

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

Issue: *New York City Panel on Climate Change 2010 Report***Conclusions and recommendations**

New York City faces significant risks from climate change and must begin taking action immediately to protect its citizens. Climate change adaptation demands a reexamination of the everyday assumptions about managing the city's critical infrastructure. Climate impacts will occur over a number of timescales. Some are already being felt today and should be addressed in the near-term, while others will occur later in the century and should be addressed as part of a long-term risk-based approach to climate change.

Climate change adaptation plans should be developed as part of a risk management process, an approach that has governed the work of the New York City Panel on Climate Change (NPCC). The use of a risk management approach to adaptation was pioneered by the Thames Estuary Project. The approach involves a process through which cutting-edge data and information on climate risks and critical infrastructure can be monitored and assessed, and decisions evaluated and reevaluated as climate change progresses. To aid in this process, the NPCC has produced New York City-specific climate change projections and a clearly defined adaptation assessment process to assist stakeholders in the identification and prioritization of potential risks that should be taken into account when making investment and planning decisions.

Mitigation actions are undertaken to reduce the long-term risks of climate change through reduction of greenhouse gas emissions, while adaptation is needed to respond to the short-term risks that are unavoidable as well as to long-term risks, such as sea level rise. Climate change mitigation and adaptation are both important elements in PlaNYC, and both contribute to the long-term sustainability of the city.

The results and findings of the NPCC's work, while broad in scope, can be distilled to a set of

primary conclusions, recommendations for action, and additional areas for study.

Key findings**New York City should begin to adapt to climate change today**

Investments are needed to begin the climate change adaptation process even in times of economic downturn. Both the public and private sectors should make investments today in order to minimize climate risks that they currently face and that are projected to grow in the future. Historical climate precedents are no longer valid for long-term environmental planning.

While uncertainties exist about the exact specification of future climate changes for the city, climate risk information available now clearly indicates that a strategic, proactive adaptation process should begin and continue. *Ad hoc* adaptation responses to extreme climate events are not enough to ensure long-term sustainability.

New York City already faces a number of climate risks without climate change as a factor

A coordinated planning process will help the city to cope with the risks we currently face from extreme events, such as the August 8, 2007 storm that disrupted transportation lines throughout the city, as well as future climate changes.

Temperature increases and sea level rise are already occurring, and, along with other climate changes, will continue to occur and accelerate in the future

Climate change in New York City poses serious and challenging risks, which interact with the other stresses that the city faces, such as population growth

and pollution. The critical infrastructure on which the people of the city vitally depend is at risk in multiple and complex, as well as direct and indirect, ways (e.g., as mediated through climate effects on ecosystems).

Heat and heat waves

Warmer temperatures are extremely likely in New York City. Heat waves are very likely to become more frequent, intense, and longer in duration. Temperature-related impacts may include increased summertime strain on materials, increased peak electricity loads in summer, more frequent black-outs, and reduced heating requirements in winter.

Sea level rise and storm surge

Climate change poses challenges to planning for coastal waterfront development in New York City, given the uncertain but significant risks of progressive sea level rise and enhanced flooding of low-lying neighborhoods and infrastructure, increased structural damage, and impaired operations.

Droughts and floods

Brief, intense precipitation events that can cause inland flooding are likely to increase, and droughts are more likely than not to become more severe. Precipitation-related impacts may include increased street, basement, and sewer flooding, and reduced water quality.

There is a potential for “tipping points” in the climate system, such as a rapid melt of polar ice sheets, which would have a great magnitude of consequence on the city

The potential for crossing thresholds with regard to both climate and impacts requires development of an effective indicator and monitoring program, so that tipping points can be identified and prepared for.

To effectively respond to climate change, the city should develop Flexible Adaptation Pathways

Effective response to climate change for critical infrastructure involves development of a risk management approach that encourages the implementation of Flexible Adaptation Pathways (i.e., strategies that can evolve through time as climate risk assessment, evaluation of adaptation strategies, and

monitoring continue). The development of Flexible Adaptation Pathways should be embedded in the operations and planning of the agencies and organizations that manage the critical infrastructure of the city. This requires ongoing coordination among the City of New York and other levels of government, public agencies, private organizations, and experts, with overall leadership as currently provided by the Mayor’s Office of Long-Term Planning and Sustainability.

Meeting the challenges to climate change adaptation in New York City

The city has many tools in place that can be used to facilitate climate change adaptation

Significant attention has been focused on the potential for climate change mitigation to promote easily accessible win–win opportunities for city managers, because they are perceived as providing greenhouse gas emission reduction benefits and economic cost savings. The results of the NPCC process show that there are numerous ways that climate change adaptation can also be effectively incorporated into the current management of the city’s critical infrastructure:

- Existing **risk and hazard management strategies** can be adjusted to meet the challenges of our changing climate—today and in the future.
- **Design standards** can be recalibrated to include climate change projections so that long-lasting infrastructure will be prepared to withstand future threats.
- The **legal framework** governing the design and operation of infrastructure can be expanded to include the effects of climate change on development projects.
- The **insurance industry** and other risk-burden-sharing mechanisms (e.g., co-operatives) can contribute to adaptation through products that respond to long-term risks, as well as by sharing its expertise on risk in climate change discussions with a wide range of stakeholders.
- Within and across agencies and organizations that manage infrastructure, adaptation strategies can draw from a broad range of responses, including **adjustments in operations**

and management, capital investments in infrastructure, and development of policies that promote flexibility.

The city has developed an effective approach to climate change adaptation

New York City's adaptation program encompasses a number of best practices, including:

- **High-level proactive leadership** to initiate and coordinate the adaptation process for the critical infrastructure of the city, as well as of the broader metropolitan region;
- **Links to larger sustainability activities**, such as PlaNYC, so that climate change is considered as part of a broad range of future trends, rather than in isolation;
- **Involvement of multiple layers of government and a wide range of public and private sector stakeholders and experts;**
- **Incorporation of climate change risks into stakeholder agency and organization operations, management, and planning;**
- **Tools by a recognized body of experts** that can help guide a wide group of stakeholders in how to address climate change; and
- **Development of an evolving dynamic process** among City government, public and private stakeholders, and experts to develop a risk management approach to climate change and to begin to implement Flexible Adaptation Pathways for the city.

Recommendations for action

Recommendations arising from the NPCC work include a broad range of policy-relevant suggestions, some focused on critical infrastructure and some focused on broader-scale actions, many of which the city and the Task Force are already doing.

1. **Adopt a risk-based approach** to develop Flexible Adaptation Pathways, which includes regular reviews of the city's adaptation program;
2. **Create a mandate for an ongoing body of experts** that provides advice for the City of New York. Areas that could be addressed by experts in the future include regular updates to climate change projections, improved mapping and geographic data, and periodic assessments of climate change impacts and adaptation for

New York City to inform a broad spectrum of climate change adaptation policies and programs;

3. **Establish a climate change monitoring program** to track and analyze key climate change factors, impacts and adaptation and evolving-knowledge indicators in New York City, as well as to study relevant advances in research on related topics. This involves creating a network of monitoring systems and organizations and a region-wide indicator database for analysis;
4. **Include multiple layers of government and a wide range of public and private stakeholder experts** to build buy-in and crucial partnerships for coordinated adaptation strategies. Take account of the private sector in these interactions;
5. **Conduct a review of standards and codes**, to evaluate their revision to meet climate challenges, or the development of new codes and regulations that increase the city's resilience to climate change. Develop design standards, specifications, and regulations that take climate change into account, and hence are prospective in nature rather than retrospective. New York City should work with FEMA and NOAA to update the FIRMs and SLOSH maps to include climate change projections;
6. **Work with the insurance industry** to facilitate the use of risk-sharing mechanisms to address climate change impacts;
7. **Focus on strategies** for responding to incremental changes (e.g., annual temperature and precipitation changes) as well as low probability, high impact events (e.g., extreme coastal flooding exacerbated by sea level rise); and
8. **Pay particular attention to early win-win adaptation strategies**—such as those that have near-term benefits or meet multiple goals (greenhouse gas mitigation, emergency planning, etc.).

Needed studies to facilitate Flexible Adaptation Pathways

In addition, the NPCC identified several key areas for further study that are needed to help the city develop a comprehensive, risk- and science-based adaptation program:

1. **Identify, characterize, and understand non-linear tipping points, triggers, and decision pathways** to help determine when and how to adopt different types of adaptation measures to facilitate Flexible Adaptation Pathways.
2. **Analyze the economics and financing of adaptation**, including multicriteria and cost-benefit studies.
3. **Conduct feasibility studies of non-structural and structural citywide protective measures, as appropriate over future time periods.**
4. **Perform sensitivity tests of critical infrastructure facilities and operations** to understand the impacts of changes in mean annual temperature and precipitation and extreme events.
5. **Study the interdependencies among and within infrastructure sectors and systems,**

such as the potential for increased electric power outages to, in turn, affect the security of transit power and cause commuting delays, as well as interim outages for pumps, thereby threatening the integrity of water supplies.

Putting Adaptation in Place

The goal of the NPCC is to contribute to an effective, ongoing, and beneficial process for responding to the risks that climate change poses on New York City in the coming decades. This is a challenging task, but as this report demonstrates, the City of New York is well on its way to implementing a comprehensive climate change adaptation strategy and institutionalizing ongoing adaptation planning.