - ▶ This works for all of the food, feed, and ground cover crops we have tested.
- ▶ Bio-remediation →
 - ▶ We clean up/reclaim chemically contaminated sites using native micro-organisms.
- ▶ Our methods are
 - ▶ Science and engineering based → the STEM in *GreenSTEM*
 - ▶ Eco-friendly - we use native, bio-safe, *non-GMO* microbes and their organic products.
 - ▶ Optimized for each site
 - ▶ Our results are confirmed by independent, third-party testing

Why It Matters: the big picture

- ▶ There will never be more land, or fewer people.
- ▶ Agricultural land impacts include
 - ▶ Quality is being degraded by overuse
 - ▶ Soil is being eroded: lost to water and air
 - ▶ Land is being flooded by rising ocean levels, extreme weather events
 - ▶ Urban sprawl is building on our best farmland
- ▶ *We must balance* between Energy Needs and Ecosystem Services that purify our air and water
- ▶ *Land and water management are 'wicked' problems* →
Conflicting needs, Multiple outcomes, Many interest groups.

Why It Matters: the bigger picture

- ▶ Human impacts are pervasive... Our recent technologies include *methods that require fossil fuel energy to use*
 - ▶ Agriculture → gathering...herding/growing...breeding...GMO
 - ▶ Energy → sun...wood...coal...oil...nuclear...
 - ▶ Resources → renewable...mining...synthetic...
 - ▶ Consequences?
 - ▶ Higher life expectancy. Higher standard of living. *Higher stress.*
 - ▶ *Global climate change. Pandemics. War.*
 - ▶ Population
 - 5,600,000 (1600) → 7,800,000,000 (2018) → 1400x increase.
- In January 2020: >600,000 people live on less than \$2 day

What are microbes? Why are they important?

- ▶ Microbes include bacteria and fungi. Most are single cells like yeasts. Others are fine tubes called hyphae (hi-fee).
- ▶ Hyphae are thinner than spider silk. They are difficult or impossible to see without technology, unless in large groups (like mushrooms) or colonies.
- ▶ *Small organisms have small genomes and short life-cycles.*
- ▶ ***NONE of our strains is GMO.***
- ▶ ***All our strains are Biosafe, antibiotic-free, and vegan. This protects our team and our clients.***



The value of 'biodiversity & ecology' *does not trump* the 'economic necessity' of extracting hydrocarbons

In the future: No more land and no fewer people

Growth of plant-endophyte symbionts



A

These tomato seedlings are the same age, 4 weeks. Both are growing on coarse tailing sand, watered with ultrapure water. The **right-hand pot was treated with our septate endophyte strain, TSTh, beginning at 2 weeks.**



Both rows of wheat are the same age. *The bottom row was treated with TSTH*

TSTh seedlings have Significantly
**Faster germination*
**Longer roots*

Soil composition, structure, function

- ▶ Soil contains mineral particles whose sizes are graded between clays and boulders. Soil also has air spaces, water, organic material.
- ▶ Organics include dead plant material, living plant roots, fungi, bacteria, protozoa, the secretions they produce, worms, insects, and burrowing animals.
- ▶ Healthy soil has a diverse microbiome. These are the the microbes that support ecosystem stability. *There can be over a billion species in the volume of a sugar cube.* Few grow in lab cultures.
- ▶ Our microbes are very rare. We isolate... <proprietary> ...before using them. Symbiotic microbes only survive as long as the plant.

GreenSTEM's take-home Messages for Agriculture

- ▶ ***None*** of our products use GMO technology. Naturally, they are organic and vegan.
- ▶ ***All*** our strains are native and biosafe. This protects both you the user, and our staff the producers.
- ▶ Many of our strains function like ***bio-fertilizers***, reducing your input \$\$ costs, ***and*** protecting our waterways from runoff.
- ▶ So far, our agricultural microbes have been effective with all of the food, feed, fallow, and ground cover crops we have tried. Significant improvements can be seen in a few days.
- ▶ ***Treatment is easy*** → our strains are usually applied as granules mixed with the seed being planted. One treatment is enough for the whole season.
- ▶ Our symbiotic strains are rare. They are not competitive with other soil microbes, so when the plant dies, so do they.