V(A). Planned Program (Summary)

Program # 19

1. Name of the Planned Program

Climate Change

☑ 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
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	20%	20%
112	Watershed Protection and Management	0%	0%	20%	0%
132	Weather and Climate	100%	0%	0%	10%
133	Pollution Prevention and Mitigation	0%	0%	20%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	20%	20%
202	Plant Genetic Resources	0%	0%	0%	15%
206	Basic Plant Biology	0%	0%	20%	35%
	Total	100%	0%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	1.5	17.0
Actual Paid Professional	8.1	0.0	1.7	8.0
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**
110912	0	171366	1122032
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
110912	0	74498	922042
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
910082	0	288685	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

AgriLife Extension

Drought has been the most destructive climatic event associated with climate change, and many AgriLife Extension faculty are involved in education on mitigation or remediation activities associated with drought. Another unusual event associated with associated with climate change in 2013 was a series of late spring freezes. When winter wheat is in the vegetative growth stages though which it normally spends the fall and winter, it is quite resistant to damage from hard freezes, but in the spring, from the time the embryonic spike pushes through the soil surface to maturity of the seed, it can be quite vulnerable to freezing weather. The number and severity of these freezes was unmatched in recent history, with most of the wheat producing regions of the state suffering a hard freeze on March 25, and locations in the wheat belt in the Texas Rolling Plains and panhandle regions experiencing up to six hard spring freezes, beginning on March 25 with the last freeze on May 3. This unusual weather caused many millions of dollars in crop losses and left Texas wheat producers with key decisions to make: to save freeze damaged wheat for a grain crop; to harvest damaged wheat by grazing or as a hay or silage cutting, or, given the timing, to destroy the freeze damaged wheat and replant a second crop. Hundreds of wheat farmers, insurance agents and ag industry representatives called up AgriLife Extension and Research to provide answers.

AgriLife Extension Leads Response to Wheat Freeze Injury

The Texas state's wheat crop suffered repeated damaging freezes which had caused significant damage to the crop. This was particularly problematic, as wheat prices were strong and acreage planted was above normal. Dates of the freezes included March 25-26, April 2- 4, April 9-11, 18-19, and 23-24; and May 2-3. The earliest freeze affected Central and North Texas, while the later freezes heavily damaged crops in the Rolling Plains and High Plains. AgriLife Extension Specialists, working closely with County Agents and the Texas Wheat Producers Association. led a massive educational effort to assist producers in understanding how to identify freeze injury and to rapidly assess losses, giving them options on grain production, haying, grazing and/or planting of alternative crops.

Key highlights of the Texas A&M AgriLife Extension response to the multitude of crop freeze inquiries from clientele included:

· A new diagnostic PowerPoint on wheat freeze injury resource was developed and distributed to all county Extension agents in the affected area, as well as to the High Plains Agricultural Crop Consultants Association, 14 seed companies, and directly to over 150 producer requests for information.

· Three County Extension agent trainings were conducted on wheat freeze injury assessment.

· A total of 32 wheat freeze injury clinics were held, many in the field, in which producers were taught diagnostics for determining freeze injury to wheat. They also brought field samples to give perspective on

their own wheat. Over 400 field samples brought to clinics were assessed. In addition, many samples were assessed individually by county Extension agents or specialists through office or field visits made by AgriLife faculty.

· AgriLife provided advice on haying options vs. leaving the stands, which included outlining the potential nutrient removal (and replacement cost of nutrients) if wheat hay was baled.
· A letter was developed a for crop insurance agents to help them assess losses of wheat due to freeze
· A website for rapid access of information on the assessment of freeze injury was created, containing information on the physiology of the crop and diagnostic information: http://wheatfreezeinjury.tamu.edu
· AgriLife Extension made four news releases, and AgriLife Extension faculty gave 30 radio and print media interviews.

As a result of Extension's response to this climatic disaster, hundreds of Texas wheat producers gained a better understanding of how to assess freeze injury to wheat and thus made solid business decisions on how to manage of their remaining crop, whether it be for grain harvest, haying and ensilage, or replanting. Having an accurate assessment allowed producers to shut down irrigation wells on impacted acres, to generate income from grazing, hay or silage cuttings or to plant a second crop. As a result, thousands of acres were hayed, generating income from what was a near total loss, and a significant acreage of grain sorghum was planted on failed wheat acres. Accurate assessment of impact in a disaster such as this is a challenge at best, but from the hundreds of producers turning out on quickly called clinics and the commentary from participants, it was obvious that the educational effort hit the mark.

AgriLife Research

The research response to this pressing issue is to generate reliable, verifiable data regarding carbon sequestration, carbon cycling, and interrelationships of cropping systems, livestock production and climate change. An example of this effort is using carbon dioxide from coal fired power generation as a feedstock for algae production. Research is also ongoing to develop and add value to co-products from algae production.

Examples of research designed to help producers cope with climate change and extreme weather events include development of integrated cropping systems, strategies to assist with watershed protection and management, advanced modeling, novel technologies to deal with water pollution, marker-assisted breeding of drought and heat tolerant plants, and reduction of methane emissions from confined animal feeding operations.

Cooperative Agricultural Research Center

On-going research projects on plants were end-user clientele-related focused on the establishment of medicinal plants (Lippia and Hoodia) garden and evaluation of the responses of the accumulation of some of the plants' constituents (camphor, zero-caloric sweetener, appetite suppressant) to weather (light and temperature) conditions; analyses of sweetpotato and cucumber genetics that regulate the responses of maturity dates to climatic changes; investigation of the added value of some waste agricultural products (chitosan, lignin) as biomaterials for remediation of petroleum spills and as bone replacement; analyses of the biochemical responses of biomass sorghum lignocellulose yield to sustainable management (crop rotation, residue return, N fertilizer rates, soil tillage) practices; evaluation of the effects of weather on the nutritional and health-related constituents of peanut and black eye peas.

2. Brief description of the target audience

Research products and educational programs focusing on the issue of weather and climate change address target audiences including but not limited to producers, corporate businesses, landscape managers, water resource managers, decision makers, and others who identify themselves with this issue.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5948	107343	214	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	16	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of educational programs conducted.

Year	Actual
2013	198

Output #2

Output Measure

- # of research related projects.

Year	Actual
2013	23

Output #3

Output Measure

- # of graduate/undergraduate students involved in research projects.

Year	Actual
2013	8

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of people reporting knowledge gained through participation in educational activities.
2	# of people reporting a willingness to adopt practices through participation in educational programs.

Outcome #1

1. Outcome Measures

# of people reporting knowledge gained through participation in educational activities.

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
AgriLife Extension and Research
Producers who soil sample after drought often save as much as 75% of crop nutrients that would be required had a normal crop been harvested. As drought drastically reduces yield, nutrient uptake is minimal. This can save as much as $75 per acre in production cost in the following crop.

Cooperative Extension Program
Small producers are eager to adopt improved varieties of crops in order to enhance their profits while cultivating less land area and minimizing fertilizer inputs, irrigation, and labor costs.

What has been done
AgriLife Extension and Research
AgriLife Extension delivered 14 educational programs to 1,017 producers focused on nutrient management during drought. These factors will directly impact the production economics of forage producers in Texas.

Cooperative Extension Program
The early maturing and drought-resistant varieties of cucumber and sweetpotato were cultivated and demonstrated in farmers? plots.

Results
AgriLife Extension and Research
Of 52 producers who responded to a survey following spring and fall Ranch Management

University workshops, we found the rate for ?definitely will adopt? BMPs for nutrient management following drought:

Will soil test before buying fertilizer: 75.7%
Will evaluate limestone quality before buying:67.5%

Cooperative Extension Program
Cucumber demonstrations attracted the interest of 12 family farmers who plan to produce the horticultural cucumber and sweetpotato varieties for sale at farmers markets. Demonstrations on farmers plots were not as productive as those on campus because farmers plots were not as thoroughly tilled and irrigated as the on campus plots.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #2

1. Outcome Measures

# of people reporting a willingness to adopt practices through participation in educational programs.

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
AgriLife Extension and Research
Producers who soil sample after drought often save as much as 75% of crop nutrients that would be required had a normal crop been harvested. As drought drastically reduces yield, nutrient uptake is minimal. This can save as much as $75 per acre in production cost in the following crop.

Cooperative Agricultural Research Center

A major portion on the land resources held by limited resource producers has been out of production for 10-30 years thereby subjecting them to some undesirable effects of weather changes. This program enables small-scale agricultural operators and commercial producers in rural and suburban areas to become more knowledgeable in effectively identifying and evaluating the basic biology of vegetable, fruit, renewable energy crops, leguminous crops etc diversification strategies for climatic risk mitigation and improved economic sustainability based on total management goals and optimal resource base use.

What has been done

AgriLife Extension and Research

AgriLife Extension delivered 14 educational programs to 1,017 producers focused on nutrient management during drought. These factors will directly impact the production economics of forage producers in Texas.

Cooperative Agricultural Research Center

Research Scientists from CARC in collaboration with Natural Resources Cooperative Extension Specialists conducted on campus demonstrations and also in Waller, Ft Bend, Washington, Smith, and Bowie counties on the use of grafted cucumbers. Training was conducted on vegetables production to new farmer via a grant from Wal-Mart that emphasized High Tunnel production mitigation of some adverse effects of climate changes. Three workshops were conducted on High Tunnel Production of horticulture crops.

Results

AgriLife Extension and Research

A total of 52 producers who had taken the AgriLife Extension Ranch Management University responded to a survey. The results showed that pre and post scores rose, on a scale of 1=Poor and 4= Excellent:

Importance of a good composite soil sample: 1.96 pre 3.89 post
Leaching and volatilization of essential nutrients1.69 pre 3.60 post
Importance of pH balance and limestone applications1.96 pre 3.66 post

Cooperative Agricultural Research Center

On-campus field demos in spring and summer gave very high yields and in some cases as many as fifty marketable cucumbers per plant were harvested. Field demo on limited farmers plots gave limited results due to poor site preparation and no irrigation. We found that even drought-resistant plants must have water in order to maintain high product levels.

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
- Other (changing programming areas)

Brief Explanation

Cooperative Agricultural Research Center
Understanding of the responses of plant genomes to the climatic changes (soil, water, nutrients, light, heat etc) is time consuming and labor intensive, research progress being influenced by sudden extremes of weather, economy/appropriations, and government policies/priorities. Repackaging of research results and making them usable by target audience (limited resource producers) are similarly influenced by competing public priorities.

Small Scale Horticulture crop production is also subject to natural disasters such as drought, insects, and diseases. CEP Extension assisted producers in migrating risk by providing risk management education to producers. Producers lack knowledge to be profitable in the high risk area of agriculture production.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

AgriLife Extension
Of 52 producers who responded to a survey following spring and fall Ranch Management University workshops, we found the rate for definitely will adopt BMPs for nutrient management following drought:

Will soil test before buying fertilizer: 75.7%
Will evaluate limestone quality before buying: 67.5%
Importance of a good composite soil sample: 1.96 pre 3.89 post
Leaching and volatilization of essential nutrients 1.69 pre 3.60 post
Importance of pH balance and limestone applications 1.96 pre 3.66 post

Cooperative Agricultural Research Center
Scientists supported by Extension Agents conducted initial participant survey to gauge producer's level of understanding and the likelihood of adoption of the information being presented. Each participant was contacted using the CEP enrollment list to follow up on their interest and adopting the horticultural technologies. Agents worked with one-on-one with those producers who were interested in adopting new practices. One-on-one evaluations were conducted to monitor progress of each producer and to determent economic impact.

Key Items of Evaluation

Cooperative Agricultural Research Center

Number of producers adopting new -practices and technology.
Number of producers reporting increased income or cost savings
Number of producers reporting increased understanding of subject matter.