From the Ground Up

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Authors: Bruce Bosley
Editor: Brad Erker
Graphic Design: Kierra Jewell

Soils, Climate Change, & Global Food Security

Bruce Bosley

American farmers take pride in providing crops to feed and clothe people of the United States and the world. They are also producing crops destined for renewable energy products so that our country is less dependent on imported oil. United Nation projections indicate the world population will increase from about 6.8 billion people in 2009 to 8.9 billion people in 2050 representing an increase in population of 30% above current levels. All of these people will cause an increasing demand for food, water, energy, and other world resources. The question that many scientists ask is whether Agriculture can increase production output enough to meet the food, fiber, and renewable energy needs of this many people.

Dr. Rattan Lal, Ohio State University Professor, gave a lecture on this topic at Colorado State University on April 22nd entitled "Soils, Climate Change, and Global Food Security". This article summarizes some of his findings and charge for how agriculture can best accommodate the world's growing population demands. But, because I'm paraphrasing from memory, what follows is what I learned and not exactly what Dr. Lal said. So please respond to me if you wish to discuss or criticize this article.

Expanding human populations increase the use of energy, water, and impact the world through deforestation, CO_2 emissions, land degradation and desertification. Furthermore, as people move from third world subsistence to higher income levels they increase their use of resources and negative environmental impacts.

A major concern is the loss of arable land suitable for producing crops. If population growth continues for these select countries, the land area to support the people will be at critically low levels that are unsustainable for self sufficiency with current production practices.

Per capita arable land by 2025			
Country	Acres per person	Country	Acres per person
Egypt	.07	Kenya	.10
Bangladesh	.12	Tanzania	.12
China	.15	Philippines	.17
Pakistan	.17	Indonesia	.20
Columbia	.27	Ethiopia	.27
India	.30	Nigeria	.35
Ecuador	.37	Peru	.15
Mexico	.44		

History has shown that when food is scarce, people will clear marginal land for farming. In these situations they nearly always remove more carbon and nutrients from the soils than they return causing a further degradation of the soil quality.

Desertification, while largely climate related, can be accelerated by human activities including climate change. Currently, 23.5% of the world's land area is covered with deserts, affecting 23.9% of the world's population (1.54 billion people).

In 2006 approximately half of the people of the world lived in urban areas. This percentage continues to grow. Currently the annual population growth rate is 70 to 80 million people. The land needed for basic living space (housing, roads, parking, and shopping malls) for each million is about 99,000 acres which is roughly equal to the irrigated land in either Morgan or Logan county. An acreage loss of prime agricultural land to urbanization and rural residential living is a trend that is reducing the productive capacity of American farmers. This is a very troublesome trend in light of the world's agricultural output needs for the future. We've taken for granted the gift of good land.

Water use and Human Needs	
Drinking	0.5 to 1.3 gal/person/day
Household	5 to 130 gal/person/day
Wheat	48 to 60 gal/lb.
Meat	600 to 1800 gal/lb
Biofuel	265 to 925 gal/gal fuel

Increasing demand on fresh water is another very critical world and local issue. Farmers and city water planners along the South Platte basin have been very involved with protecting water rights especially with increasing water needs from Front Range urban and industrial suppliers. Farmers in the Republican River Basin are also coping with higher pumping and regulatory costs in their efforts at complying with interstate water compacts. Water shortages and drought induced food disasters frequently affect many countries in the world.

World Energy consumption is expected to increase in 2050 by 84% above current consumption rates. The current worldwide daily oil consumption is 86 million barrels/day or on average ¾ of a gallon per person per day. Consider how tight the competition for oil will become as people in the developing world begin to use oil approaching that of the western developed world.

Biofuels are currently being promoted to replace our dependency on foreign oil. A 10% substitution of petrol and diesel fuel is estimated to require 43% of the

current cropland in the USA and 38% of the EU's cropland. This means that forests and grasslands would need to be cleared to enable production of energy crops. Currently US forests contain only 2% of this country's energy needs using advanced wood combustion (AWC) facilities. It is estimated that the United States could sustainably produce 368 million dry tons of wood per year which would still only provide 5% of our current energy use. Dr. Lal quoted Bobby Stewart "Some have suggested that cellulosic ethanol can be produced with low inputs on marginal soils. This is a myth at best, and a lie at worst".

Crop yield increase with 1% more soil OM (Lal, 2005)	
Crop	Yield Increase
Field corn	1.6 to 4.8 bu/acre
Soybeans	0.3 to 0.7 bu/acre
Wheat	0.3 to 1.0 bu/acre
Sorghum	1.2 to 2.1 bu/acre
Millet	0.5 to 1.2 bu/acre
Dry Beans	0.4 to 0.9 bu/acre

Dr. Lal is especially interested in soil organic matter (OM) and carbon sequestration. Soil scientists have long known that crop yields are enhanced by increasing levels of soil carbon especially where soil organic matter is very low. Research conducted by Dr. Lal's institute found higher yields with increasing organic matter even when supplying sufficient fertilizer. Yield benefits are especially likely when starting soil OM is below 2%.

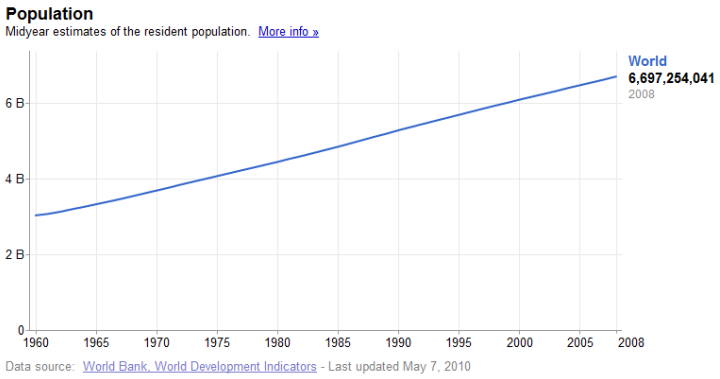
There is a significant biofuel debt in clearing natural forests, grassland, or CRP for producing biofuels. The worse case scenario is in removing peatland forest in Indonesia for producing palm biodiesel where it would take 423 years to replace the carbon destroyed in conversion. Brazilian forest removal requires 17 years to repay the carbon debt with sugarcane ethanol. Corn ethanol produced on land converted from grassland in the cornbelt takes 93 years to repay the carbon debt. The best scenario, based on North Dakota research, was in converting marginal cropland in North Dakota to prairie biomass ethanol where no carbon debt occurred.

Soil organic matter declines to 60% (or less) of the original level when virgin prairie or forest soils are converted to farmland using conventional farming methods. Using current agricultural know-how including no-till, intensive crop rotational management, cover crops, and other soil enhancing methods can bring soil organic matter up to about 80% of pre-farming levels.

It is hoped that Agricultural producers can increase this even higher through discovering innovative technologies. Dr. Lal described a concept for managing soil properties and processes for enhancing eco-efficiency in production systems using carbon, water, and fertilizer nutrients. His goal is to find ways for increasing land productivity through better management of these important field inputs that we sometimes take for granted.

Dr. Lal was asked about organic agriculture's role in feeding the world while engaging in "sustainable farming." While organic farming is wonderful for local food production and home gardening, we simply cannot feed the world with it. We must utilize all available technologies including use of GM crops to meet this challenge. If the human population was 2 billion, perhaps organic farming could do the job, but we are now almost 7 billion people.

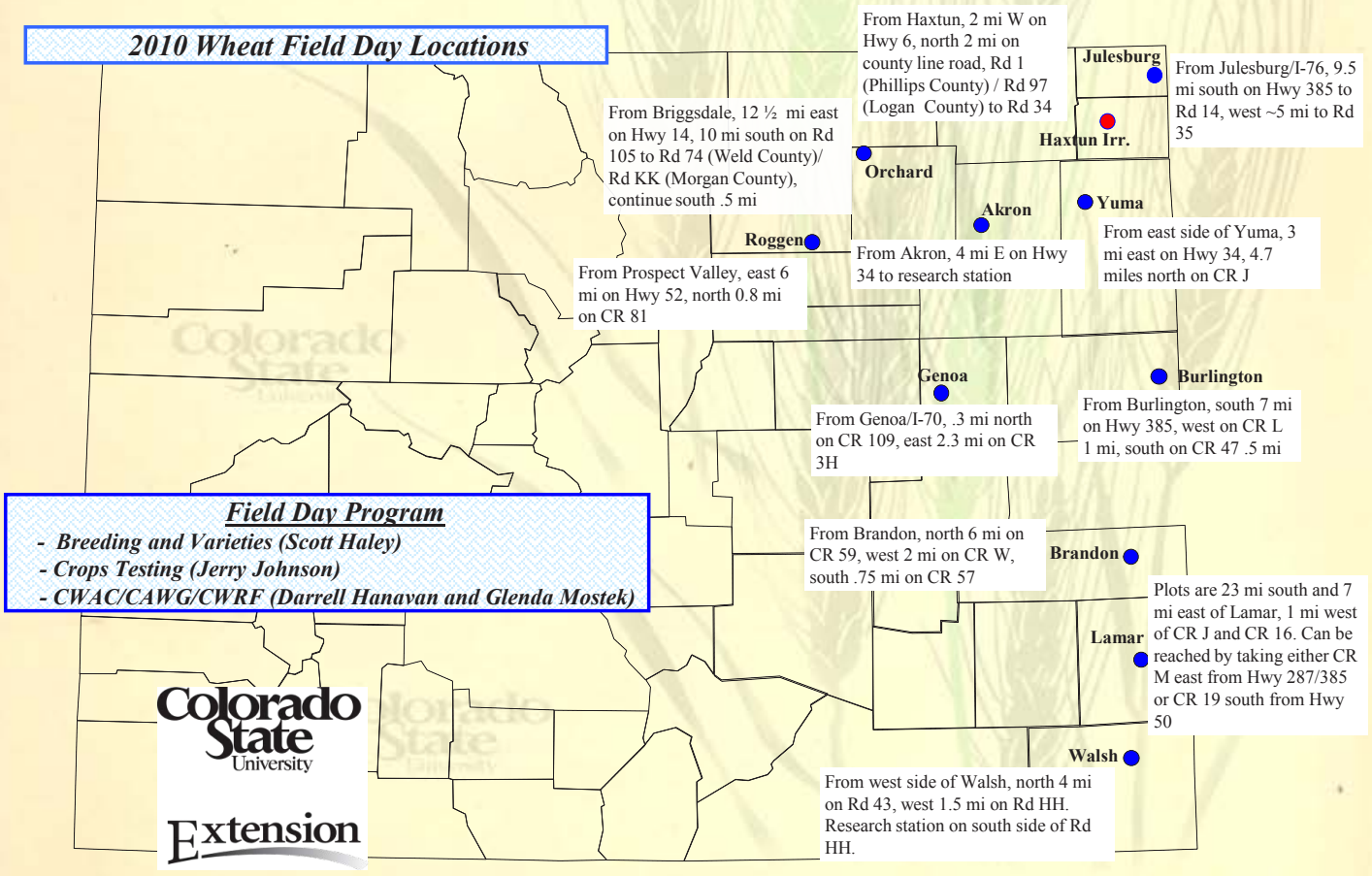
I've spent 31 years working closely with farmers & ranchers in northeast Colorado. I know that they are very capable of producing food, fuel, and fiber for a growing world of people provided that they are not hampered with loss of land, water, or short-sighted laws. Please join me in educating our society on the importance of Colorado's Agricultural industry for Colorado citizens and to the people of the world.



Colorado Wheat Field Days 2010

Walsh	*June 7 (Mon)*	*8:30 a.m. at Plainsman Research Center, Baca County*
Lamar	*June 7 (Mon)*	*12 p.m. at John Stulp Farm, Prowers County*
Brandon	*June 7 (Mon)*	*5 p.m. at Burl Scherler Farm, Kiowa County*
Burlington	*June 8 (Tues)*	*8:30 a.m. at Randy Wilks Farm, Kit Carson County*
Genoa	*June 8 (Tues)*	*12 p.m. at Ross Hansen Farm, Lincoln County*
Roggen	*June 8 (Tues)*	*5 p.m. at Cooksey Farms, Weld County*
Yuma	*June 9 (Wed)*	*8:30 a.m. at Andrews Brothers Farm, Yuma County*
Julesburg	*June 9 (Wed)*	*12 p.m. at Jim and David Carlson Farm, Sedgwick County*
Haxtun (Irrigated)	*June 9 (Wed)*	*4 p.m. at Brian Kipp Farm, Phillips County*
Akron	*June 16 (Wed)*	*7:30 a.m. at Central Great Plains Research Station, Washington County*
Orchard	*June 16 (Wed)*	*4:00 p.m. at Cary Wickstrom Farm, Morgan County*

2010 Wheat Field Day Locations



Field Day Program

- *Breeding and Varieties (Scott Haley)*
- *Crops Testing (Jerry Johnson)*
- *CWAC/CAWG/CWRF (Darrell Hanavan and Glenda Mostek)*

Colorado State University Extension

"Working Together for Colorado Wheat Farmers"

Extension Soil & Crop Department
Colorado State University
1170 Campus Delivery
Fort Collins, CO 80523-1170