2.0 Climate Change

Brief Summary of Program

In the past decade, Cornell researchers have focused on identifying and quantifying the level of climatic disruption caused by heat-trapping greenhouse gasses and the early, measurable impact on weather patterns, geographic bioregions, and living creatures. Now, researchers are exploring the looming challenges, investigating strategies to address expected impacts, and developing new resources to reduce the human “carbon footprint” that adds to greenhouse gas emissions. Multidisciplinary researchers, educators, and extension faculty – from plant biologists to economists to climatologists – are engaged in three vital areas of exploration for the well-being of future generations:

- Climate science: quantifying the current trend and predicting future impact
- Adaptation: moderating expected damage and identifying potential opportunities
- Mitigation: reducing the human “carbon footprint” to slow the pace of climate change

Situation and Priorities Statement

Climate data for the last 50 years show dramatic changes in temperature and precipitation at the global, national, regional, and state levels. In New York and elsewhere, global climate change is believed responsible for more erratic weather patterns, warmer temperatures, heavier rainfall, lower snow levels, and altered season length with intensifying impact on humans, wildlife, the economy, and the environment. Without action to reduce heat-trapping emissions today, scientists predict that summer in New York will feel like current summer weather in South Carolina by the end of this century.

Cornell researchers have been at the forefront in documenting climate change and its impact in the living world. New York farmers rely on Cornell research to make crucial decisions about controlling pests, applying fertilizer and optimal planting and harvesting times. CALS integrated pest management specialists say certain crop pests are arriving weeks earlier than they used to. Scientists are studying the worrisome prospect of potential over-wintering by some pest species that normally die out during the colder months. Scientists have studied the productivity of crop plants and how plants respond to changes in temperature. Water resources issues are closely tied to climate change, including both quantity and quality issues. Higher variability of surface water flows is expected to exacerbate pollution management and mitigation efforts.

Because carbon dioxide emissions are one of the major causes of global climate change, the study of carbon sequestration is a major research emphasis. Cornell researchers are exploring technological solutions to storing excess carbon, biomanipulative approaches to capturing carbon for use as fuel, and forest management strategies. Linking the science to the economic viability of each strategy is an area in which we have tremendous strength.

Climate change also heightens the importance of research and extension on invasive species. Invasives threaten the function and integrity of ecosystems, native species, and agricultural crops. Climate change opens new environments for invasion. Ecologically sound management of invasive species requires significant improvements in our understanding of the ecological impacts of invasives, as well as the effective management of their populations. Research spanning detection, prediction, and management of invasive species is conducted on plants, aquatic invertebrates, fish and insects.

The impact of these stressors to human habitability will be borne disproportionately by the most vulnerable of human populations: the poor, the old and the young. Poor populations have limited resources to adapt to changes and stresses. Older populations are among the most at risk due to decreased mobility, changes in physiology, and more limited access to resources, all of which may limit adaptive capacity. Children, who have been underestimated in roles they might play in disaster preparedness, could face undue burdens in adapting to negative events caused by climate change and need tailored communications related to climate change challenges. Vulnerable populations will face adaptive challenges to their new environments, with potentially far-reaching implications for health as well as for societal strategies to cope with climate change effects at both the population and policy level.

Technical knowledge of climate change issues and mitigation strategies is evolving rapidly and there is much confusion and skepticism and limited climate change literacy across audiences.
Assumptions

- New science is needed for the reduction and mitigation of climate change.
- Adaptation to climate change is necessary and must begin now, especially for climate-sensitive industries and populations.
- Tackling the issues of climate change requires multidisciplinary, multi-institutional and collaborative research and extension efforts.
- Integrated system approaches are needed to expand our understanding of trade-offs and develop approaches that address current and future challenges of climate change.
- Producers, natural resource managers, community leaders and individuals often are not fully aware of potential environmental impacts of their operations and actions and alternatives that would reduce factors that contribute to climate change.
- Technical assistance providers relied upon by producers, horticultural business people, and natural resource managers have parallel needs for current information on climate change.
- Residential, institutional and business conservation is a critical component in reducing the human carbon footprint.
- Knowledge of the interactions of environmental resources, public health, quality of life, and local economies will lead to an involved, proactive citizenry.

Ultimate Goal(s) of the Program

- Reduce factors contributing to climate change at the individual, community, industry, and institutional levels.
- Develop an agriculture system that maintains high productivity in the face of climate changes.
- Help producers and communities adapt to changing environments.
- Sustain economic vitality, identify challenges, and take advantage of emerging economic opportunities offered by climate change mitigation technologies.

Activities

This is a comprehensive effort entailing a wide range of applied research activities and multiple education methods depending on local context and need. Campus-based faculty and extension associates, regional specialists and county-based educators all are involved in designing, implementing, and evaluating tailored applied research and educational efforts depending on the focus and scope of their role. Example targeted activities include a comprehensive “Northeast Climate Impacts Assessment” that details potential impacts on crops, dairy, forests, and invasive pest species for the region and the Cornell Computational Agricultural Project that is compiling daily weather data and using complex computing tools to create a user friendly website and database for farmers to help them make critical decisions as they adapt to the changing environment. Climate change is tied intimately to sustainable energy concerns. Therefore, climate change is an important element of energy literacy initiatives across all audiences including youth.

Target Audiences

Key audiences served, directly and indirectly include: agricultural, horticultural and natural resource producers; consultants and service providers, resource managers, governmental agencies, and local/state/federal governmental leaders and policy makers, individual consumers, and youth.
Output and Outcome Indicators

Highlighted indicators are collected. Codes in parentheses are (new) and (old) classification system.

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<td># patents</td>
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2.1 Climate Change and Producers/Organizations/Businesses

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<tr>
<td>(2.1a) # of agricultural/natural resources producers, and/or organization and business representatives completing educational programs on the causes and implications of climate change and adaptive or mitigating strategies.</td>
<td>(2.1b) # of consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders who demonstrate knowledge gains about the causes and implications of climate change and adaptive or mitigating strategies.</td>
<td>(2.1c) # agricultural/natural resources producers, organization and business representatives documented to have adopted recommended adaptation strategies for production agriculture and natural resources management, including invasive species, pest management, pollutant loads, wetlands, etc.</td>
<td>(2.1e) # of agricultural/natural resources producers, and/or organizations and businesses successfully adapting to climate change effects enhancing economic viability.</td>
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2.4 Water Resources and Producers/Organizations/Businesses

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<td>(2.4a) # of agricultural/natural resources producers, and/or organization and business representatives completing educational programs on managing water resources and/or environmental planning.</td>
<td>(2.4b) # of consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders who demonstrate knowledge gains about managing water resources.</td>
<td>(2.4c) # consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders documented to have modified existing practices or technologies and/or adopted new practices to protect/ enhance water resources.</td>
<td>(2.4d) # documented instances when consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders have improved and/or protected water resources.</td>
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### 2.7 Biodiversity and Natural Resources Protection and Producers/Organizations/Businesses

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<td>(2.7a)  # of agricultural/natural resources producers, and/or organization and business representatives completing educational programs on managing natural resources, invasive species, and/or biodiversity.</td>
<td>(2.7b)  # of consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders who demonstrate knowledge gains about managing natural resources, invasive species, and/or biodiversity.</td>
<td>(2.7c)  # of consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders documented to have modified existing practices or technologies and/or adopted new practices to protect/enhance natural resources and/or enhance biodiversity.</td>
<td>(2.7d)  # of documented instances in which implementation of natural resources management practices by consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders lead to increased open space preservation, enhanced/proTECTED natural resources, biodiversity, land use.</td>
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### External Factors

Climate change issues play out in a complex and volatile context involving weather extremes, changing governmental policies and regulations, competitive land uses and shifting development patterns, evolving consumer demands, and globally influenced markets. The specific implications of these external factors vary greatly by locale and across commodities and business forms. Technical knowledge of climate change issues and mitigation strategies is evolving rapidly. There is growing antagonism between climate skeptics and climate scientists further polarizing the issue.

### Evaluation

The evaluation approach for this and all other logic models included in our plan is more accurately described as an evaluation "system" rather than as bounded "studies" or investigations. Because each of the plans addresses a broad combination of applied research and extension initiatives spanning multiple audiences, methods, and intended outcomes, a combination of routine program monitoring and documentation, near-term outcome assessment, and targeted follow-up activities is required to provide comprehensive assessment. In addition, specialized data needs of funding partners must be addressed, sometimes using methods and/or accountability structures required by the funders. In support of each of the logic models, we are working to provide educators with recommended evaluation strategies and standard instruments for their use. We will continue our work with the Cornell Office for Research on Evaluation to develop these resources. This year, we reviewed the draft national outcome framework and have selected several to link to our statewide outcome framework. We expect to continue work to align our evaluation priorities with the national framework in coming years.

In 2010, we established an Energy and Climate Change team to provide leadership for statewide program initiatives. Soon after formation, the team entered into partnership with the Cornell Office for Research on Evaluation in their Evaluation Planning Partnership. This collaboration assisted the team in developing detailed logic models for initial program emphases and development of specific evaluation approaches for the coming year.