

# **Weather and Climate in Florida**

## **Report of Accomplishment**

Authors: John Jackson, Clyde Fraisse

Contributors: James W. Jones, Carlos Balerdi, Richard Beeson,  
Anthony Drew, Joy Jordan, Norm Leppla, Ben Mather,  
Andy Rose, Mike Spranger, Larry Treadaway, Pete Vergot,  
Fedro Zazueta, David Zierden

Publication of the Southeast Climate Consortium Technical Report Series:  
SECC-04-002, Gainesville, FL

March 2004

## **Weather and Climate in Florida**

### **Extension State Major Program FL 133**

#### **REPORT OF ACCOMPLISHMENT**

##### **Situation/Program Rationale**

This State major program (SMP) is designed for all users of weather and climate information and supports a number of extension and research projects. It is tied closely to two existing efforts within the University of Florida Institute of Food and Agricultural sciences (IFAS). The first is the Florida Automated Weather Network (FAWN), which has been in operation since 1998. FAWN has provided a vehicle to collect and disseminate real time weather data to a wide variety of users. Currently this information allows growers to better manage their cold protection and irrigation systems with annual estimated savings in excess of \$10 million (more details below). Future plans call for numerous agricultural management tools, which will provide assistance with decisions in many areas of production, harvesting and marketing. In addition the data generated has been used by the Department of Emergency Management to produce weather advisories to replace agricultural forecasts, which were discontinued April 1, 1996 when the National Weather Service stopped providing agricultural products. There have been many other reported uses of the data including construction (drywall company looking at temperature, humidity, and rainfall to estimate drying time), power company (degree days to manage generation demand), and the Mediterranean Fruit Fly eradication program (use data from a site within the treatment area), and many more.

The second project is the Southeast Climate Consortium (former Florida Consortium), which is a cooperative effort involving UF/IFAS, FSU/State Climatology Office, University of Miami marine sciences program and recently added University of Georgia, Auburn University, and the University of Alabama at Huntsville. The Consortium is involved with climate predictions and the impact of climate on agriculture and water resources management. Its initial focus was on Florida, but now extends into Georgia and Alabama. Ultimately it will include other states in the SE USA. SECC is designing and implementing several web-based decision aid tools to help growers mitigate production risks associated with climate variability.

##### **Major Program Objectives**

1. To provide accurate and timely weather and climate information to all that need these data;
2. To work with those developing management tools, economic impacts, quality of life issues, etc. that have a weather/climate input. Assist in incorporating weather/climate information into projects, help with the development of final products, and find a method of disseminating the products.;
3. Provide training to those interested in understanding weather and climate, those wishing to incorporate weather and climate information into their programs, those needing assistance collecting weather information, and any other specific needs identified.

### **Summary of Design Team / State Specialist Support for the Program:**

During 2002 and 2003, members of the FL133 design team developed educational materials and programs, provided in-service training to county faculty and state specialists, worked collaboratively with county faculty and partners external to the cooperative extension service to deliver weather and climate information to Florida's citizens and visitors. The web site developed by the design team to provide weather information from a network of automated stations throughout the state [<http://fawn.ifas.ufl.edu/>] has been very successful and generated a great deal of interest and support from the industry. A second web site, currently under implementation [<http://www.agclimate.org>] will provide climate forecasts and decision aid tools to help agriculture and natural resources managers to mitigate climate variability associated risks in the states of Alabama, Florida, and Georgia.

### **Multi-state activities**

The addition of Georgia and Alabama to the Southeast Climate Consortium (SECC) significantly increased multi-state activities:

- Meeting with extension and research faculty in southwest Georgia and the Irrigation Park, Camilla, GA, October 2003. Discussion about climate forecast applications to peanut and cotton growers in Georgia, potential decision aid tools of interest, general framework for collaboration with SECC;
- Meeting with Georgia state and county extension faculty in Tifton and Camilla, November 2003, to demonstrate initial version of yield risk tool being developed at UF (see Appendix A);
- Meeting with Alabama state and county extension and research faculty in Henry County, AL, February 2004, to demonstrate decision aid tools, including yield risk and local climate forecast that are being developed at UF.

### **Extension - Research Integrated**

The activities developed by the design team for the implementation of weather and climate information systems required a significant interaction between research and extension faculties. In fact, FL 133 program has served as a channel to increase the level of communication between research and extension. Research faculty has actively participated in the training sessions organized by extension and received direct feedback on the needs and priorities in terms of information associated with weather and climate. These meetings have helped research to develop new projects and guide research to meet the needs expressed by the clientele.

### **Design Team Meetings (last 6 months)**

SECC meeting: September 15, 2003 – 6 persons (Tallahassee);

SECC/FAWN meeting: November 21, 2003 – 5 persons (Gainesville);

SECC meeting: February 5, 2004 – 12 persons (teleconference, Gainesville, Tallahassee, Miami, Griffin, Auburn and Huntsville)

SECC/FAWN meeting: February 27, 2004 – 3 persons (Gainesville).

### **In-service Training for County Faculty:**

Agricultural weather schools and in-service training for extension agents were utilized to increase understanding of the role of ENSO in shaping Florida's climate as well as eliciting feedback about the usefulness of climate forecasts in a range of existing and potential situations. A number of such meetings with approximately 150 participants have been held; two in-service training courses were organized in 2002 at Bell Glade, Everglades and Quincy whereas four workshops were held in Alachua, Milton and Tavares in 2001. In 2001 the Consortium members also presented climate information in weather schools at Palatka, Lake Alfred and Marianna. The presentations made at these meetings provided the following principal types of information:

1. Explanation of El Nino and La Nina phenomena and their relevance and potential use in agriculture.
2. Weather-climate distinction, drawbacks including lack of spatial resolution needed for agricultural decision-making.
3. Various station displays of precipitation and temperature by ENSO phase, historical analysis of locally important crop yields by ENSO phase.
4. Use of climate information in reducing adverse effects and exploiting favorable conditions, simulation results for specific sites and crops, forestry study results.

The participants at these meetings also provided valuable feedback about the potential usefulness of seasonal forecasts in a variety of situations. For example, the possibility of a seasonal freeze forecast was suggested and growers revealed how certain light-sensitive varieties of strawberry could potentially benefit from a forecast of ENSO phase. Another anecdote, which illustrated to the Consortium the potential usefulness of seasonal forecasts relates to the better performance of potato growers who took ameliorative steps (e.g., digging drainage ditches) in light of the El Nino forecast for 1982-83.

Several FAWN training sessions were organized and given to groups across the state. Presentations were made to the Polk County Citrus Roundtable, Southwest Florida Water Management staff, Fern Growers, Volusia County Citrus Advisory Committee, Lake/Orange OJ meeting, Central Florida Citrus Production Managers Association, Farm Bureau Citrus Committee, Mid Florida Citrus Foundation and FNGA Action Chapter. The following Trade show and workshops were attended: Citrus Expo, Florida Agricultural Conference and Trade Show, Southwest Florida Water Management District Expo, Open House and Dedication of the research center at Baum, and Farm Bureau Legislative Day.

Other FAWN educational efforts involved providing information to trade associations, individual growers, and governmental agencies that use the FAWN data.

## **Publications and Creative Works**

Several publications and creative works developed by the design team members have been published or are in press including refereed journal articles, program reports, news articles, reviewed extension papers, and websites.

## **Presentations and Sondeos**

A *Sondeo* refers to open-ended, interactive questioning involving specialists from various disciplines and farmers or another target group. Four sondeos were conducted during 1999-2001 including a total of 41 extension agents and 38 ranchers. The main goals of Sondeos were:

1. To assess the potential usefulness of seasonal climate forecasts from the perspective of ranchers and attitudes;
2. To discern views towards forecasts among the extension agents.

The findings of the Sondeos were that there are decisions involving various aspects of ranching which can potentially benefit from use of climate forecasts-- “when and if to plant cool season grasses, and rate of seeding; rate and timing of fertilizer application; quantity of hay needed for winter; need to purchase bulk feeds and nutritional supplements; when or if to ship cattle to another region; adjusting stocking levels during the winter and spring months, and anticipating market conditions”(Breur et al. 2003 Submitted). The extension agents interviewed in this study indicated that seasonal forecasts could be potentially useful for a number of agricultural decisions like planting dates, fertilization, purchasing irrigation, etc if the information could be placed within a risk-reduction framework. The importance of understanding farmer decision-making within the context of farm management was also underscored.

## **News Articles**

Several news articles have reported FAWN activities and climate forecasts provided by SECC. An example is the article on the impacts of El Niño in Florida by Zierden, D., published by the Orlando Sentinel on December 11, 2003.

## **Refereed Journal**

Jagtap, S. S., J. W. Jones, P. Hildebrand, D. Letson, J. J. O’Brien, G. Podesta, D. Zierden, and F. Zazueta. 2002. Responding to stakeholder’s demands for climate information: from research to applications in Florida. *Agricultural Systems* 74(2002): 415-430.

Jagtap, S. S., and J. W. Jones. 2002. Adaptation and devaluation of the CROPGRO-soybean model to predict regional yield and prediction. *Agriculture Ecosystems and the Environment* 93(2002): 73-85.

Letson, D., J.W. Hansen, P. E. Hildebrand, J. W. Jones, J. J. O’Brien, G. P. Podesta, F. S. Royce, and D. Zierden. 2001. Florida’s Agriculture and Climatic Variability: Reducing Vulnerability. *The Florida Geographer* 32(2001):38-57.

Letson, D., G. P. Podesta, C. D. Messina, and R. Andres Ferreyra. 2003. The range and likelihood of ENSO forecast value for agriculture: stochastic prices and intra-phase climatic variations. *Climatic Change* 00:00-00. (submitted).

Mavromatis, T., S. S. Jagtap, and J. W. Jones. 2002. El Niño-Southern Oscillation effects on peanut yield and nitrogen leaching. *Climate Research* 22 (2002):129-140.

### **Program Reports**

Breuer, N., V. Cabrera, P. E. Hildebrand, and J. W. Jones. 2003. Potential response of north central Florida livestock producers to long-term climate forecasting. University of Florida Southeast Climate Consortium Staff Paper 01-03.

Hildebrand, P. E., A. Caudle, V. Cabrera, M. Downs, M. Langholtz, A. Mugisha, R. Sandals, A. Shriar, and D. Veach. 1999. Potential use of long range climate forecasts by agricultural extension agents in Florida. University of Florida Technical Report FC-UF-2000-01.

Jagtap, S. S., J. W. Jones, F. Zazueta, J. Jackson, H. Beck, P. Hildebrand. 2001. Bridging the gap between climate prediction and its application in Florida agriculture. University of Florida Technical Report FC-UF-2001-01.

Mavromatis, T., and J. W. Hansen. 2000. Interannual variability characteristics and simulated crop response of four stochastic weather generators. University of Florida Technical Report FC-UF-2000-07.

Messina C. D. 2000. Simulation of on-farm research and use of climate forecasts in agriculture. University of Florida Technical Report FC-UF-2000-05.

Zazueta, F., S. S. Jagtap, and J. W. Jones. 2000. The Florida automated weather network: a new vision and plans for incorporating climate information. University of Florida Technical Report FC-UF-2000-08.

### **Websites**

1. Florida Automated Weather Network (FAWN) at [<http://fawn.ifas.ufl.edu/>]. FAWN provides up-to-date weather information through a system of automated weather stations distributed throughout the State of Florida. Research scientists at the University of Florida work closely with extension agents to monitor the FAWN system and make sure it provides fast, reliable, and convenient access. Overall, there are four parts to the FAWN system: collecting data, transmitting it to the collection site, processing the data, and redistributing it to the end user.

FAWN database servers maintained by IFAS Information Technologies receive weather data from remote stations every 15 minutes. The information is processed and made available almost instantaneously through several different search methods accessible through FAWN web server, as well as an interactive voice-response system.

2. The AgClimate Website [<http://www.agcliamte.org/>] is currently under the final stage of development and will be launched in April 2004. AgClimate will provide a series of decision aid tools including county level climate forecast, historical weather and yield for major commodities, and potential yield impacts caused by the forecasted climate. It will also include management options to help managers mitigate climate associated risks in agriculture and natural resources.

### Reviewed Extension Publications

Miller, G. L., S. Park-Brown, C. Stiles, M. Dukes, F. Royce, J. W. Jones, F. S. Zazueta, and D. Zierden. 2001. Climate-based management of lawns. University of Florida, IFAS Cooperative Extension AE-319. 6 pp.

### Grants and Contracts

Faculty Name	Title	Total	Current Year Funding
Jones, W. J., W. D. Graham, and C. J. Lehtola.	Risk Reduction for Specialty Crops in the Southeastern U.S.	\$499,969	\$229,969
Jackson, J.	Agricultural Irrigation Efficiency and Cold Protection	\$220,000	\$75,000
Jackson, J.	FAWM maintenance grant	\$45,000	\$15,000

### Success Stories

Budget cuts to the UF- Institute of Food and Agricultural Sciences (IFAS) budget have resulted in a 10% reduction in the FAWN operation and maintenance budget. To compound the problems, FAWN added 12 sites with FEMA funds, thus increasing the maintenance requirement. Bottom line, FAWN needed to secure at least \$50,000 from outside sources in order to keep the high quality data available every 15 minutes.

A sponsor program was initiated to encourage contributions to FAWN. A rotating icon on the web page thanks the sponsors. The sponsor program has generated \$13,000 in gifts. Southwest Water Management District and the Florida Department of Agriculture and Consume Services has funded a 3 year Agricultural Irrigation Efficiency and Cold Protection Project for \$220,000. In addition Southwest Florida, South Florida and St. Johns River water management districts have funded 3-year projects at \$15,000 per year to support on going activities. This \$45,000 a year will allow FAWN to maintain the entire network, from towers to web site. The grant will allow additional personnel and development of management tools. It appears FAWN now has the outside dollars to allow for proper maintenance of the system and development of management tools.

## Impacts

According to the members of the Ag Weather Task Force, FAWN has had a multi million dollar impact on agriculture through more informed production, harvesting and marketing decisions. There has been no major attempt to document the overall impact, but feedback from non-agricultural users indicates substantial use and value. NWS has used the data when evaluating fire risks, developing meso-scale surface maps; emergency management has used the data when making decisions regarding potential risks from weather events; Division of Forestry relies on the information to deal with fires; the UF/IFAS DISC project uses the weather data for input for their models; media has incorporated the data in numerous articles and presentations (NBC station in Orlando is a frequent user for early morning reports). No doubt that there are many more that we are not aware of and have no way of determining the impact.

Based on information from the Florida Agricultural Statistics Service, Florida Citrus Mutual, Florida Strawberry Association, Fern Growers, Florida Nurserymen and Growers Association and the Florida Fruit and Vegetable Association the following figures are available for the use of water for cold protection:

Average amount of water applied per acre per hour, acres protected and gallons of water used per hour:

Industry	Average Water Applied per acre (gph/acre)	Area Protected (acres)	Total Water Use (gph)
Citrus	2,100	500,000	1,050,000,000
Strawberry	16,200	6,200	100,440,000
Fern	13,500	7,400	99,900,000
Vegetables	10,800	40,000	432,000,000
Ornamentals	8,100	15,000	121,500,000
<b>Total</b>			<b>1,803,840,000</b>

At a pumping cost of \$14.17 per acre-inch (Economic Information Report 98-3) and at the irrigation rates provided the total cost per hour are:

Industry	Cost per hour per acre (\$)	Total Cost per hour (\$)
Citrus	1.10	550,000
Strawberry	8.48	52,576
Fern	7.09	52,466
Vegetables	5.66	226,400
Ornamentals	4.24	63,600
<b>Total</b>		<b>945,042</b>

Therefore the total impact from one hour of irrigation for cold protection for the horticultural crops above is: 1,803,840,000 gallons of water \$945,042

Cold Protection Tools on FAWN provide growers with a guide for when to start irrigation and an excellent method to tell when to shut down the system. Clearly the savings are tremendous every winter, a relatively warm winter will have 3 to 5 nights that require cold protection and FAWN can average 2 hours less operation per event for a total of 6 to 10 hours. A cold winter could have 15 to 20 nights requiring cold protection with the same 2 hours per event for a savings of 30 to 40 hours. Bottom line FAWN can save:

Hours Saved	Winter Type	Avg. Nights Protection	Total Volume Saved (gal)	Total Cost Saved (\$)
2	Warm	3	10,823,040,000	5,670,252
2	Cold	20	72,153,600,000	37,801,680

According to a source at the South Florida Water Management District, if the cost of water was based on the \$5000 per acre-foot and the district buys land for water storage the financial impact would be \$15 million per hour, which is the cost to store 1 billion gallons of water. Therefore if only 20% of the 40 hours was from South Florida, savings would be \$120 million.

FAWN Web Impact: The following table shows the number of visitors, how many pages they viewed and how long they were on line to the FAWN web site in 2003:

Month	Visitors	Total Hits	Ave. Time on Line (min:sec)
Jan	25,509	1,659,295	13:36
Feb	16,893	7,832,939	10:43
Mar	16,675	6,337,458	12:31
Apr	14,780	6,208,932	12:49
May	12,444	1,807,747	16:14
Jun	11,967	425,765	11:55
Jul	10,803	4,185,590	11:38
Aug	10,509	1,689,912	10:30
Sep	11,814	278,279	3:50
Oct	11,078	478,320	6:34
Nov	13,967	341,727	7:30
Total, 11 months	156,439	31,245,964	

**Climate Variability & Agriculture**  
**Southeast Climate Consortium**  
North Florida & South Georgia Trip Report  
November 12-13, 2003

**Objectives:** To update extension and research personnel with the University of Florida and the University of Georgia on project progress, request for feedback on tools and website under development, and gather information for supporting the establishment of project priorities.

**Project Members participating in the trip:**

- Clyde Fraise, University of Florida
- Gerrit Hoogenboom, University of Georgia
- Norman Breuer, University of Miami

**Locations and Faculty Visited:**

- University of Florida, North Florida Research and Education Center (Quincy, FL)
  - David Wright (Professor, Cropping Systems and Conservation Tillage)
  - Jim Marois (Professor, Plant Pathology)
- University of Florida, Jackson County Extension (Marianna, FL)
  - Clyde Smith (Extension Agent, Cotton, Forestry, Pest Management)
  - Doug Mayo (Extension Agent, Livestock, Forages)
  - Ed Jowers (Extension Director, Peanut and Field Crops)
- University of Georgia, College of Agricultural and Environmental Sciences-Tifton Campus (Coastal Plain Experiment Station; Rural Development Center) (Tifton, GA)
  - Albert K. Culbreath (Professor, Plant Pathology)
  - David Riley (Associate Professor, Entomology)
  - Robert Kemerait (Assistant Professor, Plant Pathology)
  - John Beasley (Professor, Crop and Soil Sciences, Peanut Extension Agronomist)
  - Lennie Wells (Extension Agent)
- University of Georgia, C.M. Stripling Irrigation Research Park (Camilla, GA)
  - Rad Yager (Superintendent)

**General Comments about the trip:**

The outcome of this trip was very positive. The project is generating a great deal of interest and we heard in every meeting that it will be useful to growers. The application developed in Visual Basic to analyze yield risk based on crop model results for different climate forecasts was an important tool to demonstrate potential project benefits and to generate new ideas on how climate forecasts can be useful to growers. The mockup version of the web site under development was also extremely useful to demonstrate what will be available in terms of information and how it will be organized. Figure 1 shows a screen capture of the VB tool to analyze yield risk. It was included in this report to facilitate the understanding of some of the comments made by the visited faculty.

## APENDIX A

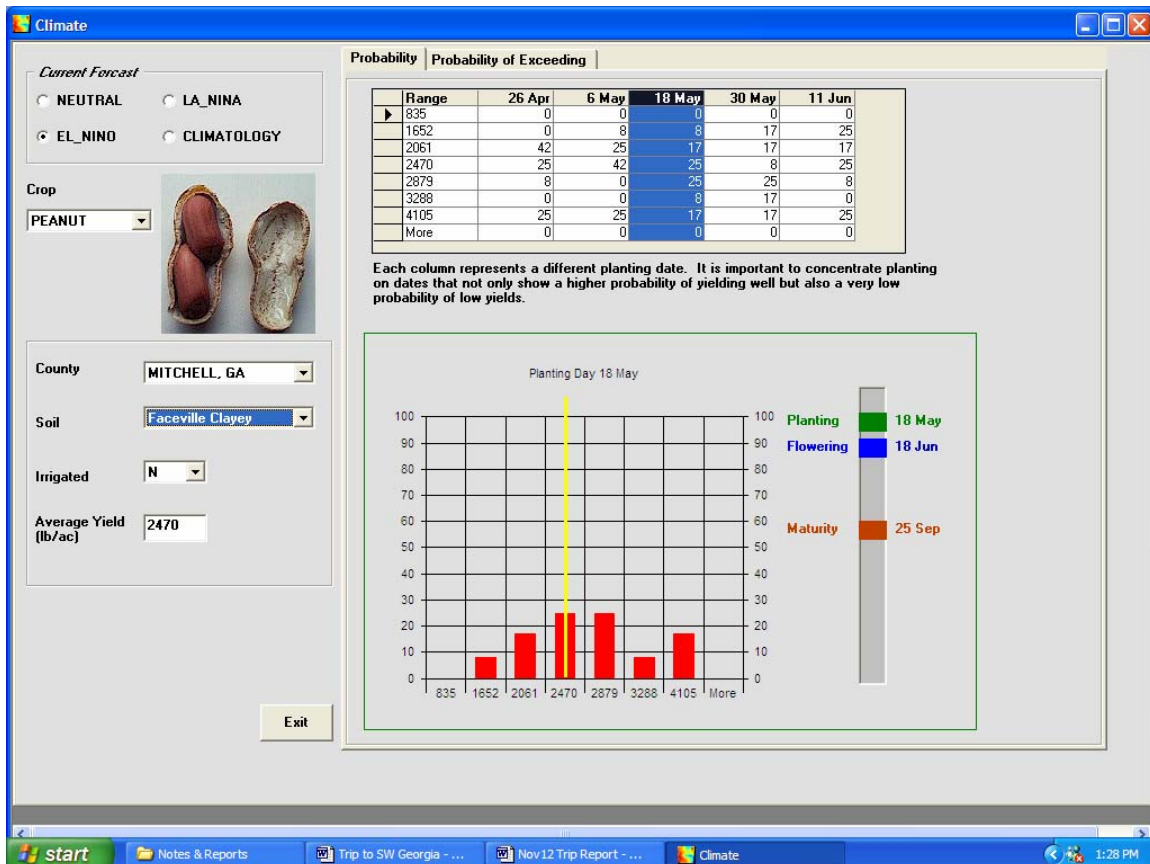


Figure 1. VB application screen. Probabilities of obtaining various yield ranges are displayed in table and graph formats after user selects ENSO phase, crop, county, soil type, and irrigation option.

Below is a selection of comments heard during the discussions. Many are directly related to peanuts since peanut is of major interest in the counties visited.

- Need to clarify what is El Nino, La Nina, pay attention to the language used. For a grower, El Nino may not mean anything (this comment was heard in one location, for the others, it was not considered an issue);
- All agreed that the best way to help a grower to identify with climate language would be to link a particularly bad or good year with an ENSO phase;
- A potential concern is that ENSO phases strongly affect the winter climate but not as much during spring and summer, when it's most important to row crops;
- Would be useful to include (in the case of peanuts) the ability to analyze yield impact on shorter varieties (results included so far are for Georgia Green);
- It is an excellent idea to have all together in one site (historical weather and yield, climate and yield forecast)
- In the case of winter pasture, Doug Mayo has been using climate forecast to help growers. He expressed a great interest but warned about potential problems. Last year he suggested planting of winter rye due to increased probability of a wet

## APENDIX A

- winter (El Nino) but results were mixed since precipitation was above average, as expected, but temperature was below average, restricting growth;
- Tomato Spotted Wilt Virus (TSWV) has become a major problem for peanut growers in the southeast. Management options to help reduce TSWV include planting resistant varieties and shifting planting dates. Yield risk assessment based on climate forecasts and crop model results could aid in analyzing potential yield impacts of recommended planting dates. In addition, there seems to be a climate effect on TSWV intensity and timing. Warmer springs could induce an early start of weeds and volunteer peanuts causing an early rush of thrips and consequently TSWV. Conversely, wet and cool springs could have the opposite effect resulting in different population dynamics.
  - Shifting peanut planting dates is causing harvesting conflicts with cotton for growers. Growers need a tool to help predict maturity dates (this would be more related to an in-season tool, an interesting idea to pursue in a second phase of the project);
  - Rad Yager suggested the inclusion of sweet corn in the system;
  - Clyde Smith suggested soybeans, farmers are considering planting soybeans due to price increases this year;
  - There is some interest in tomato yield risk in north Florida and south Georgia;
  - Yield risk tool can help farmers (and insurance companies) in their decision making process;
  - Climate statistics and forecasted probabilities should be presented in the same format used in the VB application for yield risk.

### **Conclusions and Recommendations**

The project is generating interest and a great deal of support. The consortium should increase interaction with the groups visited and keep them involved in the process of developing a climate DSS. It should also prioritize the development of databases and tools for 3 or 4 counties that are served by the groups visited before expanding to all counties. This would increase the interest in the project and the likelihood of a successful outcome. Perhaps the organization of a meeting involving 2 or 3 counties from each state (Jackson, FL, Mitchell, GA and Henry, AL would certainly be involved) during the spring of 2004 would be more appropriate than a tri-state meeting involving several counties. A larger meeting could be planned for 2005 when a full-blown web site and set of tools will be launched for all three states participating in the consortium.