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 (IPM) 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, bio-manipulative 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 is 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 are evolving rapidly and there is much confusion, skepticism and limited climate change literacy across audiences. As climate events increase the need for education around flood control and management, soil conservation, storm water management is increasing. Individuals, businesses and communities are seeking current information in order to be better respond to changing needs.

Assumptions

- New science is needed for the reduction and mitigation of climate change.
- Adaptation to climate change is necessary and must continue, 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.
- As incidences of flooding and awareness of climate change increase, there will be a greater general need and request for trusted information about situational and behavioral mitigation.
- Technical assistance providers relied upon by producers, local government, individuals, organizations, and businesses have parallel needs for current information on appropriate production practices, waste management and reduction practices, and water resources management and protection practices.

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

The initiative is guided by faculty and staff involved with several programs:

- The Cornell Climate Change Program Work Team (PWT) was formed in 2010 and currently has more than sixty five members comprised of Cornell faculty, staff, Cornell Cooperative Extension educators from around New York State, and external stakeholders who are working to advance climate change research and outreach programs. The PWT provides a mechanism through which faculty and extension educators connect with stakeholders to identify the needs surrounding climate change impacts and opportunities in New York State, create educational materials, and design learning experiences that address these needs. You can view the list of Climate Change PWT members at the Cornell Cooperative Extension website.

- The Institute for Climate Change and Agriculture (ICCA) is focused on supporting farmers of New York and beyond with decision tools for strategic adaptation to climate change, so that they are better able to cope with potential negative effects of climate change, and are better able to take advantage of any opportunities that it might bring.

- The Cornell Cooperative Extension (CCE) system extends Cornell University’s land-grant programs to citizens all across New York State.

- The Atkinson Center for a Sustainable Future’s (ACSF) Climate Change Focus Group began in 2008 and currently has 17 interdisciplinary faculty members from across campus, representing disciplines such as: climate science, ecology, agriculture, engineering, economics, history, and social sciences, that guide research and teaching at the University.

- NY EDEN [http://emergencypreparedness.cce.cornell.edu/Pages/default.aspx](http://emergencypreparedness.cce.cornell.edu/Pages/default.aspx) The New York Extension Disaster Education Network (NY EDEN) is a collaborative educational network based at Cornell University, dedicated to educating New York residents about preventing, preparing for and recovering from emergencies and disasters that could affect their families and communities. NY EDEN is affiliated with both the national USDA EDEN network and with Cornell University Cooperative Extension.

- NYS Integrated Pest Management [http://www.nysipm.cornell.edu/](http://www.nysipm.cornell.edu/) - Research, demonstrations, education, and outreach are part of a comprehensive plan to make IPM the safe, effective pest management solution for all New Yorkers. Solutions that help protect our health, our economic well-being, and our environment.

- Invasive Species Education and Monitoring Efforts: [http://www.nyis.info/](http://www.nyis.info/) The Mission of the Clearinghouse is to be a gateway for New Yorkers to access timely, accurate scientific and policy information to assist them in making informed decisions about preventing, eradicating, controlling and managing invasive species in New York State and to focus attention on the need for invasive species prevention, eradication and management in New York. The Clearinghouse also provides information on upcoming invasive species events and invasive species news of interest to New Yorkers. The Clearinghouse has subsumed the National Aquatic Nuisance Species Clearinghouse and its Aquatic Invasive Species Database and has formed linkages with the New York Invasive Species Database (iMapInvasives), the New York Invasive Species Research Institute at Cornell, and numerous State and Federal agency invasive species programs. The Clearinghouse works closely with the State’s eight PRISMs (Partnerships for Regional Invasive Species Management - see navigation bar PRISM tab) to support them in their invasive species activities.
• Master Watershed Stewards Program [http://dnr.cornell.edu/outreach/watershedsteward/](http://dnr.cornell.edu/outreach/watershedsteward/) The mission of the New York Master Watershed Steward Program is to strengthen local capacity for successful management and protection of watersheds by empowering volunteers.

Stormwater Management [http://www.clrp.cornell.edu/workshops/stormwater.html](http://www.clrp.cornell.edu/workshops/stormwater.html) Stormwater management training is part of the Cornell Local Roads program which provides training and technical assistance to local highway and public works officials in New York State.

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**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, non-government organizations, individual consumers, and youth.

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**Output and Outcome Indicators**

Highlighted indicators are collected annually.

### 2.1 Climate Change and Producers/Organizations/Businesses

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<tr>
<th>Output Indicators</th>
<th>Near-Term Outcome Indicators</th>
<th>Mid-Term Outcome Indicators</th>
<th>Long-Term Outcome Indicators</th>
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<tbody>
<tr>
<td>(2.1a) Number 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) Number of consumers, residents, agricultural/natural resources producers, organization and business representatives, and/or local government and community leaders who demonstrate knowledge gains about on the causes and implications of climate change and adaptive or mitigating strategies.</td>
<td>(2.1c) Number of 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) Number of agricultural/natural resources producers, and/or organizations and businesses successfully adapting to climate change effects enhancing economic viability.</td>
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<td>(2.1d) Number of agencies/organizations/communities documented to have adopted recommended climate mitigation practices and policies.</td>
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<td>(2.2f) Number of communities adapting successfully to climate change effects.</td>
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### 2.4 Water Resources and Producers/Organizations/Businesses
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<tr>
<td>(2.4a) Number 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) Number 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) Number 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 water resources.</td>
<td>(2.4d) Number of 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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<tr>
<td><strong>(2.7a)</strong> Number 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><strong>(2.7b)</strong> Number 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><strong>(2.7c)</strong> Number 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><strong>(2.7d)</strong> Number 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. Flooding events during recent years continues to elevate consumer and community interest in disaster preparedness and water quality protection for families, communities and farms. The shift in interest, program offerings and campus and research support is evident. These trends are expected to continue.

**Evaluation Methods**

Typical system evaluation efforts can 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 (CORE) to develop these resources.
In 2015, we will continue to review the national outcome framework and connect it, as possible, to our statewide outcome framework.

Cornell Cooperative Extension works with the Cornell Office of Research and Evaluation (CORE) to strengthen evaluation practice and build evaluation capacity in CCE. CORE has developed a Protocol for evaluation that takes a systems approach, recognizing that individual programs and their evaluations are part of larger program portfolios and are shaped by needs and context at multiple levels of the Extension system. CORE has tested and refined this Protocol in partnership with CCE programs since 2006. A key step in the Protocol is to develop program models, in both familiar columnar form as logic models and in a visual form called pathway models. These models form the basis for focusing evaluation efforts in Extension programs.

Beginning in 2013, CORE and CCE partnered to initiate program modeling and evaluation planning at the level of the statewide Plans of Work. This effort, which is ongoing, will contribute to a framework for programming and evaluation at multiple levels. The Protocol is also being integrated into professional development in CCE, in collaboration with CCE leadership, to promote consistent approaches to evaluation of county-based, regional, and state-wide programs. CCE organizational development efforts are also being devoted to organizing common high-quality measures that can be used by a wide range of programs where applicable.

During 15 we will continue to work with CORE to expand the Evaluation Partnership Program to be focused around our plan of work. Overall goals include:

- Building evaluation capacity
- Develop networks of CCE staff and associations to review, adapt and model the statewide plans of work
- Develop and implement high-quality evaluation plans around specific programs within plans
- Improve evaluation practices
- Use evaluation to improve programs

The Climate Change plan is focused on helping consumers, residents and producers to adopt adaptation strategies. Our plan focusses on water resource protection/enhancements and protection of natural resources and biodiversity. In addition to outcomes measured around general climate change knowledge, adaptation/mitigation practices and policy changes there will likely be added outcomes that include a way to measure the success of the Master Watershed Steward Program, a newer volunteer-based initiative. Indicators related to this new evaluation effort are emerging.