
DELAWARE CLIMATE CHANGE COORDINATION INITIATIVE FINAL REPORT

A framework to help further UD Cooperative Extension's engagement with Delaware climate change-related activities



UNIVERSITY OF DELAWARE
**COOPERATIVE
EXTENSION**



DELAWARE CLIMATE CHANGE COORDINATION INITIATIVE FINAL REPORT

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This work is dedicated to the future health and well-being of all the people across Delaware.



Figure 1. DECCCI Research Assistant Wylie Feaster leading a data collection exercise at the University of Delaware's 2023 Ag Day. (Courtesy of Michele Walfred)

Executive Summary

The 2022-2023 assessment of UD Extension climate change related activities recognized the critical role that Extension can play to effectively promote knowledge about climate change across Delaware and the region. Data from interviews, polls, focus groups and written materials revealed critical gaps and areas for increased engagement. Given UD Extensions trusted role with Delaware agriculture and community constituents, it is clear that UD Extension's "niche" can be that of a "trusted partner" facilitating communication across "siloes," promoting education and supporting science-based information exchange.

UD Extension has the opportunity to address these gaps and to play a pivotal role in raising awareness across Delaware about the impacts of climate change and facilitate evidence-based responses at the individual, community, and institutional levels. Based on the assessment and the recognition of the need to promote and increase risk reduction and resilience response activities, the following actions were recommended:

Communication

- **Provide Online Resources:** Develop accessible and up-to-date online resources, such as articles, links to websites, and interactive modules, to provide up to date information about climate change on the UD Extension website and through social media platforms.
- **Adapt and Integrate Climate Change Information across Extension Programming:** Using national, regional, and local information and curricula, update programs to incorporate new information about climate impacts and risk reduction efforts across Delaware.
- **Foster Partnerships:** Partner and build alliances with governmental agencies including DNREC; NRCS; the Delaware Departments of Agriculture, Education, and Health; non-profit organizations; and stakeholders to leverage collective expertise and resources for climate change activities.

Education

- **Provide Evidence Based Climate Change Education for Extension Agents:** Offer comprehensive education, skills-based training, and climate change related resources to UD Extension agents to help them disseminate information to Delaware communities.
- **Engage with Delaware Youth:** Partner with other Delaware educational institutions to incorporate climate change related education into curricula and programs at all levels. Empower youth through 4-H and other youth-led programs, clubs, and competitions to foster climate change awareness and action.
- **Facilitate Training Workshops for Diverse Communities:** Design and disseminate equity and inclusion oriented climate change materials for delivery to diverse audiences, including state level professionals, engineers, architects, homeowners, students, etc. Engage local communities, Master Gardeners, 4-H and others through forums, town hall meetings, and field trips to showcase climate change impacts and discuss solutions.

Economic

- **Support Demonstration and Workforce Projects:** Implement risk reduction, resilience, and sustainable practice demonstration projects to showcase practical solutions for community adaptation. For example, tracking and monitoring Extension's emissions and carbon sequestration on UD facilities and properties, modeling sustainable farming, innovating transportation models, solarized parking lots, and renewable energy installations.

Policy

- **Policy Advice:** Act as a trusted source of information and advise on the development of policies that address climate change at local, state, and national levels.

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Introduction

“I think it’s a strategical mistake to give this movement the name of climate change. Climate change is an effect and the causes are greed, pollution, waste and this insatiable appetite we have for convenience, comfort and the rest of it. What we need to be talking about is a change that ultimately is going to be a cultural change.”

- **Wendell Berry**

Over the past decade, climate change, in the form of extreme and slow onset events, has presented new and un-for-seen risks to the Delaware landscape, agriculture, communities and residents. At stake is the issue of how Delaware can best adapt to these new and evolving environmental pressures. Integrating responses to climate change into Extension activities is an ongoing need which will require simultaneous and coordinated responses across sectors, stakeholders, organizations, communities, and individuals. Multiple and diverse stakeholders need to work together, utilizing complementary skills to maintain the health and well-being of Delaware populations. This requires unprecedented levels of cooperation and information sharing across institutions, management structures, and decision-making processes.

The Delaware policy and decision makers who operate in this increasingly challenging context are dependent on institutions with clearly delineated responsibilities and functions, backed by individual skills and knowledge. The broad range of skills necessary to respond has become increasingly complex and now includes the ability to understand different environmental variables, recognize diversity in institutional cultures, share information and knowledge, reach consensus over priorities, and allocate resources.

The Need for a UD Cooperative Extension Assessment

The impacts of climate change continue to be monitored and recognized as a growing threat to Delaware’s environmental sustainability, local, county and state agricultural production, economic development, workforce training, and community health. To address the rapidly evolving impacts of climate change – from increased risks of devastating droughts or floods to changes in energy use and transportation delivery – new research, education, economic investments, and outreach to the public is required. What role can UD Cooperative Extension play to ease the transition, offer innovative solutions, and provide options to cope with, and address, this emerging new reality?

To answer these and other question, the, UD Cooperative Extension created the **Delaware Extension Climate Change Coordination Initiative (DECCCI)** to gather data, evidence, and information regarding the current status of Extension climate change related activities. Materials developed by DECCCI will offer a reference point for UD Extension’s work with local, county, state, and national stakeholders in climate change strategic planning, policy, and program development.

DECCCI Goal and Objectives

The twin goals of the DECCCI project were to: 1) gain an in-depth understanding of current UD Cooperative Extension’s climate change adaptation related activities and 2) offer appropriate action for the future (e.g., define what Extension’s “niche” could be regarding climate change related issues).

Specifically, the assessment focused on identifying and reviewing:

- Linkages and relationships within and between UD Extension and key Delaware (and other) stakeholders.
- The context of UD Extension, local, county, state, and national specific climate change responses.
- UD Extension climate change planning, implementation, and monitoring processes.

- Current level of climate change related skills with respect to policy, organizational management and operational logistics.
- Recommendations for increased UD Cooperative Extension climate change response capacity.

The Role of Cooperative Extension

Responding to climate change related issues means acknowledging that adapting to climate change requires both technical innovation and changes in “normal” social life. Extension has an important role to play in disseminating climate change information. In 2021, Delaware created the Delaware Climate Action Plan outlining critical issues and potential responses with respect to mitigation and adaptation. In 2023, the Delaware Climate Change Solutions Act was passed¹. From floods, to droughts, to increased health and economic risks, the complexity of the social response – the changes people need to make – may appear to be overwhelming and thus, paradoxically, can lead to denial, inaction, and resistance.

Understanding the complex interplay of social, political, environmental, and economic issues communities now face, means there is an immediate need to “make sense” of the climate change context in Delaware. Maximizing resilience and adapting to climate change impacts includes reducing disaster risk and preparing people for extreme and unexpected events. Avoiding property damage and loss, addressing direct and indirect business interruptions, and minimizing human deaths and injuries will require new organizational capacities, team and group competencies and individual skills.

“Doing something” is what Extension does. Climate change related action means preparing people, property, and economies for the impacts of a changing climate on livelihoods, community wellbeing, individual health, and lifestyles. Acknowledging that climate change impacts are already affecting Delawareans and the recognition that there are important economic, social, political and health benefits reinforce the need to proactively address those impacts through new knowledge, education, and skills development. UD Cooperative Extension is focused on addressing the impact of climate change and knows that this will require working together with a broad and diverse network of state stakeholders from different sectors to address critical climate change issues.

UD Extension is part of the Land Grant University System, created in 1862 with the Morrill Act. This Act established universities in each state to teach practical agriculture, science, military science, and engineering as a response to the agrarian and emerging industrial needs. Extension offices serve as an intermediary between environmental science and technology and the needs of end users or stakeholders. Both the Land Grant (USDA funded) and the Sea Grant (NOAA funded) Extension Services have a distinguished history of actively serving as an interface between scientists and decision- makers, focusing on problem-solving with the clientele groups they serve. Extension stresses practical outcomes and best professional judgment, and often reframes issues to suit its audience. Extension has often reinvented or repurposed its existing capacity to meet the needs of its constituents by focusing on adaptive management, testing the principles of being a “learning organization,” and investing heavily in internal capacity building.

¹For the most up to date information about the implementation of the Delaware Climate Action Plan, see: <https://dnrec.alpha.delaware.gov/climate-plan/actions-taken/#:~:text=The%20Delaware%20Climate%20Change%20Solutions%20Act%20of%202023&text=Establishes%20a%20process%20of%20regular,resilience%20strategies%20for%20the%20state>

To “do something” requires understanding the technical, management, and administrative skills, competencies and capacities, UD Extension has, and will need, to work effectively with state, county and local non-profit, private sector and governmental agencies and departments. Those skills need to be matched in all organizations so that people can work together. Institutional capacities create a climate change adaptation/response sector, see Fig. 2. In addition, there is a need to be clear about university expectations and advocacy strategies, stakeholder networks and alliances and the private sector.

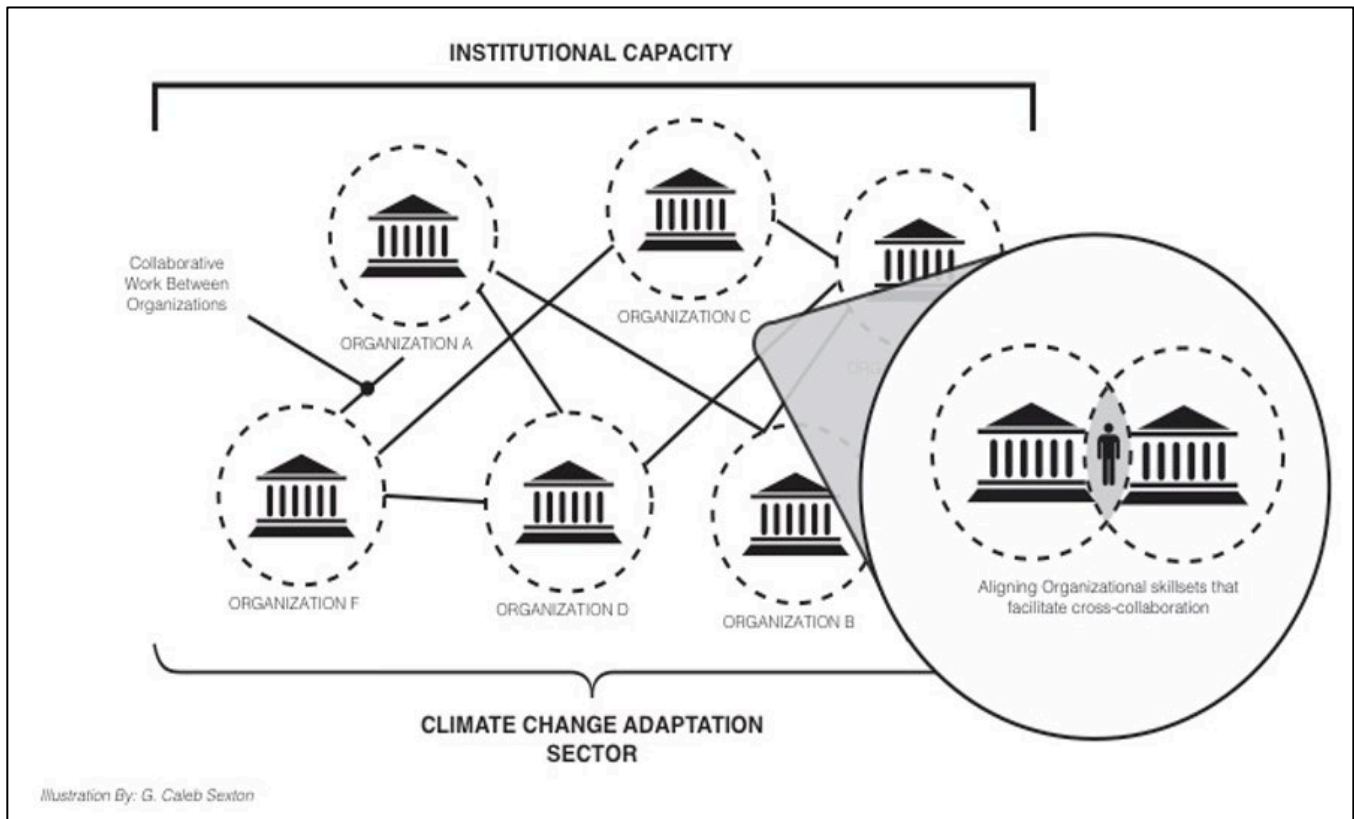


Figure 2. Climate change and institutional linkages across Delaware actors.

Ultimately, there is a need to capture the complexity of the relationships that define Delaware climate change contexts within which Cooperative Extension functions.

Assessment Methods

Primary Principles

To adequately address climate change, the ubiquitous nature of diversity and equity issues have to be acknowledged as a fundamental component of any socio-cultural assessment. The varying impacts of climate change are not neutral or evenly distributed and thus assessments need to be fully cognizant of potential biases in questions, attributions and insights. This includes reflecting on who creates specific climate responses, and, on whose knowledge, and understanding these activities are based on.

For example, observations may under-represent certain geographic locations. These limited data may then be used for regional climate models or to decide on adaptation measures. Assessment processes need to acknowledge that issues related to social equity and social justice are also related to data

collection, data use and data analysis. Cultural context recognizes that diverse ways of knowing, understanding, and interpretation are shaped by societal and cultural background knowledge. Given this recognition of the impact of culture, the DECCCI assessment adheres to the following principles:

- **Address cultural diversity:** The recognition that assumptions about societies, social dynamics, and knowledge in the context of climate change carry the risk of glossing over fundamental issues regarding the diversity of cultural beliefs, values, norms, power, agency and responsibility of social actors from individuals, social groups and societal institutions.
- **Recognize subjectivity in climate change research:** Climate change assessments have typically been conducted from an unspecified, seemingly neutral, “objective” and omniscient standpoint. This creates a potential risk of bias that may influence the questions, analysis, outcomes, and recommendations. Traditional “problem” definitions have often ignored questions critical to people in each context and bureaucratic solutions may exclude diverse ways of knowing and produce reports that may reinforce conditions of historical inequity.
- **Recognize the complex, intricate and entwined nature of environmental change and human action:** The social and physical world are interconnected in a multiplicity of ways and humans are an active and engaged part of the physical world. It is essential to recognize that the changing state of the physical world simultaneously creates new conditions that affect human practices.

Given these principles and recognizing the essential roles of social context and culture to understanding responses to climate change necessitate that “time” and “place” be central to the assessment process. Thus, DECCCI assessment methods had to be able to address the subjective and dynamic features of climate change responses.

Action Insights

DECCCI used a qualitative assessment model known as “Action Insights,” based on sociological “constructionist” theories. Social construction models view social interaction, collective action, social structures, and institutional organization as dynamic processes. Thus, how people act and what they believe both contributes to, and alters, in an ongoing dynamic, what is “real”. Action Insights was selected as the assessment framework as it offers a practical way to identify what beliefs and skills, people (“actors”) use as they engage in activities (“actions”) that produce outcomes (“artifacts”). The world people “inhabit” is dynamic and that dynamic can be “taken apart” and assessed at any given time and place.

Specifically, Action Insights focusses on describing the location, social networks, language, and timing of the skill sets (“actions”) being used to respond to climate change, and offers information about the context of those skills (“actions”). Action Insights offers a way to understand “who is doing what, where, when, how, and why.” The Action Insights method of data collection and categorization allows visualizations to be created that show linkages between people (actors) and activities (actions) in Extension, the University of Delaware, local communities, counties, and across state, regional, and national organizations and institutions.

“AAAPT” Standard Categories

To understand the skills, competencies, and organizational capacities needed to address climate change related issues, Action Insights uses a standard process to organize the information (“data”) gathered from a variety of sources. For example, to address the issue of food waste in Delaware, information about the agricultural policies, procedures and practices that are in place have to be linked to the transportation,

food preparation and eating patterns in any given community. What individual skills (“individual actions”) and organizational capacities (“processes”) are required in each of these domains and how are they connected? To answer this and to organize the diverse data, the data (e.g., who is doing what, where, and when) is sorted and placed into categories. This method uses a simple coding strategy to label people, groups and organizations as “actors,” label their activities or “actions,” and also label the outcome of people’s actions and interactions as “artifacts” (“products”) in “time” and “place.” (see Fig.3)

This coding strategy uses the acronym “AAAPT”. AAAPT is a “lens” and is the first step and basic way to categorize or “pile sort”² all the information or “ethnographic data” that characterize actors and actions with respect to any social issue, in this case, climate change. In more detail, AAAPT categories can be described as:

- **Actors** – people, groups, and institutions
Whether an individual, collective, or institution actors take on specialized ways of acting (“doing things”) that require learning various skills and “appropriate actions”. These skills are tied to “roles” and issues of status, power, authority, legitimacy, responsibility, and accountability. These roles and the related individual skills, group competencies, and organizational capacities, help organize the “who,” “what,” “where,” “when,” and “why” of any social context. Roles help maintain the patterns of interaction because they create the culturally accepted rules that give form to relationships. These rules help negotiate how power, authority and legitimacy are to be organized. Roles that actors use in relationships help create the repeated patterns of social interactions. Varying responses to climate change are related to roles, status, power, etc.
- **Actions** – activities, programs, projects, initiatives, etc.
A fundamental concept in the study of human societies and the basic building block of human social systems is “action”. The term action can represent the action of an individual, the collective activities of a group or the complex webs of activities of groups that form organizations. Action, regardless of complexity level, that occurs between actors is labeled “social interaction”. Social interaction between actors creates a “relationship.”
- **Artifacts** – objects
The “things” of life from reports, articles, books, to buildings, clothing, music, and food, to homes, cars, and smart phones are derived from the links, or “interactions” between actors, actions and other artifacts. They represent tangible manifestations of social interactions; therefore, they serve as fundamental sources of information for all social assessment activities.
- **Place** – geographic location
- **Time** – historical moment

² For more background about pile sort techniques see:
https://ebrary.net/74260/environment/free_pile_sorts#aftercont

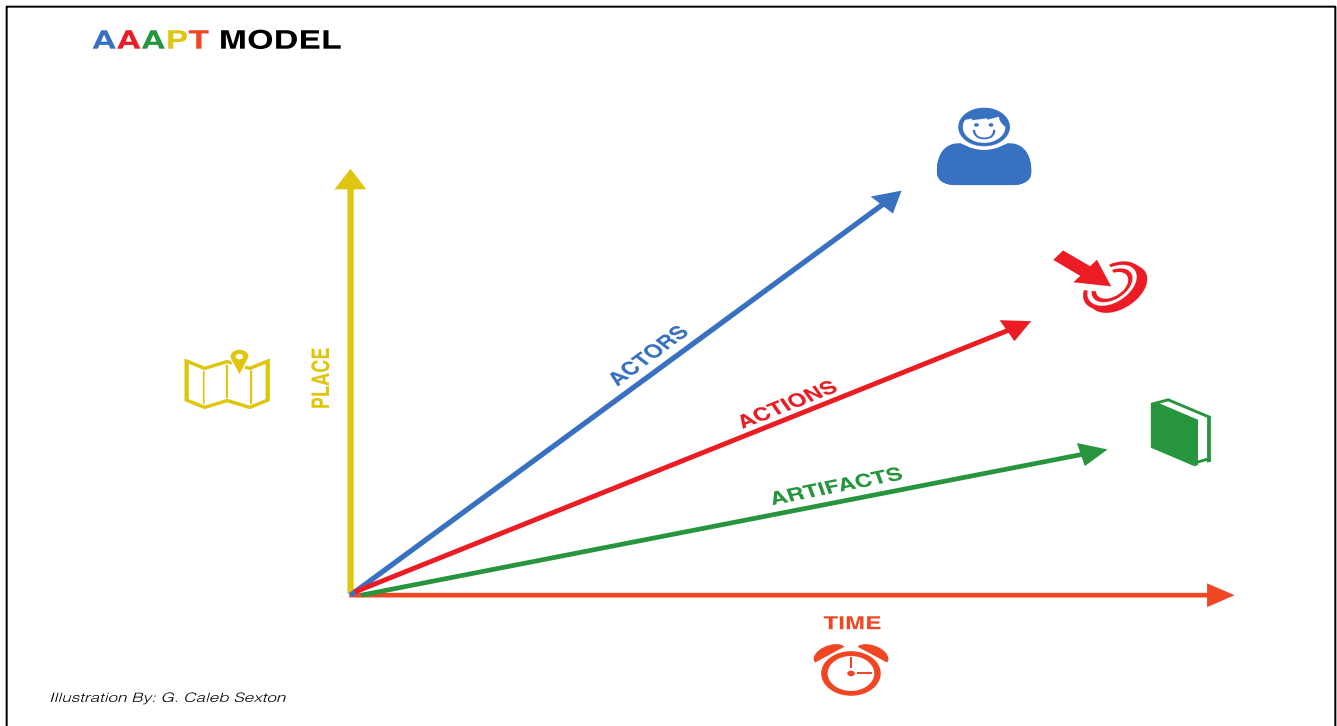


Figure 3. A visual representation of the AAAPT Model, color-coded by category with place (yellow) and time (orange) serving as individual axes that ethnographic data can be plotted over

Once actors, actions, and artifacts in place and time are identified, the next step is to identify and sort the basic attributes of the actors, actions, and artifacts into “domains”. These attributes, when identified and sorted into domains, begin to form patterns and trends over time. These domains (e.g., actor and actions focused on family or religion, or trade, or educational practices) provide yet more details to understanding how and why people act and interact the way they do.

Each of these four domains has actions and activities that form patterns at different “levels”. (see Fig.4) The levels range from simple, individual actions to the interactions between people in groups to highly complex groups within groups interacting to form an “institution.” For the purposes of the DECCI assessment, the levels are:

- **Macro-level:** organizational/institutional, strategy level
- **Mid-level:** collective/group/department/program, management level
Bridge between “micro” and “macro” levels, thus creating a continuum.
- **Micro-level:** individual/personal/project/procedures, operational level

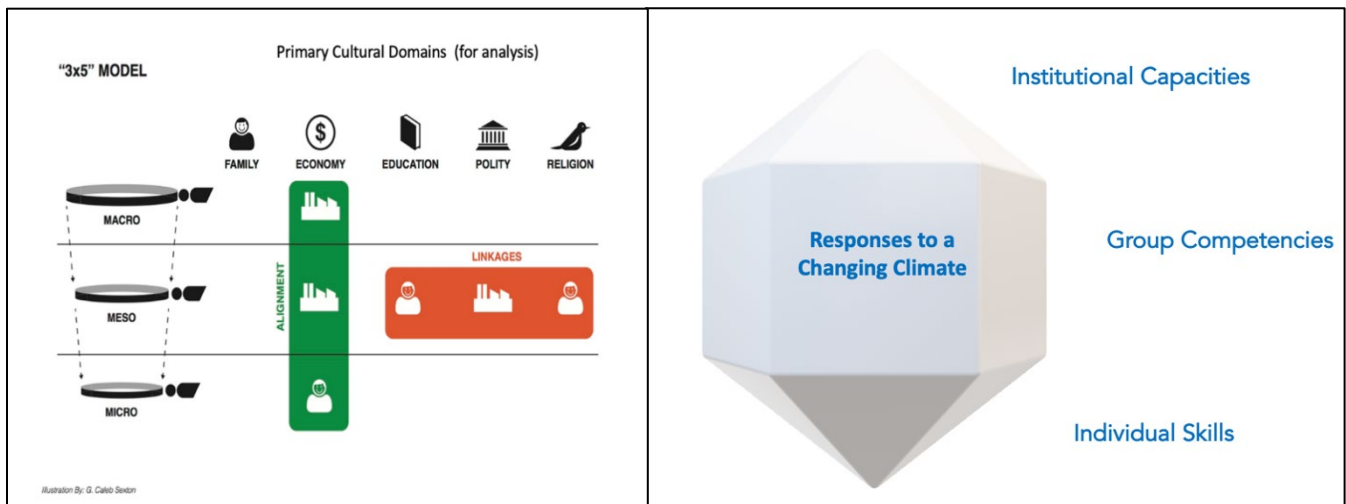


Figure 4. (Left) Levels of action with respect to cultural domains. (Right) Relationship of skills, competencies and capacities to levels of action.

All of these levels require learning, experience and knowledge, that then allow for specific skills, competencies, and capacities to be developed and maintained. Taken together as a “dynamic whole”, each level is “embedded” or “entwined” to the other levels to form human societies. When these levels are “aligned,” information, communication and action are enabled and mutually supported, thereby allowing for synergies, innovations, and “effectiveness” to emerge more easily (e.g., “flow”).³

Data Sources

Information and evidence used in the assessment was collected from across libraries, websites, strategic documents, videos, and other historical written sources. Articles, references, websites, and other written materials were then placed in the DECCCI repository. Additional data was collected and stored in the repository from over 30 key informant interviews, three focus groups at UD Extension meetings, numerous state and regional workshops, and two conferences. Over 150 people in five different settings responded to a short four question poll that provided clear indications of people’s knowledge, attitudes, beliefs, and values regarding climate change (see Appendix A for further details). Over 50 people from a variety of sectors, including UD Extension, other UD colleges, state and local governments, non-profits, and the private sector were interviewed in one-on-one sessions.(see Fig.5)

In addition, there were extensive reviews (linguistic analyses) of organizational strategic plans related to climate change across Northeast Extension programs, state programs and other community institutions with climate change responsible offices, departments, and divisions. Data was collected with respect to geo-spatial location and timing of activities to discern demographic patterns and trends.

³ For basic information about “institutional alignment,” see the Harvard Business Review article: <https://hbr.org/2017/02/how-aligned-is-your-organization>

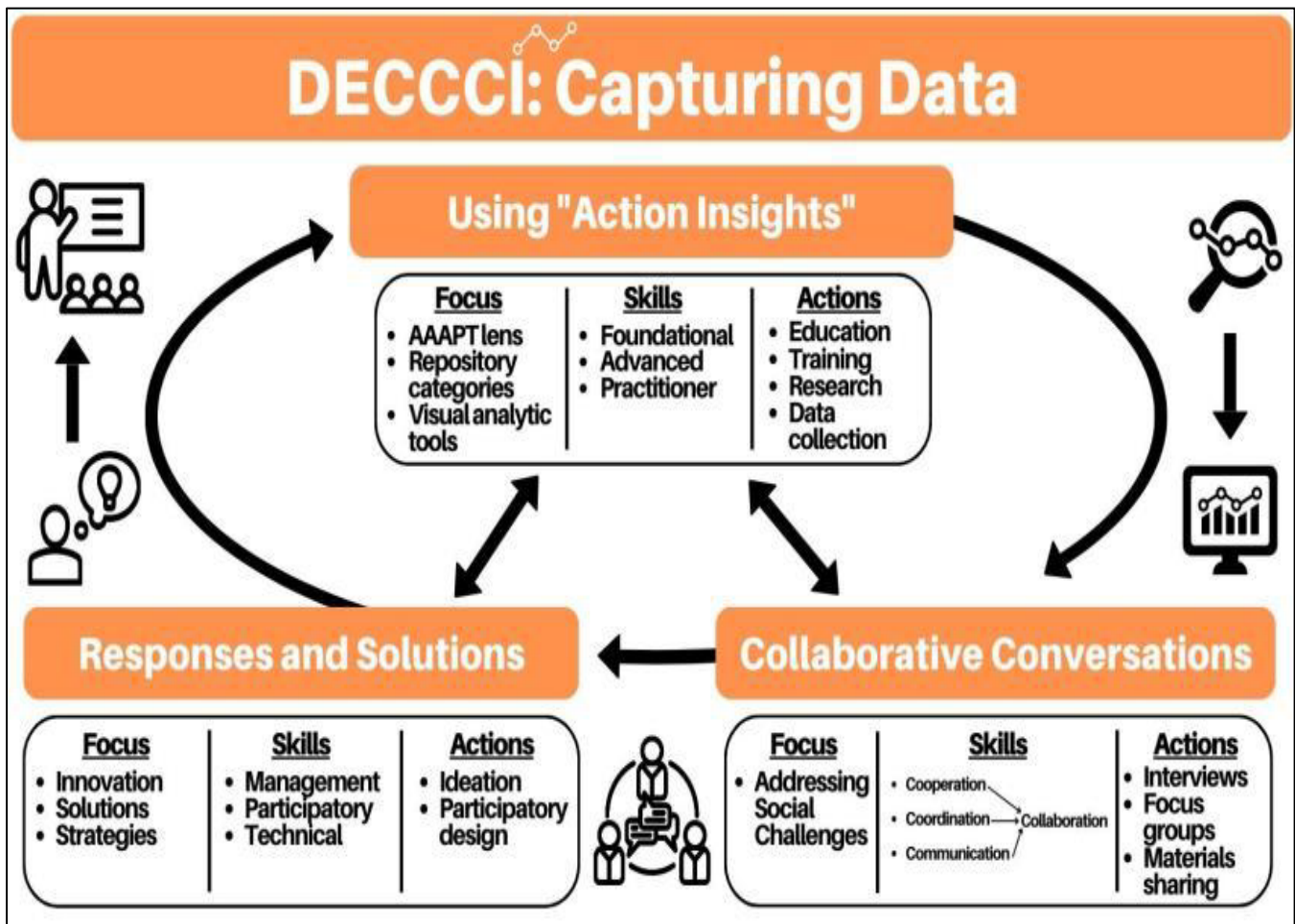


Figure 5. DECCCI assessment process flow chart.

Recognized Patterns and Trends

From the data collection, sorting, coding, and visualization, three content domains emerged as the core areas of interest: **education, policy, and economy**. A fourth domain, **communication**, was viewed as a “process” domain that *cut across* all the content domains. A pattern analysis of the assessment data recognized that the areas of **communication** and **education** were of primary importance to understanding the status of University of Delaware (UD) Extension activities to address the impact of climate change. (see Fig.6)

Regarding **education**, there is an increasing emphasis on climate change in universities globally, including at UD. At UD there is a new Office of Sustainability and The Gerard J. Mangone Climate Change Science and Policy Hub. Although the role of UD Extension in climate change education is evolving, Extension agents and personnel engaged in this assessment expressed disinterest, have not learned about and/or do not discuss or use the term “climate change.”

In terms of **policy**, the state of Delaware has shown commitment to climate action through participation in initiatives such as the Regional Greenhouse Gas Initiative (RGGI), renewable energy programs, and recently established a CAP for the state. However, there is limited focus in Extension on these issues and limited work on climate change adaptation responses. UD Extension has little or no involvement with informing the development of DE state climate change policies and there is little evidence of formal, structured collaboration, (e.g., MOU's) between Extension and DE state agencies with respect to climate change. Although national US

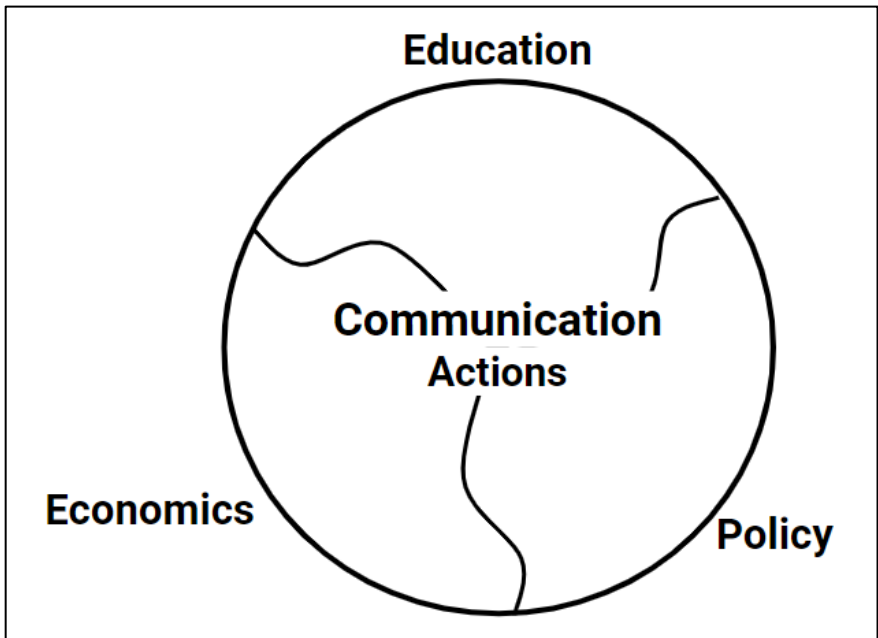


Figure 6. Key domains of the DECCCI assessment.

climate change policy is influenced by international climate change policy such as the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations' Sustainable Development Goals (SDGs) there was little evidence of UD Extensions knowledge or use of those policy materials.

With respect to **economic issues**, some UD Extension agents are aware of, and support, clean and renewable energy initiatives, energy efficiency, transportation programs, and funding conservation programs for climate adaptation programs. Although Delaware agricultural and aquaculture communities receive federal (USDA) funding from the Natural Resources Conservation Service (NRCS) and the Delaware Department of Natural Resources and Environmental Control (DNREC), as well energy saving programs through electric companies and some solar energy installation UD Extension involvement with these climate change efforts is limited.

The findings highlight the need for UD Extension to address the divide within the organization regarding the science and belief in climate change. There is limited support to develop integrated programs that recognize changes in climatic patterns and the use of the term “climate change”. Key areas of potential conflict include:

- Understanding the physical mechanisms underlying climate change.
- Recognizing its impact on ecosystems and agriculture.
- Considerations of diverse social, political, economic, religious, and scientific perspectives.
- Differences in mitigation and adaptation perspectives.
- Developing effective communication skills.

Skills Assessment

To systematically assess UD Extension’s organizational capacity to engage with current climate related activities, a checklist was developed to ascertain the current status of Extension activities. The following charts depict the status of observed skills in DECCCI categorized into the three domains of education, policy, and economy, which are further categorized in terms of “technical” or “process” institutional capacities, group/team competencies, and individual skills. If a capacity, competency and/or skill was observed, it was marked with a “Y,” or yes, and if it was not observed, it was marked with an “N,” or no. If a skill is present, but needs further refinement, it was marked with an “R” as being recognized by personnel but is not yet creating effective change. Some skills may be in between a definitive “Y”, “N”, or “R” status, and were shown with a slash symbolizing this. If the status is blank, further analysis may be needed to distinctly categorize the skill. The following tables offer insight into the activities related to the ability to engage with climate change challenges across all levels of the education, policy and economic domains.

Table 1. UD Extension climate change activities related to education

	Institutional Capacity	Team/Group Competencies	Individual Skills	Status Yes (Y), No (N), Recognized (R)
MACRO	<i>Technical</i>	Strategic climate change plans drafted and reviewed	Drafting	N
		Economics, social impacts of climate change education strategies in place		N
		Comparative knowledge of current national, regional, and state climate change education science, strategies, plans, programs, and projects		R
		Clear climate change education, training, and awareness; pedagogy and systems		R
	<i>Process</i>	Clear vision and plans for including climate change education, access, and DEI issues		R
			Advocacy	R
			Strategic leadership	Y
		Visioning, creating, inspiring	Y	
MID	<i>Technical</i>	Knowledge of linkages and “embedded” impact of climate change across Extension program areas and for constituent populations.		N
		Shared vocabulary for climate change education, training, and awareness including training content design and delivery	Use of climate change related terms and concepts	R
	<i>Process</i>	Workshop/seminar organization/management, participatory decision making; agreed upon clear vision and mission statements	Team facilitation, lesson plans	N
		Results based management – goals, objectives, activities for climate change related responses across communities	Workplans, monitoring, evaluation	N
		Financial and personnel management - resource mobilization	Knowledge of costs/risks of climate change to DE agriculture and other communities	R

		Management issues fully addressed (legitimacy, accountability, transparency)	Aware of climate change equity issues	N
		Cross organization/department/ office climate change education exchanges and training	Able to coordinate and collaborate in educational program delivery	N
		Shared standards for cooperative extension credits for climate change related education		N
		Local, county, state, regional alliances (partnerships) in place for climate change education	Knowledge of cross colleague work areas	N
MICRO	<i>Technical</i>	Climate change education, training, and awareness projects in place - use of, or adaptation of climate change curricula - Media-communication	Workshop planning, topic outlines,	N
		Resource allocation of climate change education, investment appraisal for education and training options		N
		Applications, approaches, and tools	Use of websites, social media presence	N
		IT, GIS and Data integration	Use of GIS to map key variables	N
		Climate change modeling and scenarios	Use of up-to date data methods	R
	<i>Process</i>	Results based management - monitoring and evaluation of education programs (workshops etc.)	Use of logic models for monitoring outcomes	N
		Educational cost/benefit assessments		N
		Project management	Up to date monitoring of activities	N
		HR and personnel and resource management		N

Table 2. UD Extension climate change activities related to policy

	Institutional Capacity	Team/Group Competencies	Individual Skills	Status Yes (Y), No (N), Recognized (R)
MACRO	<i>Technical</i>	Extension climate change adaptation, mitigation, policy and science activities		N
		Advising climate change policy, regulations, and rules		N
		Climate change mainstreaming and implementing policies		N
		Advise drafting and review of climate change related policies, programs, and projects		N
		Economics of climate change impacts and adaptation		N
	<i>Process</i>	Climate change equity, ethics, accountability strategies in place		N
			Visioning, creating, inspiring	N
			Strategic leadership	Y
		Advocacy	Y	

MID	<i>Technical</i>	Delaware counties, state, regional, federal climate change policy dissemination, training, and awareness		N
		Climate change mainstreaming and implementing policies – state, county and municipal budget processes developed		N
		DE stakeholders have clearly defined roles and responsibilities; clear partnerships and alliances in place		N
		Resource allocation processes are clear and disseminated		R
		UD Extension is part of NECI, NEED and other national and cross-regional policy partnerships		R
		Comparative knowledge of policy partnerships and alliances		R
	<i>Process</i>	Shared climate change workplans, objectives and agreed upon policy outcomes		N
		Extension and stakeholder shared results-based management - planning for outcomes		N
		Financial management - resource mobilization		N
		Managing risk assessment processes are maintained		N
		Climate change responses are well documented and agreed upon		N
		Institutional roles and contributions to climate change partnerships are clearly outlined		N
Institutional roles and contributions to climate change alliance building are clearly establish		N		
MICRO	<i>Technical</i>	Climate change modeling and scenarios		N
		Knowledge of climate change science and social impacts		R
		Status of climate change policies - regulatory appraisal for climate change options		R
		Use of Climate change related software applications, comparative approaches and analytic tools		R
		IT, GIS and Data are integrated		R
	<i>Process</i>	Project management		N
		Skills in climate change policy results-based management - monitoring and evaluation; workplan outline		R
		Climate change financial and resource implications and management		R
		HR and resource management		R
		Role of “green economy”, “smart ag” practices Extension programs		--

Table 3. UD Extension climate change activities related to economy

	Institutional Capacity	Team/Group Competencies	Individual Skills	Status Yes (Y), No (N), Recognized (R)	
MACRO	<i>Technical</i>	Knowledge of climate change adaptation economics and science		N	
		Drafting and review of budgets to include climate change assessments		N	
		Diverse climate change related economic models are presented for discussion and uptake		R	
	<i>Process</i>			Strategic leadership	N
		Both climate change mitigation and adaptation included as part of financial planning			N
		Visioning, creating, and inspiring inputs across areas of excellence and cross-functional teams			R
				Advisory	R
MID	<i>Technical</i>	Climate Change related budgets are clearly established		N	
		Climate change financials are part of implementing policies and Extension budget process		N	
		Extension financing and USDA/NIFA grants are clearly understood		R	
		Cross stakeholder processes to build partnerships in place		R	
		“Cost of resilience” models		R	
		Potential new economic “benefits” of climate change impacts (e.g., workforce development, innovation, new crops)		N/R (?)	
	<i>Process</i>	Monitoring climate change resource allocations in a transparent process			N
		Lending, borrowing, credit, banking, financial institutional roles in climate change economic models			N
		Building climate change partnerships			R
		Innovative partnerships and resource allocation			R
		Roles, responsibilities, and accountabilities for climate change shared budgeting are established			--
		Financial management - resource mobilization			--
		Managing finance and agricultural budget issues			Y
MICRO	<i>Technical</i>	Knowledge of different climate change finance models and budgets, including mitigation and adaptation models		N	
		Economics of climate change adaptation - investment appraisal for climate change options		N	
		IT, GIS and Data integration		R	
		Knowledge of new approaches and tools		R (?)	

		Climate change modeling and scenarios		N/R (?)
	Process	Results based management – for finance monitoring, evaluation and workplans		N
		Partnered financial management, shared budget allocations		N
		“Smart Ag” and resource management tools		N/R (?)
		Project management		--

Additional Context Information

Once the skills, competencies, and capacities of UD Extension ‘actors’ were identified, additional information was layered in to give a fuller picture of the context. Thus, the location of UD Extension county offices, the language used in conversations, written materials, and the social networks people are part of was collected, categorized, and transformed into visuals using contemporary visualization software. Additional insights were achieved by analyzing the location of actors and actions, the language of discussion between the actors and action in the form of word clouds, timelines for the actions, and links between actors as they engage in action to form social networks.

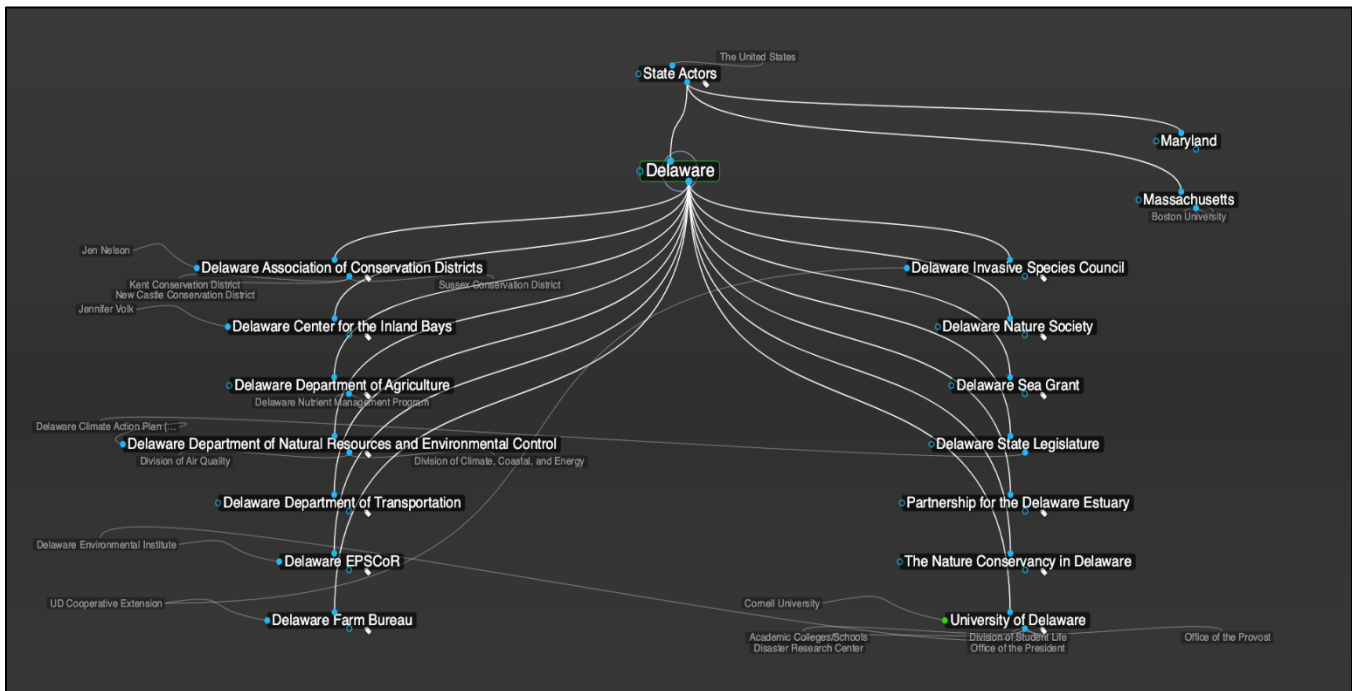


Figure 7. Example social network map, created using *The Brain* software, that helps to visualize the connections / relationships between different Delaware actors involved with climate change activities.

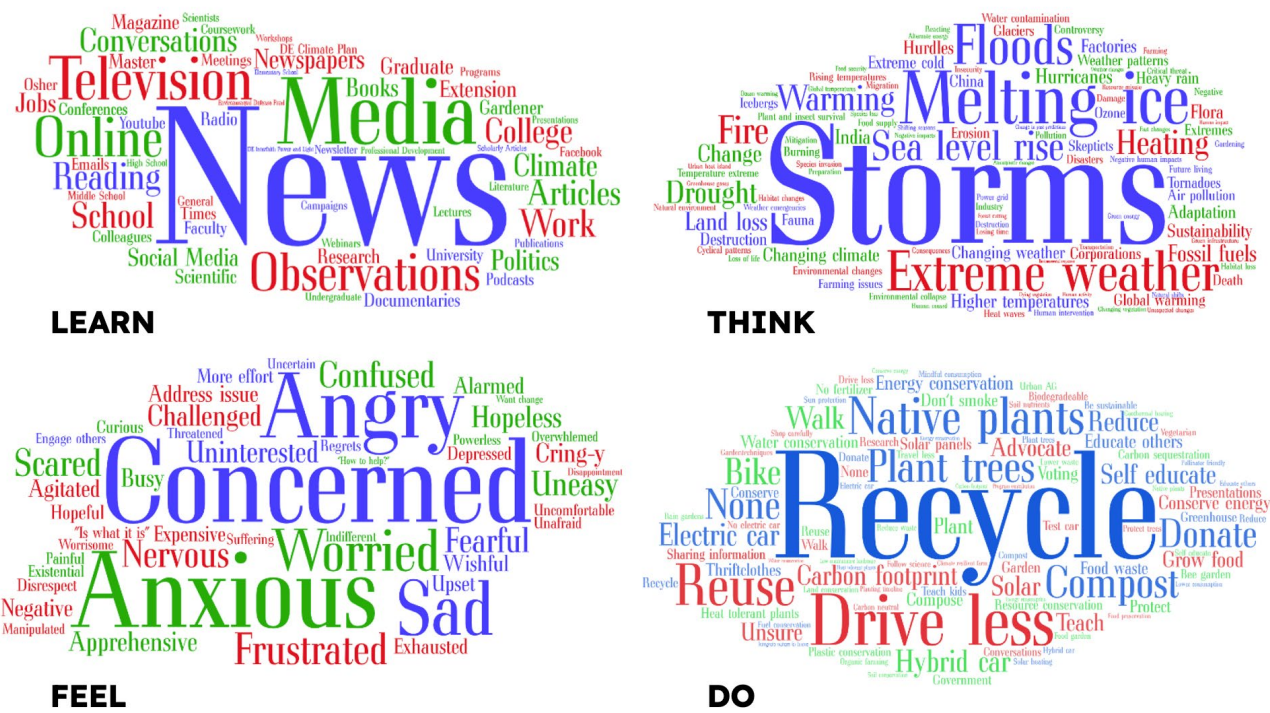


Figure 9. Terms used by UD Extension personnel regarding how they “learn”, “think”, “feel” and “do” with respect to climate change. (Qualtrics poll, N=93, January 2023)

Some media outlets that people use cast doubt on climate science and appeared to contribute to dismissive climate change related beliefs. These beliefs were further elaborated through using the “Six Americas” poll with Extension personnel in March 2023.⁴ The poll, based on work at Yale and George Mason Universities on communication, show that Extension personnel are quite often dismissive of climate change discussions. UD Extension responses as compared to national responses are visible in Fig. 10.

⁴ For further information about the “Six Americas” poll see: <https://climatecommunication.yale.edu/about/projects/global-warmings-six-americas/>

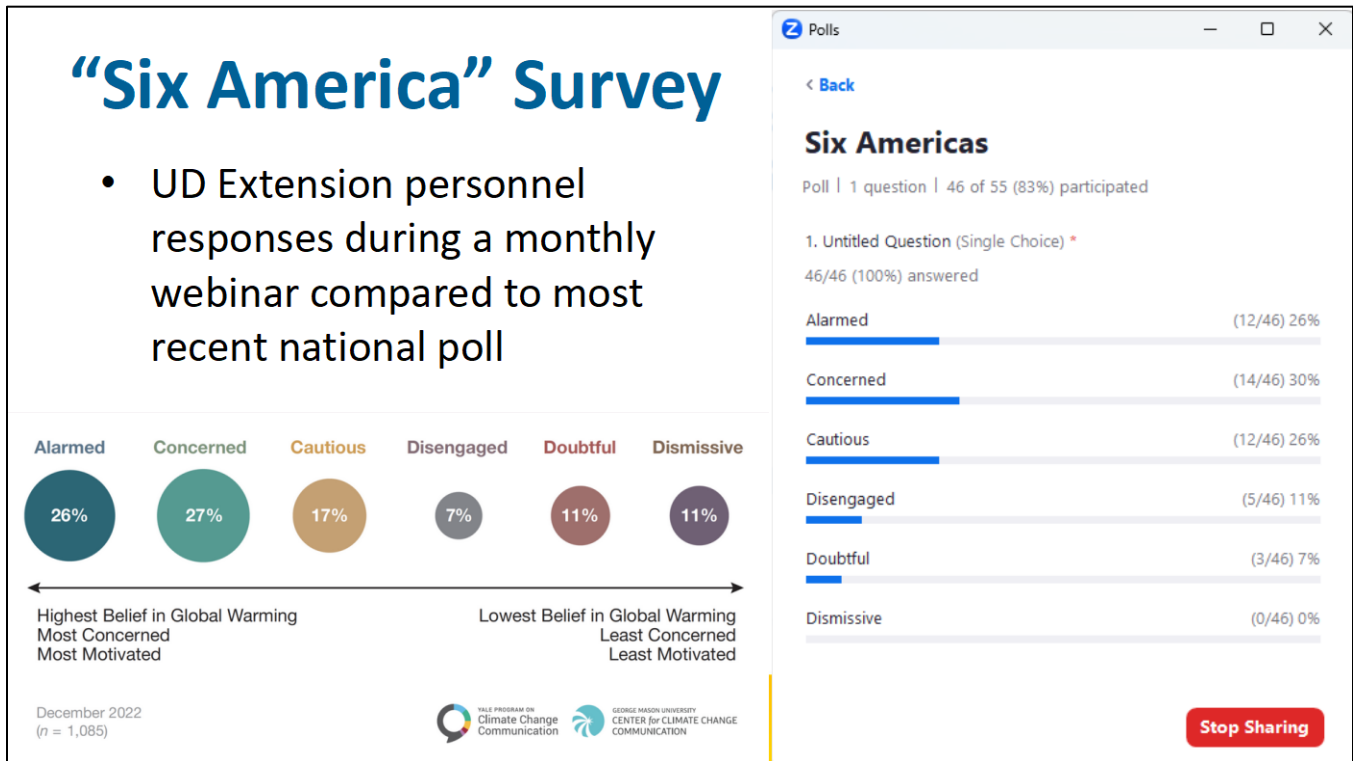


Figure 10. “Six Americas” poll. The national responses (left) are compared to UD Extension responses (right). The poll creates 6 categories of climate change perception. The perceptions inform people’s climate change related actions.

Recent 2022 studies, however, have observed, that although the media outlets casting doubt on climate science can exacerbate dismissive climate beliefs in the public, other communications can counteract negative media effects and change the narrative on climate change by amplifying personal stories and encouraging people to discuss their climate change views with others, especially with family and friends.⁵

New studies are showing the power of sharing perceived experience with climate change (personal and vicarious) to changing social norms, new interpersonal communications, and changes in the media. Clearly, personalizing, and localizing people’s lived experience of the impact of erratic and extremes in weather patterns, as well as articulating the perceived norm that most people care about the issue and support taking action, may be important information and communication strategies.

Personalizing and localizing communication about the impact of climate change on friends, family, neighbors, and colleagues can increase perceptions that others have experienced its effects and strengthen normative beliefs that other people care about the issue. Together, these strategies may encourage people to change their minds about climate change in a positive direction.

Thus, Extension can offer place-based communication strategies to bring attention to the local effects of climate change in ways that can be directly experienced, and these may be especially effective when paired with trusted local Extension agents and specialists. Extension can hold movie events and

⁵ Ballew, M. T., Marlon, J. R., Goldberg, M. H., Maibach, E. W., Rosenthal, S. A., Aiken, E., & Leiserowitz, A. (2022). Changing minds about global warming: vicarious experience predicts self-reported opinion change in the USA. *Climatic Change*, 173(3), 1-25. <https://climatecommunication.yale.edu/publications/experience-with-global-warming-is-changing-peoples-minds-about-it/>

facilitated dialogues to address people's feelings and actions with respect to climate change. The "forums" may offer the opportunity to discuss issues that may not have had an accessible arena for communication, especially to amplify personal impact stories.

Climate related communication needs to become an integral part of UD Extension outreach and training. Along with helping the agricultural and natural resource sectors, UD Extension can begin to work more closely with local leaders in schools, museums, Delaware State, and other Delaware universities.

Properly implemented, such initiatives could provide a platform for "dynamic conversations" for DE students, teachers, parents, and the broader public. Strengthening climate change communication skills as part of UD Extension activities would provide greater opportunities to explore, learn, and understand what climate change means and how it relates to promoting personal, community and state health and well-being.

Education

Given the increased emphasis on climate change that is emerging, new course offerings are being introduced in universities around the world. At UD, there are a number of climate change oriented initiatives, including the creation of a Gerard J. Mangone Climate Change Science and Policy Hub (Climate Change Hub), and new, related courses. Thus, the role of UD Extension regarding education is an area to be further reviewed with respect to new and emerging education discussions.

Climate change related topics, as part of various fields of studies, have begun to offer people the opportunity to explore climate change from a variety of disciplinary perspectives while gaining a firm grounding in basic physical, ecological, and social science as well as the role of climate history, philosophy, and the arts. However, there are also calls for greater educational changes. There are calls, for example, that climate change education needs to be transformational and that "inter", "multi" or "cross" disciplinary perspectives are not sufficient. Perhaps, a new climate change discipline is created.

Extension can help conceptualize, educate, and train people to address the *complexity* of the interconnected issues emerging with respect to the alteration of Earth's climate and environment. In this regard, climate change "education" encompasses technical knowledge about the climate system, climate science, climate change impacts, and also includes components such the relationship of climate change issues to decision-making, social justice, behavior change, and connections between climate change and economics.

For "doubtful" audiences---including UD Extension agents – the opportunities to learn more about climate change and capitalize on opportunities is essential. UD Extension can deliver current climate science information and embrace grassroots momentum toward local adaptation solutions. UD Extension can help people with differing climate change views successfully adapt their agricultural practices and farming practices based on their unique needs and aspirations.

In practical terms, the integration of quality climate change learning into existing education systems requires reconsideration of existing approaches by developing a system that equips learners with the requisite skills, knowledge, and attributes to deal with future challenges.

UD Extension should adapt climate change education strategies and:

- Develop programs focused on making climate change information personally relevant and meaningful for learners.

- Engage learners in activities (e.g., debates, small group discussions, laboratory investigations, simulations, field trips etc.).
- Design programs specifically to uncover and address misconceptions about climate change.
- Engage in designing and implementing projects to address some aspect of climate change (e.g., energy saving, emissions reduction, change of environmental behaviors).

Nationally (and globally) these options are all under discussion and there is no prescription as to which approach is the best one. A decision about the most adequate method depends on the local context, available expertise, and socio-economic settings.

In UD Extension, people recognized the gap in knowledge about international, national, and regional climate change efforts, as well as limited understanding of activities at the University of Delaware and local cities and towns. This includes limited knowledge of the “Delaware Climate Action Plan” and various Delaware climate change related policy initiatives. The UN Framework Convention on Climate Change (UNFCCC) and its call for educational and public awareness campaigns had limited recognition as did US federal climate change initiatives. Those actions were sometimes characterized as “government overreach” and/or “biased science.”

UD Extension could begin to integrate climate change information by offering adult education classes, adapting current 4H and health workshops and include Extension as part of UD environmental or sustainability studies programs. Currently, UD Extensions’ role in these activities was limited to a few interested individuals.

In summary, climate change education is a controversial topic for UD Extension personnel and there is a divide within UD Extension regarding the “science” and “belief” in planetary changes in climate. Ideas regarding Extension’s education role are similarly divided: Extension can continue with existing models of focusing on “environmental sustainability” or develop “integrated” programs that recognize changes in climatic patterns and serve as a paradigm shift. To support this shift, the following areas of climate change education should be emphasized:

- Introduce and discuss the physical mechanisms underlying Earth’s changing climate and the drivers of uncertainty in future climate projections.
- Recognize the impact of global climate change and local weather changes on Earth ecosystems, agriculture, communities, public health, economies.
- Explain the relationship between human patterns of interaction between cultures, societies, and climate change while considering historical, socio-political, economic, religious, and scientific perspectives.
- Explore the differences that “mitigation” and “adaptation” perspectives create in addressing climate change challenges.
- Develop the ability to synthesize and effectively communicate the complexities and uncertainties of social change with respect to possible solutions to climate change.

Policy

International climate change policy is guided by the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations’ Sustainable Development Goals (SDGs). Both emphasize the need for urgent action on climate change mitigation and adaptation. Nationally, US climate change policies are complex, influenced by global developments, public and private stakeholders, state

legislators, private companies and varied political perspectives on climate change mitigation and adaptation. Within Extension there was very little knowledge or utilization of international or national climate change policy materials in Extension programming.

Even at the Mid-Atlantic regional and Delaware state levels, policies to reduce greenhouse gas emissions, often defined by national or sub-national jurisdictions, were not included in current Extension programs. There are numerous organizations and individuals who have been actively advocating for climate change action in Delaware. Some notable organizations in the state include the Delaware Sierra Club, the Delaware Nature Society, and the Delaware Interfaith Power and Light. Additionally, various environmental activists, scientists, politicians, and community leaders have been advocating for climate change mitigation and adaptation measures in Delaware.

In Extension, only a few individuals were aware of some of the national, regional, and state policies, but there was no evidence of these policies being integrated into current Extension activities. These few Extension personnel were aware that these policies often include carbon pricing mechanisms, regulations, government spending, and approaches focused on information sharing and education. In Delaware, and certainly with Extension personnel, past and present climate change policy responses are viewed as primarily focused on mitigation through clean and renewable energy initiatives, energy efficiency, transportation, and agricultural practices such as “no till,” with limited emphasis on adaptation.

State actors in Delaware that are actively engaged in addressing climate change include government agencies such as the Delaware Department of Natural Resources and Environmental Control (DNREC). DNREC authored the 2021 “Delaware’s Climate Action Plan” which only a few individuals in UD Extension were aware of. There is no official partnering between DNREC and UD Extension to support implementation of the plan although DNREC personnel would like to be more closely allied with UD Extension. Both agencies work on various initiatives to mitigate and adapt to climate change, including reducing greenhouse gas emissions, promoting renewable energy, protecting coastal areas from and adapting these areas to sea-level rise, and implementing sustainability measures, however there was no formal partnering or collaboration on these efforts.

In terms of policy, the state of Delaware has shown commitment to climate action through its participation in the Regional Greenhouse Gas Initiative (RGGI) and the establishment of energy conservation codes. Delaware has also implemented various renewable energy and energy efficiency incentive programs. However, there is limited evidence of a focus on *adaptation* response in state policies and a lack of collaboration across state agencies in addressing climate change.

To help implement the Delaware Climate Action Plan, UD Extension could play a crucial role in supporting Principle No. 1: Ensure Climate Action is Ambitious yet Adaptable. UD Extension can assist with the implementation of the Action Plan through several actions, including:

- **Support research on climate change impacts in Delaware:** UD Extension can support research efforts to address gaps in knowledge that would improve the effectiveness of local/state policies to adapt to and mitigate climate change. This could include recognizing the effects of rising sea levels, changing precipitation patterns, and increased temperatures on various sectors such as agriculture, coastal communities, and infrastructure.
- **Increase the number of resilience pilot projects and demonstration sites in Delaware:** UD Extension can collaborate with local communities, organizations, and government agencies to establish pilot projects and demonstration sites that address new policies, showcase innovative and practical climate resilience strategies. These projects can focus on areas such as sustainable agriculture, energy efficiency, renewable energy, coastal zone management, and urban planning.

In addition, UD Extension could partner with DNREC and other local, state, and regional actors to contribute to policy implications and to the other principles of the Climate Action Plan as well. This could include assistance to:

- **Develop targeted communication tools and messages about climate change:** UD Extension can create educational materials, fact sheets, and online resources that provide accurate and accessible information about climate change and its impacts in Delaware. These tools can be tailored to different audiences, including the general public, policymakers, businesses, and community organizations.
- **Increase the availability of collaborative climate change related programming:** UD Extension can assist DNREC and other agencies to organize workshops, seminars, and training sessions on climate change mitigation and adaptation strategies. These educational programs can target various stakeholders, including farmers, small business owners, homeowners, local government officials, and educators.
- **Support policy related outreach programming to businesses to help them understand and build resilience to climate change impacts:** UD Extension can work closely with businesses across different sectors to raise awareness of policy and programs that enable Delawareans to be more resilient. This includes raising awareness about the risks and opportunities associated with climate change. This can involve offering guidance on incorporating climate resilience measures into business operations, supply chains, and long-term planning.
- **Foster partnerships and collaboration:** UD Extension can serve as a bridge between different stakeholders, facilitating collaboration and knowledge exchange among government agencies, community organizations, businesses, and residents. By fostering partnerships, UD Extension can help ensure that climate action initiatives are inclusive, equitable, and responsive to the needs of vulnerable communities.

Overall, UD Extension can contribute to Delaware climate change policy initiative by assisting with the implementation of the Delaware Climate Action Plan and other policy work through research, education, outreach, fostering partnerships, and promoting climate resilience strategies across various agricultural sectors.

Economy

Although Delaware has taken several steps to address the economic impact of climate change, primarily through the promotion of clean energy. However, there are a number of new and emerging economic models that are being introduced to explore how to mitigate and adapt to the impact of climate change. This includes the introduction of “green” and “blue” economic models. Both green – agriculture – and blue – aquaculture – share the same principle: i.e., “adapt to, or transform the current economy towards a more sustainable one”. To implement the green/blue economies requires “circular” economic practices.

Green/blue and circular economic frames have been developed to offer an alternative to traditional economic models based on the principle “take, make, and dispose”. Circular economies, recycle, reuse, and repurpose. Circular economic practices now use innovative technologies to create “smart agriculture.” In practice, these new economic models are related to each other, are “embedded”, and complementary, as seen in Fig. 13.

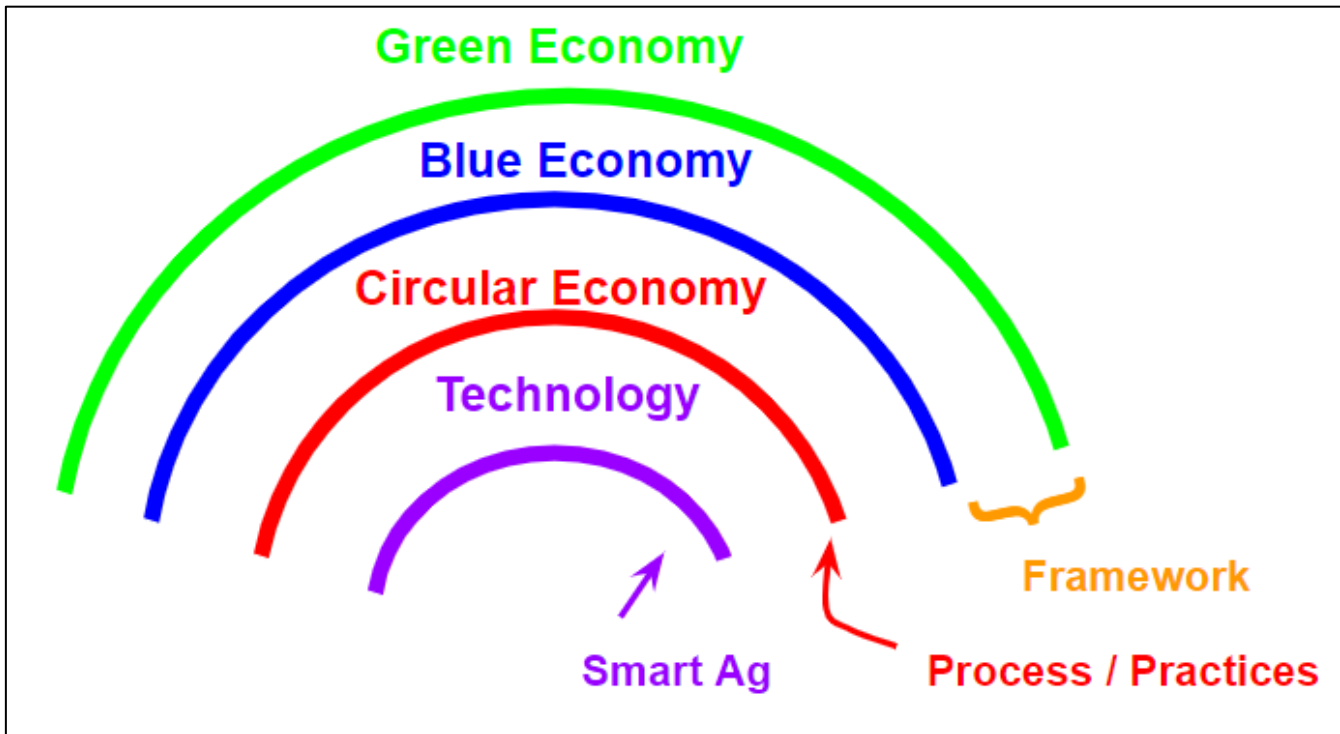


Figure 11. Substantive “embedded” areas of evolving economic discussions. Although rigorously debated by many economists, “green” (and “blue”) as well as “circular” economic models are not discussed in UD Extension

In Delaware, the most current economic models are quite “traditional” and “linear” they are primarily focused on setting renewable energy goals and establishing programs to reduce greenhouse gas emissions in transportation and energy production. Some of the key policies and initiatives in Delaware include:

- **Renewable Portfolio Standard (RPS):** Delaware has a mandatory RPS that requires utilities to obtain a certain percentage of their electricity from renewable sources. The RPS goal is to achieve 25% of the state's electricity from renewable energy sources by 2025.
- **Greenhouse Gas Reduction Plan:** Delaware developed a Climate Framework in 2013, which includes a plan to reduce greenhouse gas emissions. The state aims to reduce emissions to 30% below 2008 levels by 2030.
- **Energy Efficiency Programs:** Delaware offers various energy efficiency programs to encourage the adoption of energy-saving technologies and practices in residential, commercial, and industrial sectors. These programs aim to reduce energy consumption and lower greenhouse gas emissions.
- **Offshore Wind Development:** Delaware is exploring the potential for offshore wind energy. The state has supported research and development activities and entered into agreements with offshore wind developers to pursue wind energy projects off the Delaware coast.
- **Transportation Initiatives:** Delaware has implemented programs to promote electric vehicles (EVs) and the installation of EV charging stations. The state offers financial incentives and grants to support the adoption of EVs and increase charging infrastructure.

Delaware climate change related economic policies have evolved over time, most recently with the passing of the Delaware Climate Change Solutions Act (HB99), a landmark piece of climate change-related legislation that requires the state of Delaware to:

- Set state greenhouse gas emissions reduction targets to at least 50% by 2030
- Achieve net zero emission status by 2050
- Take climate change and the newly established emissions goals into account when passing regulations and pursuing new business investments
- Update the Climate Action Plan every five years
- Ensure that emission reduction strategies do not disproportionately impact overburdened communities

Accompanying the Climate Change Solutions Act, several other key clean energy and transportation bills were also passed, including: HB10, which requires 30% of Delaware’s school buses to be electric by 2030; HB11, which requires all new large commercial construction be built solar installation ready; HB12, which codifies and expands the state’s electric vehicle (EV) rebate program to include used EV’s; and SB51, which bans all Styrofoam and single-use plastics statewide.

Unfortunately, however, there is little evidence of the introduction of “green” or “blue” economic models, or of discussions of what a “circular economy” would mean in Delaware. UD Extension has not contributed significantly to these evolving discussions with little to no evidence of information, workshops, or other programs or projects pertaining to these key focus areas. To many, these topics are viewed as new and “future” directions.⁶

Recommendations and Future Action

Recommendations

UD Extension, by taking the lead and creating a “niche” as educator and facilitator across sectors can engage the stakeholders and foster collaboration, coordination, and communication. These recommendations aim to enhance climate change education, communication, policy development, and economic strategies within Delaware. By prioritizing these actions, UD Extension can make significant progress in addressing climate change challenges and promoting sustainability.

Communication

- Provide training for Extension personnel in climate change communication skills and tools for climate research.
- Integrate climate change language into UD Extension outreach, education, and training.
- Collaborate with local leaders in schools, museums, and universities to use the arts, sports, leisure and new communication technologies to disseminate and introduce climate change adaptation and resilience strategies.
- Develop programs focused on climate change that bridge the gap between Extension and UD colleges, departments, and communities.

⁶ For definitions and literature review of green and circular economic models see: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9048093/>

Education

- Develop Delaware-specific climate change materials and training opportunities for/with UD Extension.
- Implement a phased educational and communication approach tailored to different audiences across Delaware.
- Focus on communities and individuals with indifferent opinions about climate change.
- Concentrate efforts on local climate change impacts and specific threats.

Policy

- Clarify the distinction between "mitigation" and "adaptation" activities specific to Extension.
- Introduce information about Delaware's climate change policies and support their implementation to both staff and clientele.
- Disseminate climate change and sustainability research across Extension and for use by public/target audiences through workshops and education.
- Advise for policies that address the impacts of climate change while recognizing cultural variations

Economy

- Introduce information foster conversations about emerging economic models such as "green" and "blue" economic frameworks and circular economy principles.
- Collaborate with UD departments and DE economic development agencies to identify opportunities for green and sustainable economic growth and workforce development initiatives and programming.

Future Action

In Delaware, given the role of UD Extension in education and as a facilitator of the transfer of information, the responsibility for implementing the recommendations outlined in the different areas can be distributed among multiple stakeholders, including government agencies, educational institutions, community organizations, and Extension services. The following are concrete ideas and practical “checklists” of activities and tasks that would support increased engagement of Extension in climate change related activities across Delaware, the region and nationally.

Table 4. Checklists and timelines for implementation of recommendations

	DECCCI Recommendations	Communication Strategies	Actions	Timeframe			Key Partners and Stakeholders
				Short	Medium	Long	
Education	Clarify the distinction between “mitigation” and “adaptation” activities.	Enlist experts to provide background about mitigation and adaptation Provide up to date background materials	Contact key stakeholders	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	University of Delaware, Climate Hub, related departments and colleges, such as CANR, EOEC, Department of engineering
	Develop Delaware-specific climate change materials and training opportunities	Develop websites and disseminate information platforms	Use and adapt as needed for UD Extension, national and regional training materials	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Extension Personnel, EOEC, CANR, Office of Sustainability, UD, DNREC
	Tailor educational efforts to diverse audiences	Create community climate conversations highlighting local climate change adaptation	Adapt national and regional training materials to fit Delaware context	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	UD Extension, UD Department of Education, Biden School
	Focus on receptive individuals as well as “cautious” and “disengaged” who lack strong opinions about climate change.	Initiate practical problem-solving discussions to address future uncertainty and economic concerns	Adapt national and regional training materials to fit Delaware context	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Extension 4H and Agricultural Programs, Community Organizations such as food banks, Sierra club, nature conservancy, Farm Bureau, Department of AG,
	Enhance education and capacity building among Extension agents and the general population	Organize practical problem-solving hands-on demonstrations or pilot programs across Delaware to address future uncertainty and economic concerns	Design UD Extension focused activities and workshops Adapt, adopt, design new DE focused certification programs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	DNREC, NRCS, county conservation, NECI, NEED, Northeast climate change Hub, USDA, NIFA, UD Office of Sustainability

		related to climate change.					
	Develop locally adapted climate change programs and projects	Develop and promote community climate conversations that highlight local climate change adaptation initiatives and success stories		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Local garden clubs, local farm agencies, master gardeners, DNREC, NRCS county conservation, SEAGrant, municipal committees, local religious organizations
Policy	Increase understanding and support of climate change policies	Enlist experts to provide background about mitigation and adaptation for future use	Contact key stakeholders	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DNREC, UD experts, state legislator, US senators and representatives, Biden's School, Extension
	Provide information about Delaware's climate change policies and activities.	Develop websites and disseminate information platforms	Create and adapt national and regional policies to fit Delaware context	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DNREC, UD experts, state legislator, US senators and representatives, Biden's School, Extension
	Clarify the relationship between Extension activities and other Delaware stakeholder mitigation/adaptation activities	Create community climate conversations highlighting Extension's role in communicating about climate change policy	Use other national Extension materials	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NECI, Extension, NEED, FEMA, USDA, NRCS, county conservation, Delaware Legislators, DNREC
	Collaborate with relevant stakeholders, including government agencies, businesses, and community organizations, to develop and implement effective climate change policies	Develop and promote community climate conversations that highlight local climate change adaptation initiatives and success stories	Create and adapt national and regional policies to fit Delaware context	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	DNREC, UD experts, state legislator, US senators and representatives, Biden's School, Extension

	Advocate for policies that recognize and respect cultural variations within Delaware.	Create locally adapted climate change programming for DE counties and municipalities as public awareness grows, focusing on actionable steps and solutions	Create and adapt national and regional policies to fit Delaware context, specifically focusing on equity and recognition of historically underrepresented populations	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	DNREC, UD experts, state legislator, US senators and representatives, Biden’s School, Extension
Economy	Introduce information about emerging economic models and <i>technical aspects of smart agriculture, i.e., green, blue, circular economies</i>	Initiate practical problem-solving discussions to address future uncertainty and economic concerns	Create and adapt national and regional economic models to fit Delaware context, i.e., no-till, solar panels, organic farming, agroecology	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	UD, business college, community colleges, DelTech, Dept of labor/commerce
	Identify local and community workforce development agencies, and organizations regarding climate change related programs	Create community climate conversations highlighting economic implications and potential alternatives	Liase with Delaware state, county, local workforce development activities, i.e., composting, recycling, energy initiatives	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Delaware technical college, high schools, and other workforce development areas of focus
	Promote collaboration with relevant stakeholders to incorporate emerging economic frameworks into their financial practices	Develop appropriate economic models for counties, municipalities, and agricultural communities		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Researchers, department of finance/commerce

Leadership and the Future Role of UD Cooperative Extension

UD Extension has a significant responsibility when it comes to responding to climate change. As representatives of Delaware's largest higher educational institution, UD Extension has the power and influence and shape policies, regulations, voluntary programs, and other actions that address the impacts of climate change. In this context UD Extension personnel have an important leadership role to play by:

1. **Acknowledging the Reality of Climate Change:** UD Extension can publicly acknowledge the scientific consensus on climate change and recognize its impacts on Delaware's environment, economy, and communities. Accepting this reality is essential for informed decision-making and policy development.
2. **Developing and Implementing Climate Related Action Plans:** Extension can lead work to help design and implement comprehensive climate action plans that outline specific strategies and targets for reducing greenhouse gas emissions, transitioning to clean energy sources, enhancing resilience to climate impacts, and promoting sustainable development.
3. **Setting Realistic, Ambitious and Achievable Goals for UD Extension:** Extension can set ambitious but attainable goals that reduces greenhouse gas emissions, supports renewable energy adoption, and other climate-related metrics. These goals could be based on scientific evidence and align with national and global targets to limit global warming. Maybe a sentence about leading by example?
 - **Holding Themselves Accountable:** UD Extension agents are ultimately accountable to their constituents for their actions and decisions related to climate change. This includes regularly reviewing progress towards climate goals, report on achievements and setbacks, making adjustments and adapting to a changing environment as needed to maintain the health and wellbeing of ALL Delaware residents.
 - **Leading by Example:** Finally, UD Extension, as trusted leaders can lead by example, demonstrating their commitment to climate action through personal and organizational actions that promote sustainability, energy efficiency, and responsible environmental stewardship.
4. **Engage in the Development of Climate Policy at the State and Federal Levels:** UD Extension program leaders can engage in the development of strong and science-based climate policies and funding programs at the state and federal levels. This can involve supporting initiatives to address climate change, issues of food security, water management, recycling, waste reduction, reforestation, clean energy , and collaborate with other states and the federal government to drive meaningful and effective action.
5. **Engaging with Stakeholders and Communities:** UD Extension can use its community engagement with various stakeholders, including community members, businesses, environmental organizations, and academic institutions, to ensure that climate action plans reflect the needs and concerns of diverse populations.
 - **Supporting Renewable Energy and Sustainable Practices:** Extension can promote the adoption of renewable energy sources such as wind, solar, and geothermal power. It can also encourage energy efficiency measures, and other practices that reduce the state's carbon footprint.

- **Building Climate Resilience:** UD Extension can prioritize initiatives that increase the state's resilience to climate impacts, such as rising sea levels, extreme weather events, and changing precipitation patterns. This includes supporting investment in infrastructure upgrades (e.g., NRCS programming), disaster preparedness, sustainable agriculture, and natural resource management.
- **Promoting Environmental Education and Awareness:** UD Extension can support initiatives that raise public awareness about climate change and its impacts. Environmental education and outreach programs with 4-H can help mobilize the public and garner support for climate action.

Ultimately, the responsibility of UD Extension personnel is to act decisively and collaboratively to maintain the well-being of Delaware citizens by addressing climate change and safeguarding the future for the next generation. Climate action is a complex and urgent challenge, and effective leadership by UD Extension is crucial for promoting positive change throughout the state.

Appendix A – Delaware’s Changing Climate

Though Earth’s climate is dynamic and in constant flux, today’s rising temperatures and changing precipitation patterns cannot be explained by natural factors alone. Throughout the scientific community, there is a clear consensus that increases in atmospheric gases – like carbon dioxide and methane – are fueling climate change. As a result, in the state of Delaware, temperature extremes are expected to increase, heat waves will become longer and more frequent, and the growing season will continue to lengthen. Additionally, more frequent extreme weather events that can result in storm damage and flooding are expected along with drastic increases in the rate of sea level rise along Delaware shorelines.

Though Delaware is the second smallest state in the U.S., it is still large enough to produce some stark climatic differences across its land area. Since Delaware is part of the Delmarva Peninsula, its climate is greatly influenced by the Atlantic Ocean and Delaware Bay to its east and the Chesapeake Bay to its west. Additionally, with a mean elevation of only 60 feet and altitudes ranging from sea level (0 feet) at the coast to 450 feet above sea level at its highest point along the Pennsylvania border, Delaware’s status as the lowest-lying state in the nation also greatly impacts its climate.⁷ Measurements from weather stations across Delaware dating back to 1895 show that the state’s mean annual temperature has been rising at a rate of 0.2°F per decade, or approximately 2°F over the last century. As a result of this increasing temperature trend, Delaware experiences fewer nights with minimums below 32°F and more nights with minimums above 75°F. **Error! Bookmark not defined.**

With regards to precipitation, rain patterns in Delaware remain highly variable with no clear trends on an annual average basis. However, there does appear to be an increase in precipitation occurring during the fall months, where statewide precipitation has been increasing at a rate of 0.27 inches per decade.⁸ Similarly, as statewide precipitation rates increase, so too does relative sea level rise projections. Since 2009, the state of Delaware has had future SLR projection scenarios in place for use in long-term planning and coordination efforts. Each scenario was integrated into numerous town and county plans and formed the basis for the formation of the Delaware Sea-Level Rise Vulnerability Assessment and Adaptation reports, the Delaware Climate Impact Assessment, and Executive Order 41: Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions.⁹ However, since 2009, much research has been conducted to determine if new sea level rise scenarios should be recommended for use in Delaware long-range planning activities. **Error! Bookmark not defined.**

⁷ Center for Environmental Monitoring and Analysis (2022). “DNREC Climate Change Analysis for Delaware and the Delaware Estuary.” *Center for Environmental Monitoring and Analysis*. <http://cema.udel.edu/research/dnrec-climate-change.php>

⁸ Delaware Department of Natural Resources and Environmental Control (2014). *Delaware Climate Change Impact Assessment*. Division of Energy and Climate, Delaware Department of Natural Resources and Control. https://documents.dnrec.delaware.gov/energy/Documents/Climate%20Change%202013-2014/DCCIA%20interior_full_dated.pdf

⁹ The Delaware Geological Survey (2020). “Determination of Future Sea-Level Rise Planning Scenarios for Delaware.” *The Delaware Geological Survey*. <https://www.dgs.udel.edu/projects/determination-future-sea-level-rise-planning-scenarios-delaware>

According to the Delaware Sea Level Rise Technical Committee's 2017 report titled *Recommendations of Sea-Level Rise Planning Scenarios for Delaware*, planning scenarios for sea level rise throughout Delaware correspond to increases of mean sea level in Delaware by the year 2100 of 1.53 m / 5.02 ft (High scenario), 0.99 m / 3.25 ft (Intermediate scenario), and 0.52 m / 1.71 ft (Low scenario).¹⁰ As a result of these projections, it is the recommendation of the Delaware Sea Level Rise Technical Committee to use the 5% (Low), 50% (Intermediate), and 95% (High) probability levels of sea-level rise in Delaware as the state's Low, Intermediate, and High planning scenarios respectively. **Error! Bookmark not defined.**

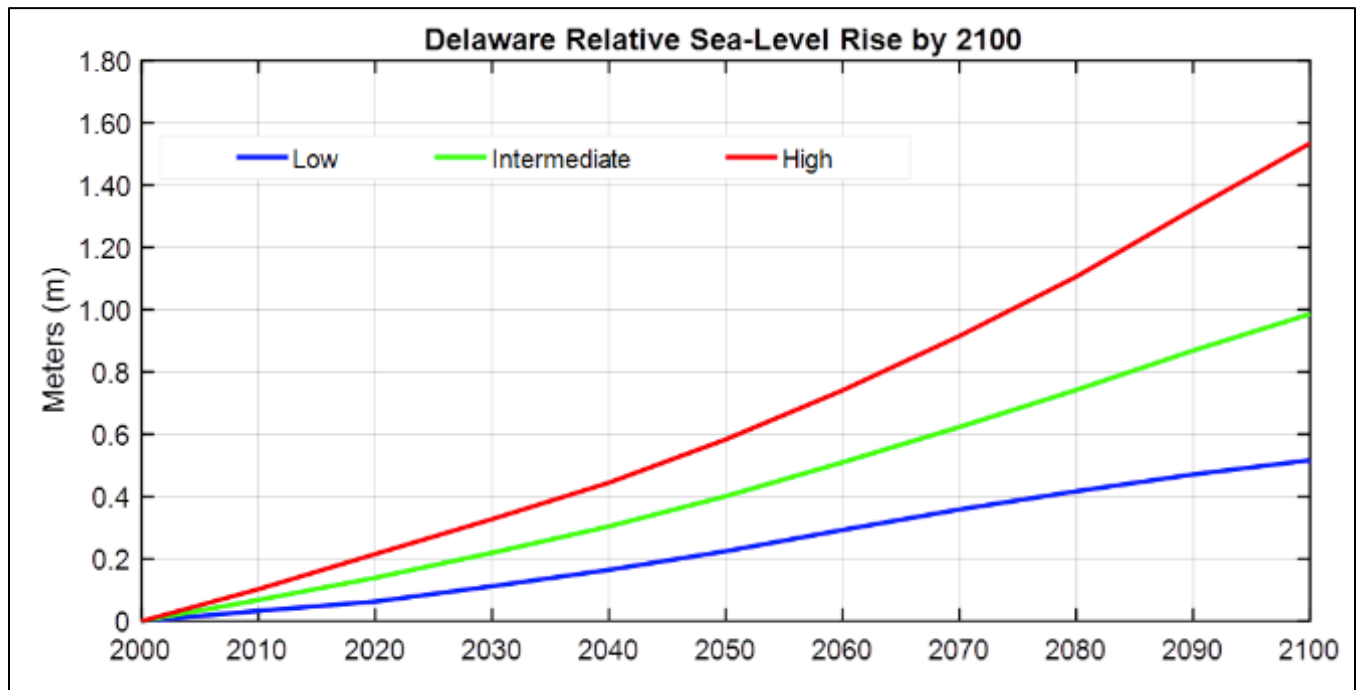


Figure 12. The 2017 Delaware SLR planning scenario curves to the year 2100, relative to 2000 MSL. (Courtesy of the 2017 *Recommendations of Sea-Level Rise Planning Scenarios for Delaware* report)

¹⁰ Callahan, J., Horton, B., Nikitina, D., Sommerfield, C., McKenna, T., and Swallow, D (2017). *Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report*, Delaware Sea Level Rise Technical Committee.
https://www.dgs.udel.edu/sites/default/files/projectsdocs/DE%202017%20SLR%20Technical%20Report_Mar2018.pdf

Appendix B - Research Methods

Basic to Action Insights, as a qualitative, sociological method, is the understanding that all human societies are made up of people engaging in universal actions, but the way they act produces diverse and unique cultures. Sociology recognizes that for a society to function – and humans to survive – there are five universal and basic “domains”, or “categories of action”. These are:

- **Family** – bonding, sexuality, and reproduction
- **Economy** – production, distribution and exchange of goods and resources
- **Education** – learning and sharing of knowledge
- **Polity/policy** – authority, roles, status, and social order
- **Religion** – beliefs in the unknown

Domains can be further categorized into “levels.” “Education,” for example, can be studied at a micro level as the role of the individual with respect to skills in reading, at a mid-level with respect to skills related to instructional design and at a macro level with respect to the structure of the school system and pedagogy. All information can be coded by domain and level and loaded into a data repository.

This standard model for categorizing information was used to organize, categorize, and analyze all the information gathered in the data collection and field work activities. This method of continual sorting and categorizing allowed – very quickly – for the patterns of “education”, “communication”, “policy” and “economy” to emerge as people’s priority areas of focus with respect to climate change activities in Delaware and UD Extension.

Data Collection Activities and Field Work

The “4 Questions Poll”

To gain insights into the current role of climate change in Extension programming, it was first necessary to understand key stakeholder perceptions about climate change in general. To gather the climate change related terms that people use in Delaware and UD Extension, a “quick poll” was designed that asked 4 basic questions about climate change. First piloted at the UD College of Agriculture and Natural Resources (CANR) Fall Festival in September 2023, the poll was then sent to all Extension personnel in October 2022, disseminated at UD Ag Week in January 2023, at PASA conference in 4 February 2023, a UD Earth Day and UD “AG Day” in April 2023. All responses were anonymous and simply organized by color to identify “student”, “staff/faculty” and “community” groupings. Over 200 responses were collected over the course of the research initiative. All data were merged, and the visualizations below show evidence of the language patterns that were clearly evident from all of the polls.



Figure 13. (A) Questions included in the "4 Questions Poll"; (B) collecting poll responses at UD CANR Fall Fest

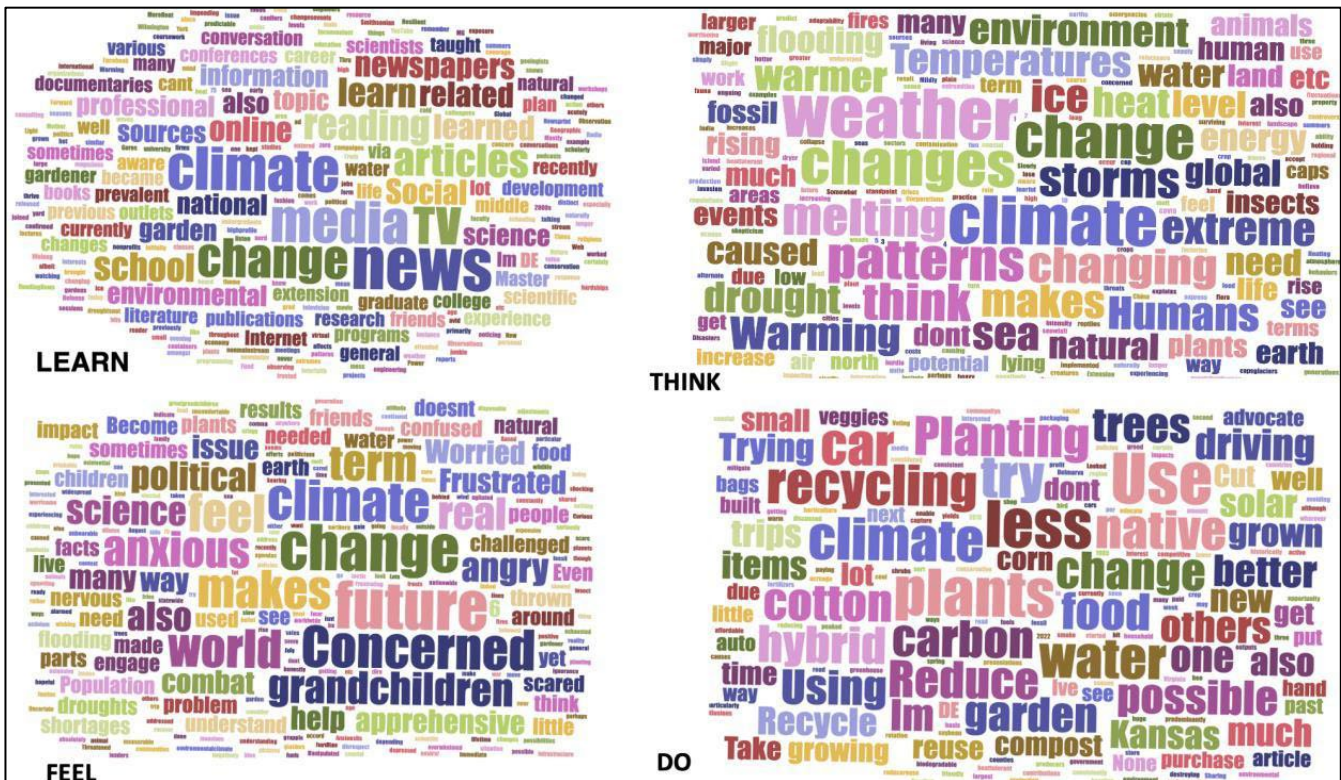


Figure 14. Original word clouds generated from poll responses at UD CANR Fall Fest

Key Informant Interviews

Building on information gathered from the “4 Question Poll” that was sent out in October via email to all UD Extension employees, as well as employee lists, Extension personnel were contacted via email and asked to voluntarily participate in in-depth conversations. The insights gathered from the “4 Question Poll” formed the basis of further investigation and the interviews led to a focus on three “3x5” domains: education, polity and economy. Conversations were directed to issues related to knowledge and skill acquisition with respect to where and how they have learned – or not–about climate change, what they think about climate change, how they feel about it and what they are doing with respect to climate change. Participants permitted the Zoom sessions to be recorded and the written transcripts of the conversations were analyzed using linguistic and text analytic software.

Delaware Ag Week

Delaware Agriculture Week was held in person at the Delaware State Fair Grounds, in Harrington, Delaware from Monday, Jan. 9, to Thursday, Jan. 12, 2023. Ag Week events were organized through a collaboration between UD Cooperative Extension, Delaware State Cooperative Extension and the Delaware Department of Agriculture.

Presentations were offered by Extension Specialists, agricultural experts, farmer representatives, state and local government personnel, commercial growers, and industry representatives. Session topics included innovation and practice in agronomy, fruits and vegetables, woodland management, animal science, IPM, till and no-till practices, poultry and Avian Flu, AMR in beef and small ruminants, Smart Ag, etc. Commercial vendors, financial institutions, insurance representatives, community health and wellness, and other non-profit representatives also were in attendance. Sponsors of the event can be found here: <https://sites.udel.edu/delawareagweek/sponsors/>).



Figure 15. DECCCI research team conducting stakeholder interviews and discussions at Delaware Ag Week in order to gain further insight into how UD Extension can shape its role in approaching climate change topics. (Courtesy of Katie Young)

Delaware “Climate Can’t Wait” Legislative Day of Action

On Thursday, March 9th, 2023, the **Delaware Chapter of the Sierra Club**, in partnership with the **Clean Energy Coalition**, organized the largest lobby day in the Chapter's history. The focus of the activity was to speak with DE legislatures to lobby for the passage of SB305. This legislation, known as the **Delaware Climate Change Solutions Act**, *which was finally passed in 2023*, follows the issuance of Delaware's Climate Action Plan in 2022, and establishes a statutory requirement of greenhouse gas emissions reductions over the medium and long term to mitigate the adverse effects of climate change due to anthropogenic greenhouse gas emissions.

Regional PASA Sustainable Agriculture Conference

From February 11-14, more than 1,500 farmers and food system changemakers gathered at the 2023 in-person Sustainable Agriculture Conference in Lancaster, Pennsylvania. Founded in 1992, PASA is devoted to advancing the art and science of sustainable agriculture. Based on a participatory peer community model, PASA offers education and resources for farmers who want to steward their land in harmony with natural ecosystems and who want to sell their products locally to support the health and vibrancy of local communities. PASA administers farmer training, research, policy, peer education, and local food programs as well as maintaining and growing a network of tens of thousands of farmers, food system professionals, and changemakers working together to advance regenerative and equitable agriculture in numerous communities across the nation.

The conference offered the opportunity to meet and interview key stakeholders in the sustainable agricultural domain, as well as offer background and a link to a “Quick Poll” to gather information regarding climate change. Members of the DECCCI team collected written materials and held interviews with farmers, state agricultural representatives, commercial stakeholders, and Penn State Extension personnel. Additionally, a DECCCI informational flier was distributed to all exhibitors and people were asked to respond to a “Quick Poll”.

Compared to the three previous polls (which were administered at UD’s CANR Fall Fest and Ag Week, as well as to Extension personnel and members of the Master Gardener program), respondents revealed a similar pattern: 1) they learn about climate change primarily from the news and media; 2) they think about climate change as it relates to “changing weather patterns”, “more and frequent droughts and floods”, and “global warming;” 3) they associate feelings of “anxiety”, “frustration” or “depression” with climate change; and finally 4) they focus on actions like “recycling, repurposing, reusing”, “using permaculture and agroecology methods”, “using smart ag practices” or “teaching” to address climate change concerns.



Figure 16. (A) Dr. Jerri Husch conversing with a table at the PASA Sustainable Agriculture Conference; (B) A member of the public interacting with PASA promotional materials

UD Extension Ag Team “Card Conversations”

On February 23, 2023, as part of the UD Agricultural team meeting, members of UD Extension participated in a group conversation about climate change and their work with farmers and agricultural producers. Comments and observations from the Extension personnel reflected a similar perspective as has been observed from previous interviews and polls conducted by the DECCCI team.

Qualtrics Online Poll

A DECCCI Qualtrics poll link was distributed at all activities and people were asked to click on the link to respond to the “4 Questions Poll”. As with the two previous polls (CANR festival and UD Extension) Ag Week respondents and PASA revealed a pattern of:

- Learning about climate change from the news and media.
- Thinking that climate change is either “not proven” or viewed as “changing weather patterns.”
- Feelings about climate produce “anxiety”, “frustration” or “depression.”
- Actions related to climate change are focused on “doing my best to recycle,” “buying an electric car,” “using smart ag practices,” or “nothing”.

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