BIO-AGRICULTURE

A SOLUTION TO GLOBAL CLIMATE CHANGE http://bio-agriculture.org

AN OVERVIEW OF THE PROPOSAL

- **All over the world conventional farming methods have reduced the amount of carbon stored in the soil. It is estimated that the total amount of soil carbon lost to agriculture is many times more than the amount of carbon emitted by industry as CO2 since the industrial revolution began.**
- **If only a small percentage of this lost soil carbon was returned to the soil a large part of current CO2 emissions would be accounted for.**
- **Bio-agricultural farming methods (organic and biodynamic) have been shown to sequester over 3 metric tonnes of CO2-e per hectare per year into the soil.**
- **These results have been verified in more than thirty world-wide and Australian comparative field trials, some of which have lasted over forty years.**
- **These trials compared bio-agriculture and conventional farming methods. It was found that while bio-agricultural farming methods continuously increased soil carbon, conventional farming systems reduced it.**
- **Our proposal is based on a gradual conversion of farmland to bio-agriculture. As more and more farmland is converted, an increasing amount of our green-house gas emissions are taken out of the atmosphere and stored as soil carbon.**

Soil carbon sequestration is a win-win strategy. It mitigates climate change by offsetting anthropogenic emissions; improves the environment, especially the quality of natural waters; enhances soil quality; improves agronomic productivity; and advances food security. It is the low-hanging fruit and a bridge to the future, until carbon-neutral fuel sources and low-carbon economy take effect.
Professor Ratan Lal (leading soil scientist)

NEW MEASURING TECHNOLOGY

New advances in technology have made measuring soil carbon, not only extremely accurate, but simple and cost effective, thus overcoming one of the major hurdles of an agricultural solution to climate change.

POSSIBLE SCENARIOS

We have developed a calculator that enables the results of scientific research into bio-agriculture and soil carbon to be explored in detail. The calculator generates figures for emission reductions, economic costs/benefits as well as land degradation/restoration and water saving.
The following Scenarios are examples of what is possible by converting 2.5% of farmland per year to bio-agricultural methods.

WORLD SCENARIO

The World will;

- Achieve a maximum temperature increase of 2 deg C.
- Achieve a 25% reduction in CO2-e emissions by 2020.
- Achieve a 76% reduction in CO2-e emissions by 2050.
- Generate Net Benefits of $2,645 billion (US) over 10 years.
- Increase food and water availability, reducing world hunger.
- Reclaim 252 million hectares of lost and degraded agricultural land.

AUSTRALIAN SCENARIO

Australia will;

- Be Carbon Neutral by 2025.
- Achieve a 71% reduction in CO2-e emissions by 2020.
- Achieve a 75% reduction in CO2-e emissions by 2021.
- Generate Net Benefits of $349 billion (US) over 10 years.
- Reclaim 23 million hectares of lost and degraded agricultural land.

BENEFITS OF BIO-AGRICULTURE

1. CARBON SEQUESTRATION

In more than 30 long range farm trials held in Australia, the US and Europe, carbon sequestration rates varied between 0.2 tonnes - 3.0 tonnes carbon per hectare/ year which equals 0.7 tonnes - 11.0 tonnes CO2 equivalent per hectare/year (CO2-e). The amount of carbon sequestered depends on farming methods, soil type, climate and crop varieties. In comparative tests, organic systems accumulated a 12% increase in soil carbon and biodynamic systems accumulated a 16% increase.

Globally soils are estimated to contain 1,500 gigatons of organic carbon which is three times more than the total of carbon in vegetation and the atmosphere combined.

How carbon sequestration works

Carbon dioxide (a molecule made up of one carbon atom and two oxygen atoms—CO2) is taken out of the atmosphere by plants and converted to organic matter by photosynthesis. The oxygen from the molecule is released back into the air while the carbon becomes part of the plant's structure. When living organisms (humans, animals, microbes) consume the plant, they release some of the carbon back into the atmosphere as CO2 through respiration, while some is transformed to soil organic matter.

If roughly 8 percent of the carbon being photosynthesised by the biosphere is retained within the soil and biotic pools, the global carbon budget would be balanced
Professor Ratan Lal (leading soil scientist)

2. LAND RESTORATION

Bio-agricultural farming methods have been proven to halt and reverse soil erosion. In October 2007, the Global Environment Outlook (GEO4) of the United Nations Environment Program, reported that: "Unsustainable land use is causing degradation, a threat as serious as climate change and biodiversity loss. It affects up to a third of the world's people, through pollution, soil erosion, nutrient depletion, water scarcity, salinity and disruption of biological cycles."

Unless urgent action is taken, continuing land degradation will make it harder and harder to produce enough food for the growing world population. This represents one of the great benefits of bio-agriculture — not only will farmers yields increase by bringing degraded land back into production, but world food security will be ensured.

Bio-agricultural farming, methods, show dramatic soil improvements on dryland soils and degraded and desertified land.

In Egypt, biodynamic agriculture has been extremely successful in reclaiming desert land for food and cotton production. Most of Egyptian cotton production, (over 10,000 sq kms) has been converted to organic methods.

3. SAVES WATER

The world grows twice as much food as it did 30 years ago, but uses three times as much water to produce it. With our growing population by 2025 about 60% of humanity could face a disastrous scarcity of water.

Research in Australia has shown that a small increase in soil carbon can increase water stability from 20 % to 50 - 60 %.

Because of the sponge-like properties of humus, bio-agricultural farm management retains 30-50% more rainwater than conventional farming. In irrigation farming, such as rice growing, water usage is reduced by up to 50%, saving about a third of total water usage.

4. POLLUTION REDUCTION AND HEALTH BENEFITS

Bio-agricultural farming methods reduce pollution of soil, water, air and food. Exclusion of the use of pesticides, inorganic fertilisers and insecticides, keeps water effluent clean, saving the life of rivers, ground water and the sea.

The US Environmental Protection Agency has declared that carbon dioxide is a danger to human health and welfare

CLIMATE CHANGE CALCULATOR

We have developed a powerful interactive calculator that puts together the research results on bio-agriculture as well as statistical data from The World Bank, UNEP, FAO, US Census figures and the Australian Government Treasury. The calculator, which is a sophisticated scientific tool, is freely available from our website in versions for all countries of the world.

The calculator includes a tool to assist world climate change negotiations. This has been designed to help negotiators fairly share the costs of emission reductions between the high income and low income countries of the world. In this way the low income countries are not burdened by the costs of emission reductions as these are fully covered by their carbon credit income from the beginning of an agreement.

EMISSION REDUCTION SUMMARY

TOTAL EMISSION REDUCTIONS Government measures + Bio-agriculture % REDUCTION OF CO2-e FROM 2000 LEVELS	2020	2050
	-27%	-79%

Maximum Temperature Increase
2.0 deg C

EXAMPLE *OF A TABLE FROM THE CALCULATOR SHOWING 2020 AND 2050 EMISSION REDUCTIONS AS WELL AS ASSOCIATED TEMPERATURE INCREASES FOR THE WORLD (2.5% yr land conversion)*

Five Yearly Net Benefits/Loss (-)

Net Benefit/Loss(-) of Emission Reduction from 2000 level	2010	2015	2020	2025	2030
Govt measures $b	$0	-$599	-$2,099	-$3,750	-$5,083
Govt measures + Bio-agriculture	$0	$481	$2,645	$7,774	$16,737

EXAMPLE *OF A TABLE FROM THE CALCULATOR SHOWING NET BENEFITS/LOSSES FOR EMISSION REDUCTIONS FOR THE WORLD (2.5% yr land conversion) WITH BIO-AGRICULTURE BY 2015 THERE IS ALREADY A COST BENEFIT. WITHOUT BIO-AGRICULTURE THE COSTS CONTINUE TO RISE.*

EXAMPLE *OF A GRAPH FROM THE CALCULATOR SHOWING CO2e EMISSION REDUCTIONS/INCREASES FOR THE WORLD (2.5% yr land conversion)*

WITH BIO-AGRICULTURE (GREEN) THERE IS A LARGE DECREASE OF EMISSIONS.
WITH BUSINESS AS USUAL (YELLOW) CO2e EMISIONS RISE.
THE RED LINE SHOWS PROJECTED GOVERNMENT MEASURES TO REDUCE EMISSIONS.

ECONOMIC BENEFITS

For the World

The projected costs to reduce global emissions by 10% by 2020 are $250 billion per year.
The projected costs to convert 2.5% of global farmland per year to bio-agriculture (25% converted by 2020) are $7 billion per year.

For Farmers

The main economic benefit for farmers results from being paid carbon credits per tonne of CO2-e they sequester in the soil. Depending on the rate of payment and the amount of carbon sequestered, farmers will receive on average $200 per hectare per year.

Other economic benefits for farmers are;

- Reduction of land and yield loss from land degradation.
- Using less water.
- Substantially increasing land fertility and yields.
- Cutting the use of chemical fertilisers.

Carbon sequestration through bio-agriculture can remove the same amount of carbon from the atmosphere for less than 1% of the cost of existing emission reduction methods.

Countries with extensive agricultural land like Australia, Brazil and Argentina, have enormous emission reduction potential even without any government reductions.

SCIENTIFIC RESEARCH RESULTS

There are over 30 studies by different research organisations that all point to the potential of bio-agricultural farming to be a major part of the solution to global climate change. Many of these studies are very long term, in some cases studying the effects of different farming methods on the

Research has shown that:

- The figures being found in current studies can be verified over the long term
- As long as the right farming techniques are used, carbon will be continuously built up and stored in the soil for many decades.
- While bio-agricultural methods increase soil carbon, conventional farming methods based on chemical fertilisers reduce soil carbon in the long term.
- When taking into account the land degradation caused by conventional farming methods and the land regeneration that bio-agriculture generates, bio-agricultural farming can match and even surpass the yields of conventional farming.

SUMMARY OF RESEARCH RESULTS

FIELD TRIAL	DETAILS	SEQUESTRATION RATE (tonnes CO2-e ha/yr)
Rodale Institute USA 1981-2005	- Organic with compost, cover crop, rotation, no till - Conventional with mineral fertilizer	11.01 tonnes/ha/yr 0.8 tonnes/ha/yr
DOK Switzerland 1977-2005	- Biodynamic, composted farmyard manure - Conventional with mineral fertilizer	2.75 tonnes/ha/yr -0.75 tonnes/ha/yr
NEC. Järna Sweden, 1958-1990	- Biodynamic, ley, composted farm yard manure - Conventional with mineral fertilizer , no ley	2.0 tonnes/ha/yr 0.01 tonnes/ha/yr
GRDC, DPI Vic, Australia 1998-2007	- 14 irrigated farms, high organic matter input - 14 conventional irrigated farms	3.96 tonnes/ha/yr 0%

IMPLEMENTATION OF PROPOSAL

Unlike other emission reduction technologies the bio-agriculture solution can be implemented straight away. Because our proposal only requires a small percentage of land to be converted each year and because it is straightforward and low cost for farmers to convert their land, the implementation is simple and easy to manage. This can buy us valuable time until sufficient low emission technologies are developed and introduced.

The bio-agriculture solution to global warming has the great advantage that it is low cost and easy to implement. The process could be started immediately in both developed and developing countries.

Up until now there has been a lot of debate over our ability to accurately measure the amount of carbon stored in the soil - which is one of the reasons why agricultural carbon sequestration has been left out of emissions trading scheme proposals.
New measuring technology has now been developed that can accurately and cost effectively measure soil carbon. As yet there is little awareness of the great implications that this development has in the fight against climate change.

FOR MORE INFORMATION SEE OUR WEBSITE AT http://bio-agriculture.org
OR CONTACT US AT info@bio-agriculture.org