

Molybdenum

Missing Element in Climate Change Equations

by David Yarrow, September 2005

IN THE WAKE OF THE KATRINA CATASTROPHE that laid low Louisiana's levees to utterly empty the streets of New Orleans and all that jazz, Americans must rethink George Bush's claim global warming is unproven science, and reducing greenhouse gas emissions is too costly for America's economy.

A sudden surge in oil and gas prices gave lie to the White House mindset. Total loss of America's third largest port—crucial to ship grain, soybeans and oil overseas—requires reassessing climate change consequences. The \$200 billion to rebuild Gulf communities in three states from a single storm casts long, dark shadows on our future, to highlight federal inaction and denial of the #1 threat to global security.

Early this summer, I bought a newspaper. Page one of **USA Today** headlined: **Global Warming not a Theory**. In 1975, I first read about rising carbon dioxide in Earth's atmosphere, and I took serious this steadily climbing curve. By February 1990, I saw enough data to convince me climate change is the overwhelming onrushing reality of the 21st century.

So, 30 years later, I had to read what America's daily paper said about our imminent climate change challenge.

I was impressed—but disappointed. Each paragraph quoted a scientist or corporate executive with evidence about this rising global thermal imbalance in the atmosphere.

But once again, the usual experts proclaim human ingenuity, while ignoring the inherent power, intelligence and integrity of Earth's natural communities. No one mentioned the effects of sea and soil in the planet's thermal and carbon cycles. The article failed to identify other fundamental factors driving global warming: **destruction of topsoil, trees and forests**. And no mention of **molybdenum**—a trace element that can tip the climate change equation in favor of future generations.

The **USA Today** article told of tailpipes and smokestacks as sources of greenhouse gases. The writers made not one mention of invisible fumes rising from farm fields and clear cut forests. Industrial technologies to remove carbon from Earth's air were reviewed, but nothing on how nature's does this task—how photosynthesis combines CO₂ and H₂O to create carbohydrates. And nothing on how micro-organisms created and kept the planet's air and soil in balance for over one billion years.

As ever, our industrial fixation is favored, while ecology is forgotten.

ON THE DOWNSIDE, FARM AND FOREST SOILS have released uncounted quantities of CO₂, CH₄, NO₂, NH₄, and other volatile gases. Regular readers of **Acres USA** need no instruction about soil destruction. For three decades, the pages of this pioneer publication for ecological farming were filled with warnings about America's fundamental fertilizer follies. But here's a thumbnail:

Deforestation: Removing centuries-old ancient forests first broke the carbon cycle that captures greenhouse gases to sequester them as carbohydrates and nitrates in soil. Carbon held in living trees and understory was squandered. Most trees weren't cut for timber, but burned for fuel, charcoal and potash. Exposed to solar heat, waters sank below soil surface. Carbon stored as humus oxidized into vapors rising from naked soil. Thousands of years of leaf litter, rotting roots and decaying limbs and trunks turned into gases in the air.

Annual Plowing: Then came moldboard plows, turning and exposing former forest soils to sun and wind to accelerate oxidation and erosion. Plowing the prairies sliced away networks of fine roots that captured nutrients, to send them upward in sap to grow new shoots each year. Organisms that recycle minerals between root and shoot, and—in death and decay—back into soil again, perished as their habitat was ripped up and ruined. Declining soil organic matter not only thinned the land's already thin skin of topsoil, but accelerated the loss of minerals as silt and trace elements raced down streams into lakes,

estuaries and seas, where soil carbon fermented into methane.

Limestone fertilizers squandered millennia of fossil carbon stored in carbonate bedrock. Acid fertilizers sped the release of soil carbon, nitrogen and trace elements. Organic matter once safely stored as soil carbon now floats free in the atmosphere. Confinement feeding of grain to livestock adds more methane and nitrous oxide to this growing chemical imbalance in **The Biocycle**.

Fossil Fuels: This destruction was underway well before industrial society began to mine carbon fossil into fuels to fire the wheels of machines and factories. Huge amounts of fossil fuel and natural gas are required to manufacture those fertilizers and pesticides, and then ship, spread and spray them on fields. Mechanized farms burn vast volumes of fossil fuel—sure to rise in price in Katrina's aftermath, driving up next year's food costs.

On the opposite side of The Biocycle, these processes not only release accumulated carbon, but they disrupt the capacity of the soil's food web of plants, microbes and other organisms to remove the growing load of greenhouse gases. Both ends of the carbon cycle are disturbed. Nature's ability to heal her damaged,

unbalanced **Biocycle** is degraded when forest is removed and soil sterilized.

Industrial farming and forestry were major contributors to the release of greenhouse gases to give us our unbalanced climate change equation. And their rates of release are still on the increase.

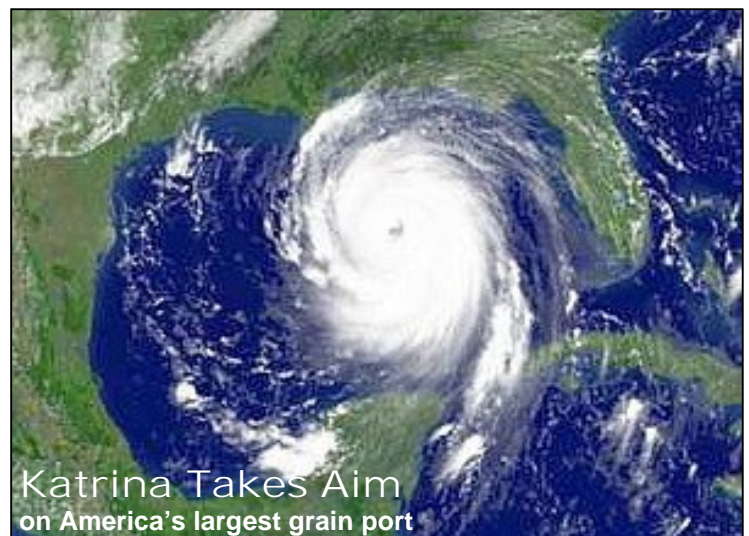
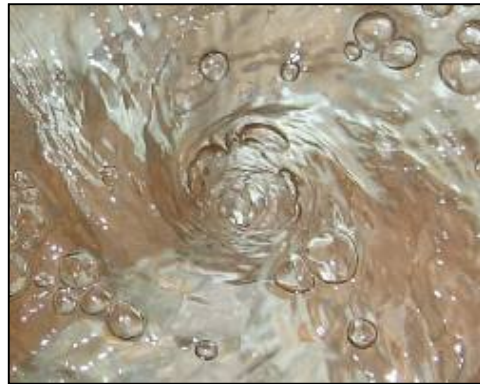
A FARMER BET A PHYSICIST he could make more free energy with an ounce of **molybdenum** than the physicist with an ounce of **uranium**.

The farmer won. He sprayed his ounce of **molybdenum** on an acre of alfalfa.

Molybdenum is a trace element essential to four cell enzymes. Three are in our liver detoxication system. A microdose of this metal allows our immune system to tag poisons in blood to eliminate through our kidneys. Infection and disease immunity are boosted by a microgram of molly in your body.

The fourth fixes nitrogen and oxygen in air into nitrates in soil. **Nitrogenase** enzyme unites these two most abundant gases into water soluble chemical. This molecular magic requires a single atom of molybdenum to carry the chemical charge in this reaction.

Rhizobia bacteria specialize in creating this enzyme, and form intimate partnerships with roots of alfalfa. These micro-organisms grow in





pink nodules on roots of this three-leaved plant and other legumes. *Rhizobia* inhabit these subterranean condominiums, and pay their rent by feeding nitrates to alfalfa roots. In return, roots secrete sugars to empower this microbial synthesis.

By ecological farming, an ounce of molly makes more *nitrogenase*, to feed a population explosion of

Rhizobia in root nodules. Thus, these microbes can fix more nitrogen into nitrates, and pump this nutrient into roots. Plants then grow more leaves full of chlorophyll for photosynthesis to fix more sunshine into sugars. The added solar energy captured as carbohydrates by the acre of alfalfa is greater than is liberated by fission of an ounce of uranium.

LIKE THIS TALE, OUR CHOICE IS CLEAR between a solar-biological versus nuclear future. The nuclear equation doesn't balance. Radioactivity released from Earth's underworld into the biosphere has incomprehensible consequences. The nuclear demon is unleashed from Pandora's box. Nuclear wastes pile up awaiting accidents to spread them. Earth's reproductive life is held hostage by the god of the atomic underworld.

In coming decades of global warming, a nuclear winter will be but premature onset to climate change. Even if the nuclear genie is put back in his underworld bottle, we still must stop burning fossil fuel, and put the carbon back in stone and soil.

This simple story reveals how nature gets the most from the least. Trace elements amplify and accelerate life's fundamental metabolisms. As co-factors in enzymes, vitamins, hormones and other key regulator molecules, these least of the elements are critical factors in biochemical reactions. Thus, a microgram of trace element means more than an ounce of major minerals.

Ecological destruction in recent decades has thrown the global carbon cycle out of balance. The folly of chemical dependent, oil addicted agriculture now requires action in the century to turn back the clock and return carbon back to the soil, and turn human society in a new direction—or, in the direction of renewal.

Cornell agriculture scientist Dr. David Pimentel recently reported, "Organic agriculture systems absorb and retain significant amounts of carbon in the soil. The implication for global warming is that soil carbon in organic systems increases 15-28%, equivalent to 3,500 pounds of carbon dioxide per hectare out of the air." Multiplied by the number of hectares in agriculture, this is a significant quantity of carbon. And then there are the forests—nature's number one producers of topsoil.

THE ULTIMATE SOLUTION to this forgotten factor in the climate change equation is in the sea—the single best source for molybdenum and other trace elements missing from soil. For two billion years, minerals in stone and soil have washed into the ocean. The sea doesn't have one, or two or a few elements. The sea has all 90 water soluble elements in nature's most perfect proportions—the same ratios as in blood and amniotic fluid. Molybdenum, iodine, chromium, cobalt, and every essential element are present in Earth's most complete and balanced solution. And only the sea exceeds the only soil at fixing CO₂, locking it up in carbonates (limestone) formed from fossil shells of living organisms.

So, ecological balance begins by recycling the sea. Soil renewal requires the return of the full spectrum of minerals in the sea to the land

from whence they came. But putting missing elements back in soil isn't enough to repair the unbalanced climate change equation. The necessary micro-organisms must be present to digest the micro-nutrients. *Nitrogenase* isn't exclusive to *Rhizobia*. Bacteria that fix nitrogen live freely in most soil and water, and proliferate in compost and similar sites of fermentation and digestion. Microbial inoculation to renew the soil food web is a second step to soil renewal.

Just as each element must be present in proper proportion to all the others, micro-organisms survive and thrive in a community of organic life. *Rhizobia* needs not only legumes and other hosts to house it. Nitrogen-fixing microbes must be in healthy balance with photosynthetic bacteria, lactobacillus, mycorrhizae, fungi, yeasts, algae, amoebae and all other living creatures. Everything from viruses to earthworms is required for a complete and healthy soil food web to nurse seeds into mature, healthy plants.

TO BALANCE OUR PLANET'S BROKEN BIOCYCLE and restore carbon to earth's soils

isn't merely a matter of recycling elements from the sea. More deeply, humans must regain a lost respect for nature, and agree to live within the limits of earth's cycles and capacities. Such a shift in thinking is as revolutionary as constitutional law and democracy. Mankind must abide by nature's law, rather than alter and engineer nature to suit exaggerated ambitions and appetites. And we must teach this humble wisdom and discipline to our children, and instill this commitment in our culture we pass on to future generations.

A thriving blend of bacteria is called a "culture." Culture isn't just community, but memories, instructions and rituals passed to offspring. The most fundamental human culture is to grow, harvest, cook, and share food. Agriculture isn't mere technology and technique, but ceremonies and philosophy to live by the bounds, bounty and beauty of nature.

However, based on reading *USA Today*, we aren't even looking in the right direction yet. Katrina was a wake up call, but Americans are still asleep, blaming nature for disturbing our oil-driven dream.

David Yarrow

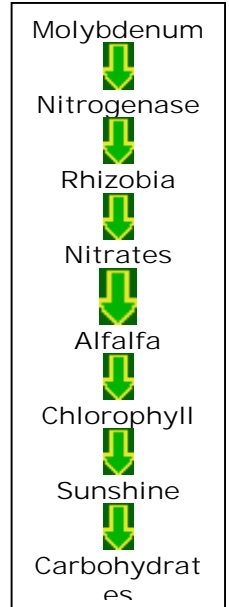
Turtle EyeLand Sanctuary

44 Gilligan Road, East Greenbush, NY 12061

518-881-6632

dyarrow@nycap.rr.com

www.championtrees.org



"Organic agriculture systems absorb and retain 3,500 pounds of carbon dioxide per hectare out of the air."

—**Dr. David Pimentel**, scientist, 2005
Cornell University, Agriculture Economics



Recycle the Sea

Nature's ultimate storehouse of trace elements



Turtle EyeLand

44 Gilligan Road, East Greenbush, NY 12061

518-881-6632

dyarrow@nycap.rr.com