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## Is the U.S. Critical Infrastructure Sector Workforce Climate Prepared?

Findings from Research Conducted on Behalf of the U.S. Department of Homeland Security from 2017-2019

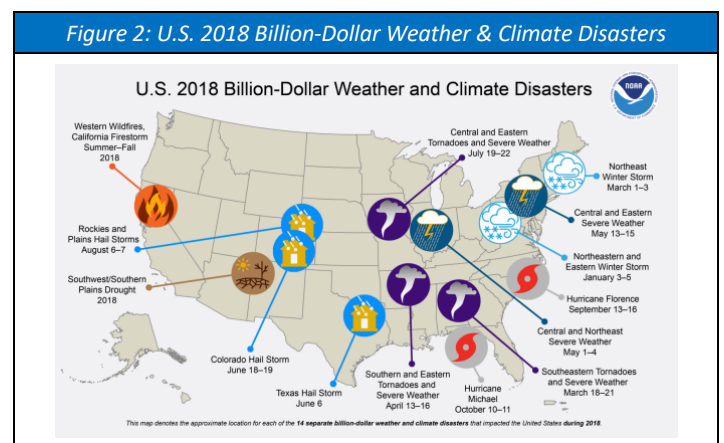
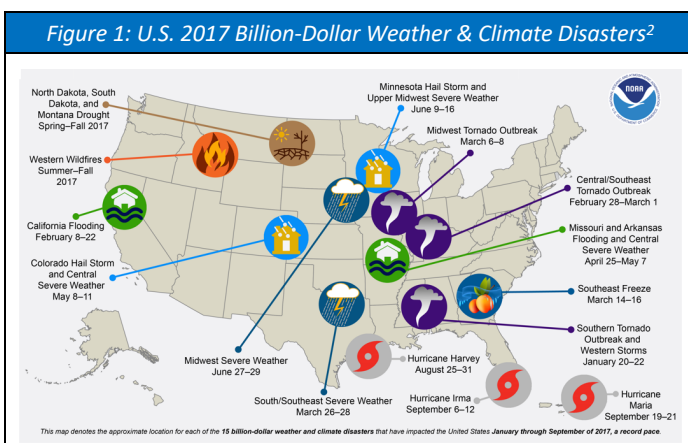
### Introduction

While peer-reviewed science continues to document the increasing frequency and magnitude of climate and extreme weather events, organizations and communities across the country have witnessed the damage to the nation’s critical—yet aging—infrastructure. Wildfires, droughts, extreme storms, floods, and sea level rise are compromising our critical infrastructure sectors, such as water, energy, and emergency services. While protecting against climate impacts requires understanding of the distinct characteristics and needs of each infrastructure type, ensuring proper workforce training to implement effective resilience-building measures is also vital to protect these crucial social and economic assets.

In 2016, ACCO was contracted on behalf of the U.S. Department of Homeland Security to assess the infrastructure workforce’s capacity to effectively engage in preparedness building in critical infrastructure sectors across the United States. **This summary highlights ACCO’s findings and offers recommendations for next steps in the process of building workforce readiness to increase infrastructure sector resilience across the nation.**

ACCO’s research gathered data, engaged subjects nationwide and examined all 16 of the critical infrastructure sectors<sup>1</sup>, but also focused intently upon five specific sectors: energy, food and agriculture, water/wastewater management, communications, and emergency services. These sectors were emphasized due to their susceptibility to climate risks, the need for these sectors to remain functional during and immediately after climate or extreme weather events, and the diversity of operational design models generally used for each. Energy is considered a “lifeline sector” as it is necessary to the functions of all other critical infrastructure sectors during extreme weather events. The project also focused intently on four regions in the United States: Colorado, Maryland, southeastern Florida, and the Los Angeles metropolitan area. These areas were chosen due to:

- Susceptibility to a broad range of projected climate risks and extreme events;
- Volume and diversity of extreme events that have already impacted the regions in recent years; and
- Economic, defense and national security significance.



<sup>1</sup> Critical Infrastructure Sectors, U.S. Department of Homeland Security. <https://www.dhs.gov/cisa/critical-infrastructure-sectors>

<sup>2</sup> NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2017-18). <https://www.ncdc.noaa.gov/billions/>

Within these regions and sectors, interviews were conducted with infrastructure stakeholders that revealed common concerns about the most immediately impactful climate threats to infrastructure, including:

- Reduced or changing patterns of water availability;
- Increased air temperatures and prolonged drought events; and
- Cascading events producing a “stacking” impact effect, such as long-term drought combined with wildfire or flooding events.

*“In general, we look across the landscape of environmental risks and recognize that—in literally all cases—we’re seeing increased frequency, intensity and duration in terms of magnitude of events and associated costs in the face of the environmental trends.”*

**— Dr. Craig Zamuda**  
Senior Policy Advisor, U.S. Department of Energy

## State of Critical Infrastructure Sector Governance, Personnel & Planning Capacity

These findings are applicable to other sectors and regions as part of a nationwide, cross-sector strategy to spark increased infrastructure resilience building in the face of climate change.

### Governance and Organizational Structure

The structure and governance of climate preparedness and resilience efforts is crucial to successful outcomes. Unsurprisingly, the research yielded very little standardization of governance and organizational structures across sectors and within any one sector. Findings included:

- More than half of interview and survey subjects indicated their organizations had assigned multiple people to serve in a non-committee capacity, rather than in a more directly accountable structure;
- Leadership on climate preparedness in each sector was generally shared across organizational divisions, departments, or teams, with no entity reporting a central business unit that manages such efforts; and
- The emerging occupations of climate change and resilience professionals are playing meaningful roles in supporting climate preparedness efforts. However, most participants reflected that there was almost no distinction between practitioners whose expertise should position them to be leaders of climate preparedness from those who should be playing supporting roles.

**Key Findings:** For most organizations to implement an effective preparedness initiative, a change management initiative will be critical to developing and implementing effective preparedness plans.

*“Adaptation is challenging, but doing the same thing that worked in the past won’t work in a changing climate. Thinking through different, innovative ways to approach your problem, in the context of a variety of future situations, is critical. Water is a very conservative field because the consequences are extremely high. Failure is not an option. Decisions are conservative to account for this, but it is really challenging in the context of accelerating climate change. The culture we need to be in is contradictory to the culture we have because of our responsibilities.”*

**— Lurna Kaatz**  
Chair, Water Utility Climate Alliance

### Nature of Job and Performance Expectations

Many stakeholders noted that their sectors do not have sufficient performance expectations, job requirements, credentialing, professional development, or continuing education programs to support climate preparedness efforts. As such, very few organizations had formally integrated climate change and resilience related competencies or expectations into the professions/functions that play a key role in successful climate preparedness. The overwhelming majority of participants indicated that:

- Individuals are being hired with a wide diversity of backgrounds for similar roles because broad standardization around preparedness and resiliency has not yet been mainstreamed; and
- Many respondents were expected to participate in multi-stakeholder preparedness initiatives, however, very few indicated other performance expectations or metrics related to climate preparedness.

**Key Findings:** The integration of climate-related competencies into the core job descriptions and requirements for numerous occupations is critical to successful preparedness and resilience efforts.

*“[Regarding needed competencies for the sector], the disappointment is that we’re not making use of some of the new educational programs that are coming through. There is training for existing groups. New emergency managers and climate change graduates will change the world in the next 20 years, but they’re still working their way through the system.”*

**— Anonymous emergency management sector official**

## Continuing Education, Training Requirements, and Preferred Credentialing

Overwhelmingly, interview and survey respondents indicated there were very few examples of credentialing, training or continuing education requirements related to climate preparedness either to be hired into, or stay in, a position. Those respondents indicated there was a strong need for specific-occupation technical credentialing around the intersection of climate preparedness and planning/engineering competencies, as well as a greater focus on translating technical details into more broadly understandable terms for practitioners and the general public. Skills recommended by respondents included:

- Understanding of finance with a focus upon disaster finance;
- Law and policy landscape and emerging strategies;
- Insurance, risk, and liability;
- Organizational change;
- Project and logistics management; and
- Public/stakeholder engagement and communication.

**Key Findings:** Professional societies need to work with policymakers, trade associations, leading experts and early adopters to establish consensus competencies, credentialing, training and updates to job descriptions.

*“There is a confluence of climate literacy underway, a push toward resilient and sustainable communities, and traditional community disaster preparedness working together to improve outcomes. [This is] reliant on folks who have the expertise, scientists and academics who are aware of the long-range impacts of climate change, to share their information with emergency managers and urban planners. Emergency management could use greater access to predictions and information on climate change.”*

— **Jeff Reeb**  
CEO, Los Angeles County Emergency Operations Center

## Formal Planning and Adaptation Barriers

Stakeholders from across sectors reported that their organizations have developed climate vulnerability assessments and similar initial climate impact evaluations. However, the majority of stakeholders across sectors noted that their organizations had not yet developed a formal climate adaptation, resilience, or preparedness plan. For those entities that have created plans, several reported that a designated team drove plan development.

The most significant barriers noted by respondents for integrating preparedness and resilience into their organizations included:

- Budgetary restrictions;
- Competing institutional priorities; and
- Lack of standardization and established/accepted best practices.

Approximately two-thirds of the stakeholders expressed concerns about their organization’s ability to meet the need for rapid design and implementation of preparedness and resiliency initiatives.

**Key Findings:** Evolving from current planning and decision-making to practices that incorporate effective climate preparedness will require a change in understanding among senior leadership in organizations of how climate change and extreme events will disrupt operations and impact their bottom line and/or mission. This transformation in understanding is foundational to obtaining the internal resources and prioritization, and is also a key cog in standardization and establishment of best practices.

*“During the 2013 flood, one of Boulder’s most critical pieces of infrastructure, our water treatment facility, lost power for close to 5 days. Boulder narrowly avoided losing its ability to treat water during the flood thanks to crews transporting generator fuel on ATVs. It was an abrupt wake-up call that cities have started experiencing the impact of climate change in a way they haven’t previously, and that better planning is needed.”*

— **Jonathan Kohen**  
Regional Sustainability Coordinator, City of Boulder

## ACCO’s Role as a Credentialing Body and Training Provider

Several organizations, including ACCO, have already established professional credentialing and certification programs designed to reflect a practitioner’s capacity to effectively integrate preparedness and resilience to climate change and extreme weather events into decision-making (or are exploring approaches to doing so). In 2017, ACCO established the Certified Climate Change Professional® (CC-P®) credential to reflect competency in the fundamentals of climate preparedness and strategic planning. The credential is currently available for practitioners across all sectors, and professional functions and additional specialized credentials for related professions are being developed, including planners/civil engineers, energy managers, supply chain/procurement professionals, city/county managers, risk managers, and budget/finance professionals. ACCO is working with peer credentialing bodies and experts in other occupations to develop credentialing programs and related training that have been tailored to specific occupations and sectors.

## Participation in External Activities

All research participants interviewed or who were surveyed indicated that some form of local, regional, or sectoral collaborations were emerging to address preparedness and resilience. Many noted ongoing actions of preparedness for emergency response through vulnerability assessments, hazard mitigation and adaptation planning activities, and active collective learning from recovery initiatives. Other trends for action measures included:

- Expansion of communication and engagement with the general public and fields of practice;
- Decentralized networks and system redundancy (particularly in energy/water sectors); and
- Coordinating across organizational boundaries through regional governance/collaboration and Federal agency and/or nongovernmental organization administered partnership programs.

**Key Findings:** Collaborating with peer organizations both in the region and within the sector is a key component of climate preparedness. However, many U.S. regions do not yet have robust climate preparedness initiatives, and numerous trade associations either do not yet have established initiatives or are just standing them up. Efforts to support and align these collaborative initiatives would benefit climate preparedness activities nationwide and across sectors.

*“[The driver for establishing the Partnership for Energy Sector Climate Resilience] literally came out of Superstorm Sandy type events for utilities on the East Coast, and wildfires and drought in the West. [It] was set up in 2015 with a focus on:*

- *exchanging information and best practices to assess vulnerabilities and resilience strategies;*
- *identifying available actionable climate data, that one can use to make local decisions;*
- *gaps in the policy framework to increase infrastructure resilience;*
- *where to make investments; and*
- *how to assess vulnerabilities and the cost / benefit of resilience investments to make the business case to regulators that the costs are prudent and should be passed on to the rate payers.”*

— **Dr. Craig Zamuda**  
Senior Policy Advisor, U.S. Department of Energy

## State of Decision-Support Tools and Usage

Developing, deploying, and leveraging decision-support and modeling tools is necessary for success in resilience planning. However, there are currently no widely used guidelines or practices for ensuring that available data and planning tools are used in a standardized way. This can lead to the tools being used in inconsistent or conflicting ways that can hinder recovery efforts.

Research participants indicated that they had trouble accessing and using existing datasets and interpreting and analyzing the data required for use. The lack of availability of data at the right scale to create accurate analyses for the systems involved is also a serious knowledge gap.

For example, while daily rainfall projections may meet the needs of a city’s risk model, the local water authority may need hourly projections in order to plan appropriately for storm water management resilience.

Without access to a decision-support tool that downscales the needed data by geography or timescale, critical infrastructure entities are not sufficiently equipped to effectively prepare for localized climate and extreme weather impacts.

**Key Findings:** As credentialing bodies will inevitably need to update competencies requirements, continuing education and training, and professional codes, they will also need to examine standardization of data usage to inform decision-making and the tools used by practitioners.

*“We’ve always had droughts and flooding. Frequency of these events seem to be coming more often now, though. It’s not that farmers, ranchers, forest managers and communities are not aware and aren’t able to address these events; it’s the length, longevity, and frequency and how we minimize the impact and improve the decision-making. If we provide the needed information and management tools for them to make better decisions as well as continue assisting them in building resiliency, I think it’s going to be a win-win for sustainable agriculture and for those making a living producing food and fiber.*

— **Dan Lawson**  
National Climate Hub Lead, U.S. Department of Agriculture

## Recommendations

ACCO envisions a three-tiered strategy for ensuring that infrastructure designers, practitioners, and policymakers are equipped to successfully prepare for and recover quickly from a broad range of climate and weather events.



### Increasing Sectoral and Regional Collaboration

The complexity of critical infrastructure systems and reality that disruptive events impact regions across organizational boundaries has led to widespread recognition that collaboration is a key ingredient to designing and implementing effective preparedness and resilience initiatives. Just as the sectors themselves have significant interdependencies, it is crucial that the many stakeholders involved with maintaining and overseeing our nation's infrastructure work together to build plans and models that can evolve with the ever-changing environmental conditions and emerging climate impacts. Collaborations can speed up standardization of terminology, development of best practices and sound policy, access to actionable decision-support tools, and lead to aggregated efforts such as shared costs and staffing.

### Advancing Workforce Standardization and Professional Development Resources

Facing a combination of aging infrastructure and more frequent, intense, or cascading climate and extreme weather events, the public and private sectors are facing an increasingly complex set of challenges in building and sustaining critical infrastructure. To meet existing and future needs, practitioners and policymakers will need to conduct modernized analyses leveraging the latest peer-reviewed, evidence-based data and corresponding decision-support tools, while balancing competing priorities with limited resources. Workforce standardization and professional development needs to mature to provide a workforce ready to address these challenges.

As the result of the enormous organizational impacts and cross-component nature of preparedness and resilience initiatives, the need for qualified professionals to serve as enterprise leaders for these efforts has become clear. Increasingly, professionals in roles focused upon emergency management, resilience, climate change, and sustainability are being tasked with these responsibilities. As these professional roles are in their early maturity relative to other more established occupations and decision-making roles, they face several challenges:

- Inconsistent authority, placement, and stature within their organizations.
- Insufficient staff support, budget authority, and technical support resources.
- Lack of clarity on job description, performance expectations, and professional standards.

It may be decades for the workforce to mature organically and/or without policy interventions. However, this maturity can be accelerated through strategic structuring of job responsibilities and sensible policy measures, and adoption as best practice by communities of practice and trailblazing organizations.

## Enhancing Accessibility of Data, Codes/Standards, and Decision-Support Tools

Based upon ACCO's research and stakeholder feedback, there is a lack of standardized guidance for evaluating climate risks, elevating best practices, using decision-support tools, and determining appropriate investments for resilient systems in the face of competing priorities. Current information is often scattered across various agency and institutional websites, with minimal support available. As climate and extreme weather events become more variable, the ever-changing policy environment also creates substantial challenges for technical practitioners and policy makers to build institutional resilience. As organizations tackle these complex planning challenges and policy environments, flexible standards and adaptive decision-making processes are needed to account for a continuous flow of new information and evolving scenarios. More streamlined data, flexible codes/standards, and updated decision-support tools need to be accessible to accelerate preparedness, resilience, and recovery efforts.

## Next Steps

Organizational and regional efforts to date stem overwhelmingly from a reactive rather than a proactive stance, such as a responding to catastrophic events that have already occurred without also ensuring preparedness for future events. Looking nationwide and across sectors, this results in substantial inconsistencies in implementation and a lack of synchronization, which leaves gaps in preparedness.

Providing training to professionals across the decision-making spectrum is a necessary and foundational component to standardize practices, provide quality standards in design and implementation, and, consequently, to ensure successful preparedness and resilience initiatives. This goal requires developing frameworks and standards for evaluating climate change risks and a set of core competencies for effective workforce readiness. This approach will provide a strong foundation for sector professionals and decision makers to develop viable business cases for their resilience plans and for their successful implementation.

## About ACCO

The Association of Climate Change Officers (ACCO) is a 501(c)(3) non-profit membership organization for executives and officials worldwide in industry, government, academia and the non-profit community. ACCO's mission is to define, develop and support the functions, resources and communities necessary for effective organizational leadership in addressing climate-related risks and opportunities. ACCO administers the Certified Climate Change Professional® (CC-P®) and Certified Climate Change Officer® (CC-O®) credentialing programs, as well as the Compact of Colorado Communities and the Maryland Climate Leadership Academy, the nation's first state-sponsored climate change training institution. For more information about ACCO, please visit <http://www.ClimateOfficers.org>.

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