Topics for Breakout Sessions

2010 Northeast Summer Joint Summer Session
Pier 5 Hotel, Inner Harbor
Baltimore, Maryland
July 11-13, 2010

In 90 years, the Intergovernmental Panel on **Climate Change** expects average global temperatures to increase by1.8°C and 4.0°C; sea levels to raise by18 to 59 cm, precipitation events to vary in their intensity and duration, and non-tidal hydrologic patterns to radically change (IPCC, 2007). Negative impacts on agricultural water resources are expected to be exacerbated by climate change but the interactions between climate-related variables and other biophysical factors are poorly understood (CCSP, 2008; http://www.climatescience.gov/Library/sap/sap4-3/final-report/default.htm).

The Atlantic Coastal Plain Physiographic Region is among the most vulnerable regions to impending climate changes. Because of their low-lying topography and high water table, these regions are extremely susceptible to hydrologic changes and alterations in the nutrient loadings of waterways. Natural, historic but often not fully drained (e.g., prior converted croplands and farmed wetlands) and restored wetlands are prevalent features in these regions. Land use patterns will be forced to adapt as some wetlands will be lost and some agricultural land will become inundated. Existing agricultural production in these regions are already heavily dependent on hydrological control and drainage ditches. Climate change models report an increase in flood conditions in the Mid-Atlantic region. Topics that may become relevant to consider for next few decades in light of Climate Change are as follows:

A. **Climate Change Adaptation in terms of Water Quality and Quantity:** Climate change is not just about reducing the greenhouse emissions! Already we are seeing changes in climate by its variable behaviors such as longer summers, more severe storms, uneven spatial and temporal distribution of precipitation, and melting of glaciers all over the world. Such changes in climate will impact our natural resources (Soil, Water, and Air) in ways unimaginable! For example, we may experience water table rise in coastal areas, thus taking land off production and reducing amount of potable water for human consumption. Such changes in hydrologic regime will result in our accessibility to clean water for domestic use. It will also affect the quality of water by exacerbating flooding and chemical transport. How do we adapt to these conditions in light of climate change is one of the urgent and timely questions for our research and extension programs! We need to identify adaptation strategies (both research and education programs) to keep agriculture sustainable both economically and environmentally.

B. **Climate Change Mitigation in terms Water Use Efficiency and Water Quality:** The Copenhagen Accord was drafted by US, China, India, Brazil and South Africa on December 18, debated by all the participating countries, but not passed unanimously. The document recognized that climate change is one of the greatest challenges of the present day and that actions should be taken to keep any temperature increases to below 2°C (http://en.wikipedia.org). Many countries and non-governmental organizations were

opposed to this agreement, but, as of January 4, 2010, 138 countries have signed the agreement. To sustain Agro-ecosystem services (e.g., food and fiber production) without further harm to our ecosystem, proper mitigation strategies in the form of Best Management Practices (BMPs) for efficient use of our natural resources (e.g., soil, water, and air) need to be investigated and implemented. Our research, Education, and extension programs need to gear towards mitigation strategies such as efficient water use, and environmentally acceptable crop and animal production systems.

C. **Ecosystem Health and Climate Change (This relates to Bio-indicators in the water system):** In last few decades, environmental changes have been occurring on an unprecedented scale. These changes will be exacerbated with the predicted climate change. Despite the immense benefits of agriculture, there is clear evidence that agriculture can be associated with local and regional decreases in ecological and human health. Existing agricultural production in relatively flat and humid Coastal Plain regions are already heavily dependent on hydrological control and drainage ditches. Wetlands in these regions serve many functions, namely they affect hydrologic routing as well as sediment and chemical transport and processing. Climate change models report an increase in flood conditions in the Mid-Atlantic region. Since hydrology is a fundamental important abiotic factor affecting wetland functions and extent, these changing hydrologic conditions will have a tremendous impact on the ability of wetlands, both historic wetlands on agricultural fields and restored wetlands, to provide ecosystem services that are important to 1) agricultural prosperity, such as the production of crops; 2) long-term environmental sustainability, such as the reduction of nutrients and sediments; 3) mitigation of climate impacts, such as the sequestration of carbon. They will also affect the mosquito population some of which could be carriers of human diseases. Understanding the relationship between the climate variables, wetland nutrient filtering capabilities and its hydrology, stream macroinvertebrates, and other biotic communities can help to assess the ecosystem health and help to the sustainability of farm productivity.

D. **Sustainable (Economic, Environmental, and Human Health) Agro-Ecosystem:** Sustainability is generally referred to as the ability of a system to maintain balance of certain processes or states. In ecological terms, it is the ability of an ecosystem to maintain ecological processes, functions, biodiversity and productivity into the future the status of today's world regarding poverty, inequality, global warming, lack of ecosystem/human health in many parts of the world, and water scarcity, sustainability loses its dictionary meaning. More than one billion people in the world are without water and proper sanitation (UNDP, 2002), which is a clear failure of the meaning of sustainability. Keeping agroecosystem sustainable in light of climate change offers huge research, education, and extension challenges. Establishing economic and environmental strategies and policies that guarantee sustainability of our production systems with both ecological health and human health vectors in mind are challenges that should not be taken lightly. Such programs will require human resources and funds to develop if adaptation and mitigation to climate change is desired.

Climate Change and Water Resources – Mitigation and Adaptation in the Northeast

Expected Outcomes

- Identify emerging issues relating to water resources and climate change in the Northeast
- Better understanding of the processes for mitigation and adaptation to climate change
- Identify potential opportunities for collaboration
- Better understanding of funding opportunities
- Identify strategies to address the challenges and constraints to collaboration
- Commitment to continue the dialogue beyond the meeting

Speakers

- Clyde W. Fraisse – Southeast Climate Consortium, Climate Extension & Applied Research Program, University of Florida
- Ellen Mecray, National Marine Fisheries Service, NOAA
- Chris Weaver, Global Climate Change Research Division, US-EPA
- Greg Warr, Molecular & Cellular Bioscience, NSF
- Nancy Cavallaro, Soils & Global Climate Changes Programs, USDA-NIFA

Breakout Sessions

- Climate Change Adaptation in Terms of Water Quality and Quantity
- Climate Change Mitigation in terms of Water Use Efficiency and Water Quality
- Ecosystem Health and Climate Change (This relates to Bio-indicators in the water system)
- Sustainable (Economic, Environmental, and Human Health) Agro-Ecosystem

Breakout Questions

- Identify and prioritize opportunities for sustainable funding
- Identify and prioritize research issues of importance to the Northeast
- Identify and prioritize extension and education needs and priorities
- Identify opportunities for collaboration
- Identify strategies for building new partnerships (internal and external)

Background Documents

- "Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions" at http://www.climatechoices.org/ne/resources_ne/nereport.htm
- "We must adapt to and mitigate the impacts of climate change on food, feed, fiber and fuel system in the U.S." Science Roadmap for Food and Agriculture [to be released]

Breakout A - Climate Change Adaption in Terms of Water Quality and Quantity

July 12, 2010

Note-taker: Tom Burr

1. Identify and prioritize research issues of importance to the Northeast

   Research Priorities:

   Research on how to develop on-site waste water systems in consideration of climate change. Some of the factors to be considered are water tables, risk of flooding, etc.

   Research should take into consideration communities. The populations in flood regions, how easy it would be to relocate them, etc. What is the overall economic condition of the region including unemployment and educational support. What is the scope of adaption?

   In this case the research should also focus on reliable data generation. This may include weather data (frequency of flooding) and frequency of insurance claims.

   Research should also focus on flood mitigation. This may relate to oceans as well as fresh water sources and should take into consideration impact on soil erosion and on farm land preservation. The effects of forests on mitigation of flooding need to be studied.

   The effects of development of increased wetlands should also be understood. Increased rural development reduces sites for runoff and water collection in new wetlands or unwanted sites may increase risk of disease.

   Research should also focus on management of wetland developments and barriers that might be established related to government structures, community structure and economic diversity.

   There is a great need to embrace and integrate the physical sciences and social sciences to make planning for future successful.

There is a great need to make climate change information understandable by general public (to make impact).

Research should focus on breeding plant varieties that are suitable for changes in climate.

Research should focus on how climate change will affect food security. Will it affect production of local foods? Is emphasis on local foods the most efficient way to feed future populations.

Research on water re-use technology and soil management will be important.

Adaption policies should be implemented.

Extension Priorities:

It will be essential to have effective communicators and provide information to targeted audiences.

There is a need to develop and professionalize the programs.

Programs should focus on specific issues that are easily understood by the public, such as, drought, floods, storms, temperature extremes

The messages need to resonate with the public. Extension needs to be ready to go with the program.

It is now important to identify the extension specialists that will carry the message. How will capacity for environmental extension be created and who will train them? How will educators sustain connection with stakeholders?

Opportunities- unique niches for NE

The NE- regional water programs- climate change is a mandated program

It will be possible to establish working groups on diverse topics.

Enhanced infiltration- ag and urban landscape

Vegetable and fruit production
Green industries

On-site septic systems

Ethnic crops – introduction
Mixed crop farms
Demographic effect on crop diversity and production
Aquaculture

Geospacial modeling

B– Climate change mitigation in terms of Water Use Efficiency and Water Quality

General conversation included the issue that BMP's for water allocation and quality are becoming more and more prevalent. Historically clients in poultry, livestock and plant production are key in addressing water issues for irrigation. Partnerships with USDA/NRCS, state agencies and Extension educators are vital to working with producers, and we will play a key role in educational processes used for refining producer knowledge even more. There needs to be a push to institute realistic BMP's, and not always utilize very expensive over-engineered "Cadillac" projects when more functional and cost effective will easily be acceptable.

The capacity of the LGU system is not always known to decision makers so legislative and regulatory issues may be instituted without actually understanding intent and actual implementation challenges of what decision makers are legislating or regulating. In the past water quality needs have had priority but water quantity is starting to move higher on the agenda as state law suits and drought plans begin t address quantity issues. LGU's need to market ourselves as innovative and in tune with current needs and not stuck in the same silo's supporting the same people and issues that we have for 100 years.

Identify opportunities for sustainable funding:
USDA and NIFA – keep conversation going on what NIFA is trying to accomplish
Other funding sources at EPA, NSF, DOE, FWS, USGS and other federal agencies
State Departments of Ag and State Departments of Environmental Protection
How we pay our people and strategic planning for how we retain and sustain faculty, staff
Strengthening our LGU credibility within scientific community for foundational grant work
Increase capacity for SL and Hatch
Increase partnerships to new private entities and organizations who in the past may have been critical of us. Bring they and their resources to the table

Identify and prioritize research issues of importance to the northeast:
Over engineered projects which may not actually address cost effective needs.
What are feasible standards?

Accusations of who is at fault in quantity and quality issues. Stand by science not emotion when trying to identify actual challenges vs anecdotal
Watershed monitoring
Water impairment, causes of impairments
Age of water systems and infrastructure must be addressed
Streamflow regulations, especially in urban areas are being driven by regulatory agencies and water companies
Shale and mining issues are also surfacing for LGU's to address, new partnerships and opportuities
Water quality and regional/municipal health departments who are now entering the arena with limited knowledge of how to interface
Long term research on what types of plants we grow to address quality/quantity issues and how we manage farms to deal with these needs
Aquaculture, agricultural production and local food movements

Identify and prioritize extension and education needs and priorities:
Create dialogue with decision makers on potential outcomes of regulatory and public policy initiatives
Provide educational opportunities to a wide variety of water users and state populations in general
Make issues, terminology easier to understand for the non-scientific parts of the community
Rain gardens, Master Well owners, Master Gardeners, Master Farmer classes, get 4-H interfacing on more of these issues

Identify opportunities for regional collaboration:
Shift culture/new hires so more and more being done in regional efforts and collaborations
Share personnel across state lines and create more critical mass in positioning ourselves as being competitive for large grants
In service trainings for crop advisers by LGU's
USDA's state and county FAC committees must be inclusive to their state, county partners and not just USDA, which holds these meetings quarterly. Need to request USDA broaden this committee as well as state emergency boards which are dealing with water issues
PA/NY are different than NE and Mid-Atlantic. We all need to reach out for new partnerships.

Golden Harvest and other private entities should be networked into

Identify strategies for building new partnerships both internal and external:
Continue to network with all agency's and make sure that these relationships are constantly strengthened.
Reach out and ensure new decision makers are brought together so they understand what the LGU system brings to the table.
More time to network at meetings - best practice sessions at each meeting should be a priority
Need to know what is happening in our own universities across campus and build in house capacity and bring new networks to play.

Breakout C-

Ecosystem Health and Climate Change

Participants names and affiliations, on handwritten sheet

Questions:

- Sustainable Funding
- Research issues in NE
- Education needs and priorities
- Regional collaboration/partnerships

Funding ideas:

- NOAA OHHI (human health initiative)
- EPA Ecosystem Services (wetlands part, water and Section 404 funding)
- USFWS and State fish and game funding (habitat loss and fragmentation)
- NOAA NEON program (baseline research)
- NIFA funds (food security)
- EPA (TMDL funding)
- NOAA Sea Grant Fellow program
- NSF and COSEE funds for education and science
- Agency FY12 and 13 plans, to move in the right direction, built the partnerships just in case
- 2012 Farm Bill reauthorization (plan it now)(specialty crops, organic, farm preservation, research impact since they can plan to real dollars)(climate (NIFA), food safety, specialty crops, community health)
- USDA- targeted climate funding: AFRI, NRCS, Forest Service
- Fundamental research, transformational research, discovery science (a % of each item)
- State/regional funding (no money in states, a lot of needs, a lot of regulation, need for SAME info in diff states, regional organizations (ag, governors, ocean) NEED for regional funding (ag commissioners)
- Tracking system for state, county, and Federal funding (i.e. NOAA ROG funds)

Research Issues in the NE

- Water, a lot of water then no water (how much and when) (water availability and variability)
- Land use issues (development reducing water flows)
- Habitat fragmentation (invasives, migrations, wildlife)
- Baseline research, what is normal vs. what is induced
- Nutrient mgmt, TMDL's, based on watersheds, changing mandates to track the loads to the watershed, need to track sources of nutrients and real impacts (battle land owners vs. farmers) (also: develop methods to TRACK non-point nutrient loading and sources)
- Legislation ahead of the science, based on assumptions on nutrient loading
- Food safety and microbial contamination
- Food security, what can be grown regionally (Appalachia as a potential region), rely less on transportation and outside energy sources (i.e. urban agricultural systems, predicting heat islands and degree growth days in urban areas= urban ag and climate impacts)
- Untapped/potential food production areas
- Crops resistant to drought and efficient at nutrient uptake (min energy and water inputs)(sustainable plants breeding)
- Land preservation (soil conservation plans (EPA) enforcement!)(acre per family? Variable, depends on crop)Farm preservation

Extension and Education

- Agric impacts vs. other land uses in the region (sustainable human use); i.e. evaluation of positive and negative impacts
- Training of Undergrad and Grad students to make them more interdisciplinary and holistic; i.e. going beyond just the research topic
- Science to understand policy and policy to understand science, programs that seek to integrate multi-disciplinary issues (traditional training is too discipline focused) (communication between research, extension, education, and policy-makers)

- Major need for youth development and education about climate and all the interrelated areas
- Huge education to general public (101, 201, 301 education on climate science, climate action) (i.e. Environmental stewards program (Rutgers), wildlife COVERS (wildlife protection), marine docents (NH), Sea Grant Climate literacy) Target middle school, HS too late.
- Extension reaching to NSF scientists, never interacted with this level of scientist (NSF Section 2!), a service to NSF, NIH, DOD funded researchers in climate and alt energy. Extension involved in research proposal process, truly integrated research. A symbiotic relationship!
- Urban ag for teaching and education, emphasis on urban dwellers and the topic of climate change (55k kids in 4-H in NJ alone! A built in audience (Trenton, Detroit, NYC)

Regional collaboration/partnerships/strategies

- Organic collaboration with internal investigators
- Request multiple institutions in the RFP
- Market the idea on leveraging to accomplish more (examples of 'big science', i.e. Chestnut blight; genomics and corn); must pool major funding resources of NSF, NIFA, NOAA, EPA, etc. for the greatest overall impact
- Deal with the admin issues (overhead rates, coordination funds,)
- Issues that benefit from collaboration, and those that don't (multi-state when it's going to be a better project, a true regional problem)
- Multi-Fed projects and programs (pilots at regional scale)
- Seed money, mini-grant programs to demo multi-state common interest ideas
- Point is not to bring people together, but to address a real societal need (great synergies, vs. completely forced)
- Feds, compare your ability to respond to next year's issues, what's coming down the pike (AFRI), know big picture, time to strategize and get together, explain FY12 and FY13 plans (*)
- Funding to science or science for funding (tail wagging dog)...go after specifics, effort so we might see the funding, vs. addressing a need

regardless of funding that actually arrives (managing expectations around collaboration for real dollars vs. maybe dollars)

- Obtain funding information ahead of time (as best as possible) to enable teams to be developed and prepare for strong funding proposals; need for streamlined communication to know what is coming
- Must do advance planning to be effective with major proposals

Group D: Sustainable (Economic, Environmental, and Human Health) Agro-Ecosystem
(Prepared by: Adel Shirmohammadi – Professor, Associate Dean for Research and Associate Director of MAES)

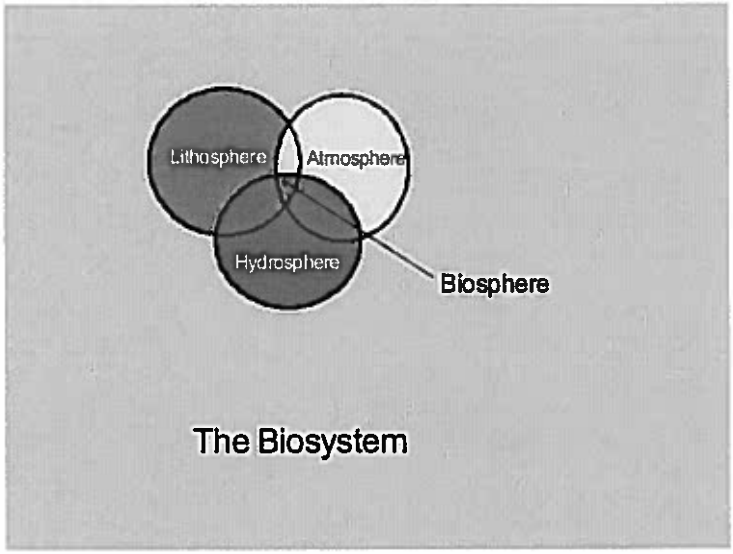

Figure 1a. Venn Diagram Indicating the Biosystem and the Supporting Natural Resources.

Three natural Resources (e.g., Lithosphere (soil), Atmosphere (air), and Hydrosphere (water)) help support the biosystem that includes living system on all scales: cellular, tissue, organ, plant/human/animal, and ecosystem (Venn Diagram above). Climate change may impact these natural resources, thus affecting the biosystem that relies on them. Each ecosystem (e.g., Agro-ecosystem, Urban ecosystem, Forest ecosystem, Wetland Ecosystem, etc..) needs to be kept sustainable in order to support the Biosystem.

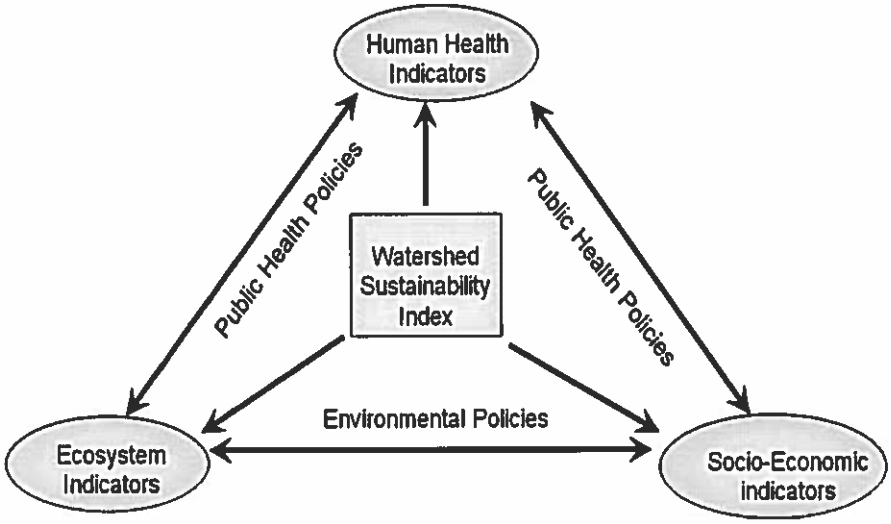

Figure 1b. The Watershed Sustainability Index and the Corresponding Indicators.

To secure Sustainable (economic, environmental, and human/ecosystem health) Agro-ecosystem, we may devise tools such as Watershed Sustainability Index (WSI) that considers component such as Ecosystem Indicators, Socio-Economic Indicators, Human Health Indicators, etc. (Figure 1a). This will require associated appropriate environmental, economic, and human health policy for implementation of strategies to achieve the sustainable Agro-ecosystem. In light of climate change such policies and strategies have to be revisited and modified. Issues such as rising water tables, period of either very wet or very dry conditions can impose conditions that will require proper strategies to adapt and keep our agro-ecosystem sustainable. We may face following challenges:

A. **Stormwater Management Exacerbation Due to Climate Change:** This may result in the consideration of following consequences:

- Health Issues in Urban Environments
- Change in Design and Capacity of the stormwater management systems which may have Economic Consequences
- Water Quality and Environmental Impacts that will have ecosystem and human health impact and economic consequences.
- Migration of humans, and animals (both domesticated and wildlife) to dry land
- Spread of insects and diseases, etc.

B. **Adaptation of Agriculture Production to Climate Change:**
- Water Management (e.g., Irrigation, water table management)
- Controlled Environmental Production (e.g., green house, animal & poultry houses, etc.)
- Crop Breeding/Genomics research to produce resilient crops for changing Climate with consideration of health/economic aspects of such new varieties (drought and wet resistant crops)
- Guarantee Sustainable Yield under exacerbated climate change and variability (e.g., use methods that guarantees proper growing season and planting date)
- Land use Choices (make proper land use changes to adapt to the climate change and sustain proper carbon footprint for climate change mitigation and reduction of greenhouse gases!)
- Combat foodborn pathogens that may be exacerbated in light of climate change

C. **Balance Our Cropping Systems as far as Inputs and Outputs in Light of Climate Change:** Balance between inputs and outputs need to be considered in terms of chemicals, yield quantity and quality, environmental and economic sustainability, etc.!

This may be accomplished by considering research and education programs in the following areas:

- Alternative/Specialty Crops that is really related to crop choices
- Decision Tools (DSS: Decision Support Systems) –Make Crop Choices
- Modeling tools that consider both climate change, cropping systems and the balance between inputs and outputs for economic, environmental, and ecosystem/human health system
- Efficient Water Management Tools (e.g., Irrigation and controlled drainage systems)
- Fruits and vegetables for diet choices and health

D. **Organic Production:** This may also help in balancing inputs and outputs in terms of chemical use and sustainability. ***Science Based Carbon Footprint in NE*** must be researched and considered for agro-ecosystem sustainability and climate change mitigation.

E. **Consider All the Climate Change Stressors** (e.g., temperature, uneven distribution of precipitation, high water table conditions, coastal flooding, dry and wet periods, human and wildlife migration, disease potential, etc.) **in our region for designing our research/education projects and programs to reduce pressure on our production system and guarantee sustainable agro-ecosystem**

F. **Communication:** This is considered a key factor in transferring our research findings to the general public and to the young generation in order to achieve our sustainability goal in light of climate change.

G. Land Use ---- Population ---- Carbon Footprint
"Systems Approach": There has to be a balance between land use, population and carbon footprint for us to adapt and mitigate the climate change and remain a sustainable agro-ecosystem. We need to use a Systems Approach to achieve it.

H. Emergency Preparedness: We need to have emergency preparedness system in place to be able to respond to extreme climate events (drought, wet,. etc.). This requires consideration of socio-economic vectors and spatial vectors that has to be established through proper research and educational programs. This may call for the development of technologies (e.g., prediction models) to forecast the climate change properly and way in advance. It may also call for strategies to deal with such extreme conditions.

I. Funding Opportunities:
- Regional/Watershed Issues (e.g., Chesapeake Bay)
- Land Use and Policy (e.g., Crop Choices, Urban Pressure)
- Controlled Production Systems in light of Climate Change (e.g., New Jersey as a Micro-Cosom)
- Cross-Disciplinary Projects across different colleges (Communication)
- Gear our projects to DOD, DOE, NIH, FDA, etc. besides USDA
- Land/water Interface (Estuarine Systems)
- Urban-Agriculture and forest ecosystem with consideration of the role of wetland for attenuating floods and chemicals.

J. Strategies for Building Partnership:

- Identify Themes (Research and Extension)
  "Capture Themes"
  "Go Beyond us"
- Provide Seed Funding for Team Project Development!
- Executive Directors Should Help Build the Partnership
- Organize Forums to Regionalize our Efforts, form teams, and Go After Large Integrated grants