Subtle Climate Shift, Major Agricultural Impact?

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Is responsible for the aridity of **Atacama Desert** in **northern Chile** and coastal areas of Peru and also the aridity of southern Ecuador. Marine air is cooled by the current and thus is not conducive to generating precipitation (although clouds and fog are produced).
In parts of the coast known as lomas the fog is so dense that water condenses enough to support the local vegetation. (also in Mediterranean and in South California)
Home of the El Nino
2016: 3rd in strength since 1950

La Niña does not necessarily follow a strong El Niño, only a 35% chance of adversely impacting Midwest crops.
El Nino

Most years strong enough about Christmas time to bring light rain.

About 1 year in 7, strong enough to bring disaster to Peru and to impact the weather of the United States.
“The climate is changing, climate has always changed & will always change. The question is; ‘how much, how fast, how come?’”  
D. M. Gates ‘66
The VICIOUS CYCLE:
Population, Agriculture, Climate
Who will BREAK the CYCLE?

Who will BREAK the CYCLE?
Atmospheric Carbon Dioxide
Measured at Manua Loa, Hawaii

Agriculture: The Earth’s Major Industry

Agriculture: Enables Climate Change
With “0” agriculture the population of Earth would not likely be of sufficient numbers to cause climate change.

Agriculture: Directly (and greatly) impacted by climate change.
Light, temperature, soil moisture, ...

Agriculture: Directly impacts climate change.
Albedo of the Earth (basis of “Gaia Hypothesis”).
Fossil energy used in Agriculture, Carbon sequestered in the soil or released from soil.
Agriculture Impact on Climate

Soil Management:
Soil carbon diminishes in disturbed soils.
Soil carbon increases in forest soils.
Prairie soils accumulate “best.”

Energy consumption:
Farming practice relies on fossil energy for fertility & equipment operation.
1940: production without fossil energy, but not sufficient to sustain a large population. Soil conserved, not built.
1990s: No-till agriculture can sequester soil carbon. High production without fossil input is possible.
World Crop Trends/Volatility


World Wheat Market Supply-Demand Trends
Daniel O’Brien – Extension Agricultural Economist
K-State Research and Extension April 28, 2010
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Warmer Nights

Diurnal Temperature Range (DTR)

Night-time temperature is often a major factor controlling crop yield.

Plant development is temperature sensitive and development continues day and night.

Plant dry-weight increase is mainly limited to day-time.

Crop yield is a function of growth rate and of development.
Management for Climate Change

• Small changes may have large impacts

• Warm Nights (Philippines) example:
  – Cut rice yield.
  – Increased CO2 may influence response significantly.

“Rice yields decline with higher night temperature from global warming”

Trends in maximum and minimum temperatures and radiation from 1979 to 2003 for the whole year (A–C), dry season (January to April) (D–F), and wet season (June to September) (G–I) at the IRRI Farm.

Philippines rice

- Trend to increased night T

  The season with most sun had highest MaxT but average MinT

  The season with least sun had the highest MinT, but ave. MaxT

+ Possible sunlight increase

Peng S et al. PNAS 2004;101:9971-9975
Warmer than normal nights, may be the primary result of increasing atmospheric composition modification.

Basic food crops may be the primary adverse result of warmer nights.

The only viable, to date, solution to the increase of atmospheric Carbon is agriculture (true biofuel).

Corn is the crop of choice, as of now, for biofuel.

Within 30 years it may be a crop with greater starch production (cassava)*

*Cassava is the basis of a multitude of products, including food, flour, animal feed, alcohol, ...
Summary

- Climate is changing
- Agriculture is impacted by climate
- Agriculture impacts climate
- Agriculture can reduce energy use impact on climate
- Agricultural interests can manage climate risk to crop yield
• MJO updates:
Persistent Heat Engulfs Nation - Summer 2011

Number of Days Maximum Temperature ≥ 100°F

June 1 - August 31, 2011

Number of Days Max Temperature ≥ 100°F

- 10 - 25
- 25 - 40
- 40 - 55
- 55 - 70
- >70

Total number of stations: 2731 (only includes 60 or more non-missing days).
Leader: Laredo AP TX 90 out of 92 possible days.
Preliminary data: full quality assurance not yet applied.
Updated: September 27, 2011

http://www1.ncdc.noaa.gov/pub/data/cmb/extremes/summer-2011-days-over-100.png
• Edging records of mid-teens &50s for old stations
Weather Stations Near You
• Clinton: Hot & Dry July-Aug.

• [http://mesonet.agron.iastate.edu](http://mesonet.agron.iastate.edu)

• Single Site Graphs
Clinton: Growing Degree Days advance after mid-July

- [http://mesonet.agron.iastate.edu](http://mesonet.agron.iastate.edu)