ESS Leadership Strategies: Adapt to and Mitigate the Impacts of Climate Change
ESS Meeting Session III
September 29, 2021

Strategic Leadership Buckets

1. *Organize interdisciplinary teams to support specific climate change programs*

2. *Enable climate change research initiatives through strategic investment*

3. *Engage internal and external agencies to address specific climate change issues*

Organize interdisciplinary teams to support specific climate change programs

- Build faculty-driven teams to prepare for federal funding opportunities, identify gaps, build partnerships, and use resources strategically
- Engage non-agricultural scientists, especially social scientists, computer scientists, and physical scientists to integrate with life scientists and engineers
- Evaluate and integrate environmental and social justice activities into climate change programs

Enable climate change research initiatives through strategic investment

- Enable faculty-directed initiatives with seed grant funding for well-defined challenge areas, multi-disciplinary student-faculty groups, and to stimulate regional multistate projects addressing climate challenges
- Seek out opportunities through university-wide programs, using proven structures such as established institutional science hubs to take a systems approach to address climate change
- Advocate for increased NIFA funding (AFRI and capacity) to support targeted research areas and to increase the number of agricultural-based climate change researchers who can collaborate with existing expertise

Engage internal and external agencies to address specific climate change issues

- Promote participatory action research as a means to link producers with scientists, increasing adoption and identifying opportunities for utilization of data from producers
- Seek out programmatic opportunities across federal and state agencies through a whole-of-government approach
- Identify regional/geographical issues and coordinate regional approaches, while reducing fragmented and possibly duplicative activities into an integrated national platform/framework
- Focus on systems approaches through institutional collaborations to develop proactive avoidance and mitigation efforts to minimize the impacts of drastic disturbances (e.g. fire, drought, extreme weather)

ESS Grand Challenge 2: Adapt to and Mitigate the Impacts of Climate Change Research Priorities

Reduce greenhouse gas emissions and improve carbon sequestration on agricultural lands
- Engage the Natural Resources Conservation Service (NRCS) to establish minimum soil organic carbon (SOC) thresholds for each crop, planting and grazing practice, and soil type in the United States
- Establish baselines for carbon sequestered in soils as the result of adopting soil carbon sequestration practices (cover crops, no-tillage, collective grazing, etc.)
- Support climate resiliency as well as "adapting and mitigating" because agriculture and forestry is the sector that can reduce greenhouse gas emissions

Collect robust data for climate modeling and predictions
- Promote use of modern sciences and new technologies (e.g., AI, synthetic biology, machine learning, big data, quantum computing, decision-support systems) as a means to innovate and accelerate
- Address challenges preventing LGU scientists from obtaining producer data

Develop decision-making tools that account for variability and uncertainty
- Develop remote sensing technologies to verify adoption of soil carbon sequestration practices
- Increase the number of data scientists with expertise in artificial intelligence to handle data generated by producers
- Create and share data across geographies

Breed crops and livestock that can tolerate water stress and extreme temperatures
- Develop new plants for greater carbon yields
- Develop adapted varieties and cultivars for local environments
- Use modern breeding methods and data handling techniques to shorten the GxE timeframe
- Use systems approaches to precision nutrition, improved waste management systems, feeding groups of animals instead of individuals

Improve climate change education
- Engagement and demonstration are key to adoption (participatory research engages the community and external audiences)
- Create regional-level efforts to connect food producers and consumers into the research process and create greater buy-in for research solutions and recommendations
- Develop citizen science approaches to speed up the adoption

Guide policy and regulation and enhance global cooperation
- Engage State Departments of Agriculture to serve as an aggregator of carbon credits, marketing and selling credits in the carbon credit market
- Engage stakeholders to help guide science and policy around climate change both on the farm and at the experiment stations.
- Work to build stakeholder incentives to address the tapestry of land ownership and land credits to set aside less productive land

- Address water quality and quantity policy and conflicts across federal and state agencies and academia through a whole-of-government approach
- Evaluate and integrate environmental and social justice activities into climate change programs
- Address increased water intake and storage across states in a systematic approach

Summary Paragraphs

Based on the expertise at your institutions, what are 2-3 strategies that leaders can take in the next 3-5 years that have regional or national potential to adapt to or mitigate climate change?

1. Land-grant universities and the Natural Resources Conservation Service (NRCS) can work together to establish minimum soil organic carbon (SOC) thresholds for each crop, planting and grazing practice, and soil type in the United States. The minimum SOC will establish a baseline for carbon sequestered in soils as the result of adopting soil carbon sequestration practices (cover crops, no-tillage, collective grazing, etc.). By doing so, NRCS will eliminate the need for third-party verification, which can reduce most of the value from the producer and cause the adoption rate to be lower than the ideal adoption rate. Remote sensing technology can verify most of these practices. The State Departments of Agriculture can act as an aggregator of carbon credits, marketing and selling credits in the carbon credit market.

2. Breeding programs are examples of long-term climate research essential to combating climate change. We develop varieties and cultivars for their local environments; however, there are concerns about creating and sharing data across geographies and shortening the G x E time frame. Land-grant universities (LGUs) provide services to communities often overlooked by industry, yet it is difficult to aggregate data to scale. The system needs more data scientists with expertise in artificial intelligence to handle data generated by producers. It is a challenge for LGU scientists to obtain producer data. We need to use modern science, including AI, synthetic biology, machine learning, and quantum. These tools will aid in developing new plants and animals that are more adaptive to a changing climate as well as mitigating the causes of climate change.

3. Increase funding and collaborations to study food systems and identify the impact of animals on reducing the human food footprint. Ruminant animals have the unique opportunity to consume human inedible feeds (by-products and co-products of human food production as well as forages) and upscale the nutrients into high quality animal protein and nutrients or fiber. Manipulating the integration of animal husbandry practices to minimize environmental losses is important to utilize embedded food, energy and water in crops harvested as well as manage range and forested areas to minimize damage associated with fire.

4. Build faculty-driven teams to prepare for federal funding opportunities. Attract faculty and staff through direct communication with department heads and the use of retreats to identify gaps, build partnerships, and use resources strategically. Give the team enough time (3 to 4 months) to develop a plan, and then evaluate the plan as the basis for investment. Collaborate with faculty outside of the college/station and collaborate with Extension to bring together a wide range of experts and learn from each other. State-wide or regional conferences also provide opportunities for team-building activities. We have the capacity to support climate resiliency. It is not only "adapt to and mitigate", agriculture and forestry can actually reduce climate change. The focus needs to be on

systems approaches and inter-institutional collaborations. Include other experts by engaging non-agricultural scientists, especially social science experts to integrate with life scientists in meaningful ways.

5. Increase capacity funding to support regional level efforts as well as funding for targeted research areas and hires at universities to increase the number of agricultural-based climate change researchers who can collaborate with existing expertise. Invest in seed grant funding through direct challenge areas, limiting the challenge areas to well-defined topics. Provide funding to stimulate regional activities to develop more effective multistate projects on climate. For example, the North central region is using the rapid response mechanism (500-series) to create seed grant proposals on climate, demonstrating the usefulness of the multistate research projects. Seek out opportunities for investments through university-wide programs, using proven structures such as established institutional science hubs to take a systems approach to address climate change.

6. Engagement and demonstration are key to adoption. Create regional-level efforts to connect food producers and consumers into the research process and create greater buy-in for research solutions and recommendations. Participatory research engages the community and external audiences. Engaged stakeholders can help guide science and policy around climate change both on the farm and at the experiment stations. The citizen science approach can shorten the pipeline and speed up the adoption. We need to develop models to advance the science and get better adoption. Agrivoltaics are a good example of energy-efficient solar systems integrated into production systems that can be shown to stakeholders. We need to work to build stakeholder incentives to address the tapestry of land ownership and land credits to set aside less productive land. We know that production varies greatly from field to field, and so we need to promote the change of problem areas to other uses.

7. Forestry and rangelands management present unique opportunities to mitigate climate impacts. The use of small ruminants to clear underbrush and reduce fuel loads in high fire risk areas is a practice beginning to be tested in areas of the Western United States. Rangeland areas that have suffered environmental damage due to drought, fire and other disturbances are often subject to invasion by non-native invasive species that serve as fuel for the large wildfires that have plagued the West in recent years. These programs need further development as well as those seeking to reduce fuel loads in the forested areas of the West. Land-grant institutions working together with State and Federal Agencies as well as communities in these areas can develop strategies to save these important resources as well as the communities they serve.

8. Water, inextricably linked with climate change, has regional impacts on agriculture and forestry. The northeast is experiencing intense and frequent heavy precipitation events, whereas the central region has more frequent clusters of intense thunderstorms. Prolonged droughts and widespread water stress are common in the west, with short-term droughts occurring across the country. Catastrophic storms resulting in flooding and increased sediment and nutrient run-off in some areas are in stark contrast to reduced snowpack, drought, and the risk of wildfires in other areas. A comprehensive approach among states is necessary to increase water intake and storage. Addressing water quality and quantity policy and conflicts across federal and state agencies and academia through a whole-of-government approach could be an important farm bill topic.