Climate and Crop Disease Management: Need for Cooperation in Uncertain Times




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16 May 2017

Southeast Climate EXTENSION | Advancing Climate Extension in Agriculture

Southeast Climate Consortium

Florida Climate Institute

1785

UGA extension

Government prepared for strong El Niño

By Aurea Calica (The Philippine Star) | Updated August 16, 2015 - 12:00am

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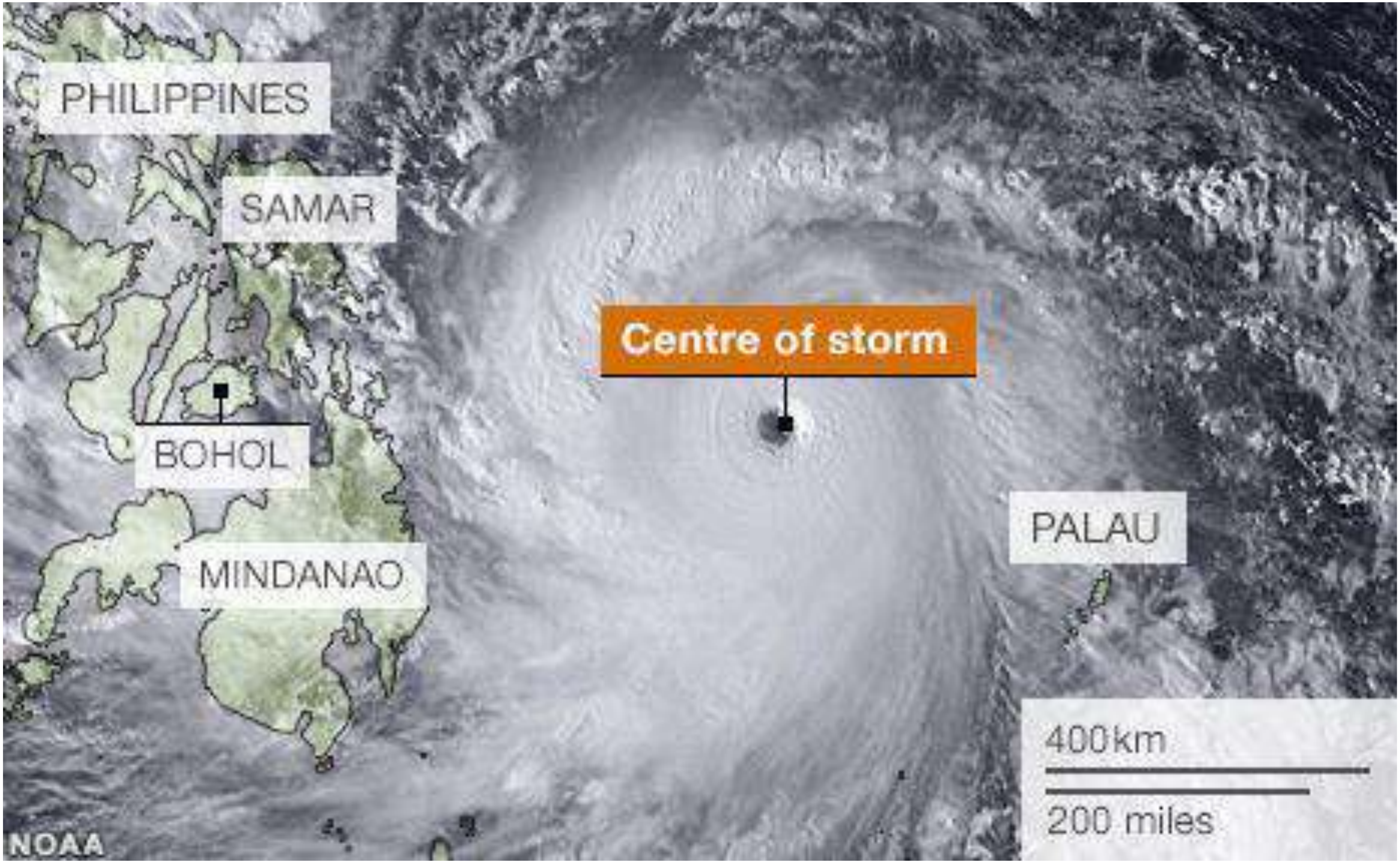
Photo taken last May shows a girl examining the cracked soil caused by the dry spell in Barangay Madayegdeg, San Fernandoe City, La Union. **VIC ALHAMBRA**

MANILA, Philippines - Malacañang gave assurance that all government agencies are prepared to address the El Niño and that President Aquino is closely monitoring the onslaught of the phenomenon in the country, particularly its effects on the agriculture sector as it may affect food production.

TYPHOON HAIYAN, 2013



By EMILY TILLETT / CBS NEWS / *May 9, 2017, 8:05 AM*

White House postpones Paris climate agreement meeting for second time

White House advisers have postponed a crucial meeting on the Paris climate agreement as the Trump White House has yet to confirm where they stand on the accord.

A senior White House official confirmed the reports to CBS News, citing "scheduling conflicts," but it is unclear when the meeting will be rescheduled.

According to White House officials, Mr. Trump's eldest daughter Ivanka was set to meet with Cabinet officials and department heads to discuss whether to abandon the treaty altogether. Her meetings with EPA administrator Scott Pruitt and Sen. Lisa Murkowski were just some of the discussions she is holding over the next two weeks as part of her White House "listening tour."

This is the second time the White House has pushed back the meeting to discuss the future of the U.S. involvement in the agreement, which secured backing of 195 nations in 2015, again citing difficulties coordinating travel schedules with various

The Southeastern USA: Since 1970

- Average annual temperatures in the region have increased by about 2°F.
- **Winters, in particular, are getting warmer. The average number of freezing days has declined by four to seven days per year since the mid-1970s.**
- Most areas, with the exception of southern Florida, are getting wetter. Autumn precipitation has increased by 30% since 1901.
- **The number of heavy downpours has increased in many parts of the region.**
- Despite increases in fall precipitation, the area affected by moderate and severe drought, especially in the spring and summer, has increased since the mid-1970s.

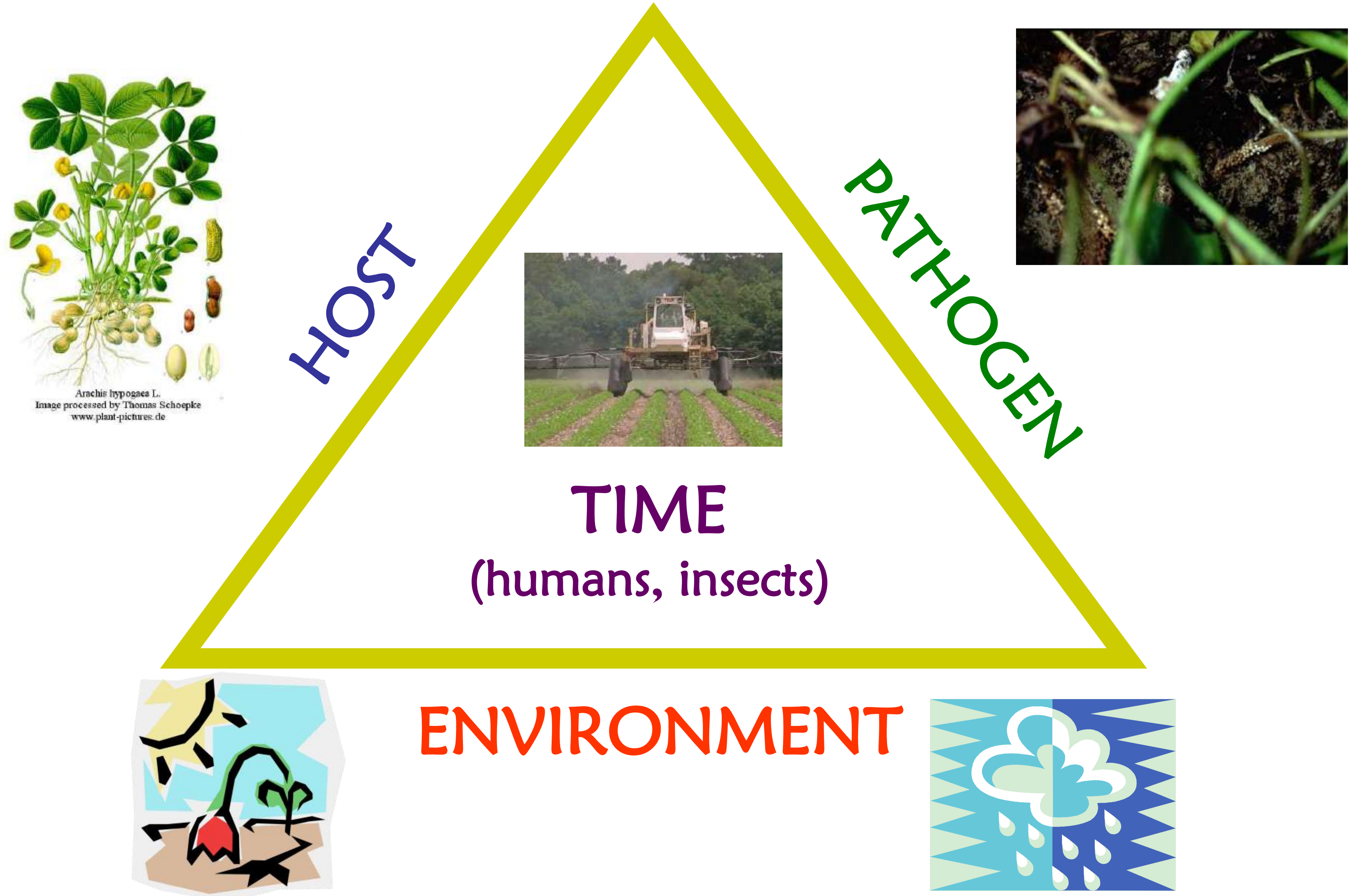
Winter 2013
What is this and why should you care?

Winter 2014
What about now?

Climate and Crop Management

- I am not a climatologist……….
- Today my objectives are to:
  - Describe impact of climate variability on environment; e.g., Southeastern United States
  - Differentiate climate variability from ENSO phase
  - Describe impact on agriculture with specific concerns for agriculture in SE USA
  - **Describe collaborative efforts to improve crop and disease management in wake of climate change.**

Disease Triangle



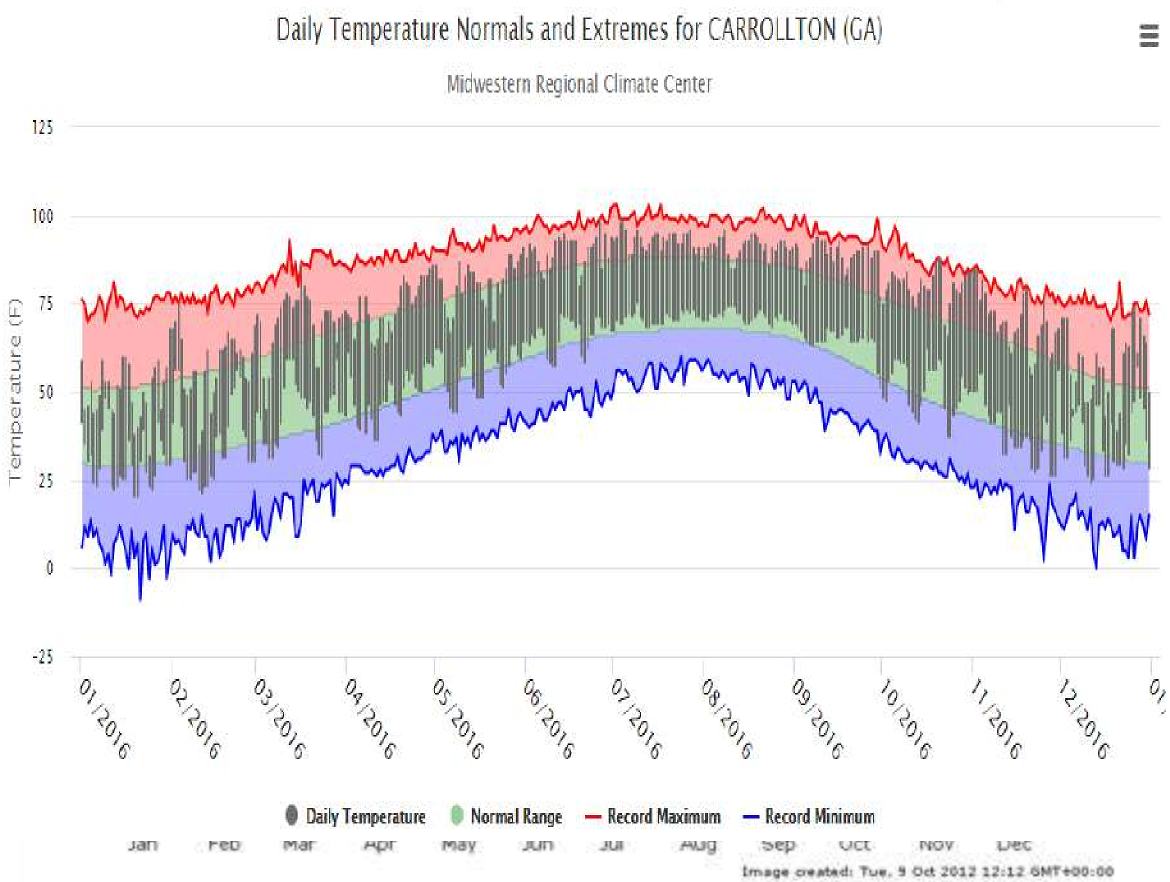
Impact of Weather on Pathogens

- Water (rain, irrigation, humidity)
  - Spore germination
  - Fungal growth
  - Splash dispersal of pathogens
  - Fungal sporulation
- Storms
  - Long range dispersal of spores
  - Crop loss from storms affects food security
- Temperature
  - Cooler temps slow growth of plant, allows pathogen to infect.
  - Some diseases (southern corn rust, white mold) favor warm temperatures.
  - Some favor cooler temperatures (CBR, soybean rust, NCLB)

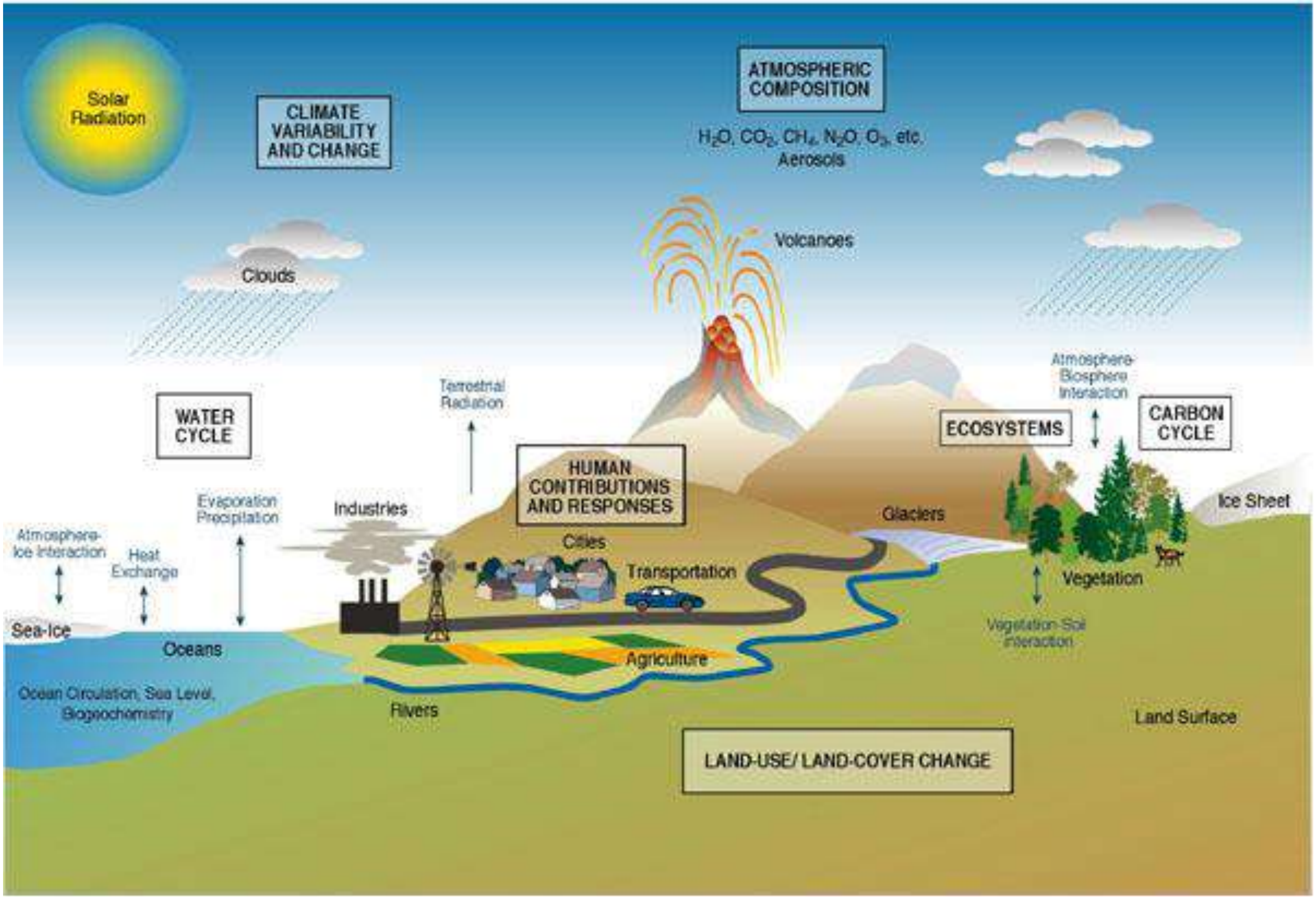
Climate versus Weather

Climate is described by long-term conditions:

- Averages
- Seasonal and multi-year cycles
- Extremes
- Spatial patterns
- Air masses
- Trends



Climate 101: Energy Balance



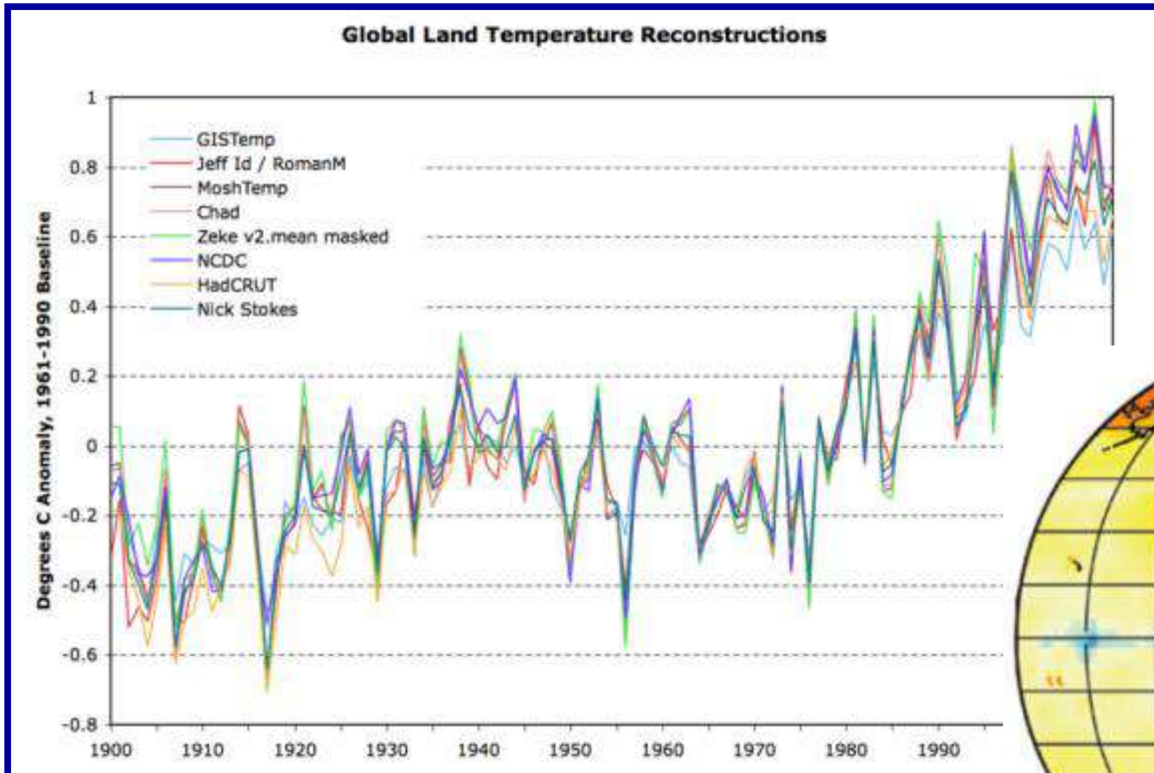
Climate Variability

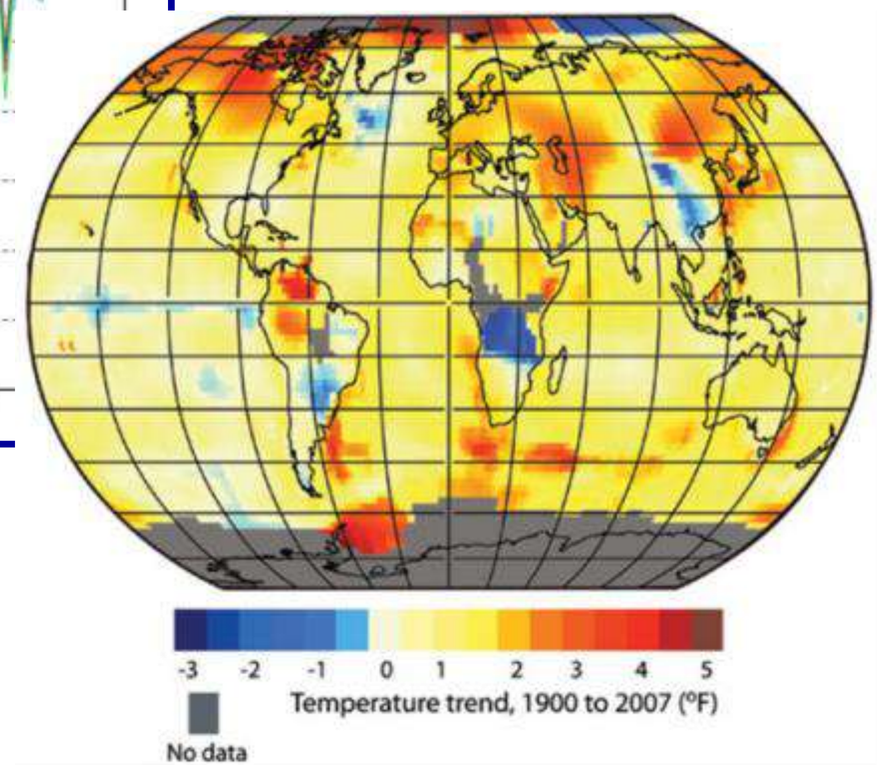
Climate variability comes from a number of causes, including oscillations in factors that contribute to energy balance and non-periodic changes in solar radiation and atmosphere-ocean interactions.

Examples:

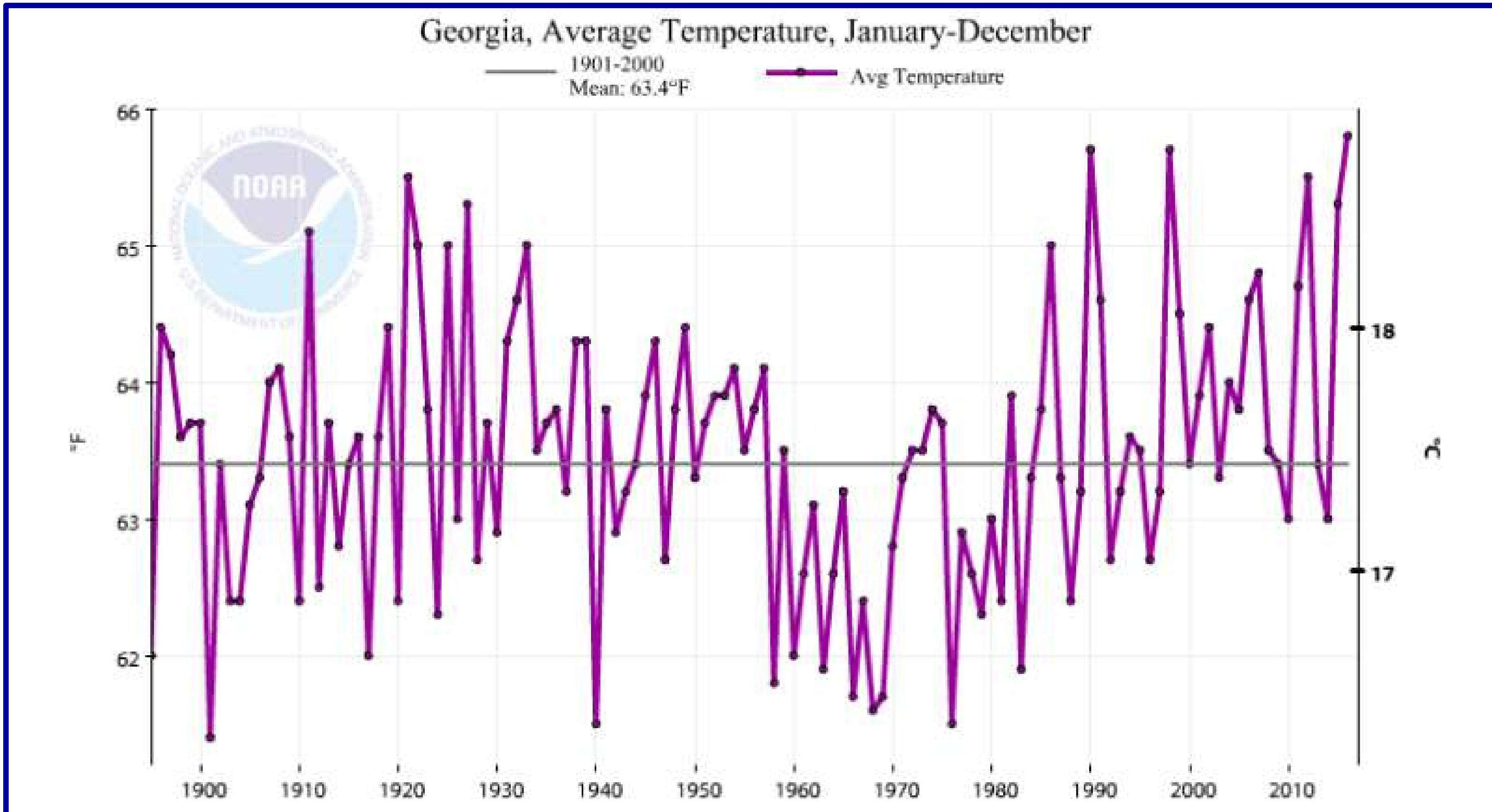
- Ice ages (100,000 year long cycles related to orbit around sun)
- Pacific Decadal Oscillation (related to 30-40 year oscillations in Pacific Ocean temperatures)
- Sunspots (related to 11 year sunspot cycle—iffy)
- El Nino Southern Oscillation (related to interactions between tropical Pacific ocean and atmosphere)—3 to 5 year cycles on average
- Arctic Oscillation (short-term variations in atmospheric pressure in North Atlantic—week to month variation)

Review of Present Climate Trends:
Global Temperature

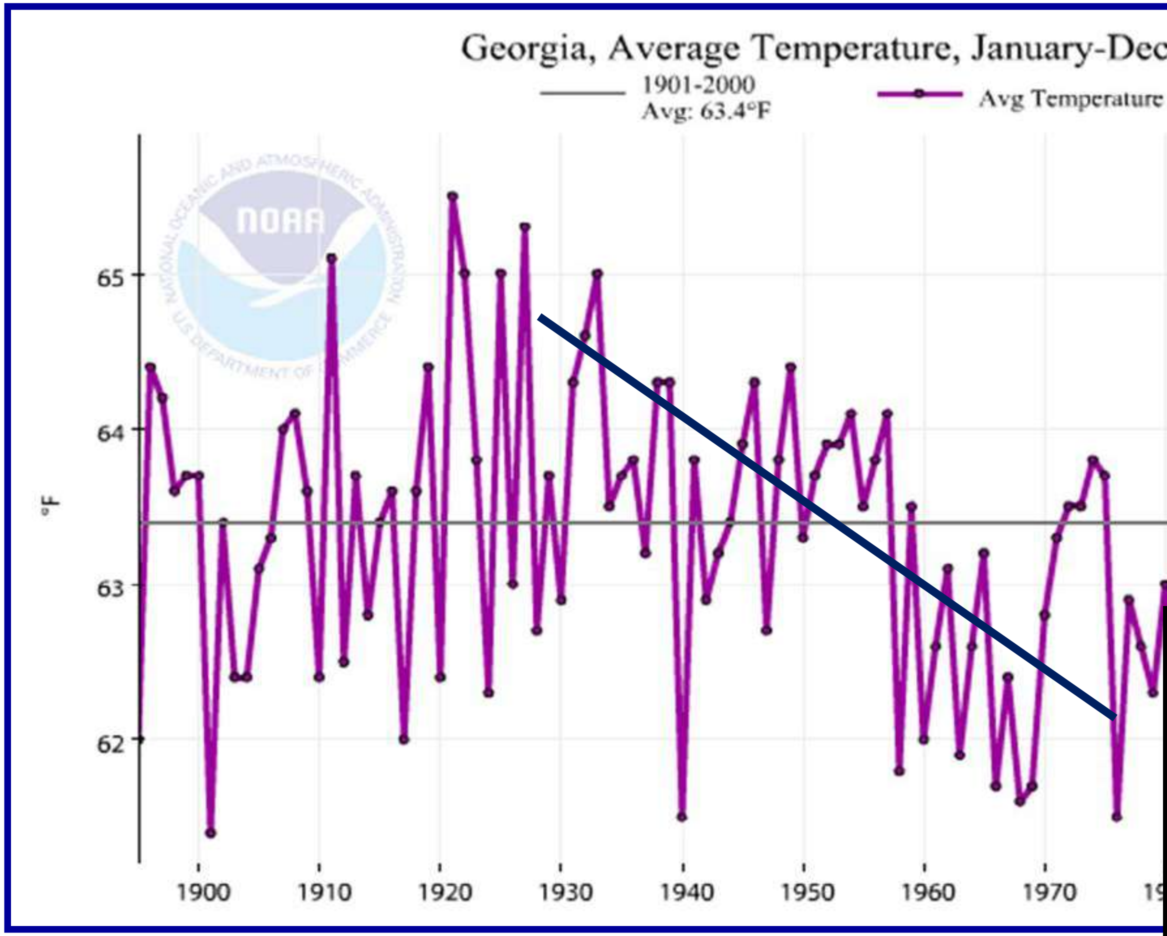


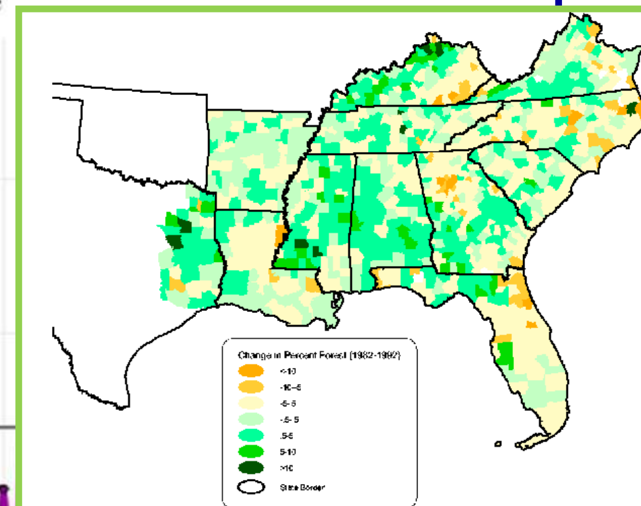


Review of Present Climate Trends
Georgia, USA



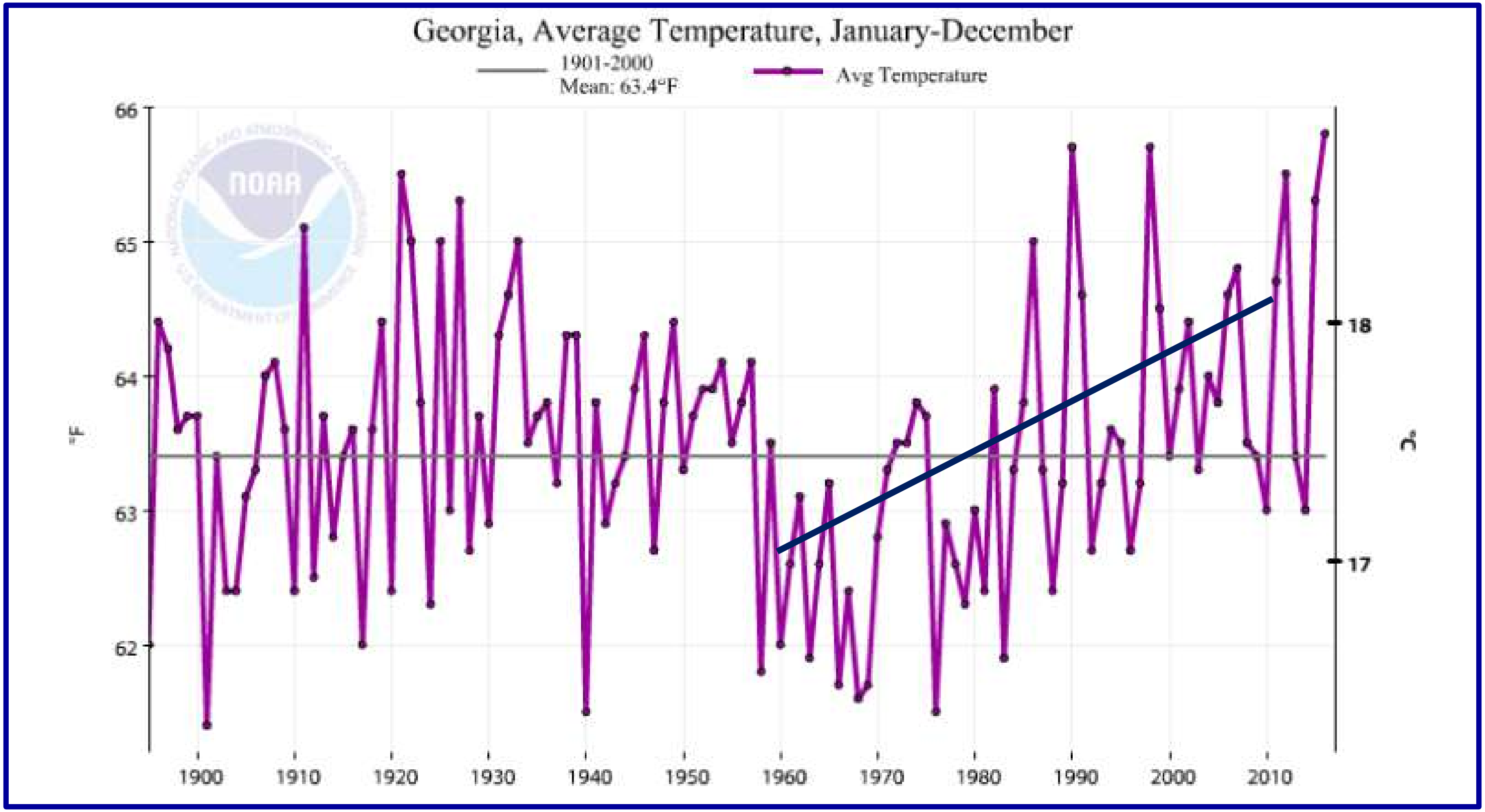
Regional Temperature Trends



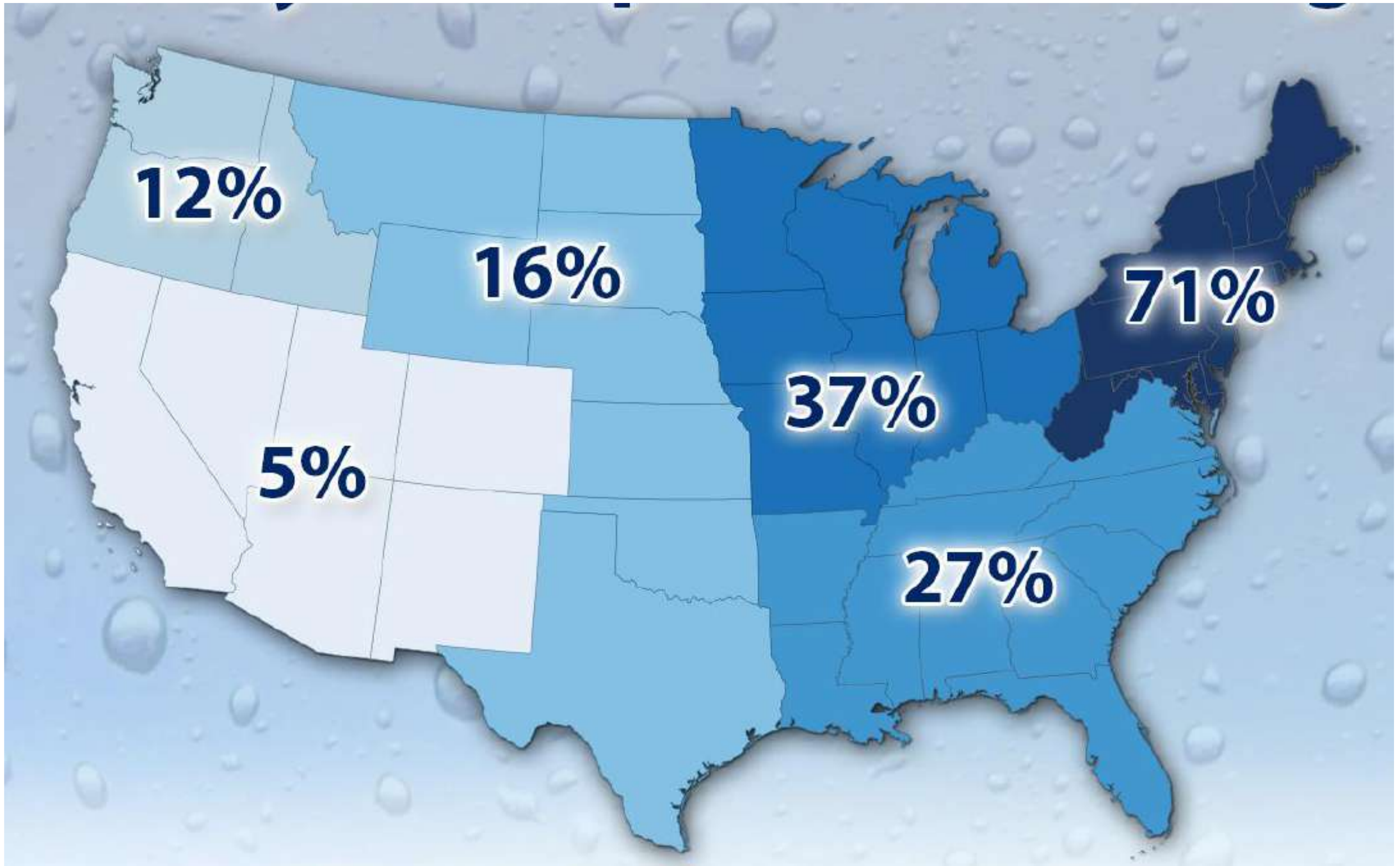


Temperature decline from the 1930s to 1960s was most likely due to reforestation and increased pollution

Regional Temperature Trends



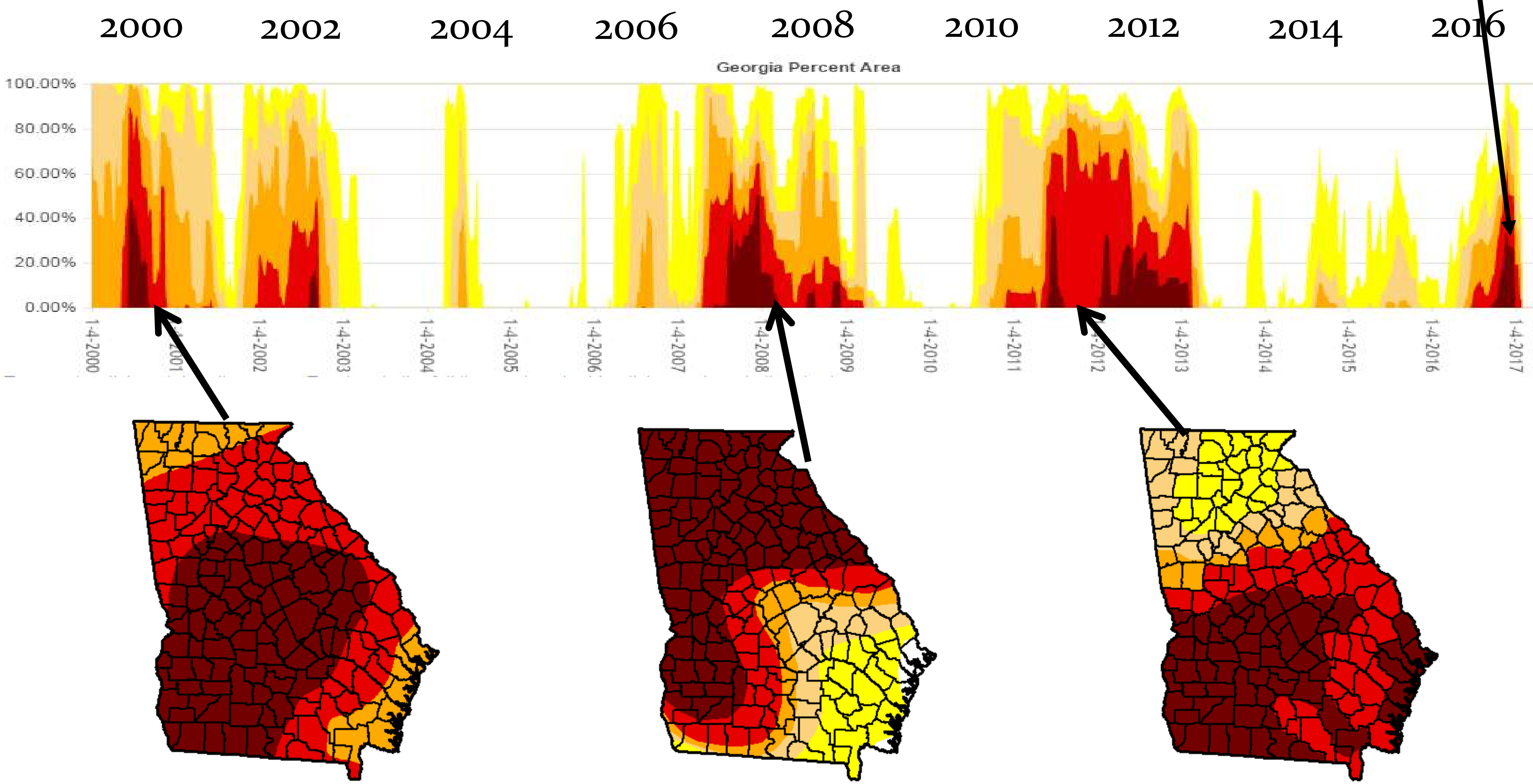
Trends in Extreme Precipitation



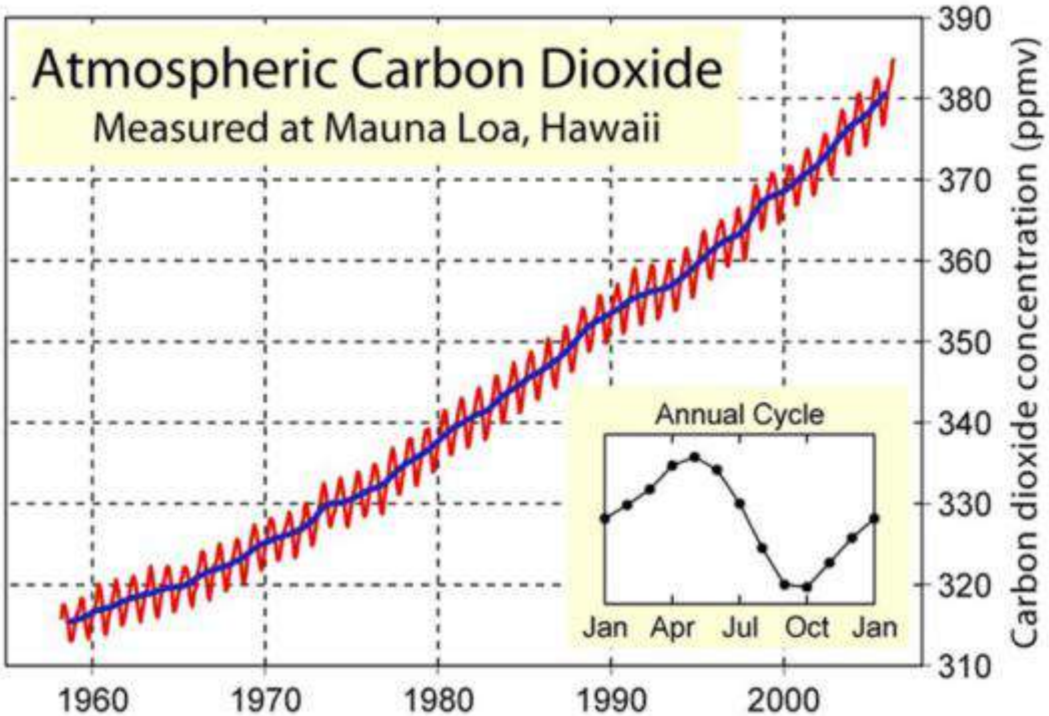
Increase in the number of 2” rainfalls per year from 1958 to 2011

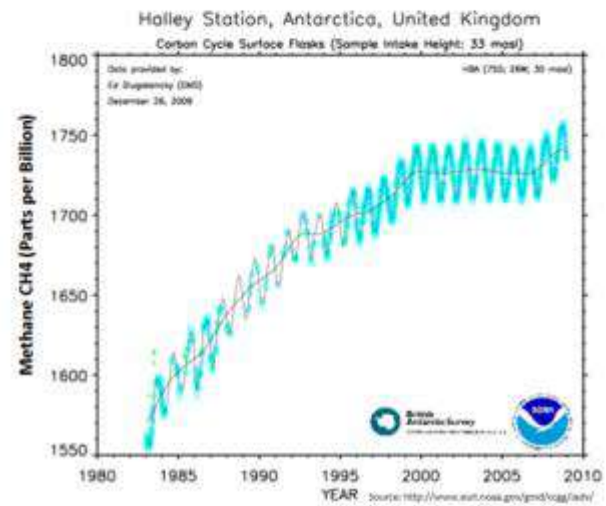
Other Extremes: Drought

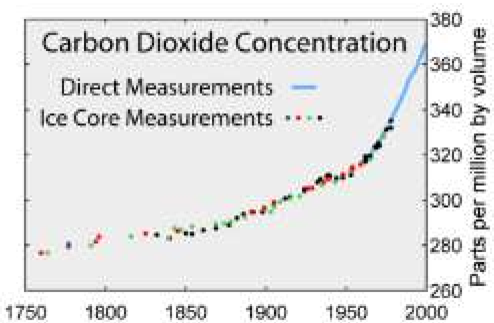
Timeline from the National Drought Monitor

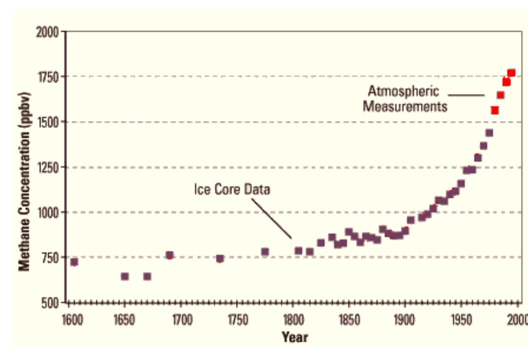


Changes in Atmospheric Composition

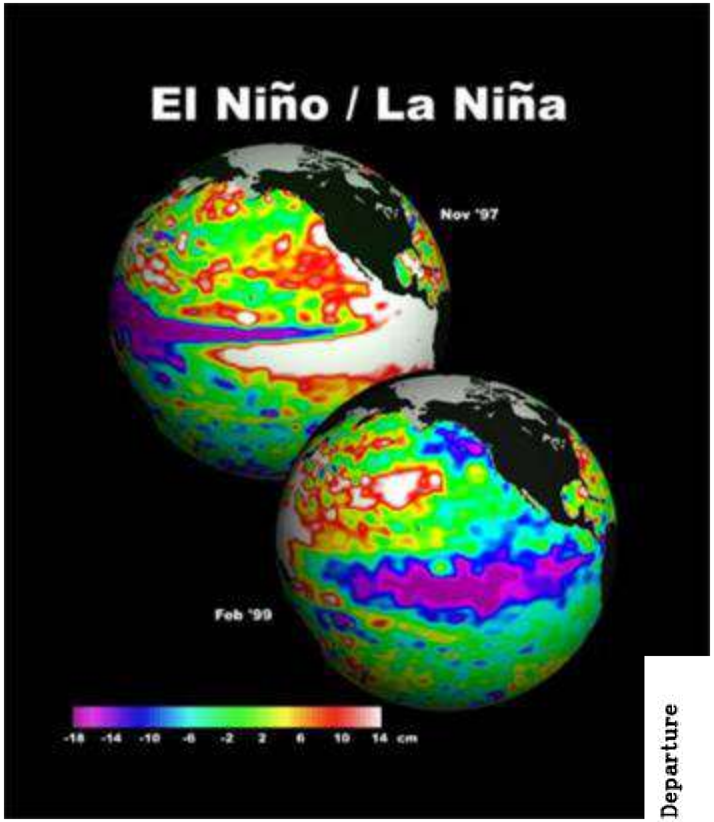






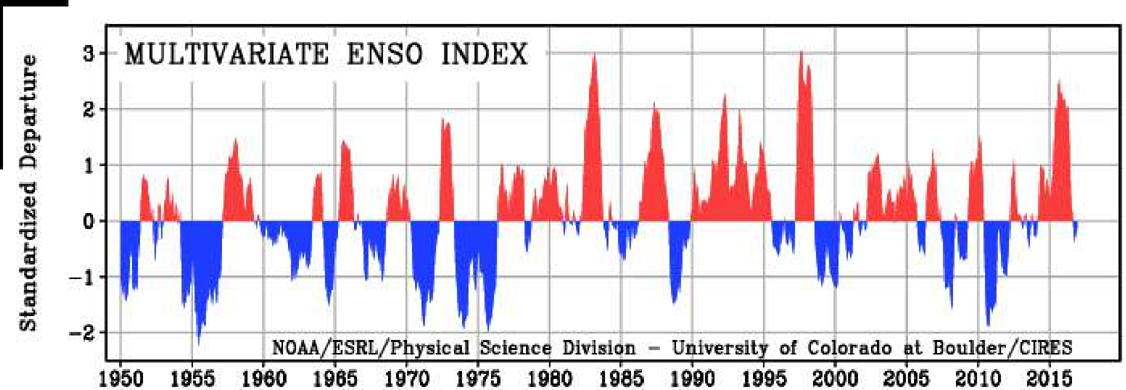


El Niño and La Niña



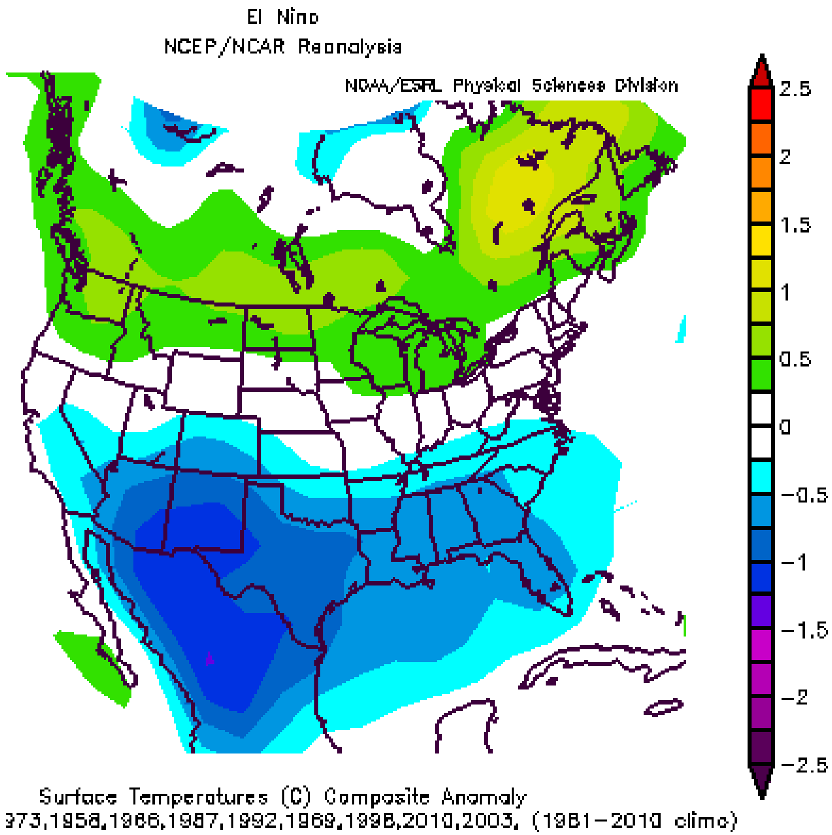
El Niño is associated with unusually warm water in the eastern Pacific Ocean, usually observed near Christmas (so associated with the coming of "The Child").

La Niña is the opposite phase of El Niño, with unusually cool water in the eastern Pacific Ocean.

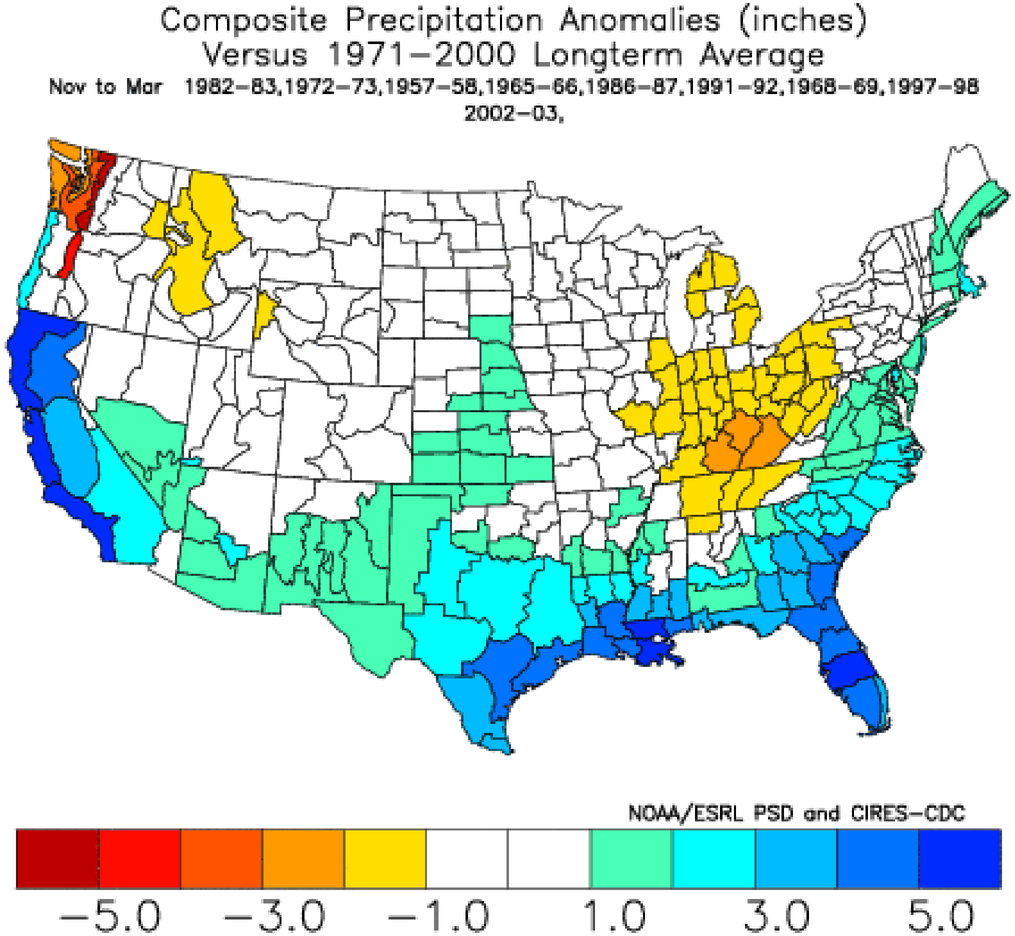


El Niño - Winter
Anomalies

Temperature



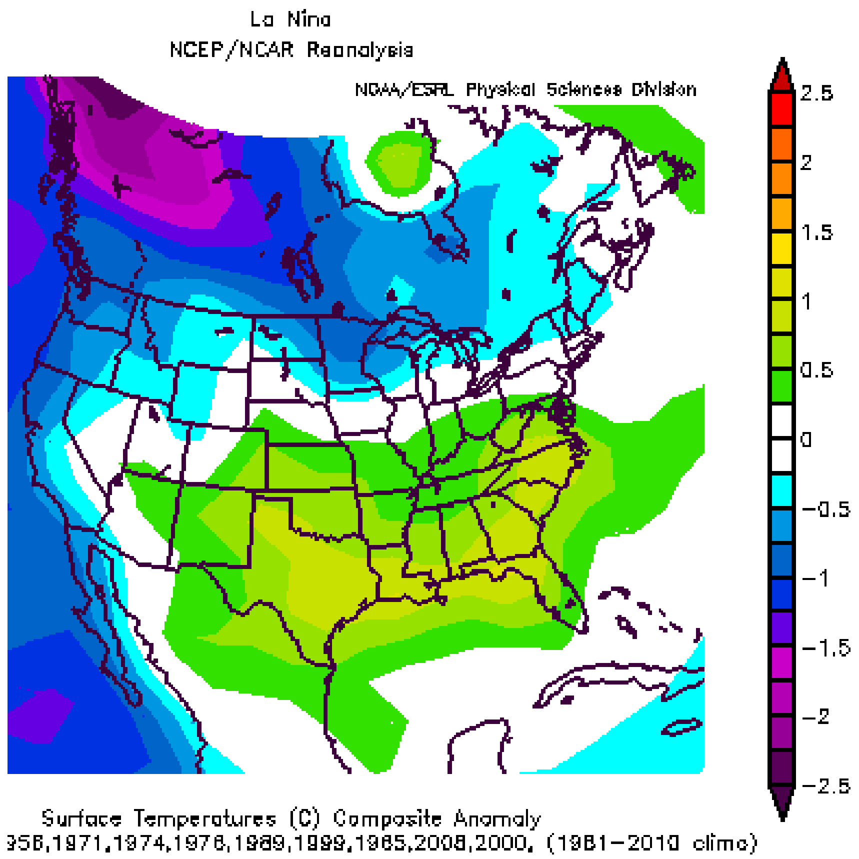
Precipitation

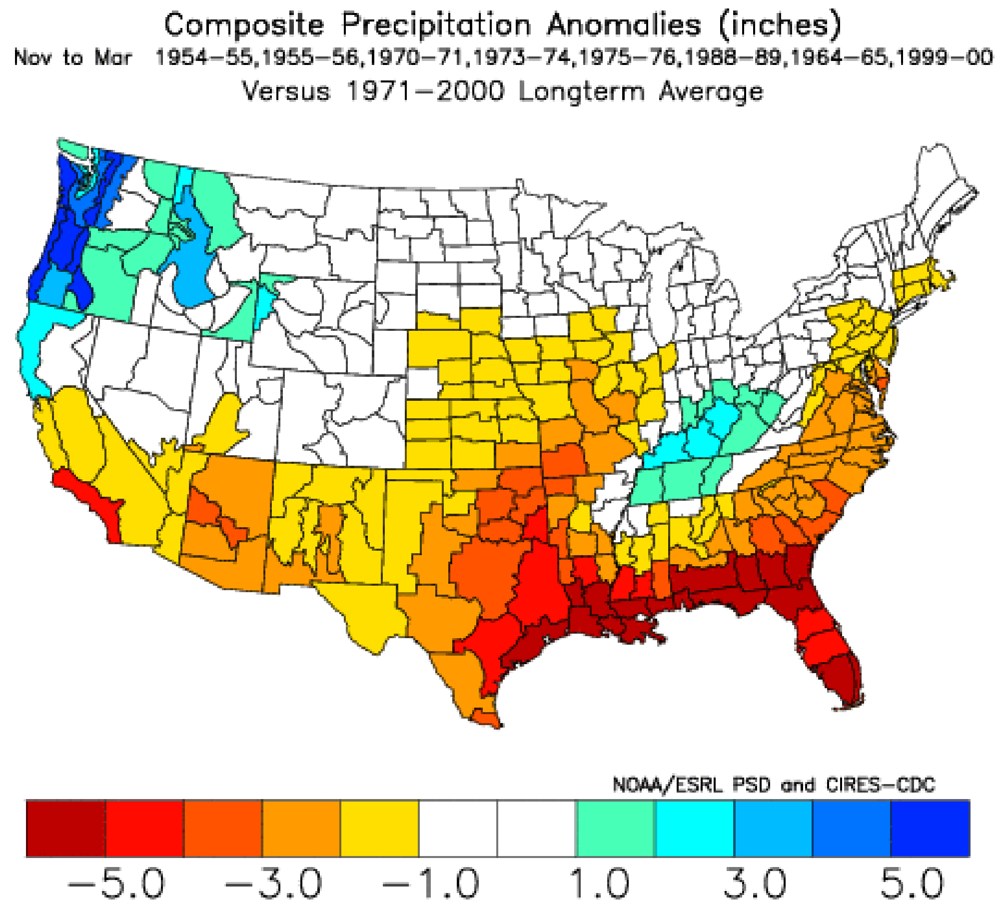


La Niña - Winter
Anomalies

Temperature

Precipitation



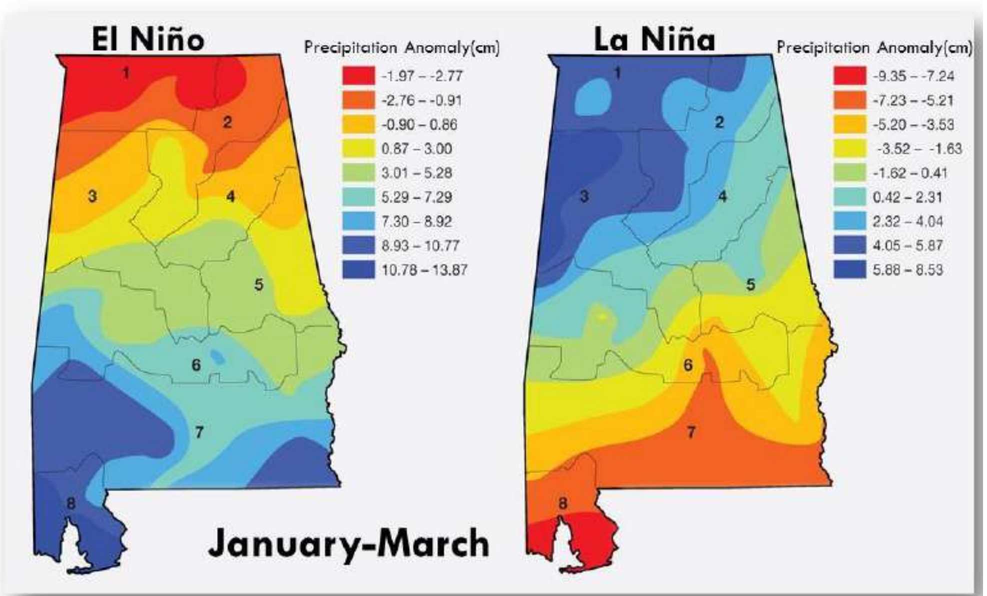


AUBURN UNIVERSITY

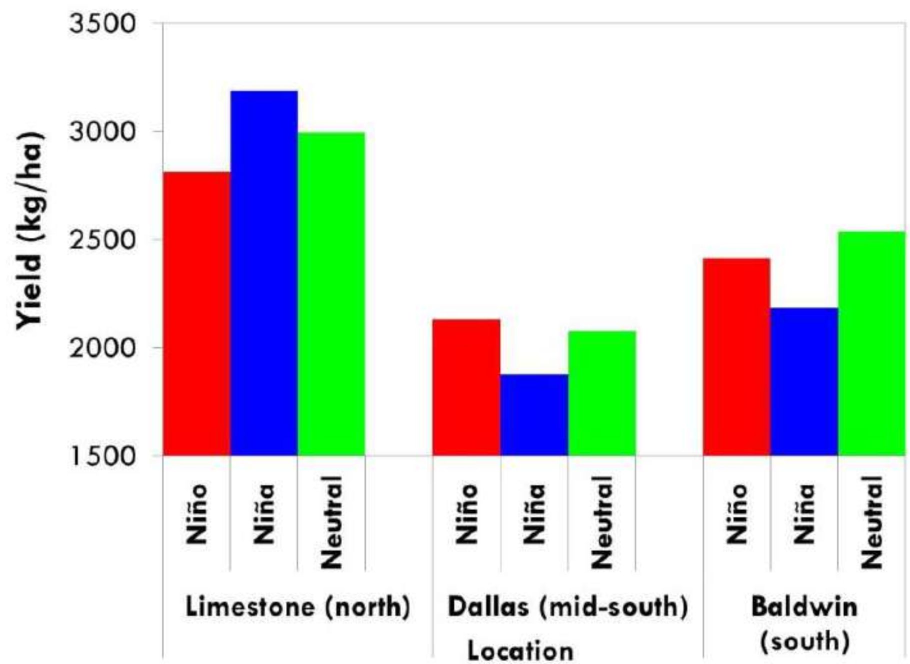
Use of the ENSO Forecast for Adapting Winter Wheat Management Strategies in the Southeastern USA

- Precipitation and Temperature not only impact crop growth and development but the response of the crop to agronomic management (fertilization, irrigation, seeding rate)
- Climate and weather forecasts can be integrated as part of the decision processes associated to agronomic management

ENSO and Precipitation in Alabama



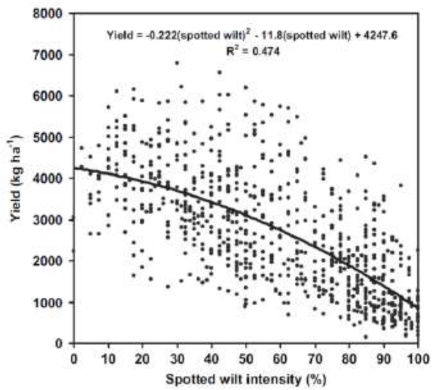
ENSO and Wheat Yield Differences

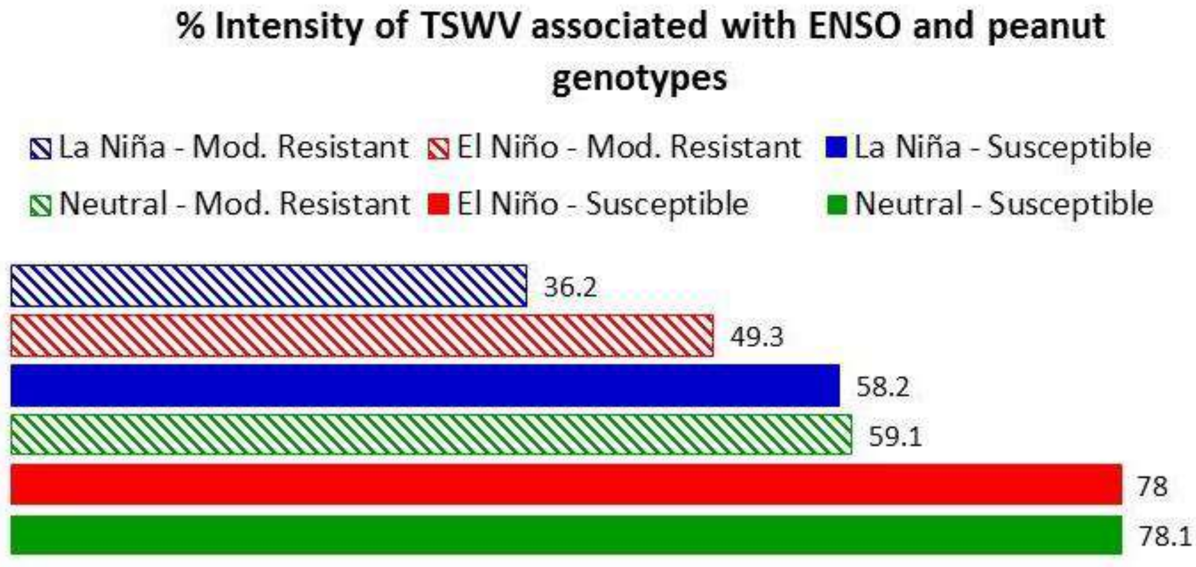


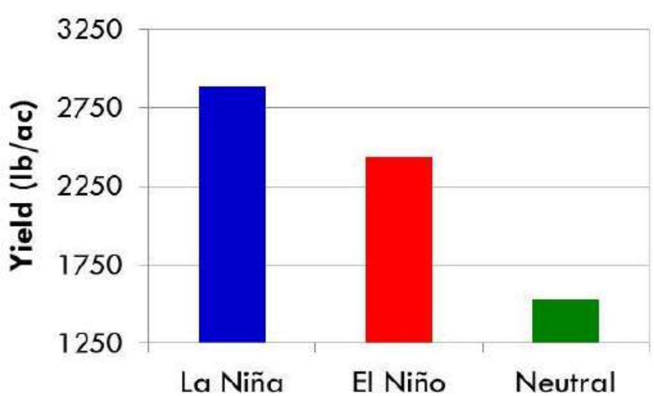
Location-specific ENSO impacts can be used to tailor agronomic practices

ENSO and the impact on Tomato Spotted Wilt Virus (TSWV) Intensity in Peanut

Higher yield losses with high levels of TSWV intensity







Lower peanut yield during Niño or Neutral years than La Niña

Spotted wilt intensity was significantly <u>lower during La Niña</u> when compared to El Niño or Neutral years.

Above-normal rainfall during El Niño might suggest favorable weather conditions for viruliferous thrips populations, virus transmission and spotted wilt development

Crop Protection 29 (5): 448–453. 2010

You are here: EPA Home » Climate Change » Impacts & Adaptation » Southeast Impacts

Southeast

Climate Impacts | Adaptation Examples

ON THIS PAGE

Over 70 million people live in the Southeast.[1] The region includes many cities with populations over 250,000, including Houston, Jacksonville, Charlotte, Atlanta, Miami, and New Orleans.[1] The region's economy includes forestry, tourism, oil and gas production, and agriculture. The Southeast also includes 29,000 miles of coastline.[2]

The region's climate is generally warm and wet, with mild and humid winters. Since 1970, average annual temperatures in the region have increased by about 2°F.[3] Winters, in particular, are getting warmer. The average number of freezing days has ...our to seven days per year since the mid-1970s.[3] Most areas, with the

Climate Impacts & Adaptation Home

Key Points

- Coastal communities in the Southeast will likely face sea level rise, increased hurricane intensity, and storm surge, among other climate change impacts.
- Higher temperatures, longer periods between rainfall events, and greater demand for water will likely strain water resources in the Southeast

Climate Change Home
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Agriculture and Food
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Adaptation Overview
Tools for Public Officials
Federal and EPA Programs

Climate Predictions for the Southeast

- Coastal communities in the Southeast will likely face sea level rise, **increased hurricane intensity**, and storm surge, among other climate change impacts.

- **Higher temperatures**, **longer periods between rainfall events**, and greater demand for water will likely strain water resources in the Southeast.

Impacts of Changing Climate: Agriculture

- Warmer temperatures would increase growing degree days for forage and crops but also weeds and insect pests and diseases.
- Warmer temperatures, both daytime and nighttime, would increase heat stress on livestock and increase the need for and the costs of cooling
- Warmer temperatures will decrease heating costs in winter

Impacts of Changing Climate on Agriculture

- Warmer temperatures will increase evaporation from farm ponds, lakes and reservoirs, which could affect water availability and affect the ability to irrigate

- Power generation from coal-burning and nuclear plants as well as hydropower from dams all depend on availability of water and power prices could be negatively affected by warmer temperatures

Impacts of Changing Climate on Agriculture

- Uncertainty of rainfall predictions makes it hard to determine what to expect in the future, especially since there is already a lot of natural variability in rainfall patterns by location and season

- Higher intensity rainfall will increase erosion and runoff from farm fields and could increase localized flash flooding in storms

Impacts of Changing Climate on Agriculture

- Longer dry spells, coupled with warmer temperatures, will increase the likelihood of drought and will reduce average stream flows

- Seasonal changes in precipitation could affect pollination and harvesting of cereal crops

Increasing impact of tropical storms and plant diseases

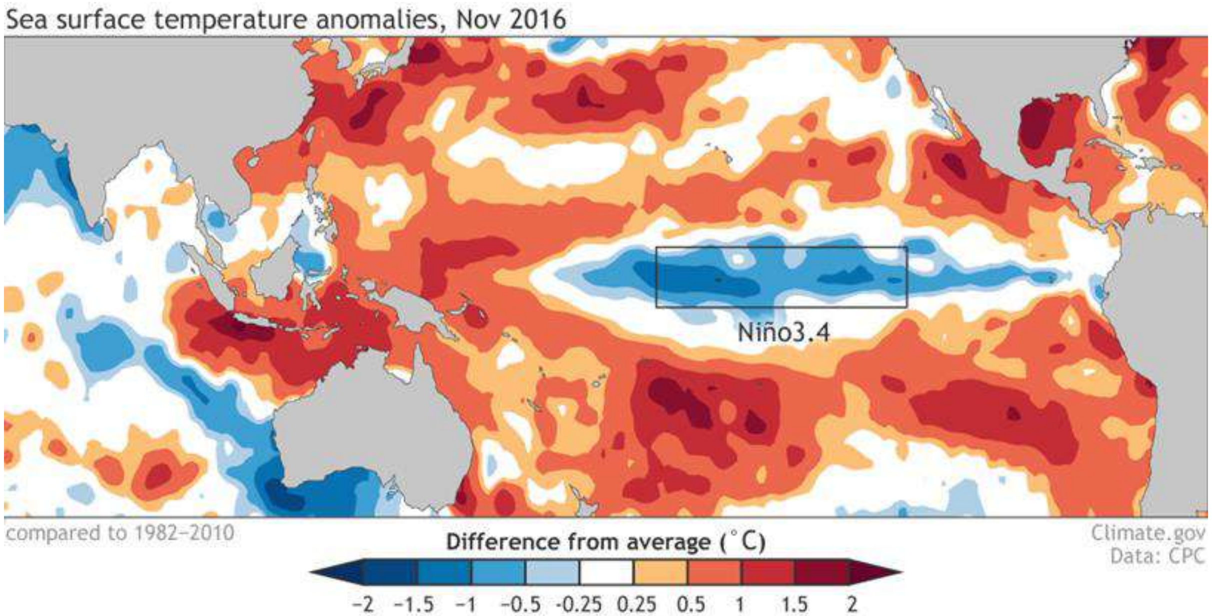
- Dispersal of fungal spores over long (and shorter) distances.
- Abundant rainfall conducive to infection and development of diseases.
- Delays in timely applications of fungicides.
- Strong winds exacerbate diseases in crops like corn (destructive lodging).
- Delays in harvest because of wet fields increase cost of late-season diseases.


REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF SOCIAL WELFARE AND DEVELOPMENT (DSWD)
AT KAUNLARAN SA BARANGAY (KKB)
Labanan ang Kahirapan"
SUBPROJECT
BATO CAM. SUR
CONCRETING PATHWAY
KALAHI CIDSS
MILLENNIUM CHALLENGE ACCOUNT
PHILIPPINES
BAYAN NG BATO
CAMARINES SUR
GEORGIA PEANUT TOUR COMMITTEE

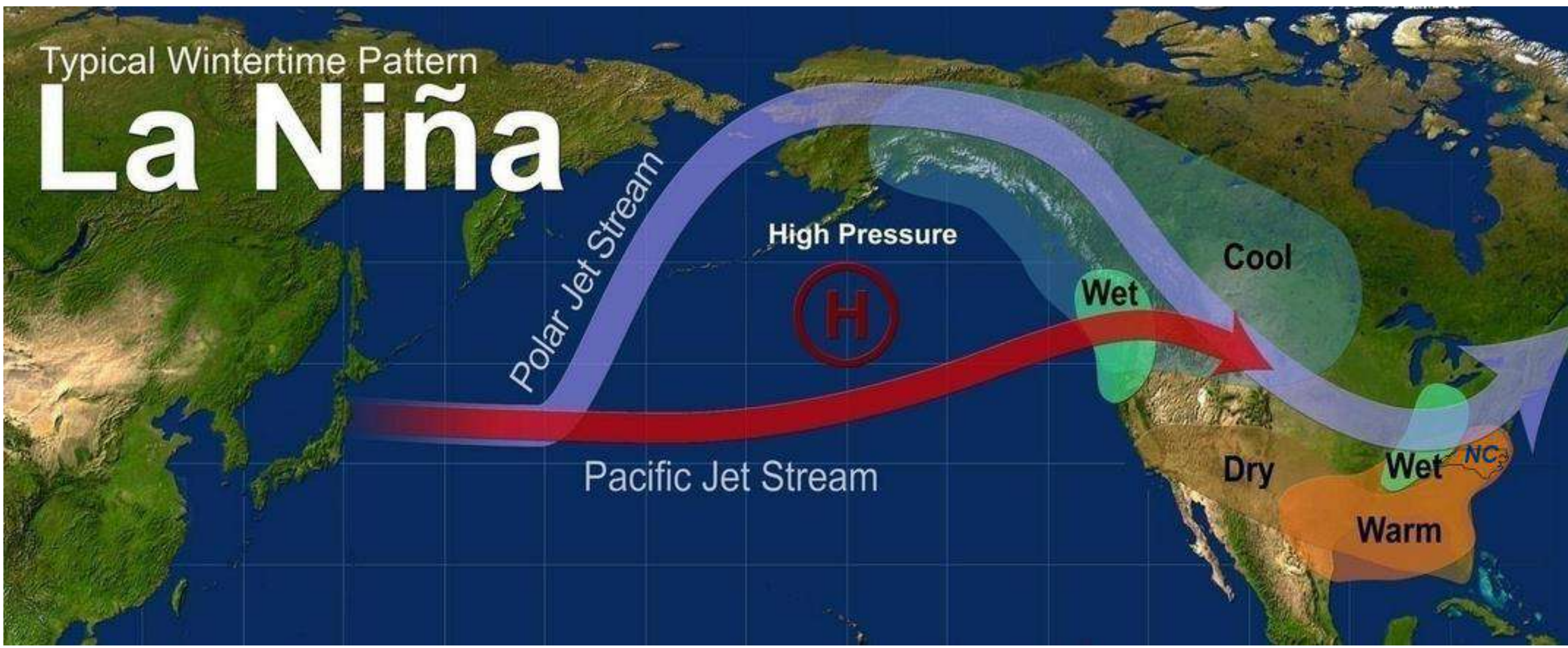
Stripling Irrigation Research Park

15 February 2017

21.7 C	5.1 cm
20.6 C	10.2 cm
19.4 C	20.3 cm



Southeastern USA WINTER 2016-2017



Nematodes continue to feed on living roots, 21-day life cycle.

Nematodes reported to continue feeding until soil 65F

Nematodes reported to stop development soil below 50F

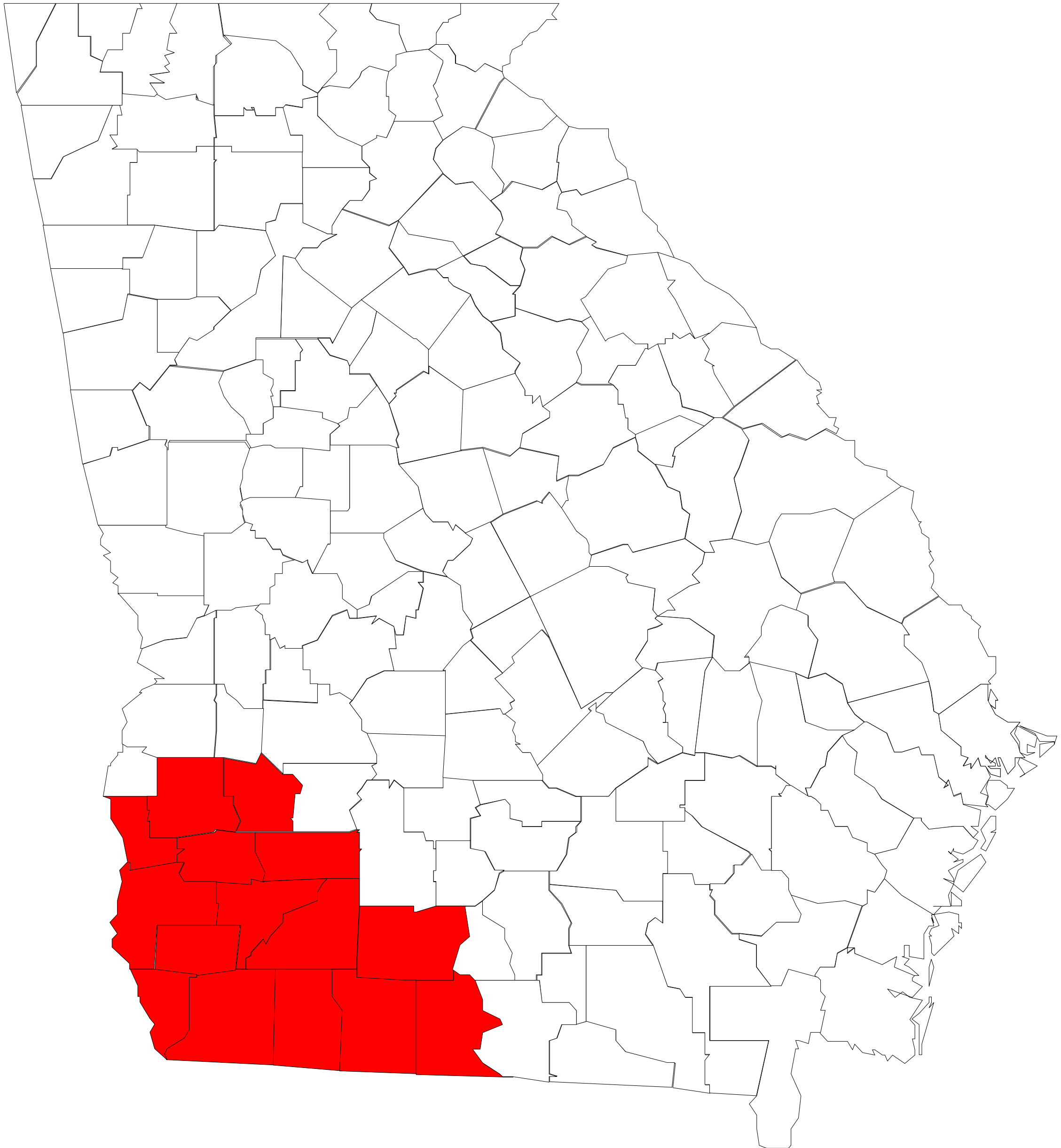
Meloidogyne arenaria

Prudent Considerations for La Niña

- Winter likely to be warmer and drier than normal.

- Possible delay in severe frost.
- Allows "volunteers" to survive and support pathogen populations.
- Crop survival may allow buildup of nematodes.
- Impact on thrips populations and TSWV
- Planting dates?

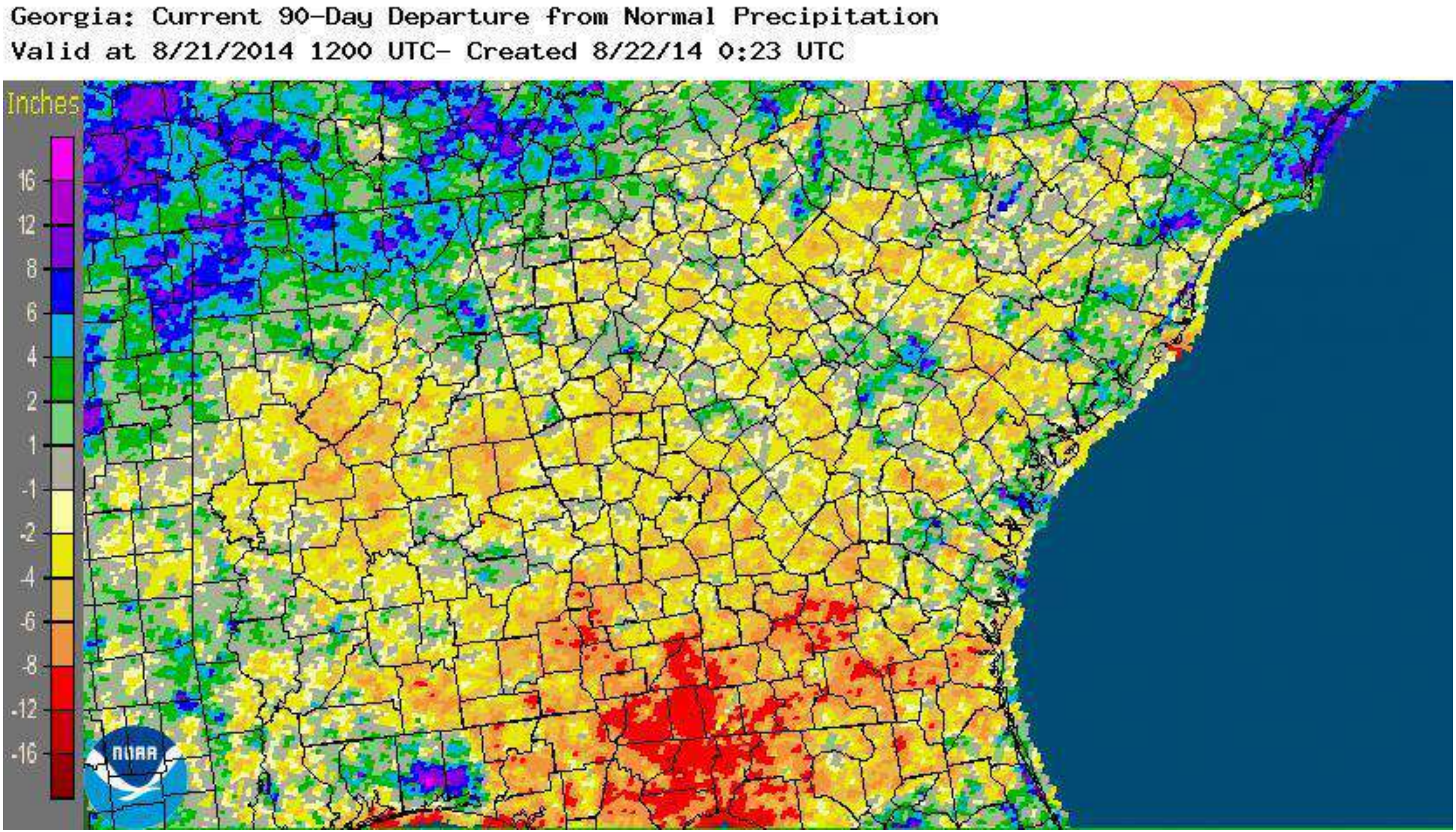
Region of Greatest Concern for Cotton Foliar Diseases

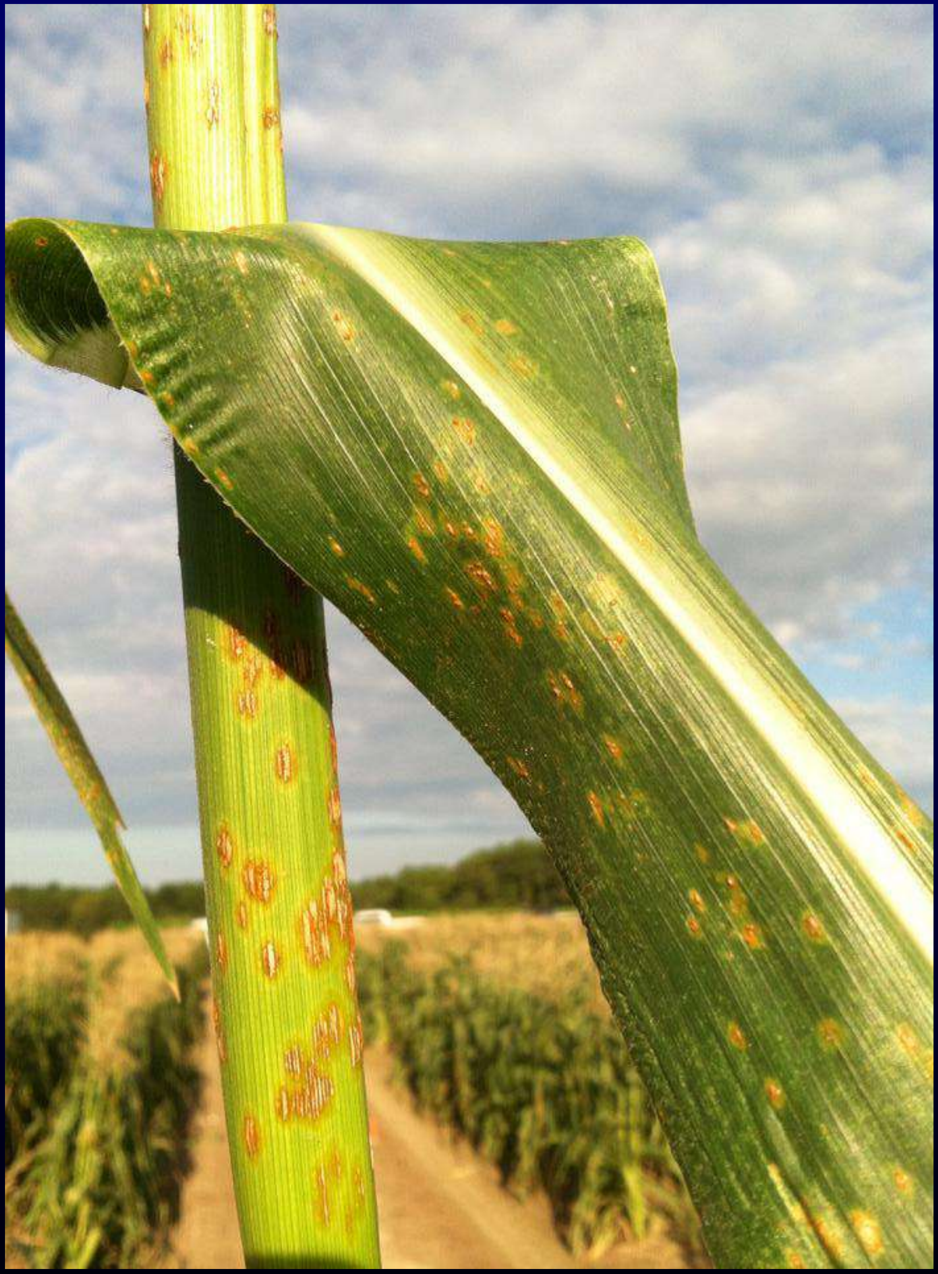






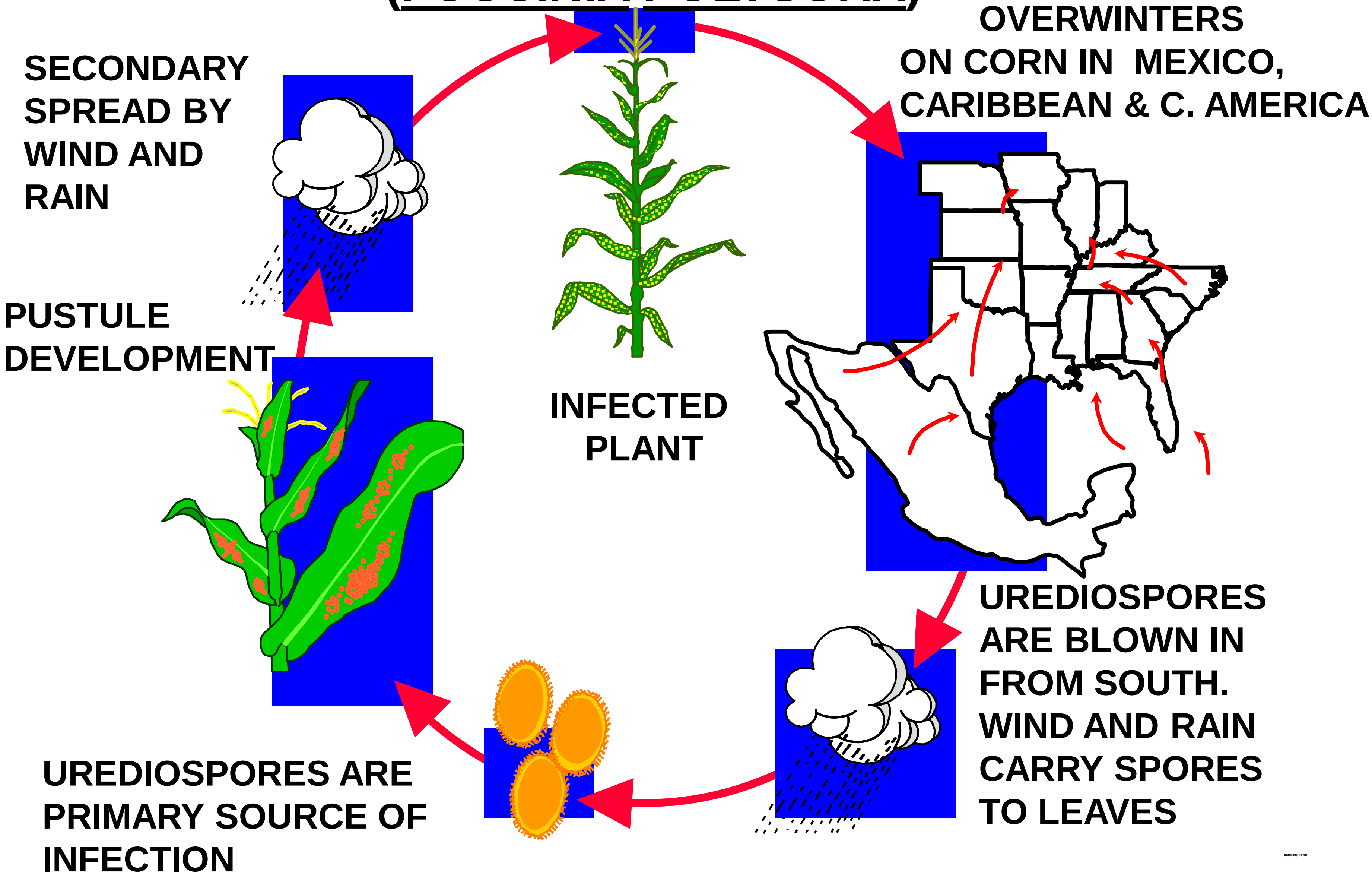

HIGH TEMPERATURES AND LONG PERIODS BETWEEN RAIN EVENTS





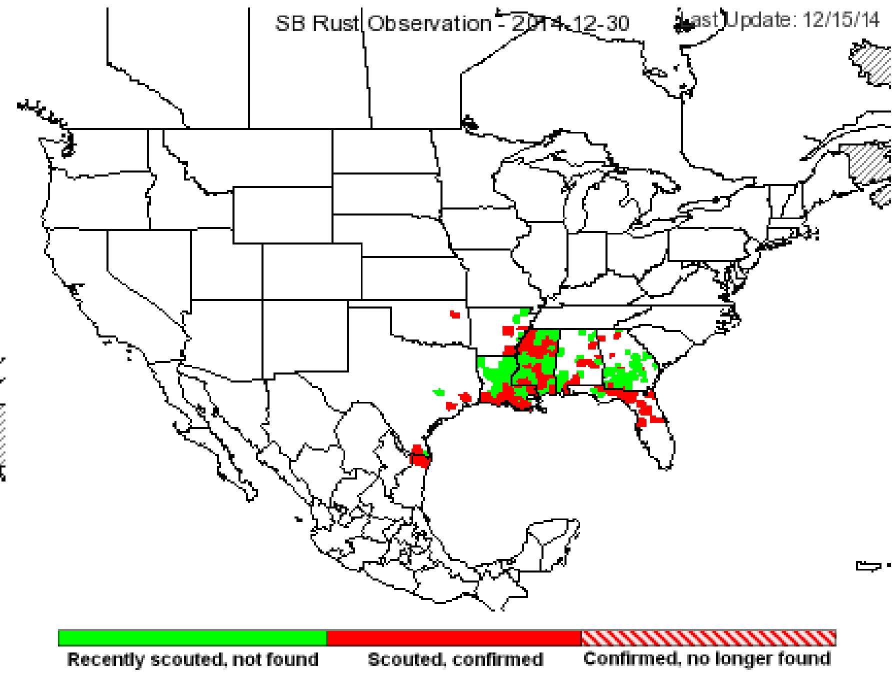

SOUTHERN RUST DISEASE CYCLE

(PUCCINIA POLYSORA)

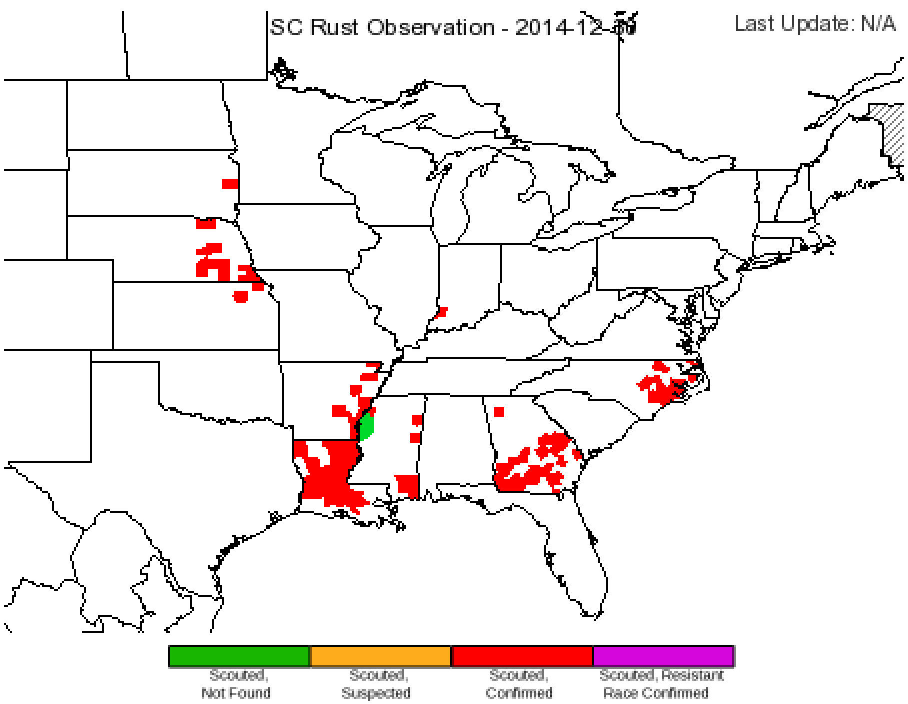


2014 Corn and Soybeans

2014 Asian Soybean Rust Map

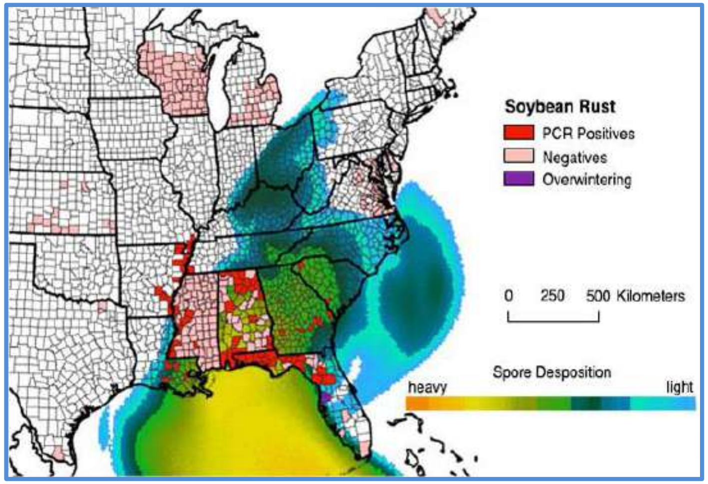


2014 Southern Corn Rust Map



HURRICANE IVAN and SOYBEAN RUST

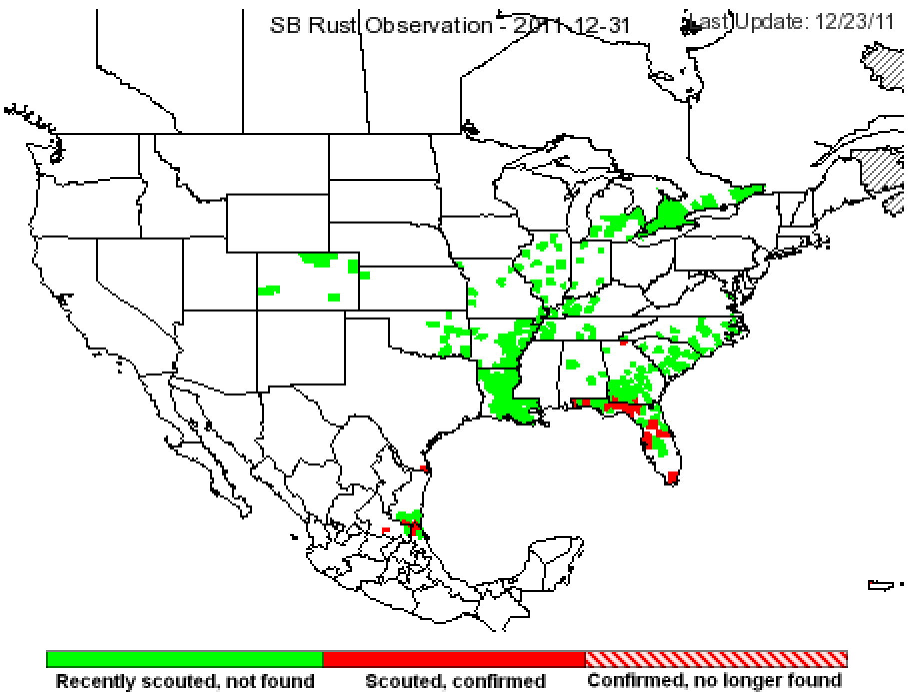
- First identified in 1904 in Japan, Asian soybean rust has spread steadily around the globe.

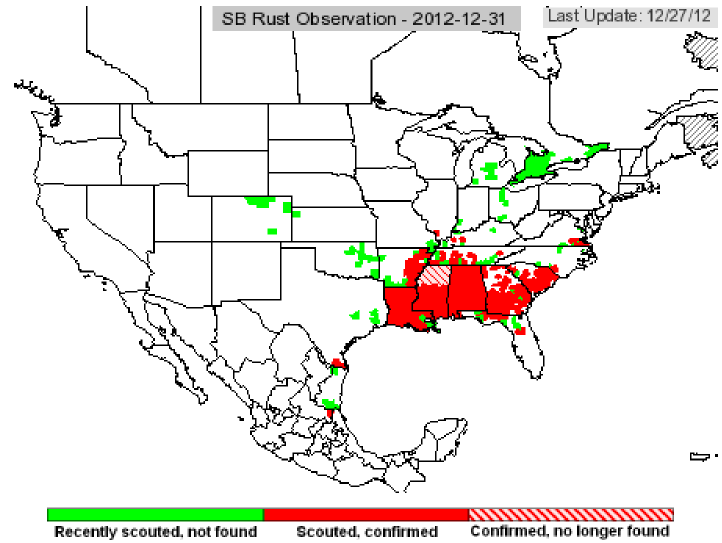


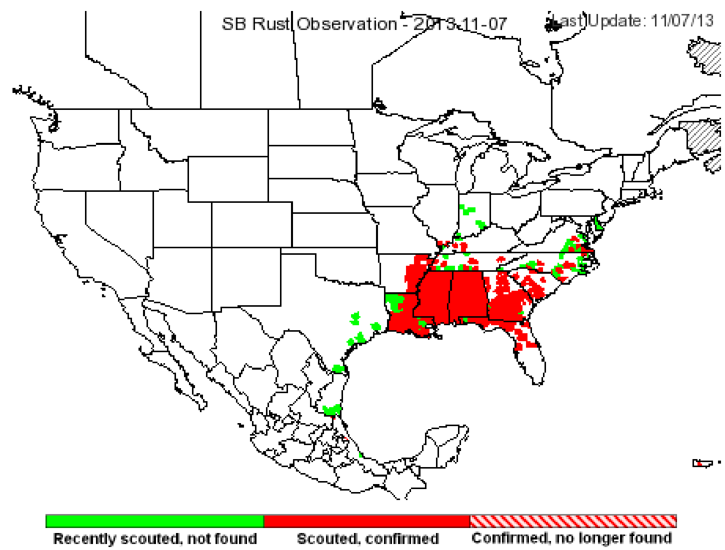
- Brazil: 2002

- Southeastern USA: 2004
  - Putatively on winds of Hurricane Ivan

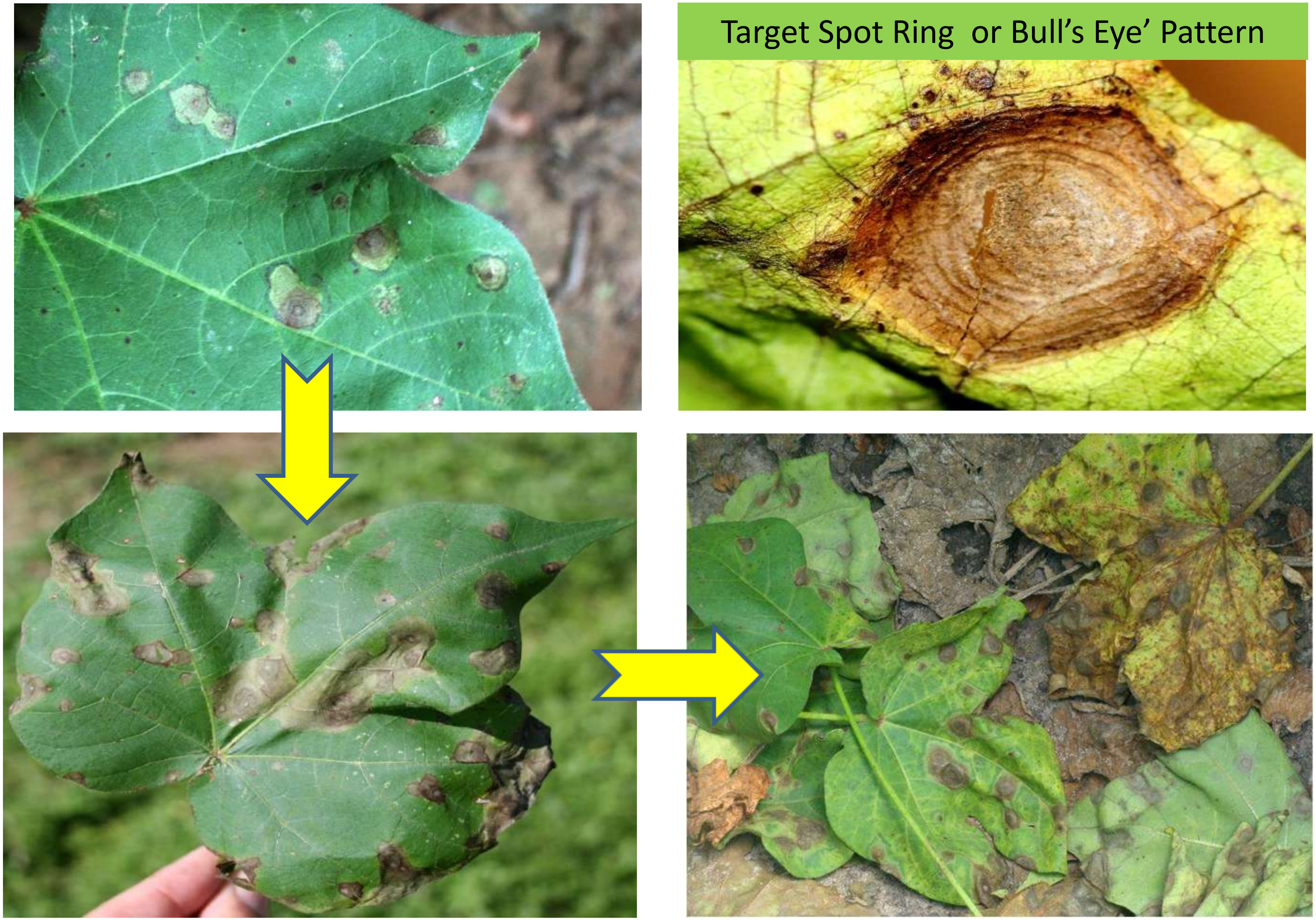

2011-2012-2013 Asian Soybean Rust



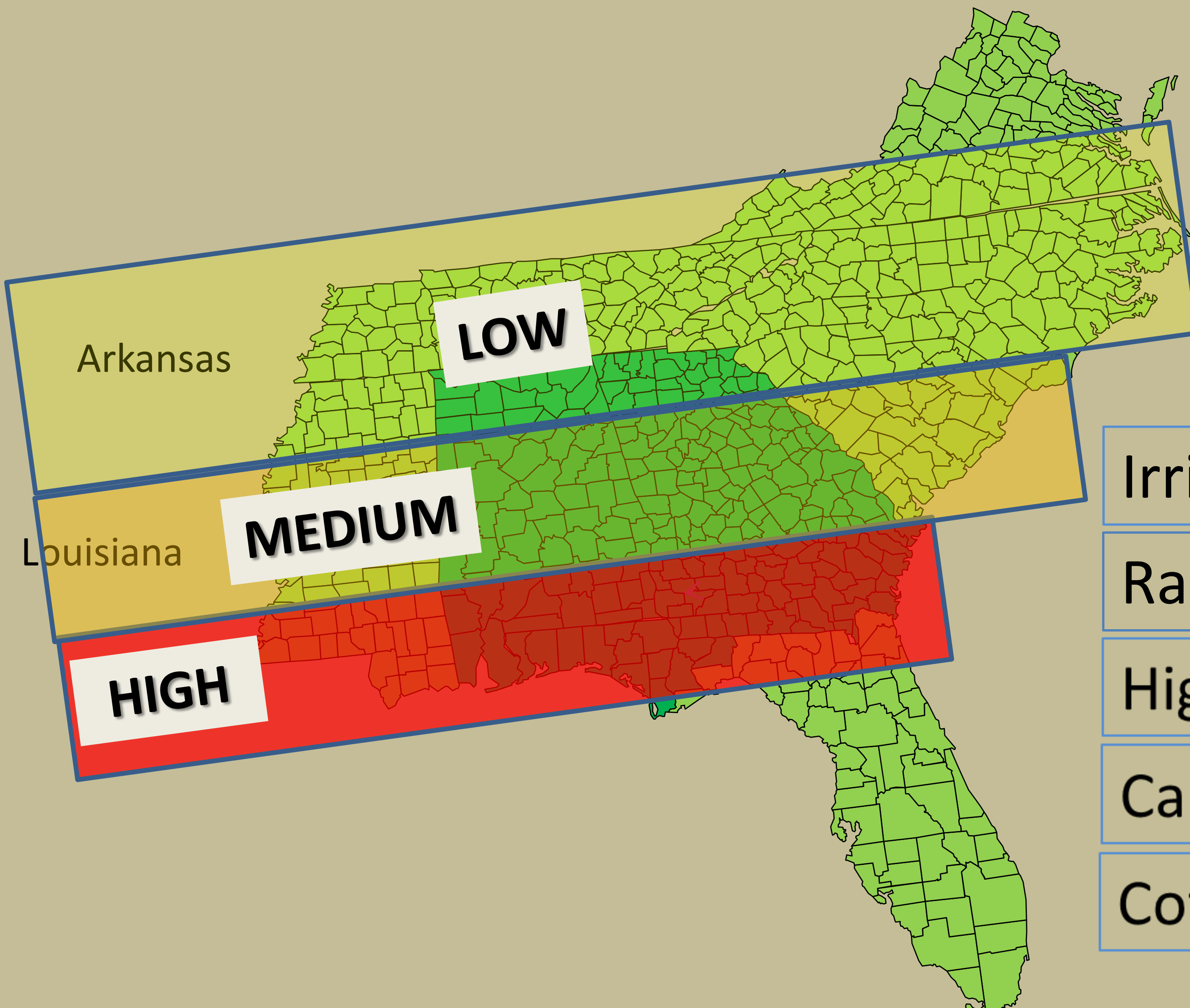




TARGET SPOT



TARGET SPOT RISK ZONES



Irrigation

Rainfall Pattern

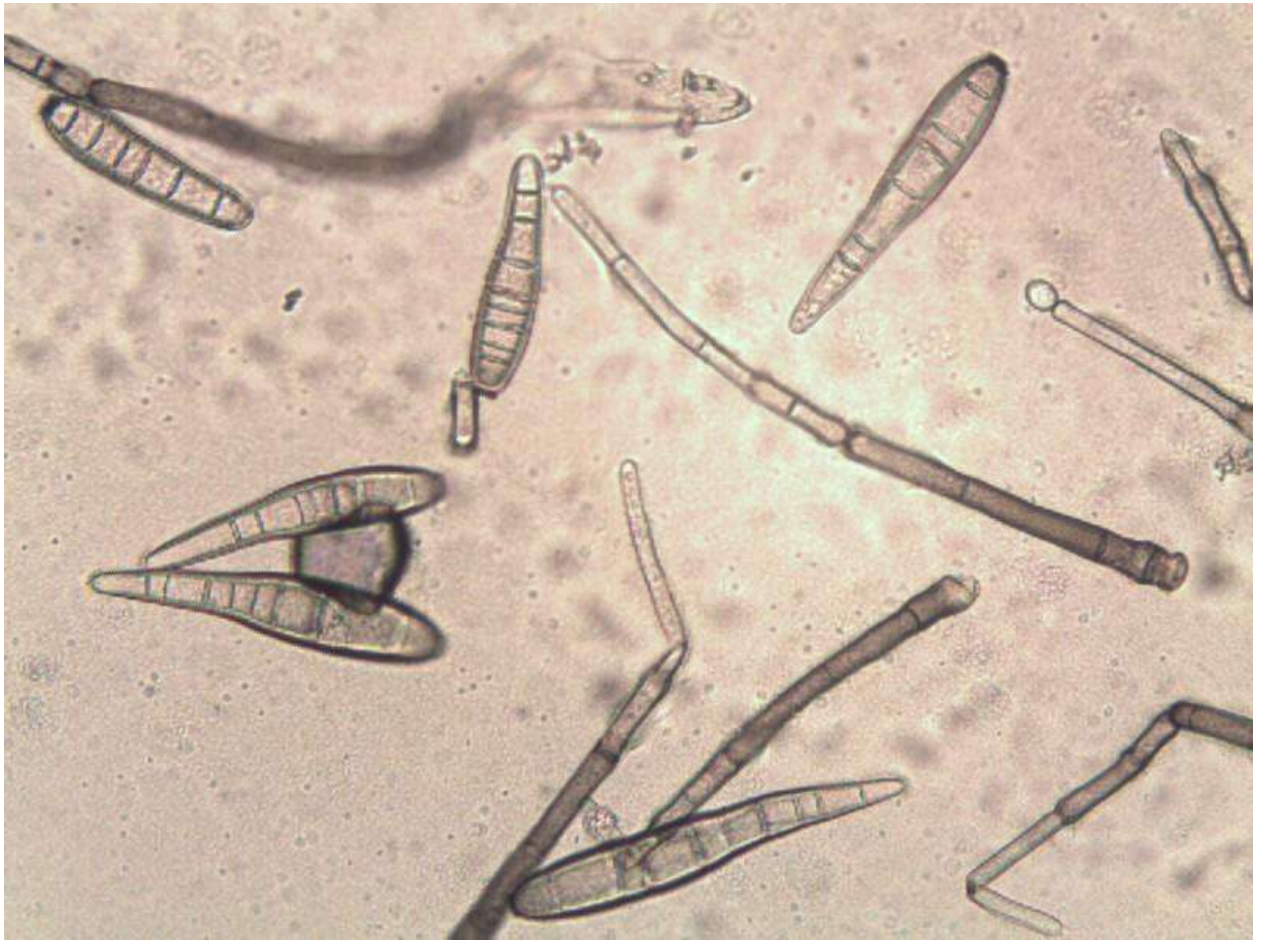
High Nitrogen

Canopy Closure

Cotton Variety

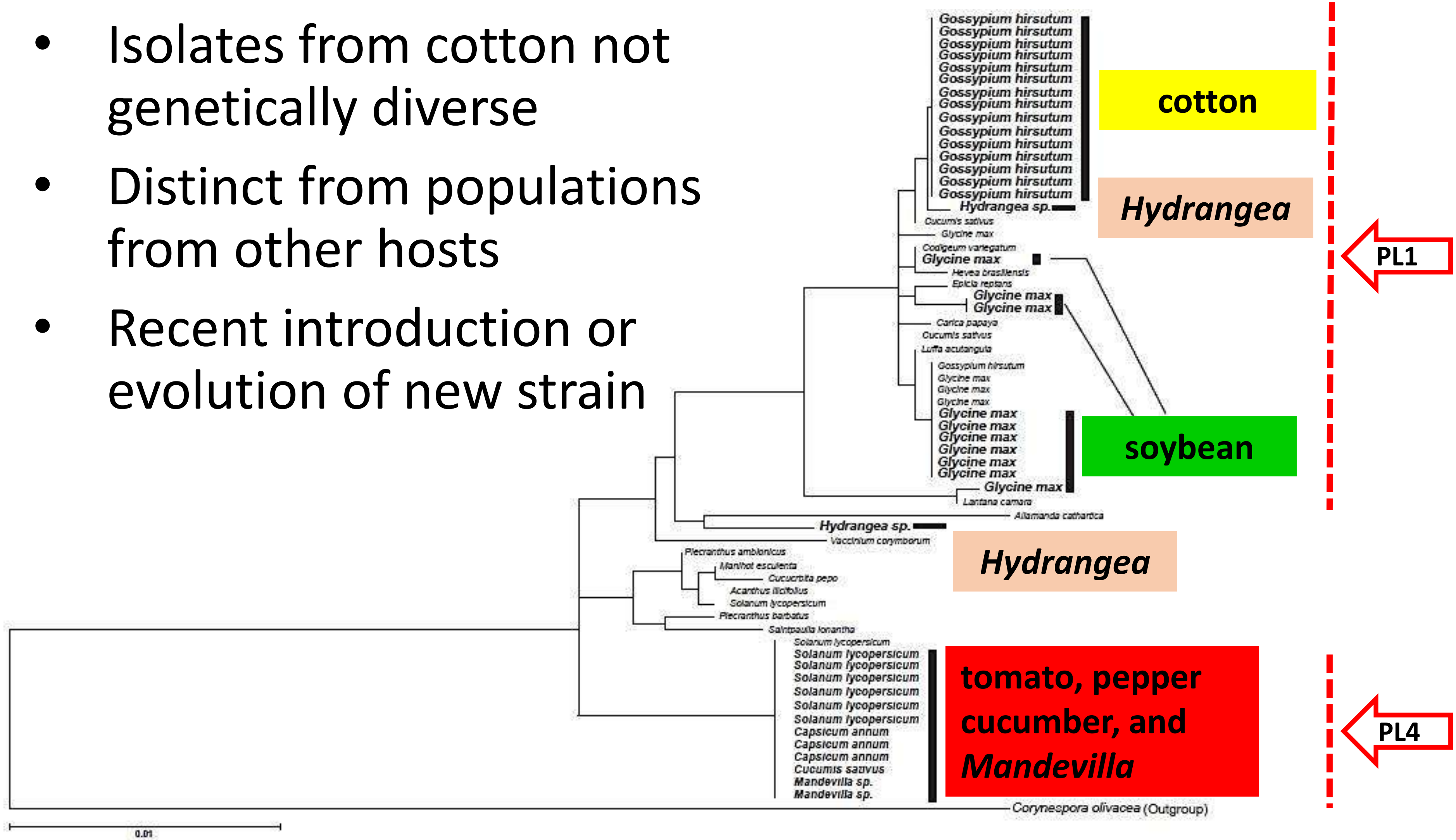
Target Spot on Cotton

Corynespora cassiicola



ML consensus tree highlighting distinct populations from SE U.S.

- Isolates from cotton not genetically diverse
- Distinct from populations from other hosts
- Recent introduction or evolution of new strain



Leilani Sumabat, Department of Plant Pathology, UGA

CLIMATE PREDICTIONS AND DISEASE MANAGEMENT

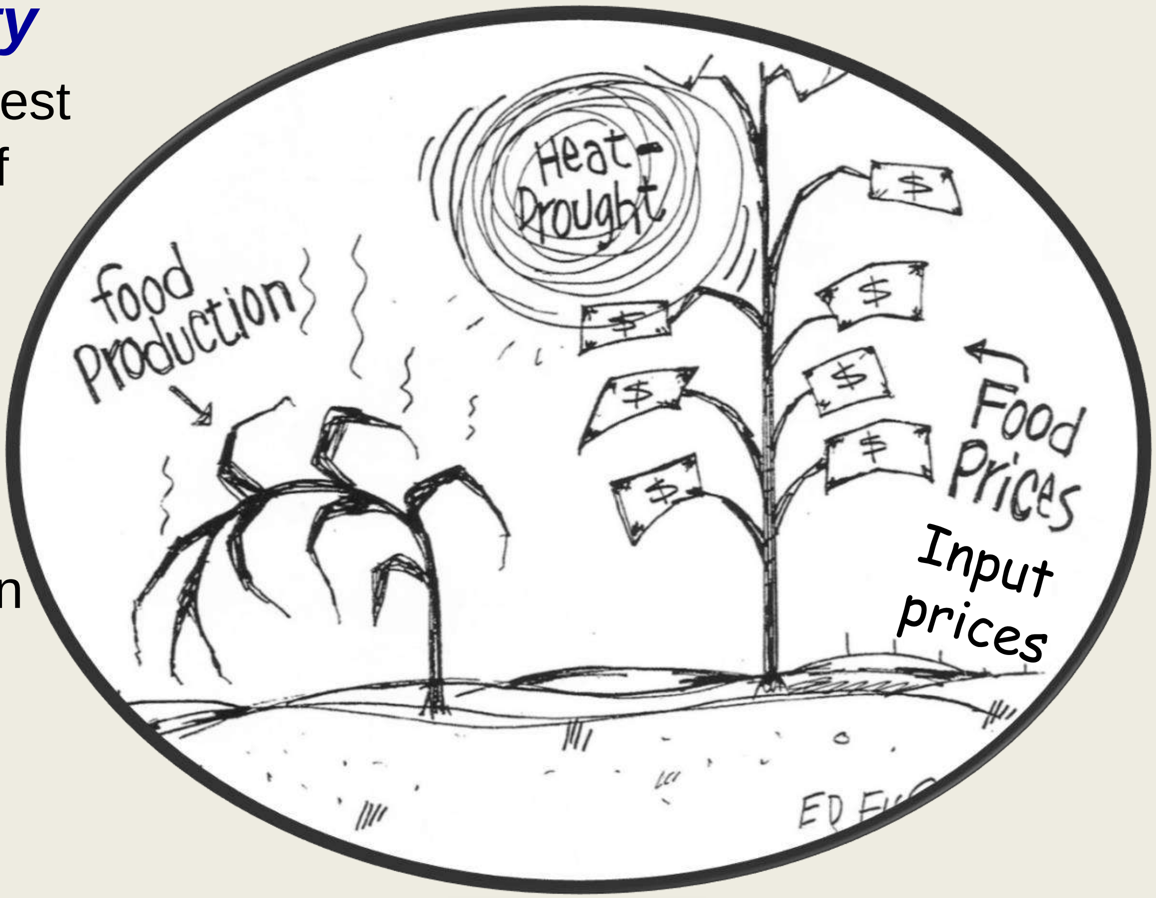
- Changes in climate could impact length of growing season.
- Changes in climate could shift the spectrum of diseases affecting crops.
- Climate changes could affect tactics used to manage diseases.
- Climate changes could lead to a shift in varieties that are planted.
- What about disease resistance?

Climate/Weather information along with technology in AG. can help us increasing resilience capacity, production, and the level of quality of agriculture

- ***Reducing vulnerability***
  (Yield losses minimized, pest and diseases, N losses… if Right strategy @ right time & place)

- ***Increase efficiency***
  (Right rate - water, fertilizer, seed - based within season and site variability)

- ***Adaptive capacity***
  (weather conditions pre- & post- sidedress N applic.)



If Climate is to be USEFUL in disease management……

- CLIMATE must be predictable with an appropriate level of accuracy.
- The weather that occurs within the predicted climate must have an affect on IMPORTANT diseases.
- There must be EFFECTIVE control strategies for management of these diseases; strategies that are sometimes, but not always, needed.
- It helps if commodity prices are not so high that growers treat anyway….

Climate Variability To Climate Change: Extension Challenges & Opportunities In The Southeast USA

Southeast Climate

EXTENSION | Advancing Climate Extension in Agriculture

Project period : 2010-2016

Multi-state – Multi-institutions – Multi-disciplinary

Funding from : USDA NIFA

Southeast Climate EXTENSION | Advancing Climate Extension in Agriculture

Project objectives

- Increase climate science literacy of cooperative extension faculty and stakeholders
- Integrate extension and research communities to facilitate the transfer of technologies and information about research gaps and needs of the industry
- Conduct workshops and field days to engage stakeholders and demonstrate adaptation and mitigation strategies
- Expand Web-based tools to include carbon, water, and nitrogen footprints on AgroClimate.org
- Develop and deliver producer-oriented educational products such as FAQs, publications, and Web-based materials
- Monitor and evaluate the effectiveness of our extension program

http://www.agroclimate.org/seclimate/

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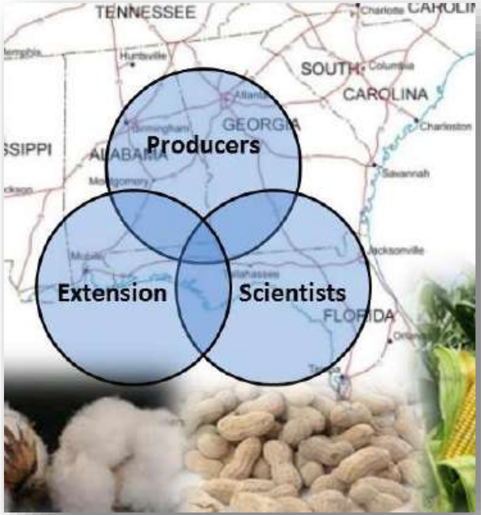
Tri-state Climate Working Group for Row Crops Agriculture

Create a space for knowledge exchange and learning to support farmers and extension professionals to cope with climate variability and changing climate

- Climate learning network engages row-crop farmers, agricultural extension specialists, and climate scientists as partners in adaptation science.
- Bi-annual meetings to exchange knowledge & experiences about how to reduce climate-related risks and increase agricultural adaptive capacity in the Southeast US.
- Strong field component (field visits) is a key element of the learning community model



Tri-state Climate Working Group for Row Crops Agriculture

How does this group works

Shared experience and participants discussing examples of how they manage risks

Included in-depth discussions help connecting new information with existing understandings

peer-to-peer learning through on-farm field visits, in-depth discussions, and experimentation

Climatologist reviews climate during previous growing season a present season forecast

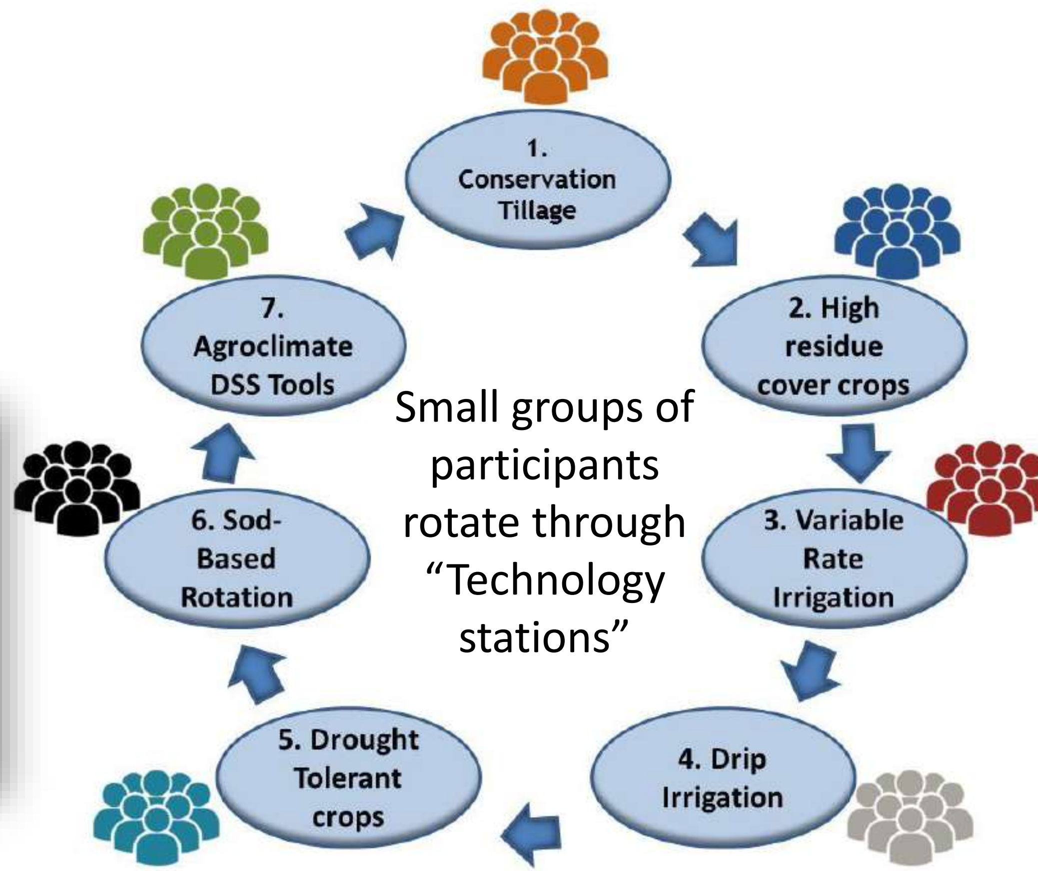
Field visits - Participants report their attempts at incorporating climate information or new technologies into existing farming

Climate Adaptation Exchange Fair

Farmers as teachers: Peer-peer leaning

1. Highlight the climate-related risk benefits of selected technologies and management practices (6 to 8 stations)

Farmer Kirk Brock , describing how he manages high residue cover crops during climatic conditions influenced by La Niña or El Niño



Climate Adaptation Exchange Fair

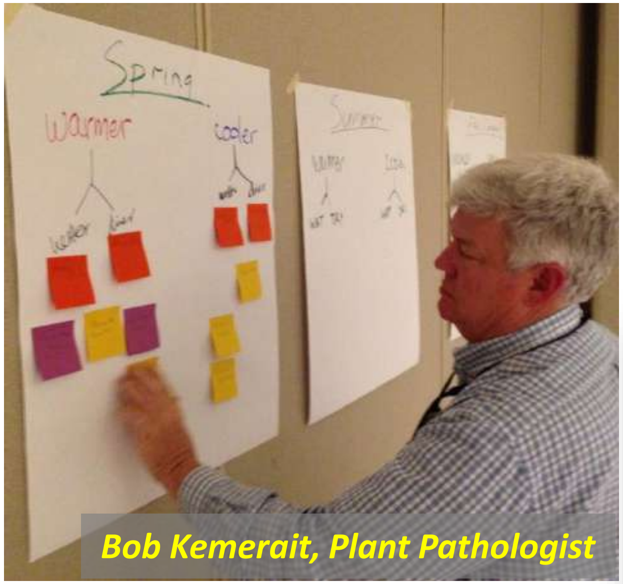
Farmers as teachers: Peer-peer learning

2. Strengthen a network of agricultural stakeholders and continue to co-develop best bets for climate-related risks

A farmer and extension specialist at every technology station

3. Generate discussion and capture feedback from participants about barriers (and opportunities) to adopting these technologies

Adapting "Crops" to the Climate in the Southeast US



Bob Kemerait, Plant Pathologist

Peanut Extension Specialists

University professors with extension responsibilities have accumulated, through applied research and interaction with farmers, a lot of knowledge of production risk factors.

Inventory of major climate-related risks and management options

Wetter/Cooler Winter and Spring	
Impact	**Strategy**
Insect Pests	
More occurrences of true armyworm caterpillars and winter grain mites	Additional scouting is needed for these insect pests.
Diseases	
Increased occurrence of the soilborne wheat mosaic disease in southern areas	Follow crop rotation, use resistant varieties, and plant at the recommended time for your location
Increased occurrence of the wheat spindle streak soilborne mosaic disease	Follow crop rotation, use resistant varieties, and plant at the recommended time
Increased outbreaks of glume and leaf blotch, rust, black chaff, and take-all diseases	Follow crop rotation, use resistant varieties, plant at the recommended time, scout at jointing through head emergence, and carry out seed dressing.
Increased risk of head scab when wetter conditions occur at flowering	Perform deep tillage, use clean seed, use resistant/ tolerant varieties when available, and apply fungicides based on head blight risk (http://www.wheatscab.psu.edu/).

Drier/Warmer Summer	
Impact	**Strategy**
Insect Pests	
More fall armyworms are likely to attack in fall.	Extra scouting is needed for armyworms.
More aphids, the vectors of barley yellow dwarf virus, are possible the following wheat season.	Extra scouting is needed for aphids.

Tri-state Climate Working Group for Row Crops Agriculture

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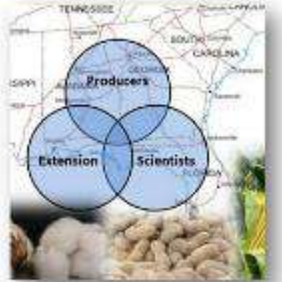

Motivation and sources of knowledge and information

Two continuous activities of the Climate Extension project

Climate Adaptation Exchange Fair

Farmers as teachers: Peer-peer leaning

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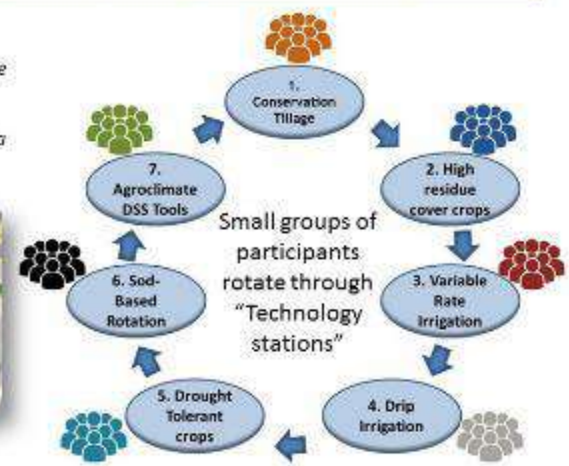
Farmer Kirk Brock, describing how he manages high residue cover crops during climatic conditions influenced by La Niña or El Niño

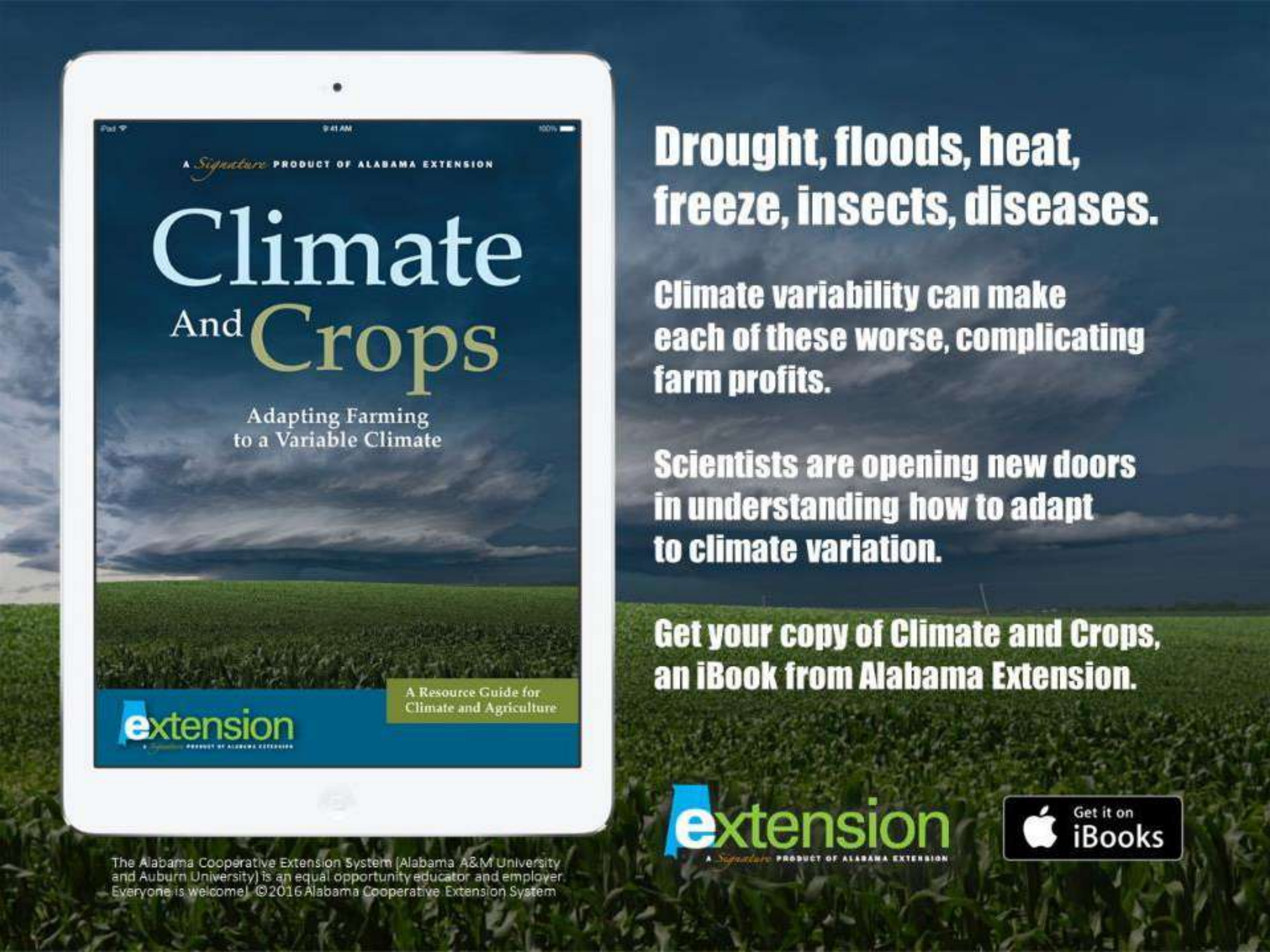


"Climate and Crops" iBook: A Climate Adaptation Guide to Farming in the Southeast US

Brenda V. Ortiz, Austin Hagan, Bob Kemerait, Kathy Flanders, R. Scott Tubs, David Zierden, Scott Monfort, Edward Sikora, Dale Monks, Mark Abney, David Buntin, Dennis Delaney, David Wright, William Birdsong, Jerry Johnson, Pam Knox, Kris Balkcom, Ayanava Majundar, James Langcuster, Jenny Crickard, Emery Tschetter

Conference "Weather & Climate Decision Tools for Farmers, Ranchers & Land Managers"

December 5-7, 2016
University of Florida Campus
Gainesville, FL


A Signature PRODUCT OF ALABAMA EXTENSION
Climate And Crops
Adapting Farming to a Variable Climate
A Resource Guide for Climate and Agriculture
extension
Drought, floods, heat, freeze, insects, diseases.
Climate variability can make each of these worse, complicating farm profits.
Scientists are opening new doors in understanding how to adapt to climate variation.
Get your copy of Climate and Crops, an iBook from Alabama Extension.
extension
A Signature PRODUCT OF ALABAMA EXTENSION
Get it on iBooks
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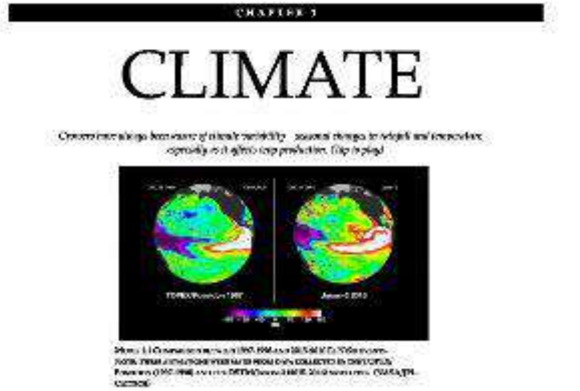
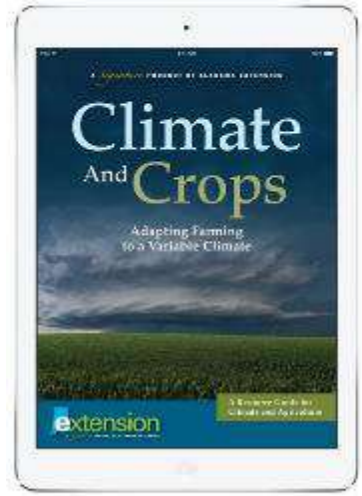
Climate and Crops iBook - Objectives

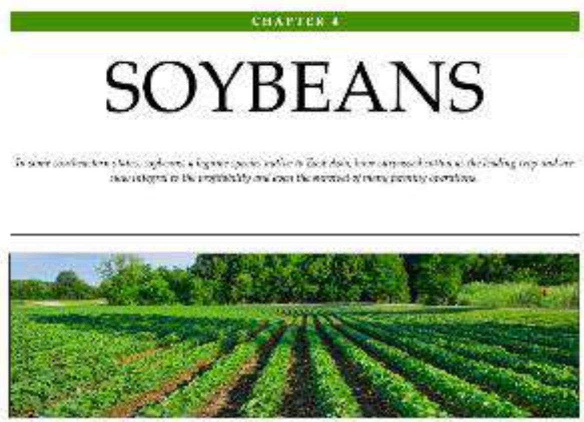
- Increase awareness on the sources of Climate variability in the Southeast US and use of climate forecast.

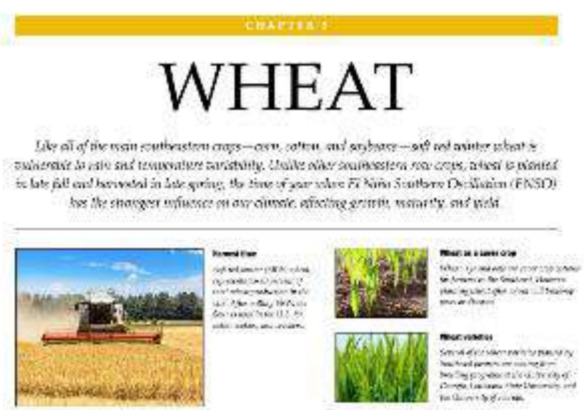
- Increase awareness on the impact climate has on crop production.

- Provide the farming community in the Southeast with risk management strategies to cope with a variable Climate.









1. Climate (Basics)
2. Cotton
3. Corn
4. Soybean
5. Wheat
6. Peanuts

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Content of Crop Chapters – Impact of ENSO on yield

WHEAT

Figure 5.1. Warmer and drier conditions during fall and spring favor high wheat yields.

Conversely, higher February temperatures are beneficial to winter wheat because it promotes tillering.

The highest wheat yields are usually achieved with warmer conditions during the fall and spring but not with drought conditions during the grain-filling period. By contrast, the wet and cold climatic conditions may lead to waterlogged soils that could result in yield losses.

KEY POINTS

ENSO phases and Yield

The impact of ENSO-related climatic conditions on wheat yields in the Southeast varies within the region. Generally, La Niña years result in higher yields for early maturing varieties compared to El Niño years. The lowest wheat yields in La Niña years may occur when late maturing varieties are planted in counties on or near the Gulf Coast region. On the other hand, there are no yield differences between ENSO phases when late-maturing varieties are planted in northern Alabama and Georgia counties.

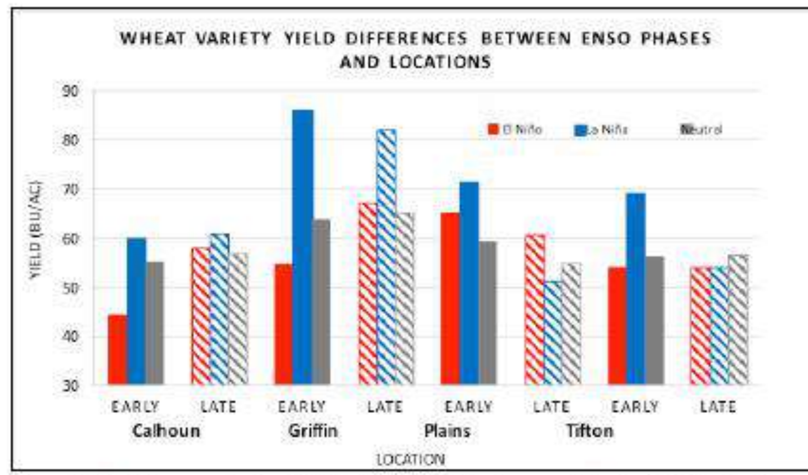


Figure 5.2. Differences in wheat yield between ENSO phases and location. Solid color bars represent yield of early maturity varieties and hatch diagonal bars correspond to late maturity varieties. (Source: Woli et al., 2015. *Agronomy Journal* 107:2193-2204)

Content of Crop Chapters – Key Management Practices

CORN

KEY MANAGEMENT PRACTICES

Planting

Conservation tillage is a recommended practice for crops grown in the Southeast, including corn. Strip-tilling into a previous crop residue or cover crop can improve water infiltration and reduce soil disturbance as well as improve soil structure and reduce soil erosion. Corn yields under conservation tillage equal or even exceed yields from conventional tillage practices, such as rip and bed, and provide ecosystem services for long-term farm sustainability.

Movie 3.1. How climate impacts corn production in the Southeast. *(Tap to play.)*

Cover crops should be terminated several weeks ahead of planting to conserve soil moisture for the corn crop and to decrease the risk of cutworm and southern corn rootworm damage to young corn seedlings.

Planting corn after winter grazing can give growers key advantages, namely securing higher levels of nutrients for the corn crop's root zone as well as a deeper root system.

Warm soil conditions (50 to 55 degrees F) and adequate but not excessive moisture constitute ideal planting conditions for corn. These conditions contribute to rapid germination and seedling growth, which let corn plants develop their root systems and avoid seedling disease.

The careful selection of planting dates is an effective climate management tool for corn growers. For irrigated corn growers, planting between March 1 and April 15 generally ensures the highest yields.

Planting dates are a far more critical concern for growers of nonirrigated corn, though these dates are greatly affected by the climatic conditions. For instance, if a dry, hot climate is forecast, nonirrigated corn typically should be planted later, in late April to mid-May.

Nonirrigated corn growers should plant hybrids with different maturity dates and enhanced drought-tolerance characteristics. Bt-corn hybrids should be selected especially for late planting due to the increased risk of lepidopteran insect pest outbreaks. Growers should

Content of Crop Chapters – Climate-based production risks and adaptation strategies

COTTON — DRIER AND WARMER SPRING

Climate-Related Effects on Cotton Production and Adaptation Strategies

PLANTING RISKS

High risk for delayed planting due to hot, dry conditions.

Strategies

- Prepare seedbed early to be ready for planting when sufficient moisture may become available. Adequate moisture at the 1/2 - to 1-inch soil depth where cottonseed is planted is critical for germination.
- Under these warmer and drier conditions, consider having access to an extra set of planters ready to capitalize on any rainfall event.
- With onboard GPS-guided tractors and implements, growers can plant night and day to capture the benefits of a timely rainfall event.

INSECT RISKS

Warmer and drier winters increase the risk for overwintering grasshoppers, leading to higher numbers of these insects in the spring. In recent years, this has become a special challenge in reduced tillage systems.

Likewise, warmer and drier winters promote the overwintering of bollworm and tobacco budworm pupae.

Figure 2.3. Growers should prepare the seedbed early to be ready for planting when the soil has the right amount of moisture and temperature for a higher germination rate.

Climate-based production risks and strategies

CORN — DRIER AND WARMER SPRING

Climate-Related Effects on Corn and Adaptation Strategies

PLANTING RISKS

Warmer and drier conditions may present a challenge to dryland corn growers, especially because of their reliance on adequate rainfall.

Warmer soils promote vigorous germination, aggressive growth, and fewer seedling diseases and nematode problems.

If the field is grazed by cattle up to the day of planting, a soil insecticide should be applied to prevent seedling damage.

Strategy

- Dryland corn growers should consider delaying planting to capitalize on later rainfall to ensure higher yields.

INSECT RISKS

In drier, warmer conditions, growers typically deal with increased populations of stinkbugs, mainly on crops grown within reduced tillage systems, planted into grassy winter crops or weeds.

Figure 3.11. Tailoring irrigation strategies to soil properties and plant needs can minimize climate-related risks.

CORN — WETTER AND COOLER SPRING

...se a higher rate of insecticide seed treatment on fields with ...highest risk of insect damage.

DISEASE RISKS

Cool and wet conditions increase the likelihood of fungal diseases.

Seedling blight is highly likely under cooler and wetter conditions.

Growers also face an increased risk of southern and northern corn leaf blight as well as southern rust.

Strategies

- Delay planting to promote germination and seedling growth.
- Scout for southern and northern corn leaf blight outbreaks and treat as needed with a fungicide, perhaps as early as the V6 growth stages. However, growers should remember that most corn hybrids have some disease resistance until the reproductive stage.

Figure 3.17. Growers should undertake extra scouting for true armyworms (Mythimna unipuncta) during a cooler and wetter spring. (Roger Schmidt, University of Wisconsin–Madison, Bugwood.org)

Figure 3.18. Black cutworm larva (Agrotis ipsilon) lying next to the damage it caused to a young corn plant. (W.M. Hantsbarger, Bugwood.org)

Figure 3.19. Extra scouting for northern and southern corn leaf blight outbreaks may be necessary in cooler, wetter climate conditions. (University of Georgia)

Figure 3.20. Roots of corn seedlings displaying symptoms of seedling blight. (William M. Brown Jr., Bugwood.org)

CORN — DRIER AND WARMER SUMMER

DISEASE RISKS

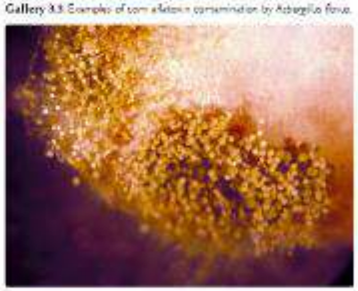
Charcoal rot, while not especially common in the Southeast, poses a greater risk to corn during warm, dry conditions, particularly under intense heat and drought.

Warmer and drier summer conditions increase the risk of aflatoxin contamination. The risk is highest if dry and hot conditions occur one week before and one week after the silking date.

Strategies

- Irrigation and the planting of hybrids with strong heat tolerance are effective strategies for reducing the risk of charcoal rot. Aside from these safeguards, nothing can be done to protect a crop against charcoal rot once the disease has been detected.
- Growers have a better chance of staying ahead of aflatoxin contamination if they anticipate hot weather conditions and use irrigation, especially during silking and grain filling periods. Afla-Guard application at tasseling may also be an effective strategy for controlling Aspergillus flavus, the fungus that causes aflatoxin contamination. Conservation tillage, by assuring better moisture retention during the hot summer months, is one effective safeguard against drought conditions that promote aflatoxin contamination.

Gallery 3.3 Examples of corn aflatoxin contamination by Aspergillus flavus.



Department of Plant Pathology, North Carolina State University, Bugwood.org

CORN — WETTER AND COOLER SUMMER

...R GROWTH AND YIELD RISKS

C... cooler, and rainy summers are not ideal conditions for corn due to reduced photosynthesis.

Dryland corn growers should expect higher yields during cooler, wetter summers, typically around 130-bushel yields. Corn growers with irrigation, on the other hand, should not expect exceptionally high yields.

The biggest impact associated with cooler, wetter summers is on the vegetative growth stages. Under these conditions, early planted corn, lacking sufficient heating units, could take as long as 70 days to tassel and silk.

Strategies

- Under irrigated conditions, consider increasing plant population and nitrogen rates.
- Careful nitrogen management is important under these climate conditions, especially because of the risk of leaching.
- Reduce the tasseling and silking period to 45 days by delaying planting until warmer conditions occur.
- Growers who plant later in the season should be cautious about the crop's rapid growth and adjust nitrogen application timing accordingly.
- Water management is critical during tasseling, silking and grain fill. Corn takes up little water on cloudy days. During prolonged periods of summertime cloudiness, growers should space out irrigation from every 3 or 4 days to every 5 or 6 days or, in some cases, over a longer period.

INSECT RISKS

Wetter, cooler summers are typically characterized by fewer chinch bugs and fall armyworms.

DISEASE RISKS

Wetter summers typically increase the risk of fungal diseases. Higher moisture promotes higher levels of southern rust, northern and southern corn leaf blight, and gray leaf spot.

If tropical storm conditions are expected, southeastern growers may face a greater risk of rust diseases as rust spores are blown ahead of these storms. The risk of southern rust increases with warmer and wetter conditions. Northern corn leaf blight is more prevalent under cool and wet weather between tasseling and grain fill.

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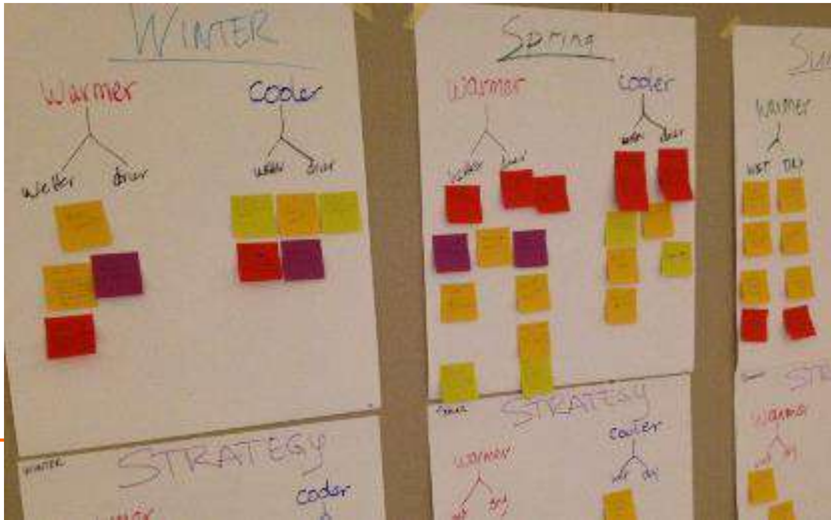
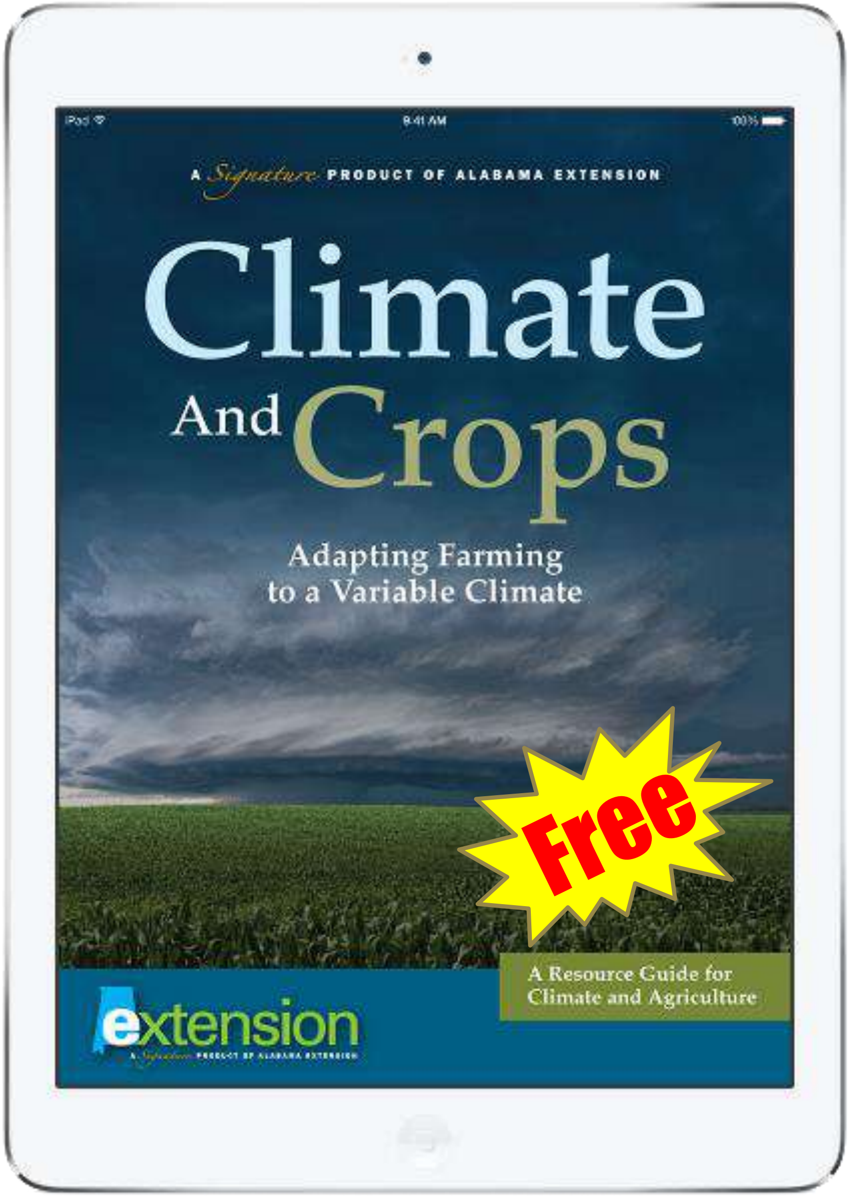
Information was collected from:

Delphi Technique: A method of group decision making and forecasting that involves successively collating the judgements of a panel of experts (Wikipedia)

- Face to face meetings with Extension specialists.
  - Crop-specific meetings were scheduled with specialists in Agronomy, Entomology, Plant Pathology, Weed Science, Cropping systems, Climatology.
  - Potential climate-scenarios were outlined and discussions were based on the risks those scenarios impose on each crop (growth, pests, diseases, weeds, harvest) and some of the main strategies to minimize those risks. Videos were also recorded with some of Extension specialists. Climate-related risks management strategies were video-recorded.
  - Tri-state Climate Working group for row crops Ag. AND Adaptation exchange fairs





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What does the Future Hold?

Challenges

- Warmer temperatures increase diseases and pests
- More stress on livestock
- More potential for drought
- More extremes
- Market uncertainty
- Economic costs of becoming resilient (for example, irrigation or power sources)
- Changing tastes and demographics

Opportunities

- Population growth means potential for market growth
- Parts of the US will see increased growing season and more rainfall
- Other parts of the world will also undergo climate change, leading to expanded markets
- Smart management can improve budget while also taking advantage of market incentives

Our children are growing up

Dr. Pam Lopez Kemerait

Many Thanks for Their Hard Work