V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

climate Change--research

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
132	Weather and Climate	0%	0%	100%	
	Total	0%	0%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	20.0	0.0
Actual Paid Professional	0.0	0.0	31.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	1106906	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1106906	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Florida has many projects planned in the area of climate change. Some projects will relate to the development of climate information and decision support systems for the Southeastern USA. Other projects will look at the development of cultivars that do well in changing climate conditions.

2. Brief description of the target audience

Agricultural Producers/growers
Florida residents/ Stakholders

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013
Actual: 6

Patents listed
1.Biorational Design of Improved Fungal Biopesticides
2.Viral-based Transient-Expression Vector System For Trees That Allows Multiple Applications China
3.Viral-based Transient-Expression Vector System For Trees That Allows Multiple Applications Mexico
4.Viral-based Transient-Expression Vector System For Trees That Allows Multiple Applications South Africa
5.Viral-based Transient-Expression Vector System For Trees That Allows Multiple Applications Spain
6.Viral-based Transient-Expression Vector System For Trees That Allows Multiple Applications (CON)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	14	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Develop new climate information that will contribute to an improved agricultural ecosystem in the SE USA.
2	Develop Climate decision support systems that improve quality of life, increase profitability and decrease economic risk.
3	Develop genetic characteristics of adaptiation traits in crops related to climate change
4	Improve water policy and management challenges in the west caused by climate change

Outcome #1

1. Outcome Measures

Develop new climate information that will contribute to an improved agricultural ecosystem in the SE USA.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While many facets of the stress inducible responses of plants are now known, it remains impossible to predict the relative degree of stress tolerance of a plant because of the overall complexity of the processes and the gaps that still remain in our knowledge of the mechanisms and systems that contribute to inducible tolerances. This project will study the role of RNA DEAD-box helicases in temperature stress responses and study the consequences of super-elevated carbon dioxide on Arabidopsis. 1) Arabidopsis DEAD-box (Db) RNA helicases are highly homologous to the E. coli Db RNA helicases. Their gene expression is increased at low temperatures. We intend to show biochemically functional RNA helicase activity. We propose to identify at least one function for a selected group of Db RNA helicases and to test the hypothesis that Db RNA helicases act to influence gene expression patterns and regulation. This will lead to an improved understanding of the function of Db RNA helicases in plant cells as they act to modulate RNA metabolism and accomplish an array of different functions. 2) Experiments will be done to identify the specific binding of mRNAs to Db helicases. The identity of the bound RNA will be determined by binding labeled-RNA derived from total and affinity purified RNA to DNA microarrays. 3) To assess the effects of super-elevated carbon dioxide on Arabidopsis, plants will be grown at ambient carbon dioxide (400 ppm)

What has been done
OUTPUTS: Studies and experiments were undertaken to assess the degree of vunerability of a group of ressurection ferns growing in the temperate rain-forests of southwest coastal Chile to predicted climate change where rainfall is expected to become less frequent and where low temperature events become more severe. In particular, the mechanism that six species belonging to the family Hymenophyllaceae, use to survive periods when the temperature in the rain-forest drops below the freezing point was determined. Other studies examined the interaction of elevated CO2 levels with sugar, hormone and stress signaling responses with respect to gene expression patterns. PARTICIPANTS: Not relevant to this project. TARGET AUDIENCES: Not

relevant to this project. PROJECT MODIFICATIONS: Not relevant to this project.

Results
Impact: The physiological mechanism bywhich members of the Hymenophyllaceae family of ressurection filmy ferns native to the temperate rain-forests of southwest Chile, cope with transient freezing temperatures lasting on the order of hours was revealed. Freeze/thaw and thermal analysis experiments demonstrated that all six species studied nucleate ice formation at tempeatures between -2.8 and -3.4 C, and tolerate extracellular equilibrium freezing with LT50 values ranging from -7 to -9 C. The LT50 values are below the lowest temperatures recorded in the region over the past 40 years and indicate an ennate capacity of the species for being able to survive even more severe freezing conditions should climate change projections prove to be prescient.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #2

1. Outcome Measures

Develop Climate decision support systems that improve quality of life, increase profitability and decrease economic risk.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One-fifth of the planet's vertebrates are classified as threatened. One particularly vulnerable group of vertebrates are mammals. Mammals play a critical role in shaping terrestrial ecosystems and providing significant value to humans in the form of food, income, and recreation; however, the growth of the human population has put unprecedented stress on the planet's mammalian populations. Currently, one quarter of the planet's mammals are threatened with extinction. The major threats to mammal and other vertebrate populations include loss of habitat, agricultural expansion, harvesting, climate change, disease, and invasive alien species. Additionally, the functional integrity of many ecological systems has been diminished because of loss or reduction

of mammals and other vertebrates .As the planet's landscapes become urbanized and dominated by agriculture we have little information to help us understand how wildlife communities and populations respond to these anthropogenic changes to their environment. The precarious state of the planet's vertebrates provides a suite of challenges to researchers and managers hoping to maintain the ecological integrity on a rapidly changing planet. We are challenged with the tasks of 1) understanding how animals respond to the changing landscapes around them 2) maintaining diversity and preventing the further loss of species, and 3) finding the most effective means for managing healthy wildlife populations that maintain ecosystem integrity. The overarching goal of my research program is to understand how wildlife responds to anthropogenic changes to their environment and to find ways to maintain communities and populations that foster healthy ecosystems. To achieve this goal, my research program will use field-based research to elucidate the processes driving vertebrate communities and populations. My field work will be complemented by a focus on quantitative ecology and the use of population and spatial models. Together, these tools will allow me to understand and address the many problems facing our planet's terrestrial vertebrate populations

What has been done

I am continuing to conduct research on understanding and mitigating the impact of introduced alien species. Along with my graduate students, we currently in the middle of 2 experiments looking at the impacts of pythons and fire ants on mammal communities. Additionally, I have continued to provide scientific information for the recovery of endangered species. My graduate students and I have completed analysis on the distribution of threatened fox squirrels throughout Florida and initiated data collection on endangered voles and threatened endemic round-tailed muskrats. Additionally, we have made huge strides in understanding and conserving African wildlife. I procured money and began the construction of a research center in Swaziland and brokered a Memorandum Of Understanding between the University of Swaziland and the University of Florida. Additionally along with the All-out Africa we initiated a long term monitoring of Swaziland faunal diversity. To disseminate our findings my graduate students and I presented our findings at four conferences and I personally presented my research findings to the US Fish and Wildlife Service and Swaziland national Trust Commission. Furthermore, my research on the impacts of sea-level rise on endangered rabbits was picked up by more than 50 news outlets including the discovery channel. PARTICIPANTS: Not relevant to this project. TARGET AUDIENCES: Not relevant to this project. PROJECT MODIFICATIONS: Not relevant to this project.

Results

Impact: The results from our research on the impacts of sea-level rise on endangered rabbits in south Florida helped reshape the debate on how sea-level rise influences wildlife populations. Our research showed the impacts from sea-level rise have been harming coastal wildlife for the last 50 years. Furthermore, we demonstrated how coastal development exacerbates the influence of sea-level rise on wildlife habitat. Additionally, our research efforts have changed managers' perceptions of the endangered Key Largo woodrat. It was thought that the species was declining from predation risks but our research helped change this perception and there is a growing belief that this species is threatened by fluctuating rates of reproduction.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #3

1. Outcome Measures

Develop genetic characteristics of adaptiation traits in crops related to climate change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop productivity depends on the availability of resources (nutrients, water and light), the environment (temperature, photoperiod), the presence of pathogens, and the genetic makeup of the crop. Agricultural management procedures can exercise some control over some of these factors, and only to some extent. However, a long term and sustainable approach to maintain and increase crop productivity is through the genetic manipulation of crops in ways that allow them to maximize the utilization of available resources, to adapt to particular environments and to resist pathogens. Accordingly, the objectives of this project are: 1) To characterize genetic mechanisms involved in disease resistance in plants, and 2) To identify genes that control growth and developmental responses to the environment. These objectives will be accomplished by analyzing progenies from crosses between cultivars that differ in their responses to particular pathogens, or environmental factors. The location of genes that encode resistance to pathogens, or favorable responses to the environment, can be identified when genetic analyses are carried out with the aid of genetic markers from known locations on the chromosomes of the crops. These markers can be used to select for particular traits in a breeding program, or can be used physically isolate the target genes for more detailed examination, and possible molecular manipulation before they can be re-introduced into the plant. This project aims to isolate up to five genes involved in resistance to plant viruses. These genes can potentially be used in other crops that are attacked by the same viruses. In addition, aims to identify a yet to be determined number of genes involved in controlling growth and development in the common bean. The association of these genes with molecular markers will be used to modify an existing computer model. It is expected that the gene-based model will be able to predict crop performance under a range of environments. The usefulness of this model is that it will help select the best cultivars for specific zones based on their genetic makeup, and eventually could be used to direct breeding efforts, not only of the common bean, but any other crop that has a map of molecular markers (most do) and a computer simulation program.

What has been done

The objective of the first sub-project is to develop a crop simulation model capable of predicting the phenotype of a crop based exclusively on two types of inputs: its genetic makeup, and weather data. Crop models are complex computer programs that simulate growth and development using a series of differential equations that represent several physiological processes including phenology. These models have to be calibrated for specific cultivars, a process that generates cultivar specific parameters. The fact that each cultivar possesses a unique set of parameters indicates that these parameters contain hidden genetic information. To extract the genetic information from these parameters, a recombinant inbred family (192 RILs) has been phenotyped under 5 different environments (Fargo North Dakota; Gainesville, FL; Aguadilla, Puerto Rico; and Palmira and Popayan in Colombia). The RILs and the two parents were planted in a latinized block design with three reps at each site. Data collection included time-to events (germination, flowering, maturity etc.), and growth analysis consisting in weekly plant harvests, organ partitioning, and dry weight determinations. Over fifty dynamic traits and several end-point phenotypes were recorded in total. Preliminary QTL analysis with a sub-population of RILs has revealed several QTL, including some for number of nodes on main stem, time to germination, time to flower, and seed size. The long range goal is to turn model parameters into mathematical functions of the QTLs. An effort was started to implement the "genotyping-by-sequencing" (GBS) method to genotype the entire RIL family and construct a linkage map. A second sub-project aims to identify genes controlling root traits associated with domestication. An RI family obtained from a cross between the landrace G19833 and the wild accession G23419 has been phenotyped for several traits of early root growth and development. Phenotyping was carried out in a 2D system developed earlier. Over 3,000 TIFF files of root scans have been obtained from different stages of development from the RI family, and are being analyzed with several software packages including WinRhizo, Root GiA, and some developed at UF in the Computer and Engineering Department. DNA samples for the "genotyping-by-sequencing" method have been prepared for this RI family. The root phenotypes of reciprocal F1 progenies have been evaluated. Statistical analysis of root and shoot development showed no significant differences between the F1s and their respective maternal parent. These results indicate maternal control of, not only seed size as it is well known, but that this control is exerted to the seedlings as well. The results obtained from these research activities were presented at the Plant and Animal Genome Conference held annually in San Diego California. I made some contribution to the characterization of oxidative responses to ethylene by immature cucumber fruit, a project carried out in Donald Huber's lab at UF.

Results

Impact: The identification of QTLs that affect time to germination and to first flower will help us incorporate genetic information into the crops simulation model. The extensive variation in root growth rates and root architecture opens the possibility of incorporating the controlling genes into modern cultivars to improve adaptation to particular soil environments. In addition, the results also showed that seed size has a significant effect on early seedling growth during stand establishment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #4

1. Outcome Measures

Improve water policy and management challenges in the west caused by climate change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water has emerged as a focal point of science, economics and policy debates throughout the western United States. Growing urban and environmental demands will likely put considerable burdens on conservation and transfers from agriculture, which currently consumes about 80 percent of the water in the 17 western states. In addition, the quest to better manage water supplies will intensify efforts at water reuse and desalination technologies and infrastructure, and improved methods and institutions for managing groundwater resources. The difficulty of meeting emerging needs is exacerbated by the threat of global warming, which is expected to increase shortages and adversely affect the timing of stream flows in parts of the west. Adjusting to more competition, higher opportunity costs, and possibly fewer supplies will challenge all current water users, especially irrigated agriculture as it tries to meet current and future food security needs. Rural economies are at risk of losing a significant part of their economic base as the amount of water allocated to irrigation diminishes. Conflicts among states, between agricultural, urban and environmental uses, and between ground and surface water irrigators within states, continue to intensify. In some parts of the west quantity problems are compounded by quality concerns, especially salinity and nitrates. The proposed research addresses the technical issues, policy choices and institutional options for coping with these challenges.

What has been done
The project is requires the development of expertise in nonlinear time series analysis, state space reconstruction techniques, and climatology. Materials for eventual dissemination are under development Over the next year we will continue to develop the decision tool for selecting the most effective drought causality detection method and beta-test it on drought indices including the Palmer drought severity index and standardized precipitation index (at multiple time scales) at the climate division scale (or other scale deemed appropriate during our analysis) for the period 1895-2013. Gridded datasets, including the CPC unified precipitation analyses (Xie et al. 2010), the GHCN CAMS gridded temperature and drought indices available based on gridded datasets,

will also be considered depending on the appropriate spatial aggregation evaluated. Causal variables to be evaluated will include (but will not be limited to) global sea surface temperatures (using the ERSSTv3b) and both land surface (including soil moisture) and atmospheric variables from the North American Land Data Assimilation System phase 2 (NLDASv2) and the Climate Forecast System Reanalysis (CFSR).

Results
Extreme droughts are often presumed to be caused by extreme climate events. Alternatively, causal detection ?data driven? methods can empirically test whether causal interactions inferred from time series data on hypothesized system variables are at the root of extreme drought. What is sometimes attributed to random atmospheric ?noise? could in-fact be a predictable pattern ?hidden? from other methods. Regularities uncovered in statistical causal detection can be applied to construct realistic networks of positive (self-reinforcing) and negative (self-correcting) feedback loops in climate system dynamics models. The major accomplishment this year was to devise a decision tool to help drought researchers select a statistical causal detection method compatible with a given geographic region chosen between the conventionally-applied Granger Causality method for linear stochastic dynamic systems and the newly-emerged Convergent Cross Mapping method for nonlinear deterministic dynamic systems. Over the next reporting period, the decision tool will be applied to empirically causally link measures of meteorological, agricultural, and hydrological drought severity with hypothesized drivers including global sea surface temperatures, and land surface and atmospheric variables.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Florida is still being heavily impacted by the economic situation. Public higher education in Florida has lost more than 50% of state funding and research has been impacted by other losses caused indirectly by the economic down turn including a reduction of funding opportunities available at the national level. In some cases faculty who leave or retire are not being replaced because of economic issues. Changes in state, county and federal appropriations can also affect the

outcomes
related to the Florida research land-grant mission. Because of limited resources in Florida and continuing devolution research projects can always be affected by changing public and governmental priorities policies, regulations and laws.
Natural and national disasters can also affect research field studies and multistate research. Natural disasters such as tropical storms and hurricanes are common annual occurrences in this state and often cause severe damage to plants and the environment in which active research is taking place.. Severe weather conditions such as droughts frequently led to large-scale fires which can also impact studies. In 2013 we were heavily impacted by severe storms and fires. We also had other weather extremes such as floods leading to large scale damage especially along the coastal regions and the panhandle of the state. All of these can have a direct and indirect impact on research.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Florida is involved in a great deal of multistate research related to weather and climate becauseof our tropical conditions. In some cases this research relates to looking at regulations that can impact future decisions related to climate change.

Key Items of Evaluation

The modern agricultural production system is critically dependent upon the financial management of agricultural operations. Producers need cost-effective access to capital and sound government policy in order to continue to meet the food, fiber, and bio-energy demands of the United States. Agriculture has evolved into a very diverse and complex system which has exposed agriculture to many new risks. One such risk is evidenced by the subprime lending crisis. Not since the Great Depression have financial markets been in such turmoil and much of this turmoil is due to the increase in mortgage foreclosures, loan write-offs, and the deterioration of new financial instruments (e.g. credit default swaps). Bank foreclosures, bailouts, and mergers have occurred. The use of credit by farmers, rural businesses, and agribusinesses has a critical impact on their long-term sustainability and competitiveness. One aspect of credit use is determining when and how much credit the business should use. At the heart of this issue is determining the extent to which the firm should utilize its credit reserves or unused borrowing capacity. Borrowing capacity has a value to the firm because it can be called upon in times of financial distress and keeps options for future projects available. Determining the value of unused credit capacity, however, is a challenge complicated by the fact that the unused borrowing capacity tends to grow and shrink as the overall market conditions in agriculture fluctuate. When times are bad, unused credit reserves tend to shrink as lenders become more conservative. These unused credit reserves are typically larger for established farmers but many of these farmers are nearing retirement and may not want to take on additional debt. Work is needed to determine how to value and manage credit reserves in agriculture as well the implications of a new generation of borrowers entering agriculture. Firms in the food, fiber, and bio-energy industry are experiencing an increase in their financial risk largely due to

the financial crisis. Their business risk is increasing as well. Output and input commodity markets have seen a significant increase in their volatility and these implications have been far reaching. Raising food prices worldwide resulting from bad crop years, possibly related to climate change, have reinforced the need to develop informed policies to promote economic development and expansion of agricultural markets in the developing world. Strengthening developing countries' emerging markets is important because these countries are important trade partners. The latest concentrated (and coordinated) research effort dates back to the 1980s and early 1990s. Nevertheless, agricultural economists have studied similar domestic problems and their accumulated knowledge can be used to evaluate what financial institutions and financial instruments are most effective in promoting growth in rural areas of the developing world.