Symposium Summary: Climate Resilient Design in the Southeast

An introduction to climate change - a special focus on the Southeast

Over forty architects, planners, and professionals convened for a daylong session to learn methods of applying climate science to their craft. Climate Resilient Design in the Southeast presented the latest in climate research, while highlighting aspects of particular concern to the design industry. The goal of the symposium was to enable practitioners to include climate factors into their designs, both to adapt to a changing climate and to mitigate climate change by reducing the carbon emissions of buildings.

Adapting means designing for the average and the extremes of climate, as Drs. Kunkel and Peterson explain. Thomas Peterson is the President of the World Meteorological Organization Commission for Climatology and Kenneth Kunkel is the lead NOAA scientist for the National Climate Assessment. Heavy precipitation, hurricanes, heat and cold waves, severe thunderstorms with tornadoes and hail, winter storms, and drought all affect the built environment (Kunkel). And the build environment gives shelter from these storms.

Importantly, extremes will become worse. In the Southeast, already it is not cooling off as much at night and precipitation tends to come in heavy downpours, not light rainfall, as climate service specialist Marjorie McGuirk said (McGuirk). Extreme heat, extreme precipitation, and sea level are highly likely to increase (Kunkel).

Heat waves will surely reoccur with increasing frequency. Each decade has been warmer than the previous decade (Kunkel). Designing for heat then becomes increasingly important. Would you design something for New Hampshire in the same way as for North Carolina asked Peterson. In a scenario of high emissions of greenhouse gasses, New Hampshire warms to be similar to the temperatures of present-day North Carolina the end of this century (Figure 1) (Karl). Furthermore, it is now possible to attribute particular storms to climate change (Peterson) A groundbreaking study, released from embargo only the day of the Symposium, showed which types of severe weather events, such as heat waves, are directly attributable to climate change (Peterson).

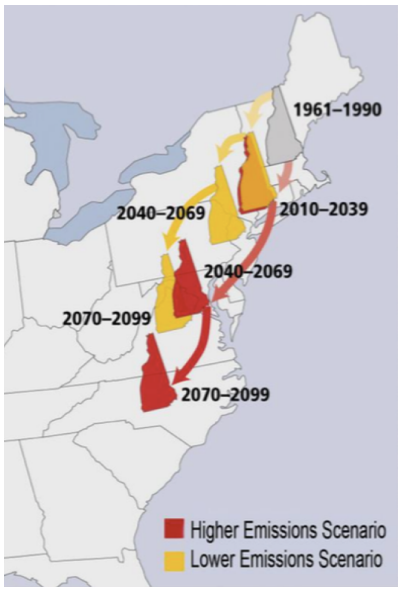

Figure 1 Under a higher emissions scenario, the climate of New Hampshire will move down to North Carolina (Karl)

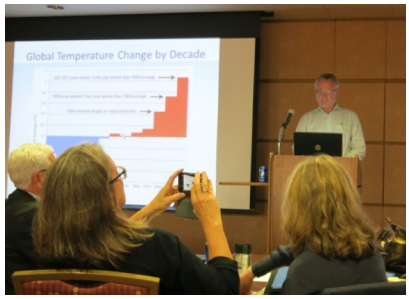

Figure 2 Kenneth E. Kunkel, a scientist from NOAA, presents the latest findings on climate change

Participants learned of new Presidential Executive Orders pertaining to new or rebuilt federally funded projects. These consider current and future climate risks in building in flood plains, new energy conservation and efficiency standards, and goals to achieve energy net-zero by 2025. McGuirk urged architects to mobilize; to prepare, plan, design buildings, plants, shops, factories, administration buildings, and structure everywhere in a climate resilient fashion, paraphrasing the 1940's Defense Aid Program of the American Institute of Architects (McGuirk).

Why should architects care about climate resilience?

The building professionals will face difficult challenges in a changing climate. They will have to design for clients who are familiar with their own climate zones, while also accounting for the climate that will exists in the future life span of the structure. They also have to ensure that the buildings sustain more frequent and intense extreme weather events. At the same time, this challenge presents them with an opportunity: By creating resilient buildings, which are highly resource-efficient, architects can strongly contribute to mitigate climate change (Cape).

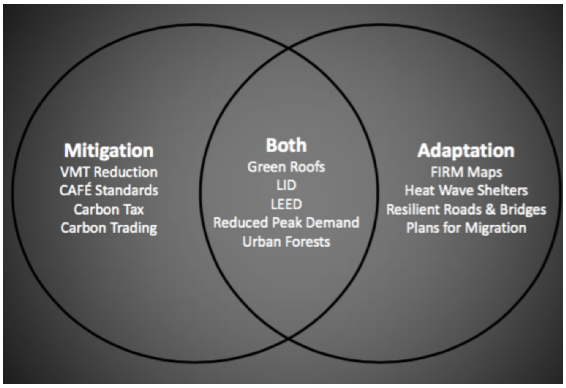

Figure 3 Often, measures can be attributed to both mitigation and adaptation to climate change

Architectural design for shaping a sustainable future is categorized in climate change adaptation and climate change mitigation. The means of "adaptation" addresses the effects (e.g. increasing resilience), whereas "mitigation" relates to limiting the causes of climate change (curbing the greenhouse gas emissions). Truly, however, quite a bit of overlap exists as the Venn diagram shows (Figure 3).

Mitigation as an approach to lessen the magnitude of climate change

It becomes apparent, that different emissions scenarios (total amount of emitted greenhouse gases into the atmosphere) will lead to different climate outcomes. An aggressive reduction in emissions would do much to mitigate, or lessen the effects of, long-term climate change. Over three quarters of the US energy consumption can be allocated to buildings. Hence, if architects design resilient buildings the overall energy consumption will decrease (i.e. fewer cooling or heating is needed, which then reflects in fewer greenhouse gases emitted). Long-term community environmental leader Robin Cape reiterated the high rates of greenhouse gas emissions and energy use by buildings. Commercial and residential buildings account for fully a third of greenhouse gas emissions. Within those structures, energy consumption for space cooling has overtaken space heating. Energy use for appliances and electronics has risen dramatically. Efforts to improve building codes, such as through the International Code Council, can effectively reduce energy consumption, and thus greenhouse gas emissions, significantly. In conclusion, Ms. Cape iterated that the choices we face today can positively affect the current environment but more so the climate of the next generation (Cape).

Adaptation as a response to global warming

Adaption is a response to global warming and aims to reduce vulnerability. Concerning the building sector, mainly two adaptive responses to climate change can be given: the buildings' forms and functions as presented by architect Laurie Miller. An inspirational example wherein we can find adaptation approaches included in the elementary design, are the dwellings of American natives. They kept warm air inside and kept cold air outside with chimneys to allow escape of emissions from fire heat sources (Miller). More modern adaption approaches as presented by landscape architect David Tuch, illustrated site elements that are included in the New Belgium Brewery in Asheville. He refers to stream restoration, wetland enhancement or invasive exotic plant control (Miller and Tuch).

Figure 5 Scott Shuford explains how adaptation to climate change through architectural design works

In the building sector, it is common, that the designs cover overlapping areas of mitigation and adaptation (see Figure 3). For example, "Green roofs" help to cool buildings (adaptation) and lower the energy demand for air-conditioning (mitigation). In that vein, Scott Shuford, a planning director for the city of Fayetteville (see Figure 5), impressively outlined the potential measures by which architectural design can help adapt to the climate. He presented neighborhoods that were designed to orient houses in such a way as to take advantage of prevailing winds for maximizing cooling, and to minimize solar heat gain. Mr. Shuford narrated films that were produced at insurers' test facilities that showed structures made more resilient to fire, hail and wind. Climate change makes resiliency to these more important. For that reason, it is crucial to inform the building professionals about their potential to achieve sustainability goals. This would involve efforts to provide them with toolkits, resources and best practices to design for climate adaptation (Shuford).

"Architecture has the potential to become recognized as a critical profession for climate change adaptation"

-SCOTT SHUFORD

In relation to these adaptation approaches, Peterson, provided cutting-edge research insights on attribution science. He introduced a relatively young science of climate change attribution, which is, attributing a particular extreme weather event to anthropogenic climate change. For instance, in-depth analyses may attribute a superlative flood to a weather pattern, which would not have been possible in pre-industrial atmospheric settings (or simplified, that the man-made greenhouse gas emissions led to this particular extreme event). Attribution science can help to provide information for sophisticated reconstruction approaches of towns or site locations destroyed by extreme weather such as tornadoes or extreme flooding. Extreme weather events afford the opportunity to redesign entire areas. In this case, attribution science can provide useful information whether a distinct area is safe or considered hazardous zone. For building professionals, it may be difficult to identify the mitigation and adaptation potential for real-world cases. Therefore, public agencies have created several toolkits in order to support the decision-makers. (Shuford)

Tools, climates services and resources

Glenn Kerr, Executive Director of the American Association of State Climatologists, introduced important tools that architects can use to comply with the new Executive Orders on climate change. Firstly, one of the most developed tools for helping the professionals to build resilience in the face of the ever changing climate is the U.S. Climate Resilience Toolkit. It includes tools for accessing and analyzing climate date and offers a five-step process to plan for resilience (see Figure 5). Furthermore, real-world case studies and training on climate variability and its impacts are available.

Figure 5 Action steps proposed by the U.S. Climate Resilience Toolkit

Secondly, The Climate Explorer displays databased maps of climate stressors and their impacts. It allows one to compare historical records of daily temperature and precipitation observations to long-term averages of climate, or normal conditions, at thousands of weather stations throughout the United States.

Thirdly, further tools available, are the Climate at a Glance (generates graphs and maps showing climate information), the FEMA Flood Map Center and the Storm Water Management Model. Mr. Kerr also explained that architects can rely on the resources provided by their State Climate Offices.

Figure 6 Conference participant Janice Craig of Perkins and Will presents a case study on conceptual redesign

To complete the day, Nathan Bryant, President-elect of the AIA Asheville Section, moderated a group activity. With an aim to equip participants with hands on experience with new knowledge and tools, seven teams used the provided resources and collaborated on an activity for conceptual redesign of a region. Each team suggested design solutions that included elements of both mitigation and adaptation to climate change (Bryant). The findings were presented and exchanged in the last plenum session of the day (see Figure 6).

Learning Objectives

As approved by the American Institute of Architects, six credit hours were offered addressing specific learning objectives. At the end of this course, participants were able to:

- Use publicly available tools and resources to understand vulnerability to natural hazards and climate change and adapt building designs to improve performance.
- Comply with recent federal regulatory changes designed to manage risk and adapt to climate change.
- Incorporate building materials that will better withstand characteristics of expected future climates in the Southeast.
- Identify methods and design elements commonly used in other regions that may can be incorporated in the Southeast to enhance resilience to future climates.

Course Description

“Climate Resilient Design in the Southeast” will provided architects and building design professionals with a thorough understanding of the latest climate science and opportunities to reduce vulnerability through mitigation and adaptation. The course incorporated problem-based learning and drew from numerous case studies to help participants identify the role of architecture in addressing climate change risks and gain hands-on experience using publicly available tools to facilitate climate resilient design.

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