HARNESSING PLANTS

To Fight Climate Change

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Sometimes, It Depends on How You Look at Something

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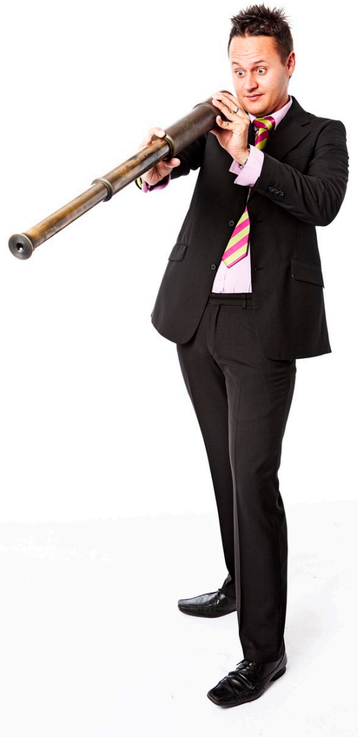
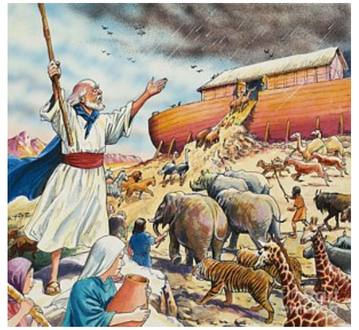


For Example…

Gravity	Rights of Man	Speciation	Computing

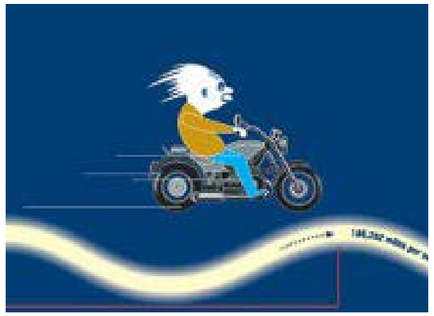
Newton

The Devine Right of Kings

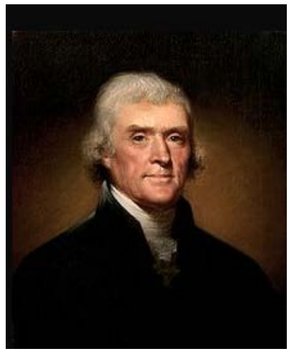


Noah's Ark

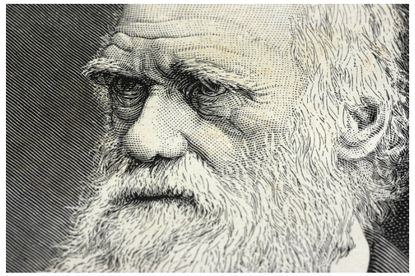
Bill Gates



Einstein



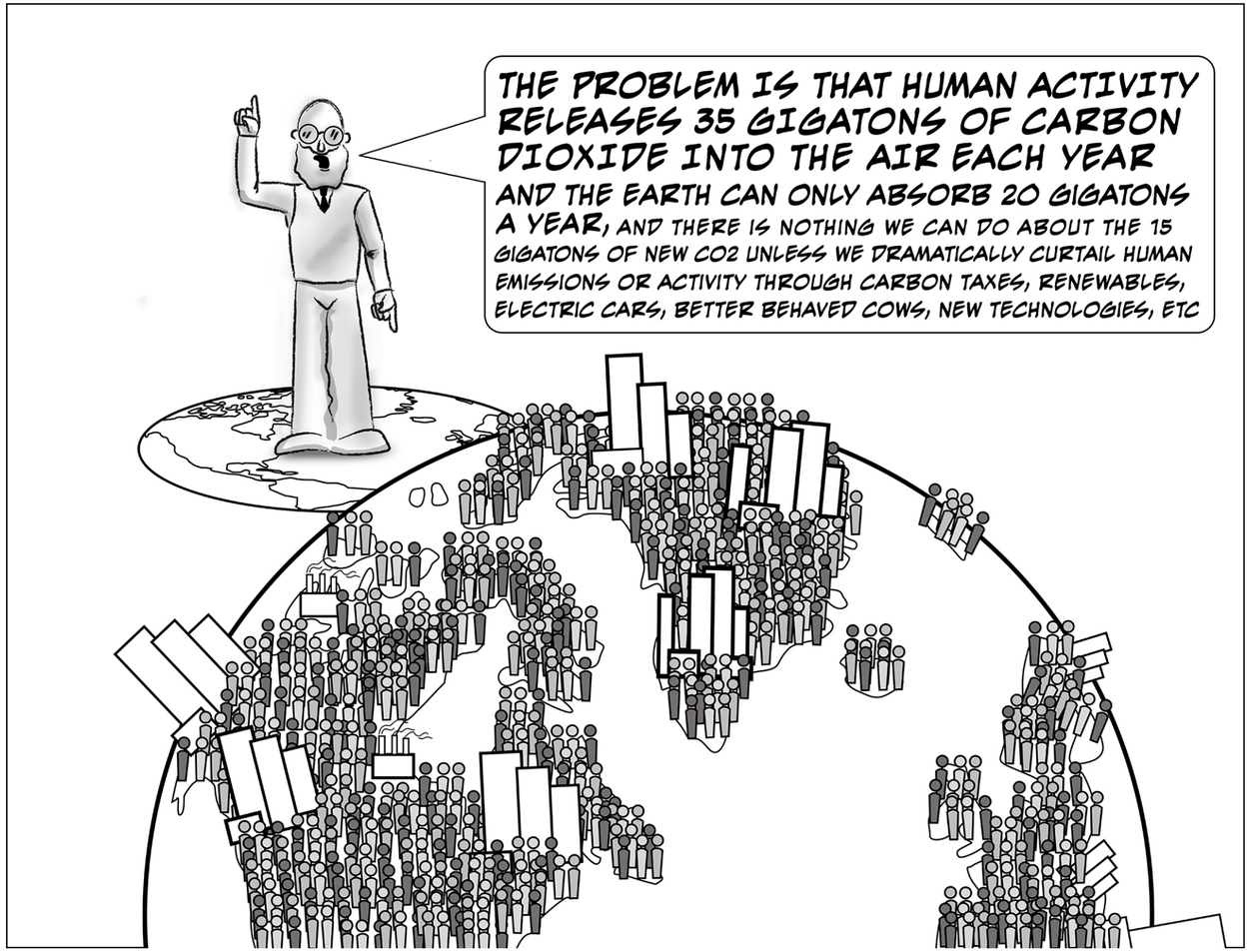
Certain Unalienable Rights



Darwin

Steve Jobs

The Problem as We See it Today



We Need to Reframe the Problem

Here is the CO_2 problem

840	naturally released
+35	human contribution
875	total released
-860	total captured
=15 GT excess	

15 Gt of CO_2 more per year than the earth can handle

It’s impractical to believe that changes in human behavior will reduce emissions by almost 50%

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Consider:

- Population will grow by 50% over the next 40 years
- Middle class population may double
- Global economy will more than double


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Salk scientists believe:
Increasing plant efficiency by 2% is more viable
than a 50% reduction in human CO_2 contribution

Biological Sequestration-the 2% Solution

- Plants are quite good at pulling CO2 from the air. In fact, they pull more and more each year.
- In North America, the CO2 concentration varies seasonally by 64-100 gigatons (8-12ppm)
- Nearly all of the CO2 captured by crops is quickly returned to the atmosphere. Unless it is buried somewhere.
- The challenge is to breed plants with large, long-lived roots that are also protected by forms of carbon that bacteria and fungi – microbes - don’t eat when the plant dies

Step One: Increase Root Mass

- Recent Salk research has shown how a single gene can alter root architecture in a model plant by changing how the plant responds to gravity, and in the process, grow deeper and more extensive roots without noticeably affecting the plant above ground.
- Other research groups have found a second gene that works in a similar manner in many different plants.
- **But simple burying in not enough. Rapid decomposition must be avoided.**

Step Two: Add Suberin

- Suberin is the cork that seals most fine wines.
- Suberin is common. It is the netting on cantaloupe rinds, the peel of avocados, the thick bark on certain trees, and the skin on potatoes. It even exists in short-lived annuals where suberin-rich cork cells exist in their roots
- Bury each of these in a compost bin, return months and even years later, and the cork, the netting, the bark, and the peels remain!
- **Suberin is highly resistant to decomposition and can maintain its molecular form for hundreds, or perhaps thousands, of years**

Step Three: Add Water and Stir

- Seagrass and other coastal marine plants are naturally high in suberin
- The evolutionary key to seagrass survival in the oceans is their ability to make large amounts of suberin in their roots
- 50% of all seagrass habitat has been lost since 1990
- Researchers can select seagrass varieties that flourish in harsh environments by enhancing their already substantial suberin levels.

More Powerful than Locomotive…

- Recent research has shown that a gene for deeper rooting can almost triple the size of some root systems without affecting plant height.
- Other studies have shown it is possible to increase suberin levels by more than 1,900 percent in leaves
- By increasing root depth and biomass and increasing the suberin content, carbon sequestration per acre can be increased by 20 times
- And coastal marine plants can be 30x more efficient at carbon sequestration than terrestrial plants

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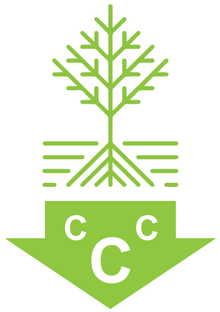
Approach One
TERRESTRIAL

1.



Store more carbon to sequester 25% + of human emitted CO_2 per year

Approach Two
MARINE

2.

Employ genome-informed restoration to sequester 25%+ human emitted CO_2 efficiently

But WAIT. THERE'S MORE…

Salk® Ideal Plants™ will produce more suberin which removes more CO_2 from atmosphere, revitalizes ecosystems, and improves agriculture.

We call this the 3-in-1 solution.

A Prime Candidate for **Salk® Ideal Plants™: Chickpeas**

- a protein-rich crop that returns fixed nitrogen to the soil
- a major source of feed for animals
- becoming a major food staple
- well-adapted to semi-arid climates
- fits well with existing infrastructure
- genomes of >60 chickpea varieties sequenced, including perennials
- farmers want to plant it
- chickpea earns $104/acre while winter wheat loses $21/acre

“Our greatest responsibility is to be good ancestors.”

Jonas Salk

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