

Draft Policy for Long Term Food Security and Climate Action

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The problem: In 2014, the UN's Food and Agriculture Organization reported that the world, on average, has just 60 more years of growing crops left if soil degradation continues (ref: Scientific American, Dec. 5, 2014). The causes of soil destruction include chemical-intensive farming, tilling, current livestock management, deforestation, and global warming. Even though we rely on soils to grow 95% of what we eat, very few people have any awareness of how badly we are treating the soils we all depend on. What use is our technology if we have nothing to eat. The good news is that in the last 30 years there has been a revolution in our understanding of how healthy soil biology can rapidly rebuild degraded soil, sequester large amounts of atmospheric carbon in the soil, and increase the profit of the farmer. What is required is a massive educational effort coupled with incentives to encourage farmers to make the transition to regenerative farming practices.

Policy Proposal

How do we accomplish these wonderful things in the short time we have available? One easily overlooked event that occurred in the 2015 landmark Paris Agreement to fight climate change, was a French Government initiative named "4 per 1000", (<http://4p1000.org>). They propose changes to current agricultural practices based on our new knowledge of soil biology to increase the carbon content in the soil by 0.4% per year, to halt the rise in atmospheric carbon dioxide levels. France is committed to ensuring that at least 50% of its agricultural holdings will have adopted this approach by 2020. Sixty percent of Saskatchewan crop farmers have already moved in this direction and gone from one cash crop every two years to one every year.

- 1) **Canada should vigorously participate in the French initiative "4 per 1000" and improve on it.** This policy should include financial incentives to reduce the risk to early adopting farmers to transition to regenerative farming practices. Current evidence indicates that after the transition regenerative farming is more profitable. I believe that consultation with some of the leading pioneers in regenerative agriculture like Allan Savory, Dr. Elaine Ingham, Gabe Brown, and Joel Salatin could lead to improvements in the "4 per 1000" initiative.
- 2) **The time frame for action is very short if we want to prevent the worst effects of climate change.** We may need something approaching a war measures act to turn our agriculture around in time to save the planet for the current generation. It requires the urgent attention of the prime minister and cabinet. There is a great need to prepare and distribute educational material to every farm in the country to make them aware of the importance and the incentives of the program.
- 3) According to <http://scienceline.org/2011/07/lawns-vs-crops-in-the-continental-u-s>, homes, golf courses and parks may grow more acres of turf grass than U.S. farmers devote to corn, wheat and fruit trees — combined. Again, it is common practice to apply fertilizers and herbicides to turf which destroys the soil biology and the average home owner is less skilled in the application of these chemicals. **There is an urgent need to provide educational material** and opportunities for the public to learn how to restore the soil biology that will permit their lawn grass to grow healthier, sequester more carbon, and permit more infiltration and storage of rain water, resulting in less watering.

- 4) It is crucial in this Anthropocene Era that **ecosystem processes be an important part of everyone's education**. This is especially true for key decision makers who are frequently urbanites with little connection to current agriculture issues. Recent progress in our understanding of soil biology and nature's complexity is a game changer.
- 5) **Provide a credit** to all those that achieve meaningful levels of carbon sequestration through regenerative practices that restore healthy soil biology.
- 6) **Establish soil carbon monitoring and testing stations across the country**
This should include the development of training kits and an accreditation centre for individuals and companies wishing to enter the field. **Include a reporting system** that allows the provinces and federal government to monitor province and country wide progress and assign tax credits. We have the possibility to become the world leaders providing services to other countries.
- 7) **Establish a soil biology testing accreditation system** for individuals and companies wanting to offer these services to farmers, home owners and compost producers. **Include a reporting system** that tracks the provincial and country wide progress. Items (6) and (7), together with increased demands for high quality inoculating compost and compost tea products, will provide important new employment opportunities for workers that will inevitably be displaced from the chemical fertilizer, herbicide and pesticide industries.
- 8) **The Canadian government consider providing support for the work of the Savory Institute** to enable more rapid progress in reversing rampant desertification in Africa.

The Departments of Defence and Foreign Affairs are engaged in many programs to try and maintain peace in the world. Wars in the Middle East and Africa together with the massive exodus of people from the region is very destabilizing. The policies of the major Western countries never seem to get at the root of the problem. I believe the root cause of many of these issues is the collapse of agriculture in the region due to desertification and droughts. This leads to migration into the cities where there is little or no work and chronic food shortages.

The African biologist Allan Savory and his organization, Savory Global, has for many years been demonstrating how to quickly reverse desertification using livestock to emulate the ancient herds of wildebeests, together with their natural predators, which were essential for the development of the grasslands in the first place. Healthy grasslands can feed many more herbivores and the human population that depend on them. His work together with our new understanding of soil microbes is providing the needed answers to rapidly reversing desertification in a very low cost low tech way.

Savory Global has already established over 30 training Hubs world wide including one in Canada at Hay River in the Northwest Territories. With an estimated 45 million acres already holistically managed using his approach, Savory Global seeks to establish 100 Hubs by 2025, to influence 1 billion hectares.

The potential benefits are long term food security, reduced climate warming, greater peace and security. My sincere hope is that my country will help to lead the way.

Background Information

The causes of soil destruction include chemical-intensive farming, tilling, current livestock management, deforestation, and global warming. The historical pattern has been to wreck the soil, then move on, trashing rain forests and other precious habitats. We now realize that even the action of plowing (tilling) causes much of the essential carbon in the soil to be released as CO₂ into the atmosphere making climate change worse.

A recent revolution in soil biology and agriculture is opening our eyes to the amazing symphony of life that occurs in healthy soils. A handful of healthy soil contains more micro-organisms than all the people that have ever lived. These microbes (bacteria, fungi, and their important predators) are nature's way of providing plants with all the nutrients they need to grow strong and healthy. In addition to recycling dead plant and animal matter, bacteria and fungi can secrete enzymes and acids to extract the rest of the elements plants require from the rocks, sand, silt and clay. In a healthy environment the plant roots attract and feed the microbes best suited to provide them the nutrients they require in just the right proportions.

Apart from providing plant nutrients, the healthy soil microbes and earth worms create crucial soil structure (micro-aggregates held together with biotic glue and aggregates held together by fungal mycelia) that allow air and water to penetrate to great depths. This soil structure protects against droughts and naturally filters the water leading to clean drinking water for humans and animals.

Plowing destroys the crucial soil structure along with many of the essential microbes and produces a compaction zone below which plant roots cannot grow due to an absence of air. It turns out that man made fertilizers (inorganic salts), herbicides and pesticides are only necessary once we have destroyed the microbes and converted the living soil to dirt. This compaction zone together with an absence of good soil structure leads to runoffs, loss of soil, and chemical pollution of streams and rivers. These chemical salts destroy the soil biology and eventually poison the agricultural land.

The solution is **regenerative organic agriculture**, a term coined by Robert Rodale. The Rodale approach defines regenerative farming as a long-term, holistic design that attempts to grow as much food using as few resources as possible in a way that revitalizes the soil rather than depleting it, while offering a solution to carbon sequestration. Some pioneers in this arena that have caught my attention are Allan Savory, Dr. Elaine Ingham¹, and farmers Gabe Brown and Joel Salatin. One of the key papers indicating the important role of the soil biology was,

“Interactions of Bacteria, Fungi, and their Nematode Grazers: Effects on Nutrient Cycling and Plant Growth,” Russell E. Ingham, J. A. Trofymow, Elaine R. Ingham and David C. Coleman
Ecological Monographs, Vol. 55, No. 1 (Mar., 1985), pp. 119-140.

As the farmer Gabe Brown is discovering, why would you want to write a check to the chemical companies when you can produce a healthier crop for much less money by letting nature do most of the work.

¹ Dr. Elaine Ingham founded Soilfood Web Inc. in 1996. There are now 8 Soilfood Web sites around the world including one in Alberta. They provide consulting services to farmers and landscapers transitioning to regenerative practices, soil biology testing, training courses, and a Soil Life Consultant Certification process.

We now know how to restore dirt to living soil by inoculating with high quality compost and compost teas that are loaded with the needed microbes, and by copying nature.

- Nature doesn't plow the soil which releases the organic matter as CO₂ into the atmosphere and destroys the soil structure. By not plowing we sequester much more carbon and water in the soil.
- Nature favours biodiversity. A typical natural prairie grassland has over 140 different plants living together in a mutually beneficial symbiotic relationship. Recent studies are showing that combining a commercial crop with up to 20 different companion cover crops can lead to greater vigour of the soil's micro fauna for long-term health and productivity benefit.
- Natural soil is full of living microbes: they provide all the nutrients plants need, in the right proportions, and protect against disease. Fertilizers are only necessary when we have turned the soil to dirt through the actions of plowing.
- Nature has plants covering the earth year round. Plants actually provide food (exudates) for the microbes in exchange for the nutrients they need.

A new breed of farmers is discovering that nature's way is not only healthier but also much more profitable than investing heavily in expensive fossil fuel based fertilizers, pesticides and herbicides and all the equipment needed to apply them. The current agricultural model is all about killing: weeds, fungi, insects, pests, biodiversity and even the farmer's profit. Note: there are 1700 beneficial insects for every 1 pest species. According to the food writer Michael Pollan, the current model requires the expenditure of 10 calories of fossil fuel energy for every one calorie of food produced.

Most people today live in urban environments and have little contact with the farms that produce the food they eat. According to a World Bank 2014 report, in most western countries agriculture contributes only a small percentage to the GDP and so does not figure prominently. It is crucial in this Anthropocene Era that ecosystem processes be an important part of everyone's education and especially for the key decision makers.

An interesting story about a group of Saskatchewan farmers

I wanted to find out more on the science behind how tilling results in soil carbon being released into the atmosphere. I did a search and found some interesting soil physics research that quantified the effect very nicely. I corresponded with the author, Dr. Don Reicosky, and asked him a lot of questions which he kindly answered. One of my questions was whether there was interesting research happening in Canada on this topic. He drew my attention to a news item about Saskatchewan farmers.

<http://www.grainews.ca/2016/01/29/farmers-ahead-of-carbon-curve/>

Because of extreme water shortages more than 60% of Saskatchewan crop farmers made the change to no-till farming. Tillage results in massive loss of soil carbon and soil moisture. They went from one commercial crop every two years to one every year and returned to profitability. The Saskatchewan Soil Conservation Association (SSCA) measured changes in soil organic carbon on 137 Saskatchewan field sites under direct seeding management over a period of 14 years and proved conclusively that significant amounts of carbon — averaging 0.94 tons of carbon per hectare per year — are sequestered under direct-seeded cropping systems. Greater carbon sequestration is possible by taking the next step of transitioning from chemical-intensive production to soil biology based production. It turns out that

the Saskatchewan no-till farming has not been emulated by farmers in other provinces because they don't have the such extreme water shortage issues.

At COP21 in Paris, the Government of France launched the '4 Pour 1000' initiative with the support of the United Nations Food and Agriculture Organization (FAO). The goal is to increase carbon sequestered in the soil by 0.4% per year. This doesn't sound like very much but keep in mind that soil carbon in most agricultural land is less than 2%. In nature it is more typically around 4%.

<http://4p1000.org/understand>

For details on how much carbon can be sequestered in the soil see the following analysis.

<https://thecarbonunderground.org/the-formula-is-easier-than-you-think>

Of course we need to greatly reduce fossil fuel use if we have any hope of saving humanity, but even if we do that, the temperature will still gradually increase for hundreds of years unless we can get the excess carbon out of the atmosphere. Ceasing plowing is one proven approach to sequestering a significant amount of atmospheric carbon in the soil. Additionally, if we restore the soil biology this will create soil structure that allows air and water to infiltrate to much greater depths allowing for the growth of deeper plant roots and fungal material all of which will help sequester much more carbon. Additionally, increasing soil carbon will have a big positive impact on our food security.

What about cattle? Another important revolution in our understanding of ecosystem processes concerns the role of herbivores. One third of the earth's surface is grasslands which are rapidly turning to desert leading to more climate change, soil loss, droughts, famine and poverty. Conventional wisdom has it that desertification is caused by overgrazing of livestock, mostly cattle, sheep, and goats. According to Allan Savory we were once just as certain the earth was flat. The problem is not numbers but timing.

A typical wild grassland contains more than 140 plant species and like humans, herbivores have their preferences. They first eat their preferred grass and only move to another type after it is all gone. If left in the same pasture for an extended period they will return to eat their favourite as soon as it starts to regrow before the root has been recharged by photosynthesis. By this process they kill off their preferred grass species one at a time, particularly in areas with long periods of drought, leading to desertification. Initially, the baby grass grows slowly and then rapidly in its teenage phase after which it stops growing, which is the time to bring back the herbivores. One solution is to confine the herd into a small part of the pasture with an inexpensive mobile electric fence and move the herd frequently before they get a chance to crop the baby grass again. In Africa, Savory trains herders to achieve the same result.

This process occurs naturally in nature where ferocious predators concentrate the herds of wildebeests for safety. They pee and dung everywhere and have to keep moving to avoid eating eating their own waste. Savory offers a vision for restoring desertified regions of the world using livestock to emulate the ancient herds of wildebeests and bison, together with their natural predators, which were essential for the development of the grasslands in the first place. Healthy grasslands can feed many more herbivores and the human population that depend on them. His work together with our new understanding of soil microbes is providing the needed answers to rapidly reversing desertification.

Holistic Management

Land alone is not separately manageable because it is so tied to the culture, beliefs and values of the people occupying it. Holistic Management, as developed by African biologist Allan Savory, involves using a decision-making framework that ensures all their significant management decisions are simultaneously economically, socially and environmentally sound, both short and long term. No longer are decisions made toward isolated objectives alone, but always toward a new concept called the *holistic context* for any management situation. This helps greatly in avoiding unintended consequences to our actions. The most significant reference in this area is the book “Holistic Management: A New Framework for Decision Making,” by Allan Savory with Jody Butterfield published by Island Press , 1999. A new updated version was released in November of 2016. To handle nature’s complexity, Savory borrowed ideas used by the Military in battle field management where the planning decisions are expected to fail at some point and need to be constantly tested and updated in response to the ever changing conditions. In the context of the ecological restoration of grasslands worldwide, managers implement Holistic Planned Grazing to properly manage livestock — mimicking the predator/prey relationships in which these environments evolved.

If we are to head off environmental disasters, all of us must acquire a basic understanding of the fundamental ecosystem processes that nature employs to provide a healthy soil biology required to support the plant and animal life for our survival.

Note: a digital copy of this document can be retrieved from:

<http://www.phas.ubc.ca/~gregory/papers/CanadaFoodSecurityClimateActionPolicyProposalPhilipGregory18Mar2017.pdf>