



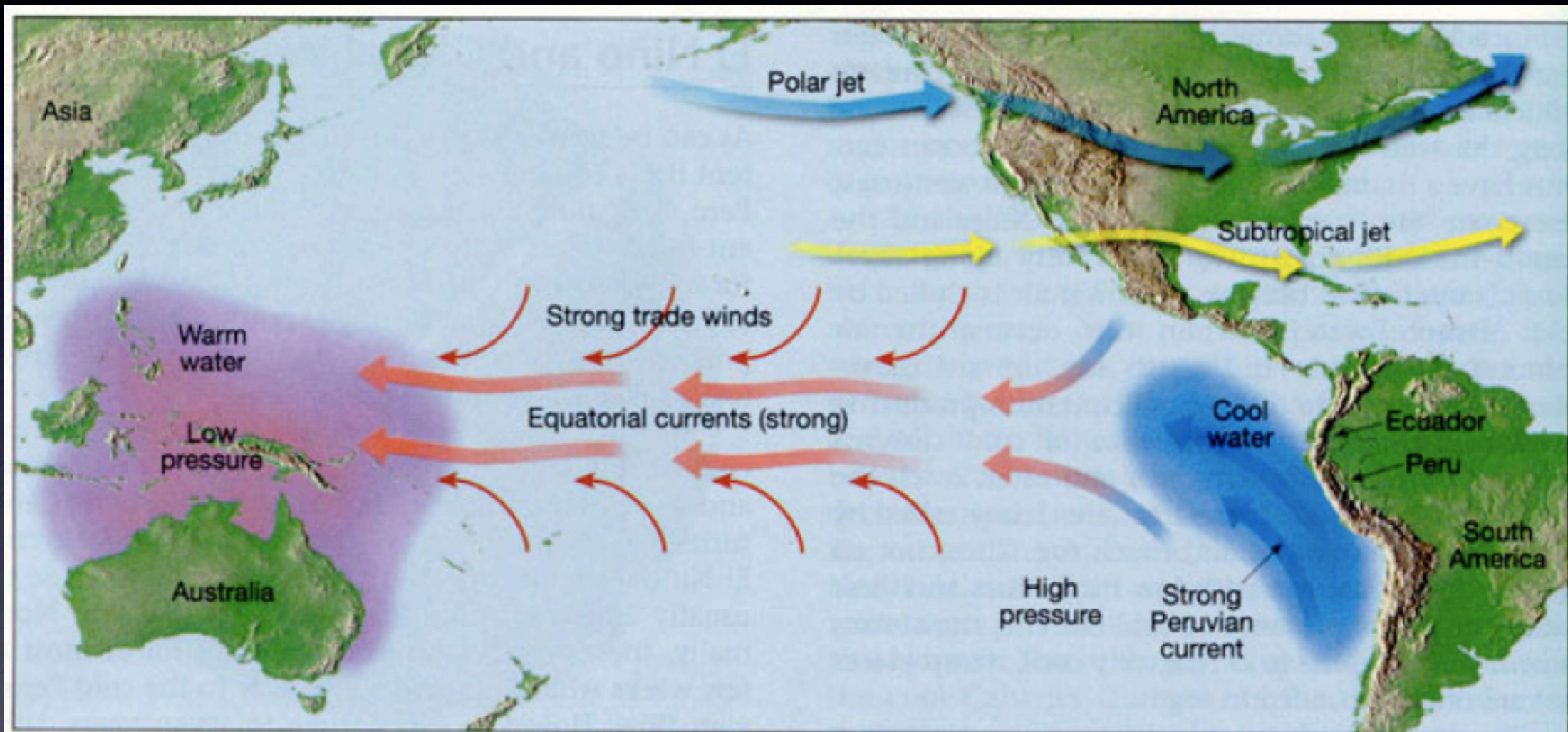
# AgroClimate for Climate-Smart Agriculture

David Letson

University of Miami/RSMAS



# Climate Variability in the Southeast U.S.A.

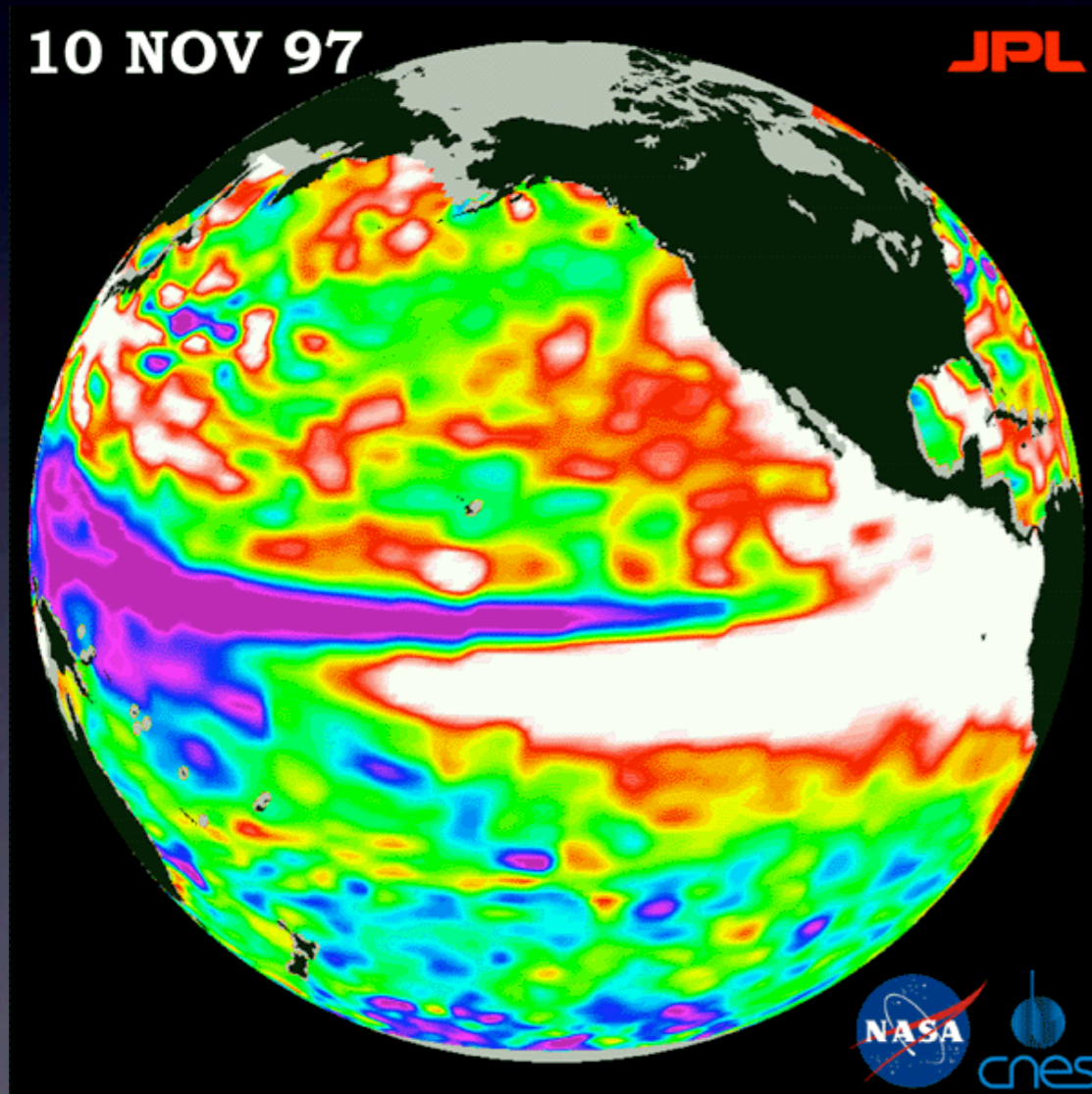


**Fig.6 Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes upwelling of cold water along the west coast of South America.**

## Normal Conditions in the Tropical Pacific Ocean

# El Niño - Southern Oscillation (ENSO)

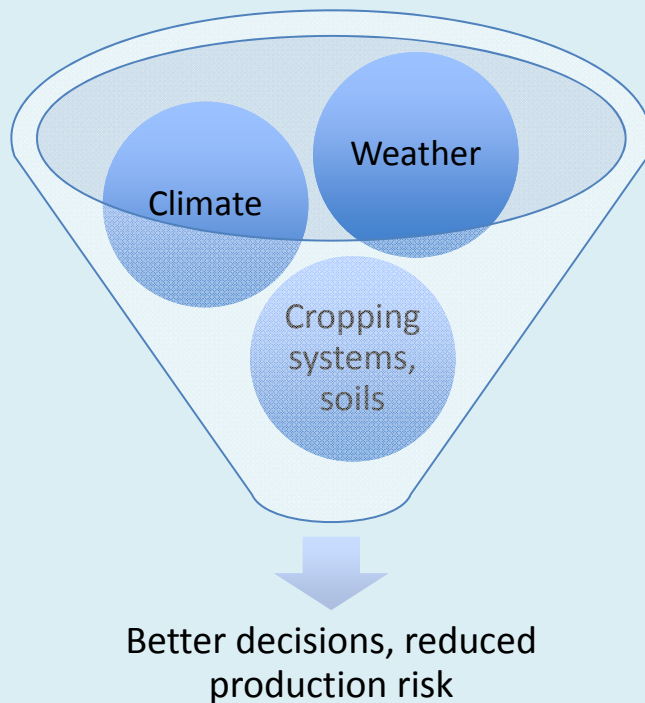
**The El Niño / La Niña cycle is the predominant mode of year to year climate variability in the Southeast U.S.**



**El Niño**

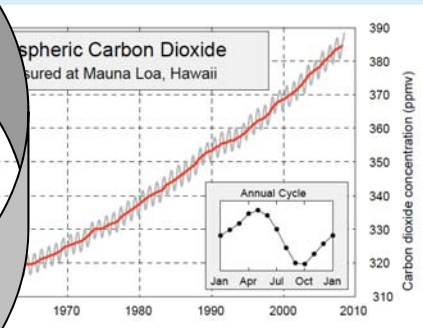
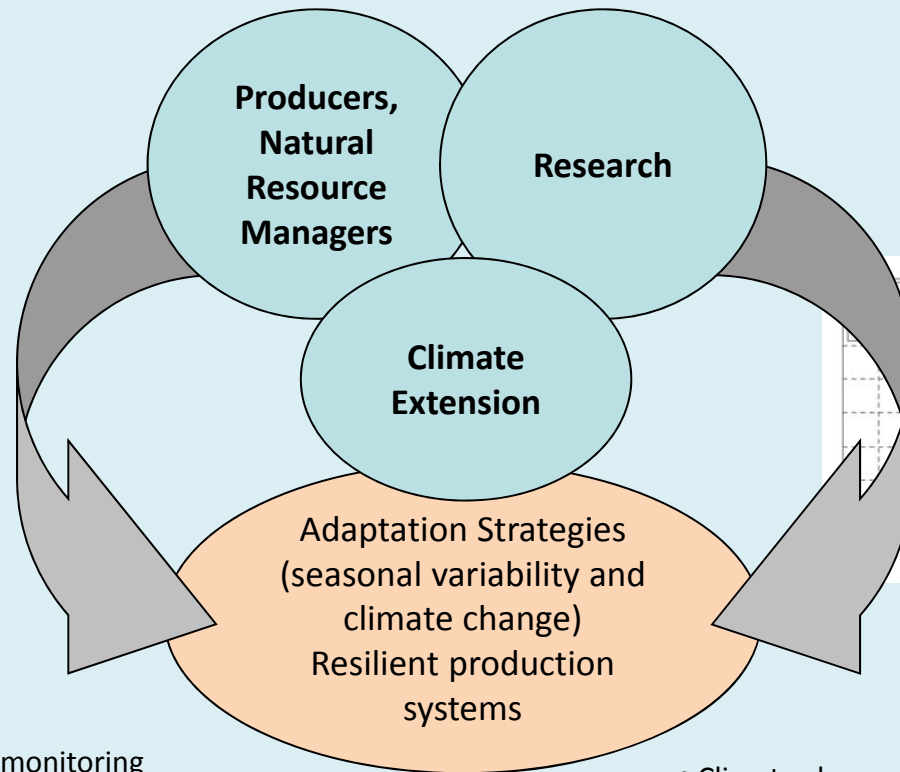
- Warmer than normal sea surface temperature (SST) across the eastern tropical Pacific
- Wetter and cooler winter and springs in the Southeast U.S.
- Fewer Atlantic hurricanes

# AgroClimate.org



- Climate extension and applied research program.
- Dedicated to translate **climate and weather** data into information to help producers reduce risk.

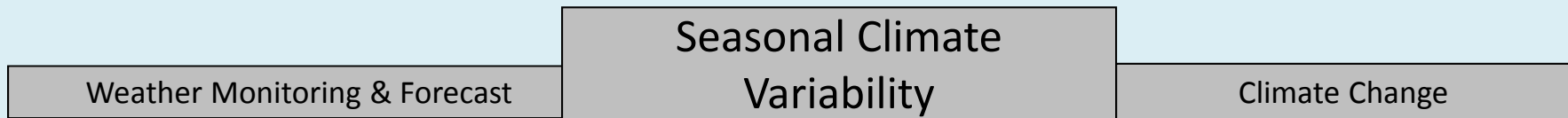
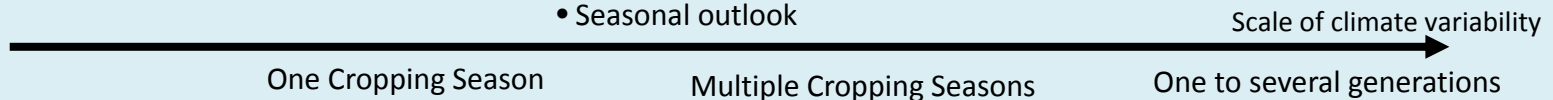
# Our Vision for AgroClimate.org



- Weather monitoring
- Short term forecast

- Seasonal outlook

- Climate change projections



Source: Fraisse, C.W., N.E. Breuer, D. Zierden, K.T. Ingram. 2009. "From climate variability to climate change: Challenges and opportunities to extension." *Journal of Extension* (On-line), **47**(2) Article 2FEA9.

# Translating weather/climate information into decisions

## Monitoring & Weather Forecast

- What field can I work on this afternoon?
- When can I plant my seeds?
- Should I apply N fertilizer to my fields?
- Will it be dry enough to harvest?
- Should I cut hay today?
- Cold protection tonight?
- Should I apply fungicide today?



Flooded peanut field. Doug Mayo – August 2013.



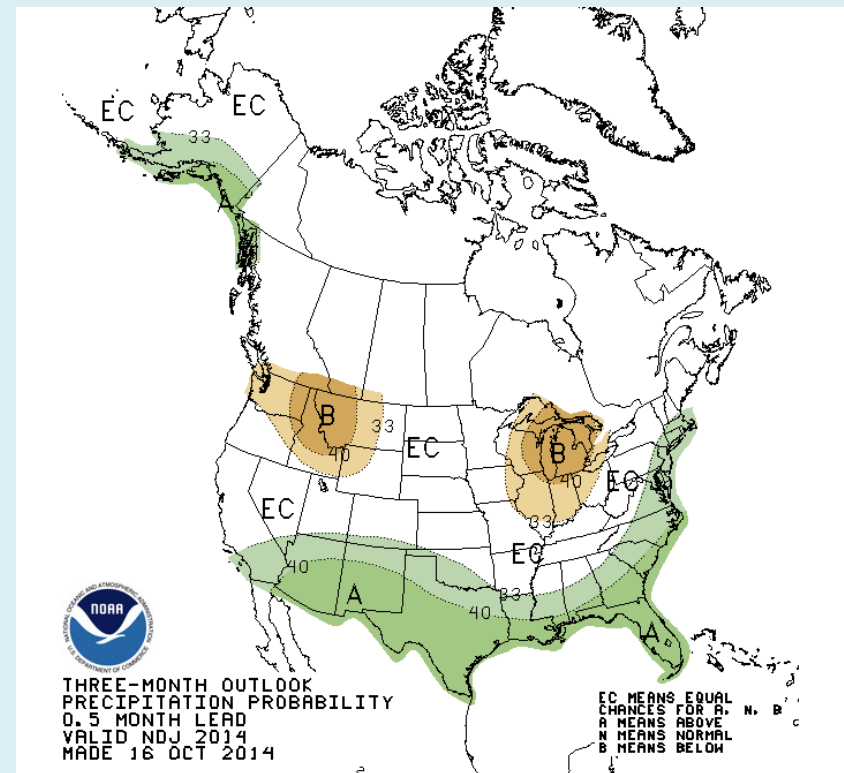
Blueberry freeze, UF-IFAS, February 2002.

Operational  
decisions

# Translating weather/climate information into decisions

## Seasonal Climate Outlook

- Best crop/variety to plant this season?
- How much should I invest in fertilizer? How to apply N?
- Should I purchase/increase crop insurance coverage?
- Marketing decisions?
- Should I invest in winter pasture or feed?



Strategic  
decisions

# Our top challenge is to translate climate change projections into decisions



## Long-term Climate Projections

- How do I become more resilient to climate extremes?
- What cropping system will be more appropriate based on existing projections?
- Should I invest in land somewhere else?
- ?

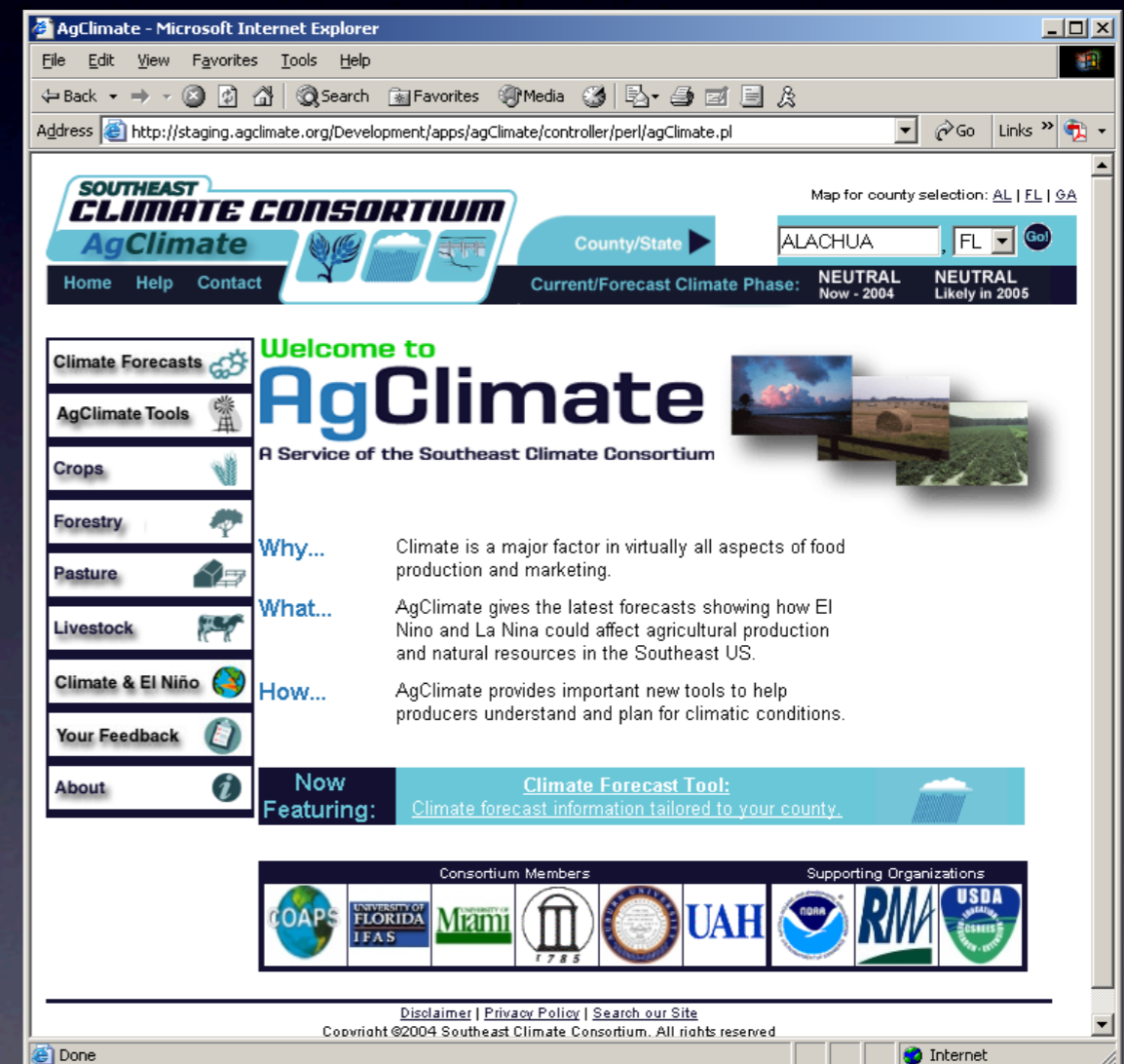
Making \*decisions based on long-term climate projections is much more difficult!

One of the main reasons for extension faculty to be reluctant about addressing climate change issues is the lack of “practical solutions”

\* Decisions at the producer level, not in terms of national or regional planning

# How to communicate this knowledge to producers?

- In 2005 we started creating a web-based climate information system under a project funded by the USDA - Risk Management Agency



First version of AgroClimate (AgClimate) released in January of 2005.

## Examples of questions that AgroClimate.org can help answer.

1. Effects of the El Niño Southern Oscillation on rainfall/temperature in your county?
2. Current strawberry disease risk?  
Should I apply fungicide?

**Current Climate Phase: Neutral**  
El Niño watch issued

HOME TOOLS FORECASTS STATE SUMMARIES MANAGEMENT CLIMATE EXTENSION ABOUT

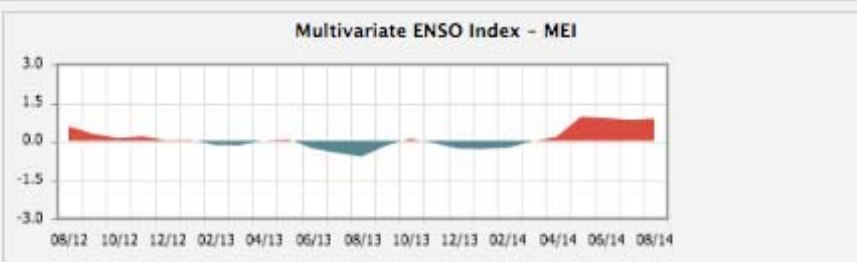
**WaterFootprint Tool**  
Calculate the water footprint – the consumptive water use per unit yield – for a specific season and production system.

Climate Phase Forecast for Nov-Dec-Jan

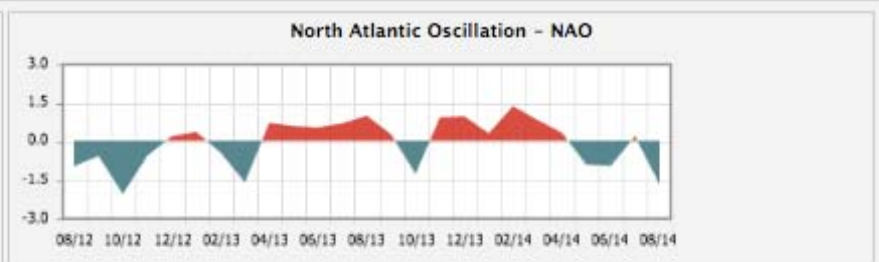
- Neutral (28%)
- El Niño (72%)
- La Niña (0%)

Provided by the International Research Institute for Climate and Society

**AgroClimate Indicators**



The Multivariate ENSO Index (MEI) is used to characterize ENSO phases and strength. High positive (red) values indicate El Niño, while negative (blue) values indicate La Niña phases ([read more](#))



Strong positive (red) phases of the North Atlantic Oscillation (NAO) tend to be associated with above-average temperatures in the eastern United States while strong negative phases tend to be associated with the number of daily cold extremes during the winter ([read more](#))

# AgroClimate Tools

All

Climate

Drought Indices

Crop Yield

Crop Diseases

Degree Days and Chill Hours

Footprint Calculators



## Climate Risk

Air temperature and precipitation climatology and current observations



## Freeze Risk Probabilities

Freeze probabilities based on El Niño Southern Oscillation (ENSO) phases



## Climate Anomaly Maps

This tool provides maps showing monthly temperature and rainfall departures from average (1981-2010 climatology).



## NWS Forecast

Site-specific, detailed 3-day forecast of hourly weather variables



## ARID Monitoring and Forecast

Agricultural Reference Index for Drought



## LGMI Monitoring

Lawn and Garden Moisture Index LGMI



## County Yield Statistics

Crop yield series, trends and residuals at the county level



## Regional Yield Maps

Average yield residuals (%) for El Niño, La Niña, and Neutral years

# AgroClimate tools: Climate risk - Maps



Average    Deviation from Average    Digital Map, Average

Average - Total Rainfall (Inch) - El Niño Years - January

Select region

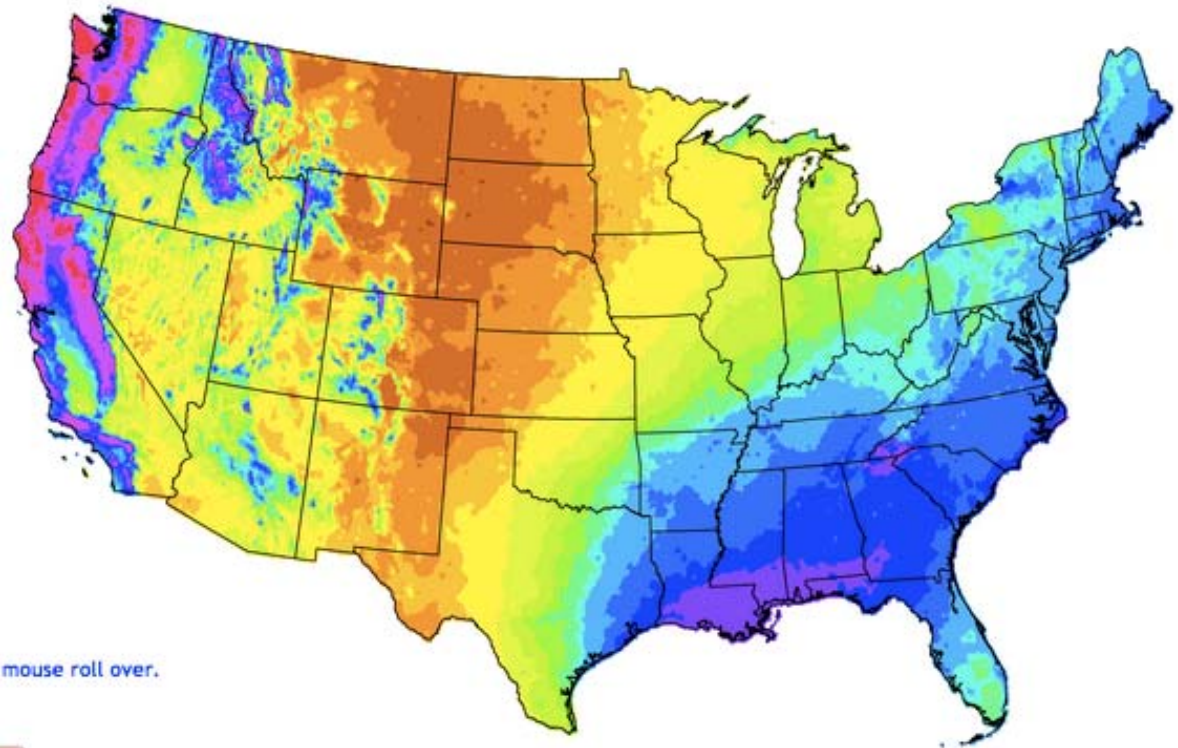
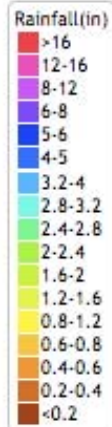
Select rainfall or temperature

Select ENSO phase

- Neutral
- El Niño
- La Niña
- Average for all years
- Compare all ENSO phases

Select month

About



\*Enlarge the map on mouse roll over.

Download map

Data source: [PRISM Climate Group, Oregon State University](#)

# AgroClimate tools: Climate risk - Maps



Average

Deviation from Average

Digital Map, Average

Select region

Select rainfall or temperature

Select ENSO phase

Neutral

El Niño

La Niña

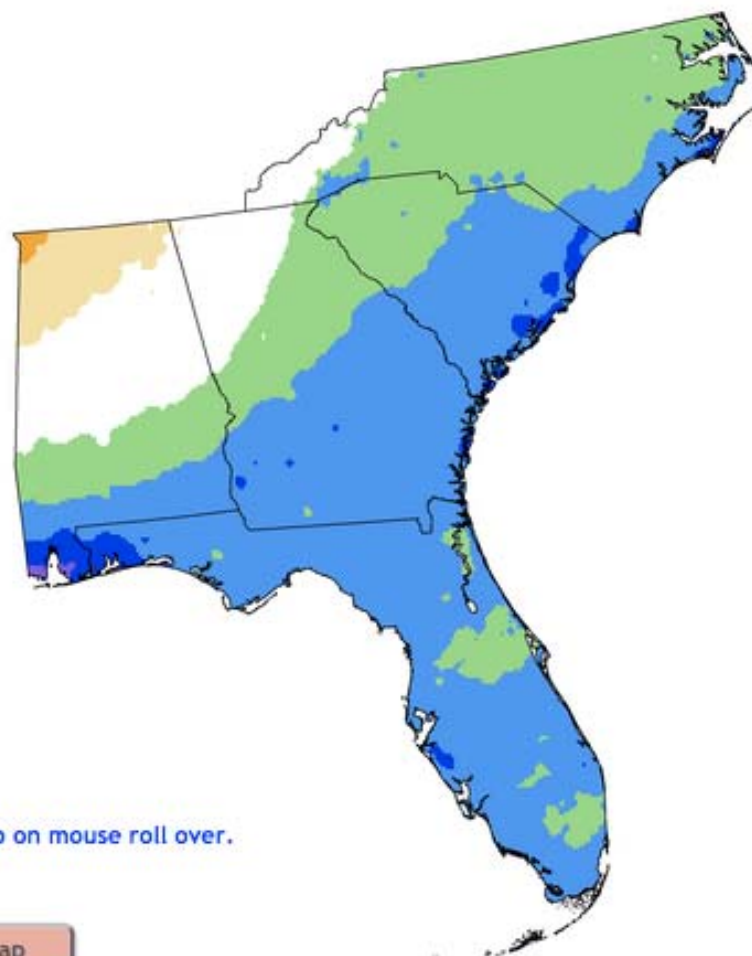
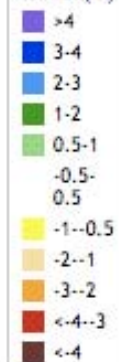
Compare all ENSO phases

Select month

About

Deviation from Average - Total Rainfall (Inch) - El Niño Years - January

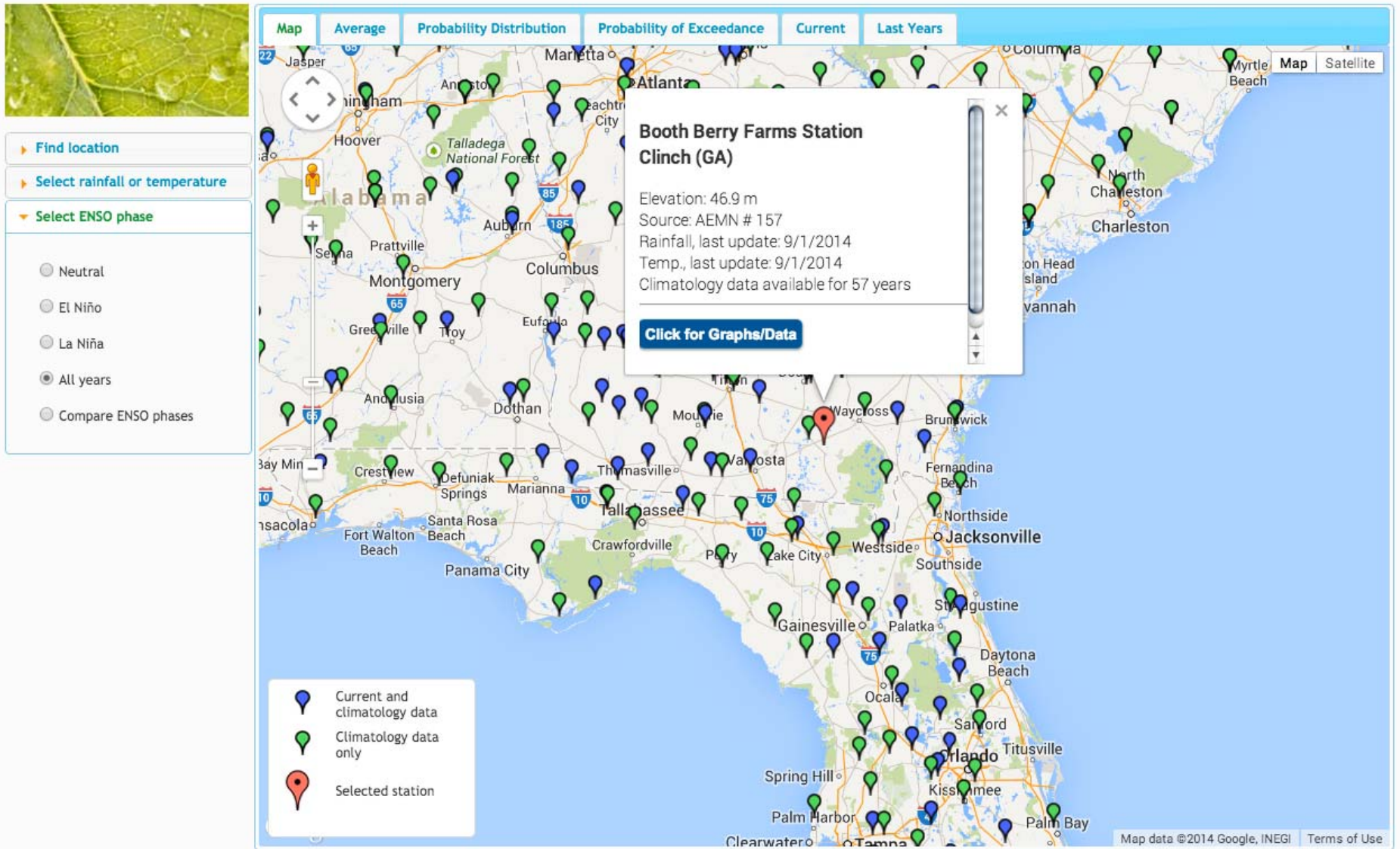
Rainfall(in)



\*Enlarge the map on mouse roll over.

Download map

# AgroClimate tools: Climate Risk - Stations



# AgroClimate tools: Climate Risk – Average rainfall – El Niño years



- ▶ Find location
- ▶ Select rainfall or temperature
- ▼ Select ENSO phase
  - Neutral
  - El Niño
  - La Niña
  - All years
  - Compare ENSO phases

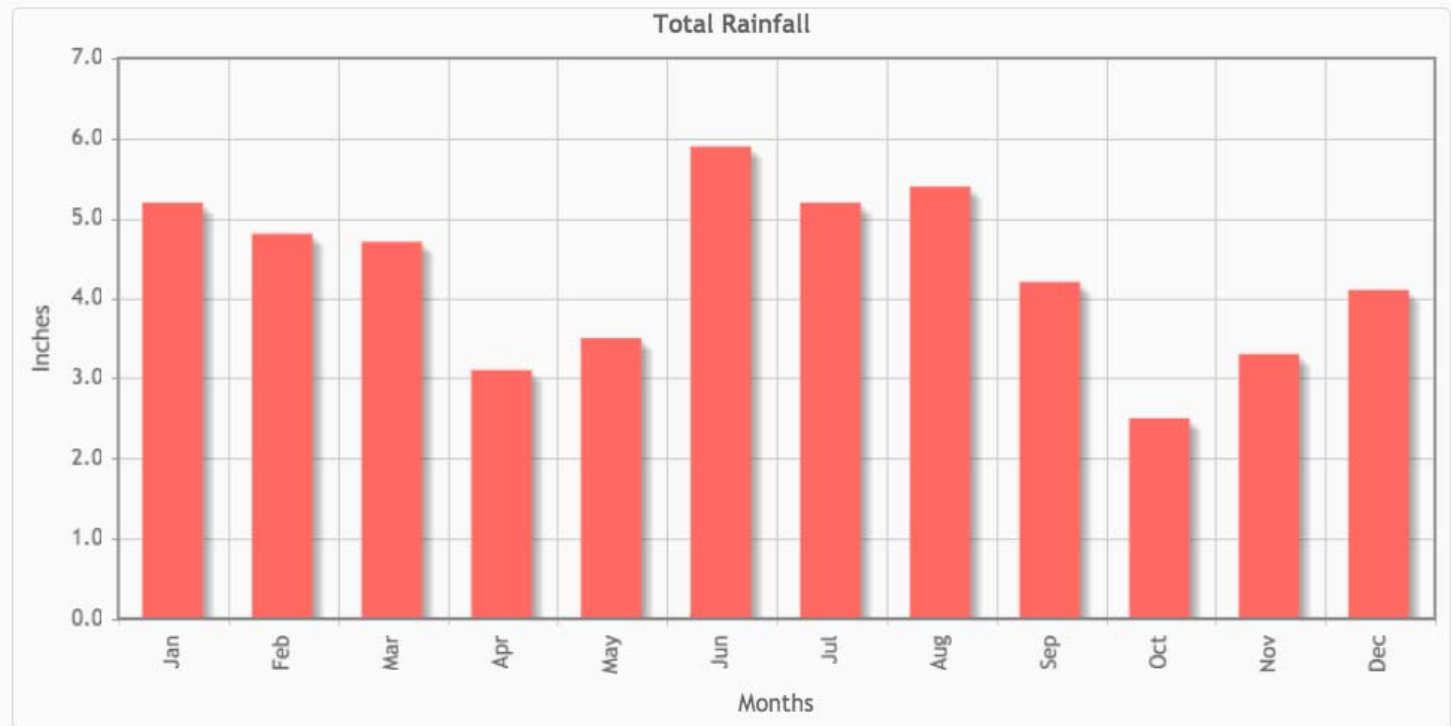
Map Average Probability Distribution Probability of Exceedance Current Last Years

Close

Total Rainfall (Inches) - Clinch County (GA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	5.2	4.8	4.7	3.1	3.5	5.9	5.2	5.4	4.2	2.5	3.3	4.1	51.9
Deviation	0.7	0.7	0.0	-0.3	0.0	0.2	-1.1	-0.7	0.1	-0.2	0.8	0.6	0.8

■ El Niño years



# AgroClimate tools: Climate Risk – Deviation from long-term average – El Niño years



Find location

Select rainfall or temperature

Select ENSO phase

- Neutral
- El Niño
- La Niña
- All years
- Compare ENSO phases

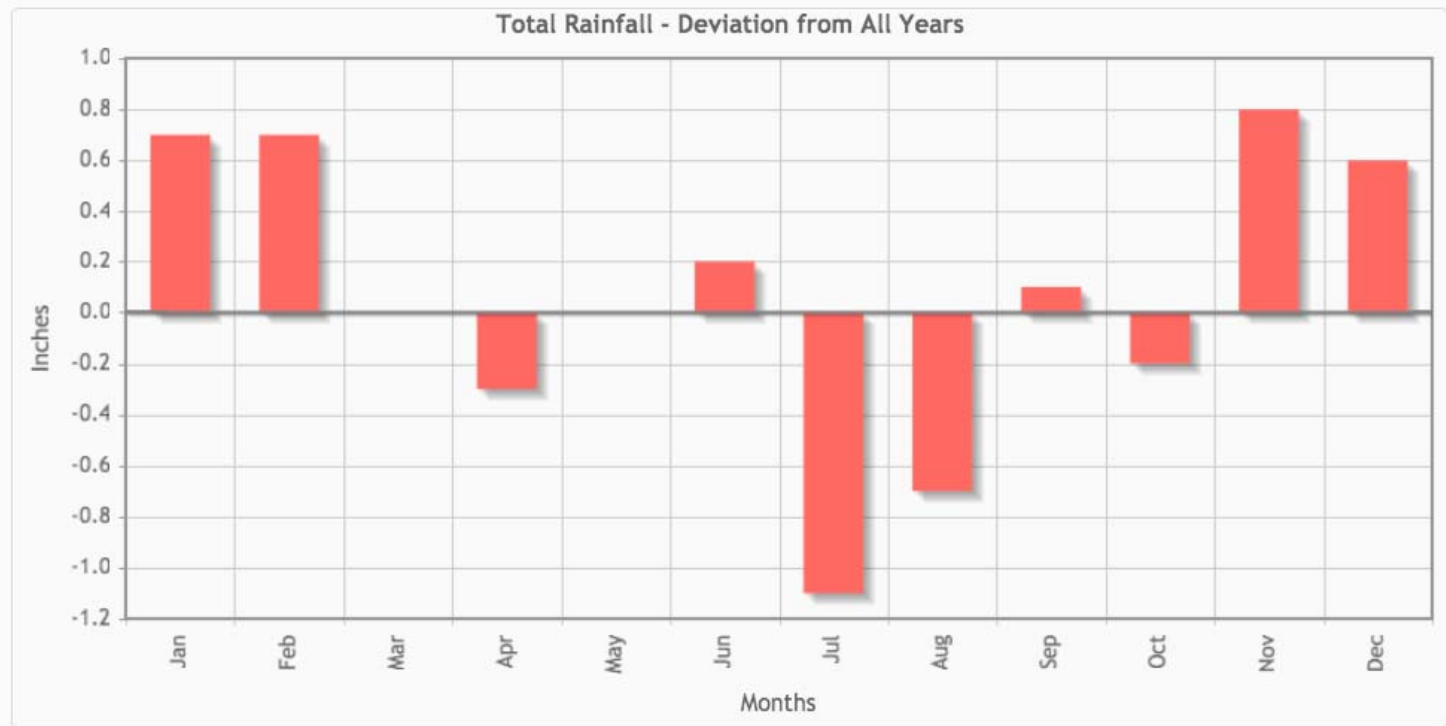
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Deviation	0.7	0.7	0.0	-0.3	0.0	0.2	-1.1	-0.7	0.1	-0.2	0.8	0.6	0.8

El Niño years



# AgroClimate tools: Climate Risk – Probability of exceedance – Rainfall La Niña years



Find location

Select rainfall or temperature

Select ENSO phase

- Neutral
- El Niño
- La Niña
- All years
- Compare ENSO phases

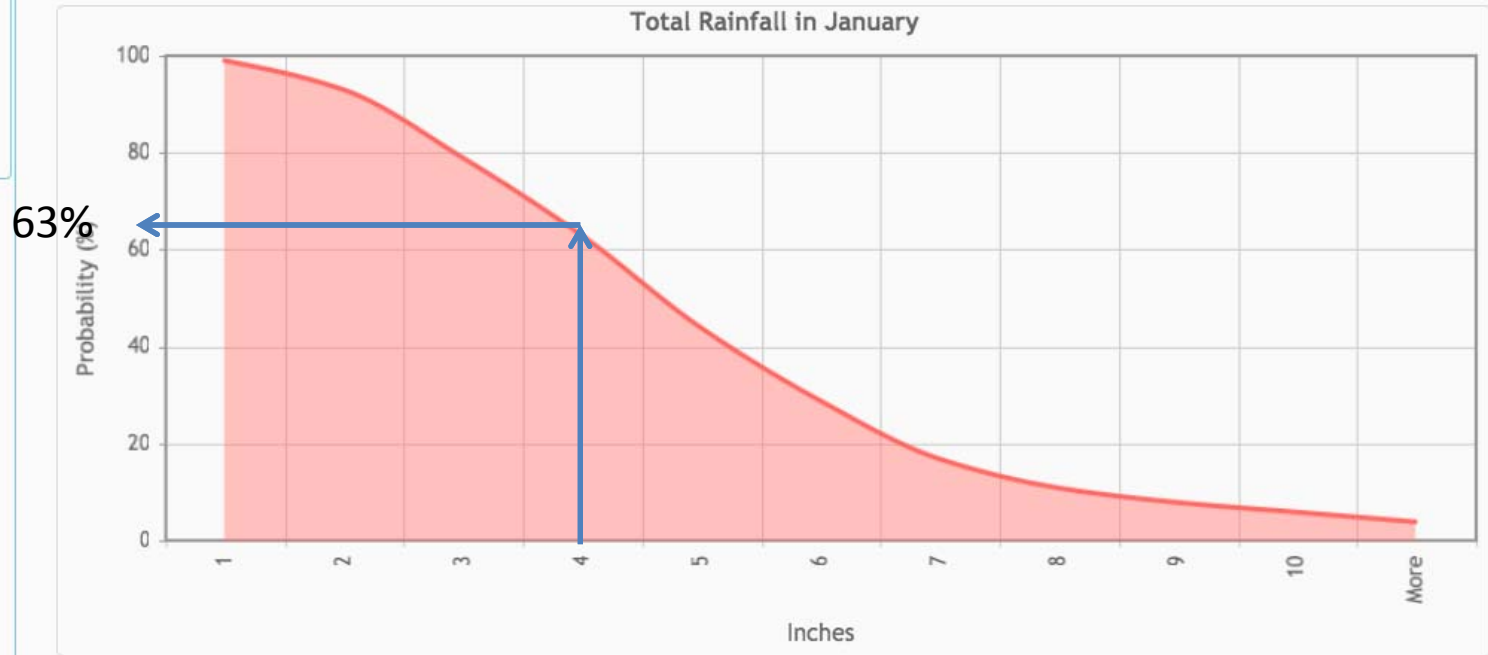
Map Average Probability Distribution Probability of Exceedance Current Last Years

Close

Probability of Exceedance (%) - Total Rainfall - Clinch County (GA)

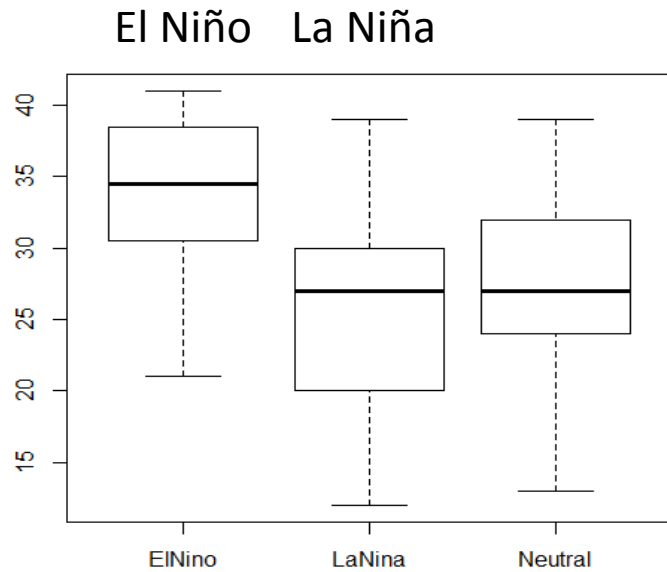
Inches	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	99	99	100	87	97	100	100	99	95	71	95	97
2	93	94	99	67	80	99	94	93	85	35	76	88
3	79	79	91	43	59	92	84	81	63	19	54	68
4	63	65	78	25	33	78	69	66	48	11	35	46
5	44	46	56	12	17	65	49	49	34	10	18	30
6	29	31	35	6	6	47	35	36	22	9	8	18

El Niño years



63%

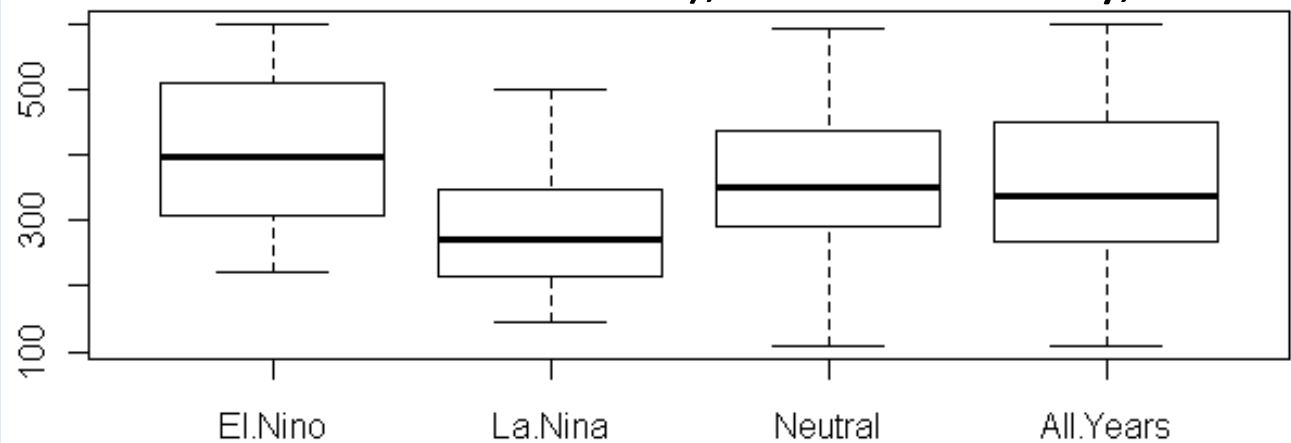
# ENSO Impacts



Number of days with moderate or high Botrytis risk in Plant City, FL



Chill accumulation (hours per season), Marion County, FL.



# Disease Pressure

## Botrytis - Plant City, FL



Pre-harvest



Post-harvest

**Potential adaptation strategies?**

Phase	Low	Avg	High
Neutral	29%	34%	37%
El Niño	8%	23%	69%
La Niña	61%	32%	7%

Number of years with low, average, and high disease pressure (Fraise et al., preliminary results)

# Strawberry Industry

- 15% of the U.S. production but 100% of winter strawberry
- 8,000 acres (3,250 ha)
- \$250 M industry



# iPhone App



- One of our most popular tools is the Strawberry Advisory System (SAS).
- Monitors infection risk for Anthracnose and Botrytis fruit rot
- Users receive notification messages when the model detects a potential infection risk according to observed weather conditions.



# Strawberry Advisory System (SAS)

[« Back to Tools](#)

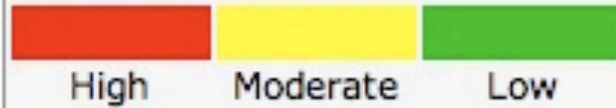


Select station/county:

Balm/Hillsborough

Display County Boundary

Disease Risk Levels:



Fungicide List: [Click here](#)

Publications:

[Fruit Rot of Strawberry](#) - Anthracnose fruit rot, caused by the fungus *Colletotrichum acutatum*...

[Botrytis Fruit Rot or Gray Mold of Strawberry](#) - Botrytis fruit rot, also known as gray mold, is caused by...

[A Web-based Decision Support Tool](#) - Plant disease decision support systems are management tools to help...

Balm Station

Recommendations
Disease Simulation
Weather
Contact
Disclaimer

## Spray Recommendation

» **When was your last fungicide application?**

Last 7 days
  More than 7 days
  None

» **Select product(s) used\*:**

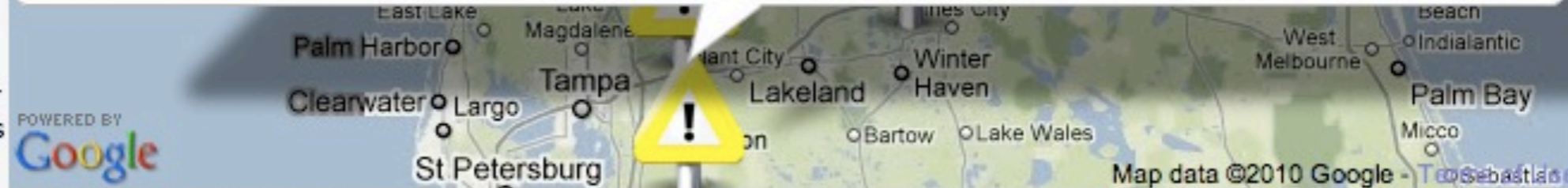
\* Use Ctrl or Shift to select more than one.

Abound (Anthracnose) - Systemic  
 Cabrio (Anthracnose) - Systemic  
 Captan (Anthracnose, Botrytis) - Contact  
 Captevate (Botrytis) - Systemic

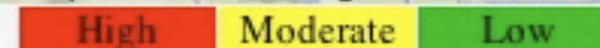
View Recommendation

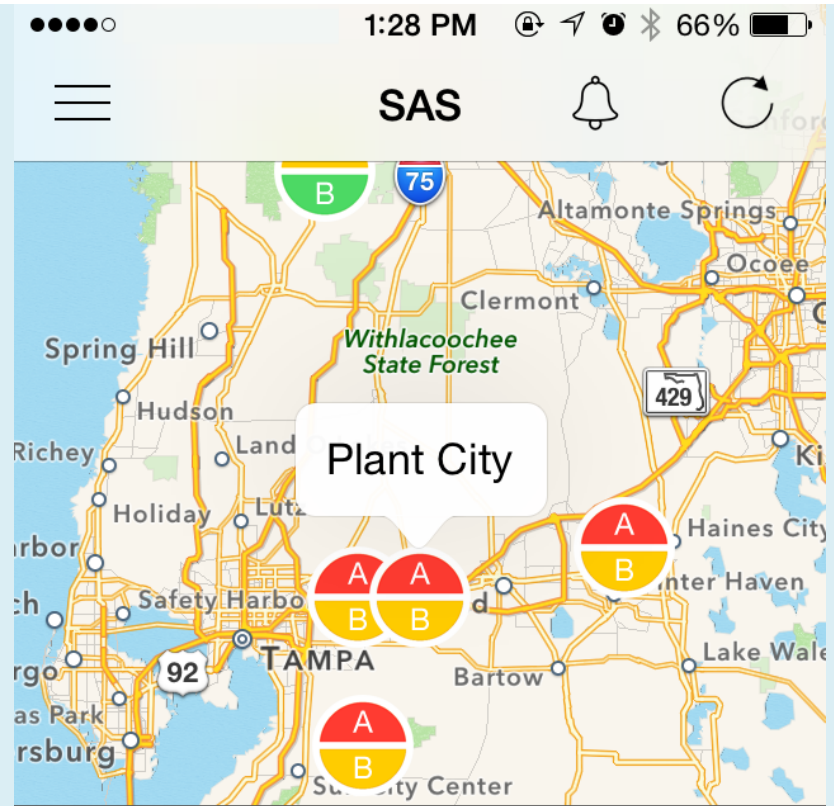
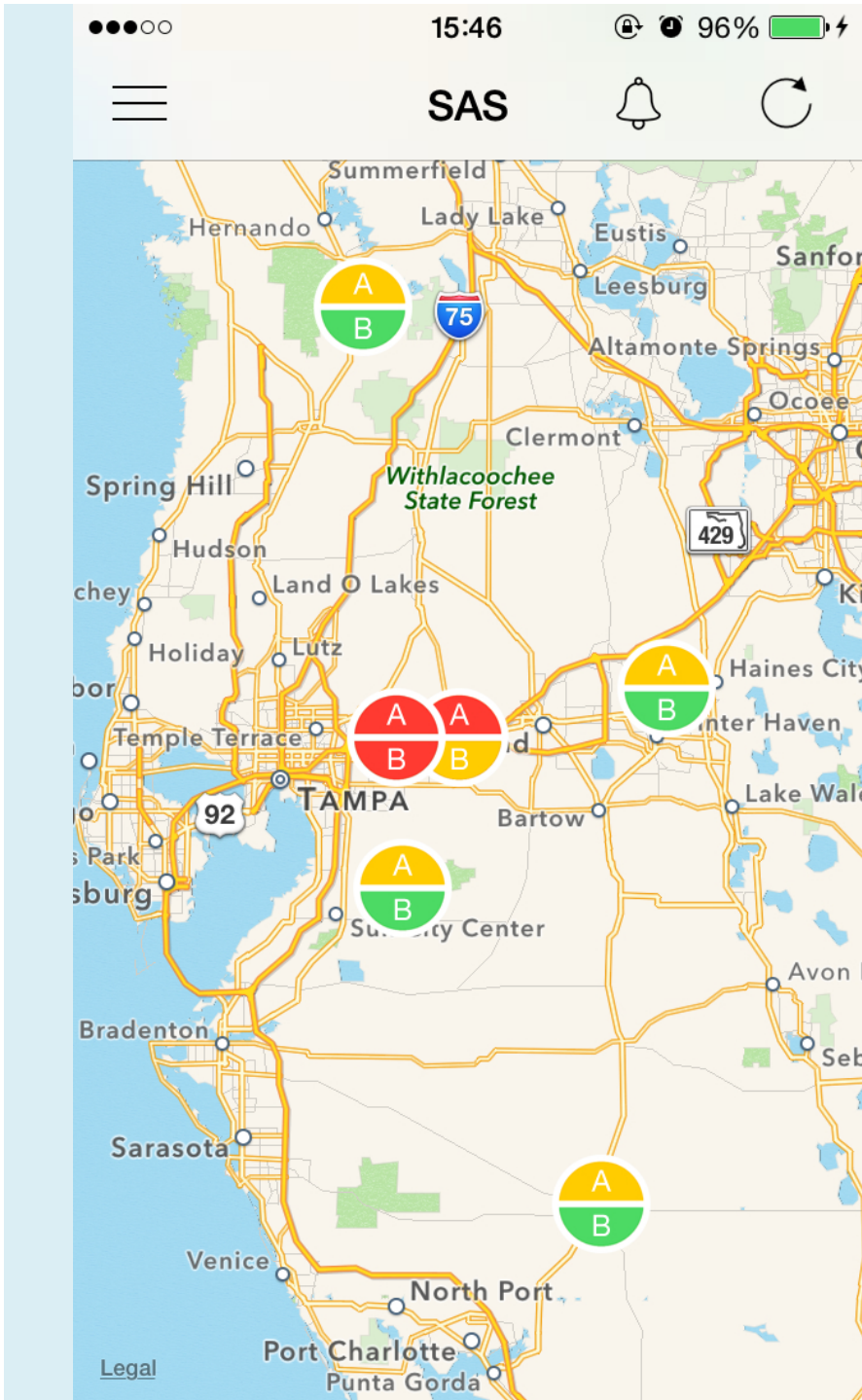
**Botrytis: No Spray!**

**Anthracnose: Spray Contact Fungicide (Products recommended: Captan)**



[Publications](#) | 
 [Contact US](#) | 
 [Fungicide List](#) | 
 [Disclaimer](#)





## Plant City

Last update: 07/11/2014 1:00 PM

**A** Anthracnose  
High risk

**B** Botrytis  
Moderate risk

[Recommendations](#)

Recommendations

WHEN WAS YOUR LAST FUNGICIDE APPLICATION?

Last seven days

More than seven days

None ✓

IS IT CURRENT PEAK OF BLOOM?

Yes

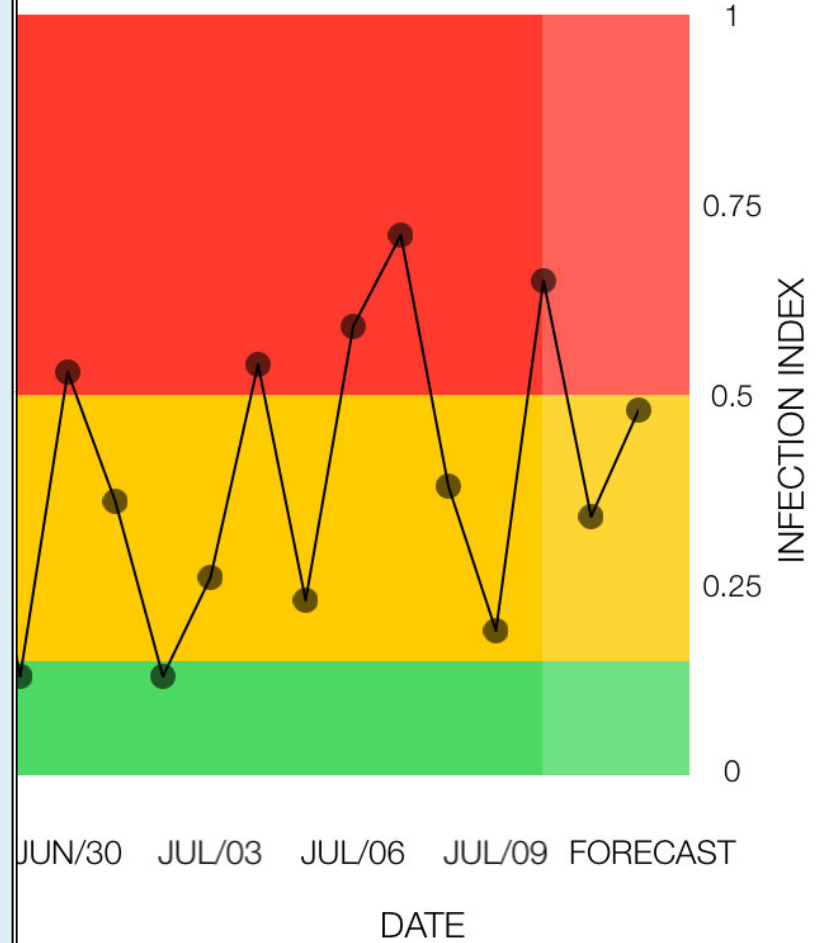
No ✓

ARE ANTRACHNOSE SYMPTOMS PRESENT?

Yes

Anthrachnose disease simulation

JUL/10 Infection index: 0.65



# OK, Looks Great, But What About Data Poor Environments?



- How to apply these tools in a region with **no station-based weather** data or **field trial results** widely available?

# AgroClimate Mozambique (<http://mz.agroclimate.org/>)



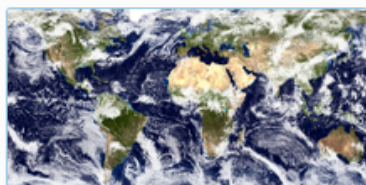
Atual Fase Climática: Neutro

Condições de El Niño são esperadas para a primavera.

Principal	Ferramentas	Clima e El Niño	PSAL	Boletim Agromet	Sobre	Contato
-----------	-------------	-----------------	------	-----------------	-------	---------

Contact: Eduardo Gelcer – [egelcer@ufl.edu](mailto:egelcer@ufl.edu)

## Ferramenta de Monitoramento



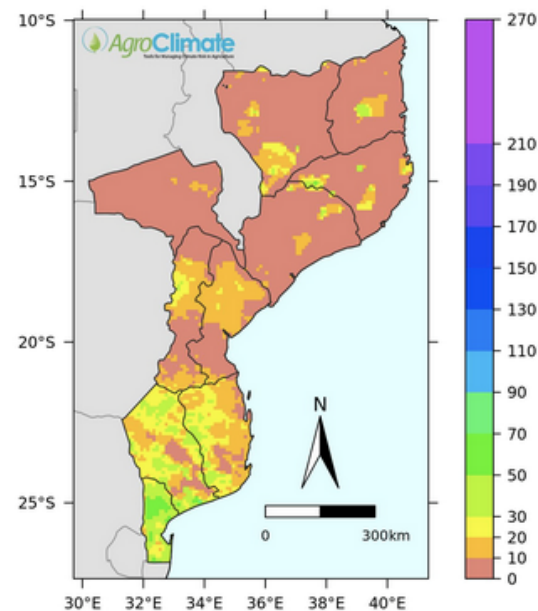
Selecione chuva ou temperatura

Período

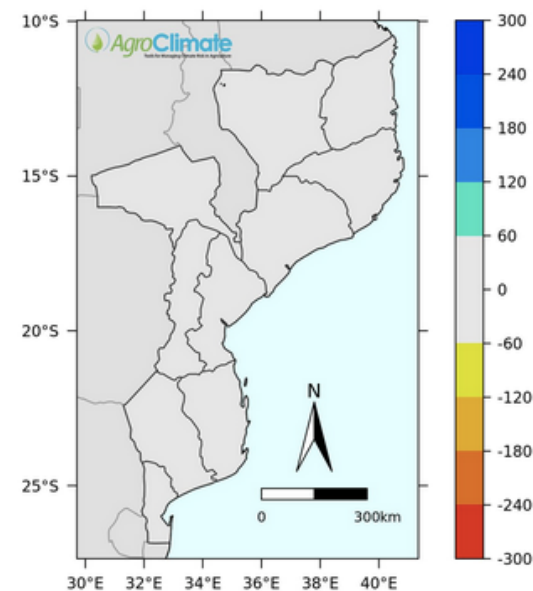
- Ontem
- Últimos 2 dias
- Últimos 3 dias
- Últimos 7 dias
- Últimos 15 dias
- Últimos 30 dias
- Últimos 45 dias
- Últimos 60 dias
- Últimos 90 dias

Clique no mapa para obter zoom

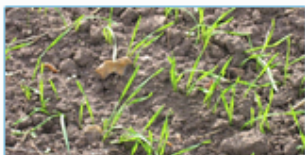
Chuva Acumulada (mm) - 05/10/2014 até 19/10/2014



Chuva Acumulada (mm)  
Desvio de todos os anos - 05/10/2014 até 19/10/2014



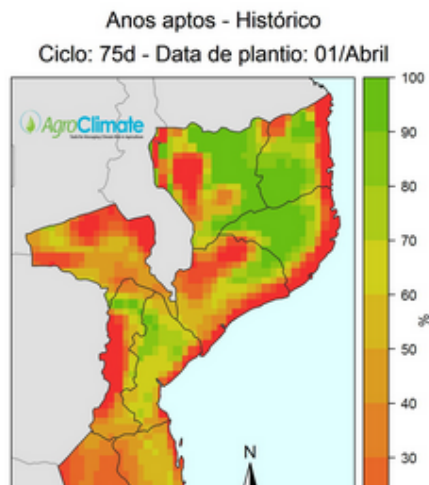
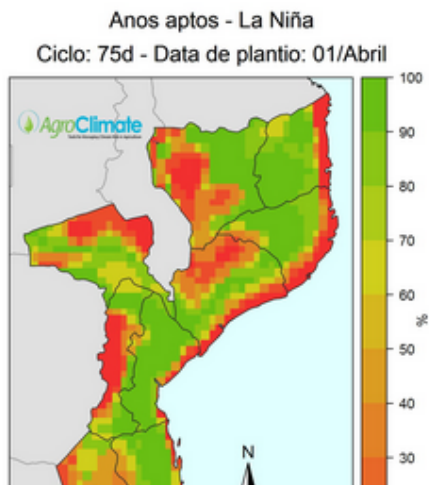
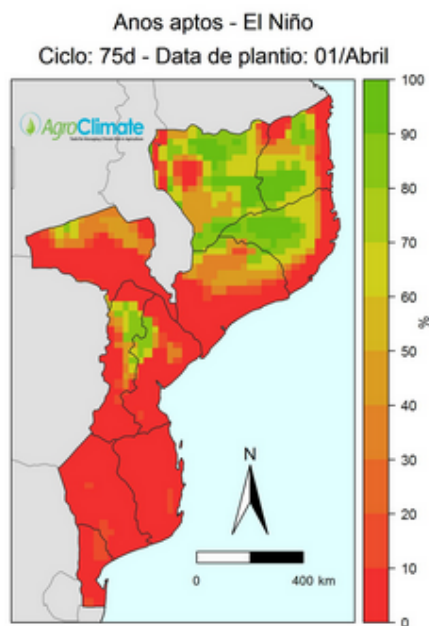
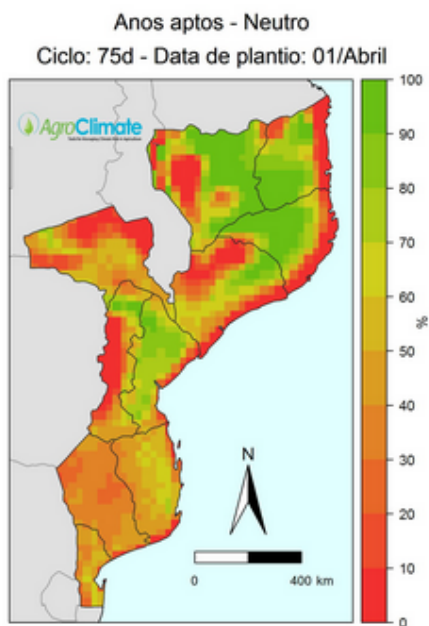
# Datas de Plantio



Mapa Unitário Comparação dos tipos de Mapas: **Comparação das fases do ENOS**

Clique no mapa para obter zoom

- > Tipo de Mapa
- > Data de Plantio
- ▼ Seleccione o ENOS
  - Neutro
  - El Niño
  - La Niña
  - Todos os anos
- > Ciclo da Cultura
- > Cultura
- > Sobre



# AgroClimate.org as an Appropriate Technology for Mozambique

- The whole website was implemented using **WordPress**, an easy content management system.
- Whole website (except the tools) can be managed by a person with no computer programming knowledge.
- Whole website structure is in **Portuguese**.
- Works well in locations with **limited internet connection**.
- All **images** can be easily **downloaded**.

# Thank you!

David Letson

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<http://agroclimate.org/>

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352-392-1864 ext. 271

UNIVERSITY  
OF MIAMI  
ROSENSTIEL  
SCHOOL of MARINE &  
ATMOSPHERIC SCIENCE



Video: <https://www.youtube.com/watch?v=r50mZZ9hcy8>