Migration of Agriculture Back to the Southeast as an Adaptation to Regional Climate Change

A Sustainable Solution for the 21st Century

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In the coming century the United States will be faced with three critical agricultural issues

Food Security

Can the US maintain its agricultural output in the face of potential declines in production due to water pressures in the West and High Plains?

Energy Security

Can the US expand its agricultural output to meet biofuel needs and not impact food supplies?

World Food

With the world as a whole still facing a calorie deficit can the U.S. provide leadership to help bridge this gap in a sustainable fashion?
The Past
Rain-fed Agriculture in the Eastern U.S.

- At the turn of the 20th century most of the U.S food and fiber production was found in the East and Midwest based on rain-fed agriculture.
This 1900 Eastern agricultural system was broad based.

Potatoes were grown in NE.
Cotton was King in the SE.
New Jersey/Del Marva Peninsula provided vegetables for urban areas.
Corn was grown in almost every State for local use.
In a curious way – this eastern rain-fed system and regional markets partially insulated the farmer from the effects of drought.

When regional droughts occurred reducing yields - the price went up due to supply and demand in regional markets.
By 1950 this Eastern rain-fed agricultural system and local markets that had endured for generations was faced within an intrusion due to transportation improvements and western irrigation.

- Corn produced in the deep water holding soils in the Midwest could now be transported efficiently throughout the country.
- Western irrigated high yield cotton competed with Southeastern rain-fed cotton.
- Western irrigated vegetables could be shipped across the country for consumption in the populated East.

While there may have been some attendant social and economic issues the heart of the loss of competitiveness was the inability of Eastern rain-fed farmers with their relatively poor water holding soils to deal with frequent droughts.
With an adequate supply of rainfall, there would be no dirt visible between the rows of peanuts in this Dale County field near Headland. Rainfall for the year is almost 20 inches below normal, similar to other parts of South Alabama and adjacent northwest Florida.

Corn crops vanishing in South Alabama

Current drought makes farm risk that much greater

By BOB JOHNSON
The Associated Press

HEADLAND - Kris Balkcom shakes his head as he stands in a dusty field surrounded by waist-high, brown and barren corn plants that by this time of year should be taller than him and filled with ears of tasty sweet corn.

Rainfall for the year is almost 20 inches below normal, similar to other parts of South Alabama and adjacent northwest Florida. As wide sections of the Southeast bake, National Weather Service forecasters say a combination of factors, including a high pressure system parked over the rabbits, Christmas trees and llamas. In southeast Alabama, some farmers are hoping that blueberries might be the answer.

Parker said some of his neighbors are planting blueberries on what used to be corn, cotton or peanut fields. Blueberries must be irrigated, but require fewer acres to produce a profitable crop.

"It takes a small enough acreage that maybe a family can make a living at it," Parker said.

Agriculture officials and farmers say the recent succession of dry spells in a region historically considered one of the wettest in the country is joining other factors - low prices, the high cost of insurance, fuel costs, trade deficits and government regulations among them.
Decline in Alabama commodity crops was characteristic of Southeast
Corn Acres Planted As Fraction of 1950

Iowa  
Nebraska  
Texas  
Alabama  
Mississippi
Coastal Plain June Rainfall

Inches

The problem with crop production in the SE

Coastal Plain June Rainfall

Corn evapotranspiration requirements 8-9 inches water
As long as SE farmers were competing with themselves everything was fine. In fact when droughts reduced supply corn prices went up. But transportation changed this.
At prices set by Midwest yields growing corn in SE was a losing enterprise

Net Profit Per Acre
(2003 dollars / 2003 Genetics)

Base production costs from NASS - $303/ac

Average Profit/Acre
Rainfed $ -4
Alabama imports 200 million bushels of corn – only produces 16 million bushels
By 1950 another factor altered SE’s competitive balance – western irrigation.

Western water projects coming fully online and cheap electricity in the Great Plains for pumping from the Ogallala Aquifer substantially increased the amount of irrigated acreage in the U.S.
With the upturn of western irrigated agriculture, Eastern rain-fed farmers were faced with an intrusion into the market that removed drought losses as a cost of production.
The end result of the western irrigated agriculture and transportation improvements was a substantial decrease in agricultural output in the east from 1950-1990.

Alabama lost over 12 million acres of farmland since 1950.

Farm decline in Alabama almost inversely mirrors agricultural increases California as water projects came on line.
Climate variability can change the face of agriculture.
This massive shift in agriculture was highly subsidized. The Federal government spent billions of dollars on Western water projects for agriculture. This included massive dams, canals, piping to provide basically free water to farmers. Transportation via rivers and highways was made possible through locks and dams and interstates built in large part by the federal government.
The tremendous increase in western agriculture due to irrigation came with additional costs beyond what the federal government paid.

For example in California tremendous environmental damage was done as rivers were totally depleted destroying salmon runs and wetlands.

Lakes were drained for farm land.

River is gone

See Cadillac Desert

Tulare Lake

See King of California
In the East the loss of agriculture devastated rural economies.

Landowners resorted to accepting government set asides (CRP) or timber farming.

Poverty and government assistance soared in the rural south.

Land is now in timber or low intensity pasture.

Rural towns dependent on farming business died out.

(Birmingham News. Bernard Troncale)
The Future
The next 50 years in the West may be much different than the last 50 years.

New pressures are now forcing a cost-accounting for Western irrigated-agriculture. In the long-term many observers feel this desert agriculture is not sustainable.

• Ground water overdrafts from pumping
• Water demand from rapid urban growth
• Farmers vs municipalities ($15 farmer cost vs $200-600 municipal water cost per acre-foot)
• Silting of reservoirs
• Salt and selenium surface poisoning
• New air, water, and soil pollution regulations
• River restoration and endangered species initiatives
Population growth in the west is expected to continue at a rapid pace.

Environmental initiatives for river and wetland restoration will consume additional water (Salton Sea, San Joaquin river). Thus, billions of dollars will have to be spent to find and develop water sources just to keep pace with needs.
Irrigated Land - Change in Acreage: 1997 to 2002

1 Dot = 1,000 Acres Increase
1 Dot = 1,000 Acres Decrease

United States Net Decrease -977,936
WILL THE WET GET WETTER AND THE DRY DRIER?

Warming of the global climate is expected to be accompanied by a reduction in rainfall in the subtropics and an increase in precipitation in subpolar latitudes and some equatorial regions. This pattern can be described in broad terms as the wet getting wetter and the dry getting drier, since subtropical land regions are mostly semi-arid today, while most subpolar regions currently have an excess of precipitation over evaporation.
Aggregate of climate models predict drying in the Southern High Plains and Southwest but no change or an increase in precipitation in the SE.

From IPCC 2007
Trends in Alabama Precipitation

Annual Precip NOAA Clim Div

+21% since 1895

+12% since 1895

Southeastern Irrigation
Even if anthropogenic climate change does not play out as modeled, the West may be in trouble.

Recent reconstruction of climate indicate that the past 70 years may have been abnormally wet and future supply could be much less.

From Piechota et al. 2004
Agricultural Security

• Agricultural production is already decreasing in the Ogallala region as ground water is depleted.

• Water for agriculture is now being redirected away from agriculture in California – e.g. the DOI Colorado Agreement.

• Throughout the arid west agricultural water is threatened due to supply and urban demands for water.

• U.S. trade surplus in agriculture has nearly disappeared.

How can the U.S. preserve its agricultural output in the face of water issues in the west?

Can we afford to let our food supply go offshore?
The solution we propose is that agriculture should return to the east under an irrigated assisted rain-fed system. The vast and sustainable surface water resources in the east dwarf water availability in the west.

In the west 4 ft of water or more is needed for crops. In the SE we need only 6-12”

The Alabama River in Monroe County had an annual flow for the driest year on record (2000) of near 10 million acre-ft - 12 times that of the Rio Grande
For corn the average difference can be $300 per acre!
Belle Mina Profit/acre Irr. vs. Non-Irr.

Average Rain-fed $3.70 per acre  Average Irrigated $143.93

@ $5 Corn
Rain-fed $120
Irrigated $348
Average Inches of Annual Precipitation in the United States 1961-1990

River Flows Are Huge in SE

- Colorado River – Glen Canyon
  10 million acre-ft/yr

- Tennessee – Huntsville
  30 million acre-ft/yr

- Tombigbee River - Coffeeville
  19 million acre-ft/yr

- Alabama River - Monroeville
  24 million acre-ft/yr

- Apalachicola – Blountstown
  16 million acre-ft/yr
Net Consumption of Water

EXPLANATION
Billion gallons per day
11.0 1995 Consumptive use
68.7 Renewable water supply

Consumptive use as a percentage of renewable supply

- 0 – 10
- 10 – 40
- 40 – 100
- > 100

Southeastern Irrigation
Many parts of the east simply not participating in irrigated agriculture.
Streamflow at Claiborne: Jan 1931 - Dec 2002

Mean Monthly Streamflow (acre-feet/month)

Month of Year
Sustainable Southeastern Model - Storage of Winter Surface Water

Even in dry years crops need less than a foot of water. Irrigation can be supported with a fraction of the winter river flow removed.
East needs help for investment in storage infrastructure

Wringing the final drops of water out of the western system will be incredibly expensive. Catching and storing water in the east is easy and inexpensive.

In many areas a 15 acre pond ten feet deep (enough to irrigate nearly 400 acres) can be constructed for less than $300,000.

We had a $300 million program AWEP in the 2008 Farm Bill – But Western interests changed bill in Conference so that 85% of money went west of Mississippi.
It is our opinion that the nation cannot continue to subsidize desert agriculture to support low value high water use crops such as cotton, corn and alfalfa. The value of water in the west is vastly overvalued relative to what can equivalently be derived from eastern agriculture.

The recent DOI agreement on allocation of Colorado River water included a requirement to line the American canal at a cost of $200 million which will save 77,000 acre-ft per year. This would equivalently serve 20,000 irrigated acres.

In Alabama $200 million would build on-farm storage for 100,000 acre-ft which would support 200,000-400,000 acres of irrigated land.
Pure rain-fed agriculture in most areas is inefficient. Energy, fertilizers and time are wasted if rains don’t come at the right time. Irrigation solves these problems but it must be sustainable. World should encourage irrigation where water is plentiful!
20th Century: Move Water to Agriculture

The western belief that it was a crime to let water flow into the sea lead to the financing of colossal projects to divert water onto deserts. Moving water is expensive and long term problems are now apparent.

21st Century: Move Agriculture to Water

In wet climates, only inches per year of irrigation are needed to supplement natural rainfall. The most cost effective and sustainable solution for U.S agriculture is to bring it back to water.

This will enable food security and allow expansion of agriculture for bioenergy needs.