Cool Livin’

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Global Village Institute
for Appropriate Technology

Franklin, Tennessee
6 May 2011
Deepwell Injection
Deepwell Injection
2090

Hyperwicked
Cool Science
Cool Food
Cool Houses
Coolonomics
Cool Livin’
The Farm
NARCAR Leaders in race to crack one billion in earnings this season

New archaeological dig finds evidence of previously unknown bipeds off North Atlantic

Seine net detritus from last century still a threat to the unwary in Sargasso Sea

Ancient nuclear waste casks from mid-ocean trench transported to shoreline for disposal

Polo World Series: Late nets help Back Bay upset Islanders
The graph illustrates the feedback strength (W/m²/°C) as a function of temperature increase (°C). It shows a curve that peaks at a temperature increase of 10°C, with a notation of 'Radiative damping' near the peak. The temperature range is from 0°C to 20°C, with a scale for feedback strength ranging from -3 to 6 W/m²/°C. The area below the curve is shaded, indicating a higher feedback strength in the range of 10°C to 20°C. The graph also includes an arrow labeled 'Venus' pointing upwards, indicating a significant increase in feedback strength as the temperature increases.
“Hyperwicked Problems”

Embedded, complex problems that defy resolution using “paleonormal science.”
—Valerie A. Brown

With giant problems like climate change and human behavior, there are limits to traditional scientific problem-solving. What is required is a transitional approach, drawing upon

1. Key individuals
2. Affected community
3. Science
4. Those with power in the situation
5. Holistic thinking
Carbon Reservoirs

- Air
- Ocean
- Life
- Earth
null
Wedges

- Biochar / BECS
- Afforestation & Reforestation
- Emissions Reductions
- Carbon Farming

Time to implement

GtC

Hyperwicked  Cool Science  Cool Food  Cool Houses  Coolonomics  Cool Livin’
The Columbian Encounter and the Little Ice Age: Abrupt Land Use Change, Fire, and Greenhouse Forcing

Robert A. Dull; Richard J. Neve; William I. Woods; Dennis K. Bird; Shiri Avnery; William M. Denevan

* Department of Geography and the Environment, University of Texas, Bellarmine College Preparatory, Department of Geography, University of Kansas, Department of Geological and Environmental Sciences, Stanford University, Woodrow Wilson School of Public and International Affairs, Princeton University, Emeritus, Department of Geography, University of Wisconsin-Madison,

First published on: 01 September 2010
Key points:

- In 1492, diseases decimated the populations of the Americas and forests replaced cities and farms; so much that it brought the “Little Ice Age.”

- Conversely, the build-up of Native American populations from AD 600 to 1200 may have caused the ”Midaeval Maximum” and the Moorish invasion of Europe.

- Land use changes and agriculture have the capability of swinging global climate in less than a century.
Proposed definition

**Biochar** is a solid carbonaceous material obtained from thermally degrading **biomass** in the presence of little or no oxygen. The resulting material has properties that have the potential to improve soil fertility and sequester carbon in soil. These properties are measurable and verifiable in a biochar characterization scheme.
Knowledge of charcoal’s soil benefits is not new.


“Charcoal absorbs and condenses the nutritive gases within its pores, The economy and benefit of such applications can be readily understood, as they are continually gleaning these floating materials from the air, and storing them up as food for plants.”

“Guano should be mixed with twice its bulk of charcoal dust.”

“Charcoal should be added to tanks holding liquid manure to absorb the ammonia.”

“Poudrette is the name given to the human faeces after they have been mixed with charcoal dust.”

“The turnep (Brassica rapa.) Charcoal dust applied in the same way has been found to increase the early growth from four to ten-fold.”
“There were many roads here that entered into the interior of the land, very fine highways. Inland from the river at a distance of 30 leagues (6 miles) more or less there could be seen some very large cities that glistened in white and besides this, the land is as fertile and as normal in appearance as our Spain.”

Journals of Fra. Gaspar de Carvajal (1542)
Ballard S. Dunn, Brazil: Home for Southerners (1867)

"... for about twenty miles, on either side of [the river] are lands of the best quality, producing every description of crops ... in the greatest perfection and abundance. "

The character of the soil is usually called with us 'mulatto,' and its depth from eight inches to five feet."
Ballard S. Dunn, *Brazil: Home for Southerners* (1867)

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Charles Frederick Hartt
Cornell University Expeditions
(1865-1887)

“the bluff land owes its richness
to the refuse of a thousand
kitchens for maybe a thousand
years”
Wim Sombroek (1944-2003)
*Amazon Soils* (1966)

**High Carbon (SOM) content**
up to 45% recalcitrant carbon
compared with .5% in nearby soils
one to two meters deep

**Age:** 800-4000 years
radiocarbon dating (charcoal)
recent research: 8000 years

**High Microbial activity**
“microbial reef”
nitrogenous bacteria (nitrogen fixing)

**High nutrient content**
Calcium & Phosphorus
Nitrogen
Cation Exchange Capacity (CEC)
primary char which means it maintains much of its original physical structure. This structure seems to support enhanced microbial growth, aid in water retention and enhanced soil structure.

The material has good CEC and extended lifetime in the soil matrix. It has excellent chemical, physical and biological properties.

IBI conference 9/08
Hyperwicked
Cool Science
Cool Food
Cool Houses
Coolonomics
Cool Livin’
Compost

**BENEFITS OF COMPOST**

**ENRICHES SOIL**
- Adds organic material
- Improves fertility and productivity
- Suppresses plant diseases
- Discourages insects
- Increases water retention
- Inoculates soil with beneficial microorganisms
- Reduces or eliminates fertilizer needs
- Moderates soil temperature

**PREVENTS POLLUTION**
- Reduces methane production in landfills
- Reduces or eliminates organic garbage
- Reduces or eliminates sewage

**FIGHTS EXISTING POLLUTION**
- Degraders toxic chemicals
- Binds heavy metals
- Cleans contaminated air
- Cleans stormwater runoff

**RESTORES LAND**
- Aids in reforestation
- Helps restore wildlife habitats
- Helps reclaim mined lands
- Helps restore damaged wetlands
- Helps prevent erosion on flood plains

**DESTROYS PATHOGENS**
- Can destroy human disease organisms
- Can destroy plant pathogens
- Can destroy livestock pathogens

**SAVES MONEY**
- Can be used to produce food
- Can eliminate waste disposal costs
- Reduces the need for water, fertilizers, and pesticides
- Can be sold at a profit
- Extends landfill life by diverting materials
- Is a less costly bioremediation technique

And author's experience.
Compost

photo courtesy Elaine Ingham, SoilFoodWeb.com
Compost
Compost Tea Application

photo courtesy Elaine Ingham, SoilFoodWeb.com
Hendrikus Schraven holding roots of rygrass planted July 15, 2002

Harvested Nov 6, 2002

Mowed twice to \(\frac{1}{2}\) inch

70% Essential Soil, 30% Compost with organic fertilizer

Compost tea once

No weeds, no disease

www.soildynamics.com
CharBiological

charcoal based microbial fertilizers
Feasibility study by Yasuyuki Okimori, Makoto Ogawa and Fumio Takahashi: Biochar carbon sink in South Sumatra, Indonesia

18,500 tC/yr used as soil amendment in agriculture and forestry.
Biochar is a charcoal produced under high temperatures using crop residues, animal manure, or any type of organic waste material. Biochar looks very similar to potting soil. The combined production and use of biochar is considered a carbon-negative process, meaning that carbon is removed from the atmosphere and will not be released into the atmosphere at a later time.

Obstacles that may stall rapid adoption of biochar production systems include technology costs, system operation and maintenance, feedstock availability, and biochar handling. Biochar research and development is in its infancy. Nevertheless, interest in biochar as a multifaceted solution to agricultural and natural resource issues is growing at a rapid pace both nationally and internationally.

Past Congresses have proposed numerous climate change bills, many of which do not directly address mitigation and adaptation technologies at developmental stages like biochar. However, biochar may equip agricultural and forestry producers with numerous revenue-generating products: carbon offsets, fertilizer, and energy. A clearly defined policy medium that supports this technology has yet to emerge (e.g., soil conservation, alternative energy, climate change).
Cool Food
Pyrolizing Kiln producing Biochar

Heat Extraction and Transfer

Biogas Compression and Storage

Sterling Engine for Electricity

Harttung’s Farm

Pyrolysis

Cool Science

Cool Food

Cool Houses

Coolonomics

Cool Livin’
Experimental sale of “Cool Vegetables” (CV)

- Materials for sales

CV Promotion at COOP Kobe supermarket

- Panel
- Video Display
- URL access from cellular phone
- Price card
- Questionnaire sheet

Brand logo

食卓から地球を冷そう！

クルベジ™

↑
courtesy Carbon Minus Project and Steven R. McGreevy, Kyoto University
cool vegetables
“Indigenous” Agriculture

Local food production

Nutrients cycle; concentrate at population centers
Cool Fuel
At the Tamera Solar Village in Portugal, vegetable oil is heated under parabolic Fresnel lens arrays to 200°C then stored up to 3 days in insulated tanks before being used for heating, cooking and to fire Stirling engines for electricity.
Hyperwicked
Cool Science
Cool Fuel
Cool Houses
Coolonomics
Cool Livin’
Carbon Zero
BIOCHAR PYROLYSIS REACTOR

Swirl Burner
Inflated Mapper
Syngas Manifold
Air Injection Line
Inflated Auger

Hot Gas Injection Tube
Syngas Supply Line

Pulse Jet Burner

Support Frame
Outflow Auger
Inert Gas Supply

Questions? Comments?
Need more information?
Register your interest at
WWW.CARBONZERO.COM

Diameter: 7.4 inches
Height: 52 inches
Lucia Stove
12 vDC at 5°
Like a solar panel that works at night as well.
Adam Retort
BEC Mobile Retort
Michael Antal’s experimental moderate-temperature aqueous alkaline/carbonate biocarbon fuel cell.
Terra Amata, France
400,000 BCE
Natural Building

- Earth
- Stone
- Gravel
- Sand
- Grass
- Thatch
- Bamboo
- Cactus and other plants
- Straw
- Lime and Gypsum
- Recycled materials
Pacas de paja

Photo by Alejandra Caballero

Centro San Isidro
Cob
Living Roof
The Farm
Summertown, Tennessee
Derinkuyu
Underground City
(Turkey, 300 AD)
Cool-onomics
Food

Fuel

Fiber

Soil

Carbon

Recycle

Wastes

Heat

Cool Fuel

Cool Science

Cool Houses

Coolonomics

Cool Livin'

Eco Village

Carbon Field

The path to sustainability starts here
Quality of Life

Source: Maslow's hierarchy of needs
An “ecovillage” is...

“A fully-featured human settlement, with independent sources of initiative, in which human activities are integrated into the natural environment in a way that is sustainable into the indefinite future.”

—Robert and Diane Gilman
Ecovillages and Sustainable Communities
(1991, updated)
transparent government
egalitarian and open access
freedom of thought and expression
right livelihood
clean and safe workplace
healthy homes
fair wage
non-exploitative business practices
race, ethnic and gender neutrality
clean renewable energy
full cycle re-use
soil and climate restoring
responsible water use
progressive full-life education
life-cycle costing
pursuit of happiness
truth and justice

Ecovillages
10 BASIC HUMAN NEEDS
• a clean and beautiful environment
• a clean and adequate supply of water
• basic clothing
• a balanced diet
• a simple house to live in
• basic health care
• simple communications facilities
• basic energy requirements
• well-rounded education, and
• cultural and spiritual sustenance
Sasardi
Colombia
The Haitian Earthquake Experiment

Nathaniel Mulcahy showing designs that metal workers added to the stove wind screens. The metal workers say that trees and birds will return to Haiti when soil is rebuilt with biochar.

Photo Credit: World Stove
Step One

• One or more demonstration stoves
• 30 small stoves for training
• Small manual press for biomass testing
Step Two

- Shop for beginning production of stoves
- Material to build 500 stoves
- Small pellet mill (50-600 kg/hr)
Step Three

- Expand stove production
- Either increase pellet production or purchase larger mill.
Step Four

- Start measurable offsets program
- Begin char collection/analysis/quantification
- Begin CDM certification
Step Five

Use approved & documented char in

- Afforestation/Reforestation/REDD+ programs
- Soil improvement programs (Super Gardens)
- Combatting desertification
Aerobic, odor-free composting toilet

Requires:
Two 5 gallon buckets
Three kg biochar
Two lids
12 cm of 1 cm rubber tubing
Water Purification

Water filter made with tested biochar

Materials needed
One 1.5 liter plastic bottle
Small scrap of cloth
Small amount of boiled clay

Water reservoir

pH neutral biochar

cloth

clay

Water reservoir

Works the same way as a store-bought water filter

Add 1 drop (0.05 ml) of bleach to 1 litre of water, shake and allow to stand for at least 30 minutes before drinking. Each use of the LuciaStove will produce enough char to filter 100 liters of water.
Global Treeplanting
Potential = 80 GtC (PgC) per year

Key Actors:
- UNCDD
- Bellona Foundation
- Sahara Forest Project
- Permaculture Research Institute
- Waterboxx
- WorldStove
Agroforestry

More food per hectare
Food sovereignty
Resilence to climate change & energy prices
Eco-Farming Can Double Food Production in 10 Years, says new UN report

GENEVA – Small-scale farmers can double food production within 10 years in critical regions by using ecological methods, a new UN report* shows. Based on an extensive review of the recent scientific literature, the study calls for a fundamental shift towards agroecology as a way to boost food production and improve the situation of the poorest.

“To feed 9 billion people in 2050, we urgently need to adopt the most efficient farming techniques available,” says Olivier De Schutter, UN Special Rapporteur on the right to food and author of the report. “Today’s scientific evidence demonstrates that agroecological methods outperform the use of chemical fertilizers in boosting food production where the hungry live -- especially in unfavorable environments.”

Agroecology applies ecological science to the design of agricultural systems that can help put an end to food crises and address climate-change and poverty challenges. It enhances soils productivity and protects the crops against pests by relying on the natural environment such as beneficial trees, plants, animals and insects.

“To date, agroecological projects have shown an average crop yield increase of 80% in 57 developing countries, with an average increase of 116% for all African projects,” De Schutter says. “Recent projects conducted in 20 African countries demonstrated a doubling of crop yields over a period of 3-10 years.”
Emissions Peaking After 2020: More than 1 Kyoto per Year

(Meinshausen et al. 2009b)
Soil Carbon Incentives  
(Douthwaite & Byrne, 2009)

Inventory C by satellite and ground surveys
Pathways to adaptation and mitigation:

Permaculture (carbon minus) trainings for
- Government agencies (e.g. UNITAR)
- NGOs
- Students and smallholders

Prototyping and demonstrations
- Transitional farming & resilience
- Localization & self-reliance initiatives

Model eco-communities
Transition towns and cities
Governmental incentives & UNFCCC process
Seiben Linden, Germany

Zero Energy Self-Built Housing

Cool Livin’
for more...

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CLIMATE IN CRISIS
by Albert K. Bates
The Greenhouse Effect And What We Can Do

The Post-Petroleum Survival Guide and Cookbook

The Biochar Solution
Carbon Farming and Climate Change
Albert Bates
with a foreword by Vandana Shiva