# Climate Change and GROW BIOINTENSIVE®

Perspectives from Ecology Action

*"... don't treat climate and environmental energy issues as something that's completely separate from poverty reduction and millennium development goals. If you totally undermine the very basis of life on the one planet we've got to live on, then we'll never have sustainable development."*
*-Helen Clark, Chief Administrator of the UNDP*

## Climate Change: Cause and Effect

The planet is getting warmer.

Over the past 200 years, since the beginning of the industrial age, we have been burning fossil fuels, cutting down trees and producing livestock at unprecedented rates. As a result, the levels of green house gases – such as carbon dioxide, methane and nitrous oxide – in the atmosphere have increased dramatically from preindustrial levels. These greenhouses gases trap solar radiation, just like the glass panes in a greenhouse, and warm the planet. This is good to some extent, since that warmth allows life as we know it to flourish. But, as the level of greenhouse gases gets higher and higher, more and more solar radiation is trapped and the temperature of the planet increases to levels we have never experienced. In the last 100 years, the average surface temperature has increased by 0.7°C and it is expected to rise by as much as 4°C over 1990 levels by the end of the century[1]. The eight warmest years on record have all been since 1998.

So what does this mean? According to the World Health Organization, in the year 2000, the increase in temperature cost the lives of 160,000 persons, and this number is expected to double by 2020[2].

- As temperatures get hotter, crop yields are reduced, as crops are not designed to thrive under these conditions.
- Rainfall patterns shift, as we are seeing, causing more droughts, flooding and other catastrophic weather-related events, which will lead to regional food shortages and famine.
- Finally, with increased temperature, polar ice caps begin melting, which we are also seeing, causing dramatic rises in sea levels, flooding of coastal cities, loss of land through erosion, salinization and contamination of drinking waters and soils.

Each of these events has huge negative consequences but combined together become catastrophic on an unprecedented global scale that threatens life as we know it.

## Agriculture and Climate Change: Problems and Solutions

So, we can feel overwhelmed. But then we ask: what can we do? Some people – increasingly few these days – respond by saying that this type of warming is just a natural cycle, that our activities like burning fossil fuels, deforestation and livestock production have nothing to do with it, and that there is not much we can do about it anyway.

But as farmers and gardeners, we know there is something we can do – but it is not simply to continue farming as most of us do, because it turns out that *our current methods of farming are actually a large part of the problem*.

- 25% of carbon dioxide emissions are from cutting and burning forests to grow more crops or cattle, burning biomass and burning fossil fuels[3].
- Livestock production uses 70% of all agricultural land and, along with wetland rice cultivation, accounts for about 50% of all methane production[3].
- Finally, over 70% of nitrous oxide emissions (one of the most heat-trapping of the greenhouse gases) are from the use of conventional tillage and conventional fertilizers[3].

We as farmers and gardeners know that plants take in carbon dioxide from the air and use the carbon to form their stems, leaves, roots and flowers. When the plant is harvested, we can put that carbon into the soil. So, if we farm in a way that maximizes the amount of carbon captured in our crops, and we return as much of that carbon as possible to the soil, we can effectively remove carbon dioxide from the atmosphere and store it in the soil.

The amount of carbon dioxide in the atmosphere is currently about 384 parts per million, higher than any time in the last 150,000 years[4]. This level is expected to reach 600-700 parts per million by 2100[4]. Prior to industrialization, it was 270 parts per million. In January of 2010, NASA climate scientist Dr. James Hansen proposed the target of 350 parts per million in order to stabilize the climate[5]. This may be too modest a goal, but if we consider it a good first step, how can we achieve this?

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*"During the last 50 years... availability of natural resources has shrunk faster than at any other time in history ...This has been compounded by a range of factors including... unprecedented loss of biodiversity, deforestation, loss of soil health, and water and air quality."*

*-IAASTD (2009) Agriculture at a Crossroads: A Global Report*

*"Organic farming leads to many improvements to the natural environment, including increased water retention in soils, improvements in the water-table ... reduced soil erosion combined with improved organic matter in soils, leading to better carbon sequestration and increased agro-biodiversity."*

*-UNEP-UNCTAD: Organic Agriculture and Food Security in Africa*

## Biointensive Solutions to Global Challenges

We must first change the way we farm.

Conventional intensive tillage and conventional fertilizer usage need to be minimized. Livestock production needs to be minimized. We must increase our crop production on our currently available agricultural land, and reduce or halt deforestation. How can we do these things and still feed ourselves and our growing population? GROW BIOINTENSIVE® offers some real solutions here.

- GROW BIOINTENSIVE® is a complete food growing system that requires no fossil fuels, and uses simple people-powered tools, and open-pollinated seeds, making it a system that anyone on the planet can use. It has been successfully used in over 140 countries for more than four decades, and much longer in some cases.
- GROW BIOINTENSIVE® food production uses close-spacing, farm-produced compost, double-digging as needed for cultivation, and minimal inputs of organic fertilizers to balance the soil's nutrients.
- With GROW BIOINTENSIVE®, we can produce 2 to 4 times the yields in the same area because GROW BIOINTENSIVE® –managed soil can support 4 times as many plants per unit of area.
- GROW BIOINTENSIVE® techniques have demonstrated energy production efficiency. Research in onion production indicated an energy efficiency ratio of 51.0 meaning for every calorie expended from direct and embodied energy 51 calories were produced[6]. In US mechanized agriculture, onion production has an efficiency ratio of 0.9[7]. Similar work in flour corn showed GROW BIOINTENSIVE® to be 16 times more energy efficient than conventional production. Much of the energy used in GROW BIOINTENSIVE® is renewable. This combination of renewable energy, and dramatic energy-use reduction through efficiency, results in a significant reduction of greenhouse gases and the global warming they cause.

## Biointensive Compost and Carbon Sequestration

This means more food is produced, to offset losses from increased temperature and other weather-related causes. It also means that our currently used farmland can be much more productive and we do not need to cut down forests in order to produce more food.

Also, GROW BIOINTENSIVE® encourages each farm to grow its own compost crops, in order to generate its own compost material to maintain the organic matter levels and fertility of its soil.

Since compost crops are often taller, larger plants that capture more carbon dioxide, growing them increases the amount of carbon captured from the air and stored in the soil. In addition, with up to four times more carbon-rich crops per unit of area, much more carbon is removed from the atmosphere with GROW BIOINTENSIVE® compared to current agricultural practices.

While GROW BIOINTENSIVE® can be used for sustainable livestock production, its focus is on creating nutritionally complete diets primarily from grain, legume, vegetable and root crops in order to minimize the total area needed to feed ourselves. So, instead of feeding the straw to livestock, and generating more methane, it can be returned to the soil. Most of the carbon that is returned to the soil as compost or as crop residues does not stay in the soil for more than a few years, but a small amount will stay for decades or longer. This means that growing compost crops and adding compost to the soil is not a one-time solution if we want to reduce carbon dioxide levels year after year. Instead, we as farmers and gardeners need to grow compost crops and return as much carbon to the soil as possible every year or more often in warmer climates in order to continually keep the carbon in the soil and out of the atmosphere.

Finally, GROW BIOINTENSIVE® does not require the use of fossil fuels, so its widespread use would greatly reduce the amount of carbon dioxide being emitted by agriculture into the atmosphere.

*"Agricultural carbon sequestration has the potential to substantially mitigate global warming impacts ... practical organic agriculture, if practiced on the planet's 3.5 billion tillable acres, could sequester nearly 40 percent of current $CO_2$ emissions."*

*-Rodale Institute (2008) Regenerative Organic Farming:A Solution to Global Warming*

*"Climate change will affect the four main elements of food security – availability, stability, utilization and access.... The next stages in agricultural development will need to be ...about conserving natural resources, recycling carbon and ensuring that soils retain vital nutrients."*
*- UN-ESCAP: Agriculture and Food Security, Asia/Pacific*

## We Can Change the World

Our analysis assumes that greenhouses gas emission levels will not increase over time, which is not a fully realistic asumption, since the level of atmospheric carbon alone increases by roughly 3 gigatonnes (equivalent to about 1.4 ppm of carbon dioxide by volume) annually[8]. So, what would we need to do to store enough additional carbon in the soil to reduce the atmospheric carbon dioxide level to about 350 parts per million, as proposed by Dr. Hansen?

**Use GROW BIOINTENSIVE® to reduce CO2 emissions**

As mentioned previously, 25% of all carbon dioxide emissions are attributable to agriculture (deforestation, burning of biomass and burning of fossil fuels)[3]. However, as we have illustrated here, an exception to that rule is GROW BIOINTENSIVE® which, in addition to reducing deforestation, uses much less energy compared with conventional agriculture[6] and as little as 1% to 6% of the fossil fuel compared to consumption rates of conventional agriculture. Widespread use of GROW BIOINTENSIVE® may be able to reduce the agricultural carbon dioxide emission rate to as low as 5% or less, reducing the annual carbon dioxide emissions to slightly over 1 ppm.

**Use GROW BIOINTENSIVE® to store carbon in the soil**

If we all change our farming practices to increase the organic matter (OM) content by 150% in tropical soils (to go from 1% to 2.5% OM) and by 300% in temperate soils (to go from 1% to 4% OM) to the depth of one foot (which are obtainable, realistic goals when using GROW BIOINTENSIVE® methods), we would sequester enough carbon to decrease the atmospheric carbon to about 350 ppm - the amount recommended by Dr. Hansen!

With each of us doing a small part, managing our forests well, and adopting methods like GROW BIOINTENSIVE® to reduce the need for reforestation and the use of fossil fuels in agriculture, we can help reduce carbon dioxide emissions, store carbon, and alleviate negative environmental effects. Working together, we can use the tools available to us right now to avert one of the greatest challenges humankind, and in fact, all life on the planet is facing.

## References


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**How Plants Store Carbon in the Soil**

**Plants form a "carbon highway" from atmosphere to soil, and this process of turning air into soil has four stages:**

1. Photosynthesis, whereby plant leaves use the sun's energy to absorb carbon dioxide and separate the carbon and oxygen to form sugars.

2. Re-synthesis occurs inside the plant, where the sugars are transformed into more stable carbon compounds.

3. Exudation and the release of organic matter happen when plants exude carbon into the soil through their roots, and when leaf, stem and root matter enters the soil through the natural life-cycle and/or composting processes.

4. Humification takes place when soil microbes decompose plant carbon into a more stable form (humus).

Adapted from: *Climate-friendly Farming* by Mukti Mitchell in the Nov/Dec 2009 issue of *Resurgence Magazine*

*"...sustainable agriculture can produce enough food for the present global population and, eventually an even larger population, without increasing the area spared for agriculture."*

*-IAASTD (2009) Agriculture at a Crossroads: A Global Report*

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