American Planning Association
Planning Advisory Service
Creating Great Communities for All

No. 113

PAS MEMO

The Use of Foresight and Scenario Planning in Hazard Mitigation and Climate Adaptation Planning

By Petra Hurtado, PHD, and Joseph DeAngelis, AICP

Planners today are increasingly familiar with the concept of scenario planning. Relatively new to planners, however, is the practice of foresight, which enables practitioners to better prepare for an unpredictable future by identifying and considering external drivers of change that are outside of our control.

As a key component of the practice of foresight, exploratory scenario planning offers significant benefits for planning in dynamic and complex systems. Thus, it can be a particularly useful tool in planning for natural hazards and adapting to climate change, given the complexity and uncertainty involved in both of these areas.

Though hazard mitigation and climate adaptation are overlapping fields, scenario planning has thus far been more widely used within climate adaptation than in hazard mitigation. This is largely because the federal regulatory processes and requirements that drive most hazard mitigation planning in the United States do not address scenario planning. Climate adaptation planning, which is not widely standardized and is more often driven by local and regional needs rather than federal requirements, has more readily adopted tools like scenario planning.

This *PAS Memo* offers guidance to planners on how to expand their use of foresight through exploratory scenario planning in both the hazard mitigation and climate adaptation fields. It first defines foresight and scenario planning, discusses how they are related, and explains how they can be useful when planning in highly dynamic and complex systems. Then, the challenges and benefits of scenario planning are discussed in the context of hazard mitigation and climate adaptation planning. Next, practical examples on the use of scenario planning in adapting to climate change in Cape Cod, Massachusetts, and in Seattle (Figure 1) are discussed. Finally, key action steps are presented for planners interested in using scenario planning techniques in their hazard mitigation and climate adaptation efforts.

Planning With Foresight

Planners help their communities navigate change and prepare for an uncertain future. This task is becoming ever more complex in a world of accelerated change where the future is more unknowable than ever before. The shortcomings of traditional planning practice become obvious when trying to adapt to a changing climate by using knowledge based on data from the past; when trying to pivot along the way because the world around us continues to change; or when trying to proactively help a community prepare for what is on the horizon by using long-term processes that lack short-term decision-making capabilities.

Today's planning processes need to evolve to meet the needs of a changing world. Currently, planning is very linear, and it approaches cities and communities as if they were frozen in time.

Figure 1. Planners must consider climate change and its impacts on natural hazards to help Seattle and all communities prepare for an uncertain future (Dicklyon/Wikimedia (CC BY-SA 4.0))

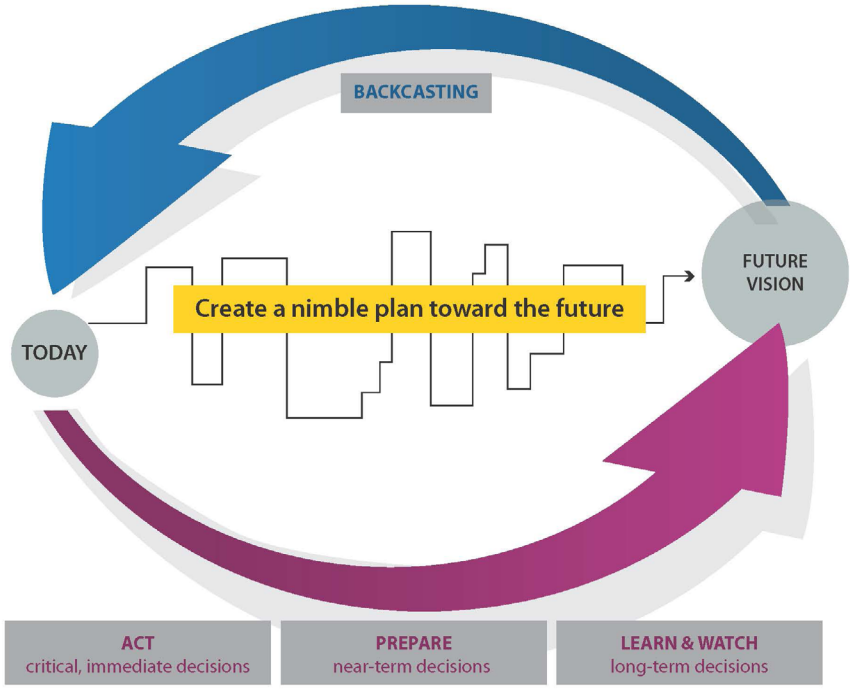

Figure 2. The practice of foresight can help planners make sense of the future to create more nimble plans (APA)

> *We are working with a very deterministic, rational approach—starting with goals and objectives, collecting information and data, analyzing the data, making and implementing the plan, and then ideally evaluating and monitoring this work over time. It is a linear path that doesn't consider a changing world around us. (Dixon and Tewdwr-Jones 2021)*

In pursuing this linear path, planners develop goals for the future based on today's perspective and what we and our community members see, feel, know, and desire today. Our plans reflect our today, but not our future (Hurtado, forthcoming). It is important to learn from the past and use hindsight to improve today's conditions. But if we project the past into our future vision, we risk exacerbating challenges, such as social inequalities, that were created in the past, and we risk being unprepared for unprecedented events, such as life-threatening storms, extreme heat, and devastating wildfires that exceed all historical records.

Last, but not least, the overwhelming and increasing pace of change makes us try to respond to challenges immediately, forgetting about the importance of what's on the horizon. Therefore, more dynamic planning that combines short-term decision-making with "courageous long-term thinking," allowing us to pivot and adjust, is needed (Krznaric 2020).

Defining Foresight

The concept of foresight, or strategic foresight, is an approach that aims to make sense of the future, understand drivers of change that are outside of our control, look outside the box, and prepare for what may lead to success or failure in the future (Figure 2). It originates from the business world, where strategic foresight is used to "future-proof" a product, a business plan, or an entire company. It's about understanding how markets may change, how consumer behaviors and preferences may shift, or how innovation in other sectors may require different applications of a product. The practice of foresight can help businesses to become more agile while becoming more resilient, and to adapt as needed to remain successful in the future (Hurtado 2021a).

For example, if taxi companies had practiced foresight and had understood potential impacts to their business model from the convergence of trends such as smart phone applications, a trending sharing economy, and platform organizations, they might have been better prepared for the competition from transportation network companies such as Uber and Lyft, which completely disrupted the taxi industry.

This business strategy approach can be very useful to planners as well, as we are planning for the future of our communities and are therefore responsible for their success and long-term resilience. Particularly in the context of hazard mitigation and climate adaptation, we must contend with many uncertainties. The practice of foresight won't eliminate these uncertainties, but it will help us prepare for them and make sense of the things outside of our control.

In addition, foresight is a participatory approach where diversity is key. Engaging our community members in the process can result in hyperlocal insights about short- and long-term needs, emerging trends, observed changes on the

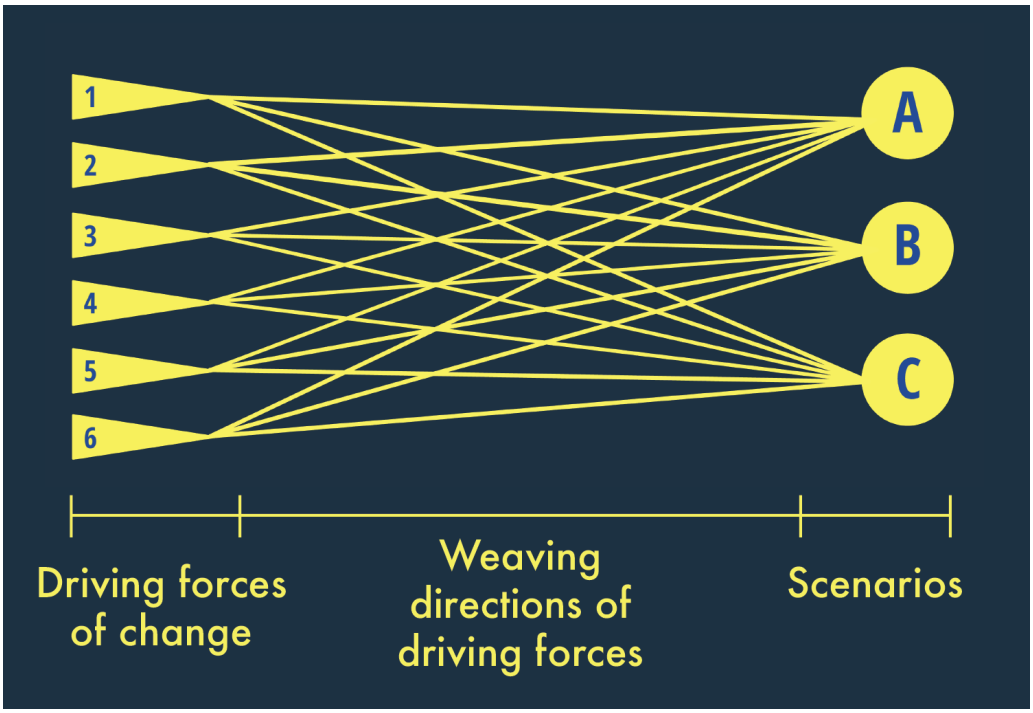

Figure 3. Exploratory scenario planning identifies and explores driving forces of change to understand and prepare for future uncertainties (Janae Futrell, Lincoln Institute of Land Policy)

ground, and insights about lived experiences we otherwise would not know about.

Defining Scenario Planning

Scenario planning—specifically, exploratory scenario planning—is a tool or process that can be used to imagine multiple plausible futures. In this capacity, scenario planning can be seen as a means to practice foresight.

APA's 2019 *PAS Memo* on scenario planning identifies two types of scenario planning: normative scenario planning, and exploratory scenario planning (Futrell 2019). Normative scenario planning is oriented around a distinct end goal or target state, with the scenarios being developed as potential ways to reach it. Exploratory scenario planning is used to make sense of drivers of change and to prepare for, navigate, and consider future uncertainties (Figure 3). For this reason, exploratory scenario planning tends to be the model used for climate change adaptation and the one best suited for hazard mitigation.

Dynamic Planning With Foresight

When integrating foresight into planning, one key question is how to combine long-term planning with short-term actions. According to Jennifer Gidley, PhD, of the Institute for Sustainable Futures at the University of Technology, Sidney, foresight is about "taking responsibility for the long-term consequences of our decisions and actions today" (Gidley 2017).

The world around us is in constant flux. Our plans need to reflect that and allow for change and adjustments. What might be an ideal future from today's perspective could be problematic in a few years. To create nimble plans, continuous discovery, and monitoring of external drivers of change, regular scenario planning and the ability to pivot and change directions when needed are crucial. Further, the cyclical practice of foresight supports regular updates of plans and makes them more resilient (Hurtado 2021b).

Scenario Planning in Hazard Mitigation and Climate Adaptation

Planning is inherently concerned with questions of risk and uncertainty. The future—and the many challenges that come along with that future—cannot be reliably "predicted." They can, however, be contextualized as more or less likely based on information that is available today. Understanding this dynamic is central to the practice of climate change adaptation and natural hazard mitigation.

Uncertainty and Future Conditions

Climate change, and the ways in which it disrupts historical climate and weather patterns on the global, regional, and local scales, poses a particular challenge to traditional planning methods, including hazard mitigation planning. For example, we cannot say exactly how much sea levels may rise in a specific location over a precise number of years. We rely on models that are based on a wide variety of inputs. These models may be used to project greenhouse gas emissions, associated atmospheric and oceanic warming, rates of ice melt, and changing development patterns in coastal areas. Each of these variables are themselves influenced by other outside inputs (or drivers of change) that are also uncertain. How do we account for less likely, but more extreme events, such as rapid ice melt and its consequent impacts on sea level rise? How do we consider the potential for rapid housing or commercial development in a highly vulnerable

location? This dynamic, where the multitude of variables (and the potential for extreme outcomes) can paralyze decision-making, is called "deep uncertainty."

Deep uncertainty occurs when stakeholders and decision makers have difficulty agreeing on or determining the likelihood of future outcomes (WUCA 2019). In this case, traditional planning methods can lead to indecision, underestimating risk, or not considering highly uncertain and extreme events. In the context of climate change adaptation and hazard mitigation, this may mean overly rosy predictions about risks, limited actions to effectively prepare for the future, or in some cases, a failure to act entirely.

Scenario planning, as a tool for practicing foresight, can help to mitigate or overcome these challenges by helping to create plans that are more nimble, robust, and adaptable to a variety of potential futures. This is easier said than done, especially when considering the numerous differences between established and broadly formalized planning methods such as hazard mitigation planning and emerging areas of practice such as climate adaptation. Though related, the approaches used for integrating scenario planning into each process can differ significantly.

Scenario Planning and Hazard Mitigation

Hazard mitigation planning is intended to reduce loss of both life and property by minimizing the impacts of natural disasters (FEMA 2013). It involves identifying risks and vulnerabilities to natural hazards and developing strategies that can reduce the exposure of people and property, all with the intention of saving lives.

While mitigating the impacts of natural hazards can be done through a variety of planning and nonplanning processes and policies, "hazard mitigation planning" as a formalized practice tends to refer to a set of policies, legislative requirements, and regulations that originate at the federal level and that apply to state, tribal, and local governments. Historically, emergency managers have been the primary leaders of hazard mitigation planning efforts, with local land-use and community planners playing secondary or advisory roles in developing or writing hazard mitigation plans, though that dynamic has begun to change over the last decade.

The robust suite of federal and state regulatory requirements and incentives has led to the widespread adoption of hazard mitigation plans and planning efforts across the United States. FEMA's guidance outlines a process (Figure 4) that

Figure 4. FEMA's four-step mitigation planning process (FEMA)

includes determining the planning area, building the planning team, developing an outreach strategy, performing a risk assessment, developing a mitigation strategy, and ultimately, adopting and monitoring the plan over time.

The adoption of this process has undoubtedly reduced loss of life and property and led to better overall outcomes for communities. However, with the formalization of state and local hazard mitigation plans, new and beneficial techniques such as scenario planning may be difficult to integrate within hazard mitigation planning efforts. Additionally, climate change is complicating the use of existing sources of hazard data such as floods of record, 100-year storms, the delineation of floodplains, and other traditional methods of measuring risk and vulnerability.

FEMA provides guidance in its hazard mitigation planning handbook on how a "scenario analysis" can be used in planning for unlikely but highly impactful events (for example, a major earthquake in New York City). However, a deeper integration of scenario planning techniques within the hazard mitigation planning process may be helpful in effectively considering the wider range of potential risks, strategies, and outcomes that are associated with climate change and other potential disruptors and drivers of change. While scenario planning tends to be seen as a strategic framework for organizing planning efforts, it can also be used tactically within an existing planning process or framework (Futrell 2019). Additionally, FEMA's guidance, while providing best practices for the primary components of a hazard mitigation plan, does offer significant leeway in the use of other planning techniques to achieve the goals and address the primary elements of a hazard mitigation plan. However, this likely will require new or modified data sources that are less reliant on historical patterns, guidance on where scenario planning can or should be used in the existing hazard mitigation planning process, and information on how scenario planning can relate to mitigation actions.

While both the research literature and real-world cases on the use of scenario planning for hazard mitigation are extremely limited, there have been recent attempts to develop practical guidance for practitioners and communities. One such approach focuses on the decisions that are within a community's control, while also using existing and familiar hazard datasets (Norton et al. 2019). This approach identifies three "climate futures" ("lucky," "expected," and "perfect storm"), and three "management options" (based on a particular policy or regulatory approach). It makes assumptions about future storms and conditions using current flood hazard data (e.g., the 100-year storm of today may become the 50-year storm of tomorrow), and pairs it with a specific zoning policy or action (e.g., no-build, full buildout, or modified buildout with flood resilience measures) to understand how different flood conditions may impact different development conditions within a 20- to 50-year timeframe. By relying on familiar datasets, this type of scenario-based planning approach could likely be included within the risk assessment stage of the hazard mitigation planning process. This could help communities and practitioners to form a variety of mitigation strategies that are more easily adaptable to observed changing conditions during the monitoring stage.

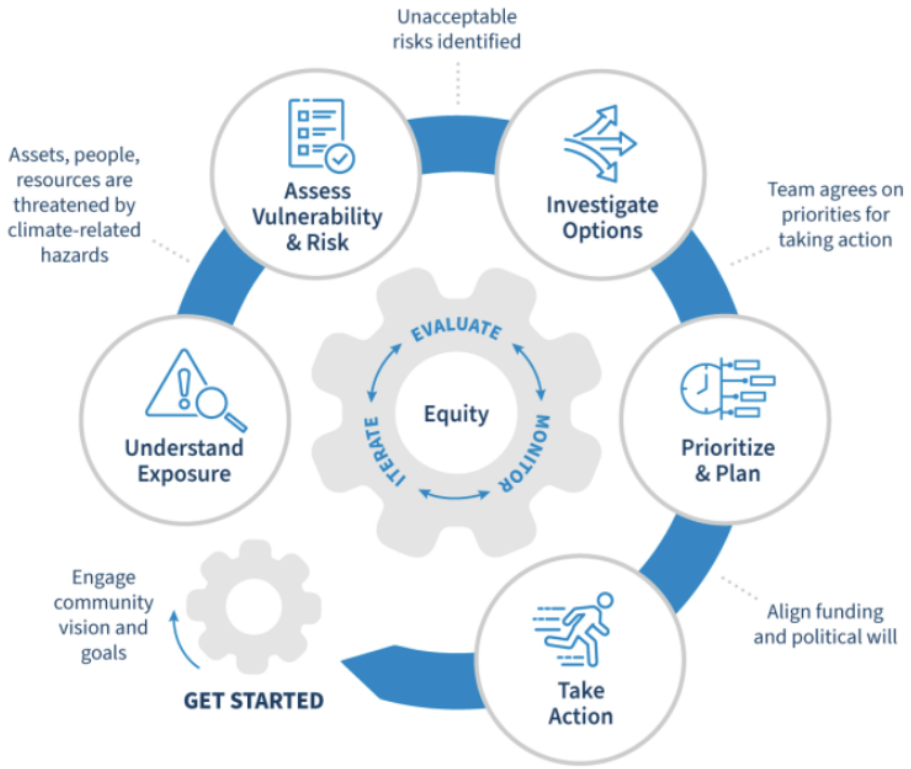

Figure 5. The five-step climate adaptation planning process (NOAA)

This "simplified, decision-centered approach" is just one possible way that scenario planning can be more deeply embedded within the hazard mitigation planning process. However, the use of scenario planning within hazard mitigation planning is still largely unexplored in research and untested in practice. Definitive and practical guidance may be necessary to provide communities with discrete steps and strategies for using scenario planning within the hazard mitigation planning process.

Climate Adaptation and Scenario Planning

Climate change adaptation tends to make much more robust use of scenario planning techniques, both as a strategic framework for developing a new plan and within existing and established climate adaptation planning efforts. While the task itself is no less daunting, the less standardized methods for creating a climate adaptation plan and the deep uncertainty of climate change impacts lend themselves to a planning framework that is based on understanding a range of possible futures and actions.

Adaptation planning as an area of practice has matured significantly over the last decade. While lacking the federal regulatory framework of hazard mitigation planning, federal agencies such as NOAA and the EPA and state and local governments across the United States have coalesced around a broad set of steps for building local resilience and developing an adaptation plan (Figure 5, p. 5). These are: (1) understand exposure, (2) assess vulnerability and risk, (3) investigate options, (4) prioritize and plan, and (5) take action (NOAA n.d.).

These steps can be used in a wide range of planning contexts, from a specific piece of infrastructure or single location to an entire community. Additionally, these steps can readily integrate potential scenarios related to future climate conditions, external drivers of change, and policy and regulatory actions on the part of a community. For example, Step 1, Understanding Exposure, is concerned with defining the community's existing conditions. It is here that hazards and potential climate and nonclimate stressors are established, and where the overall scope of the adaptation planning effort is defined. Given the right tools, a community can identify how climate stressors (such as sea level rise) may worsen existing hazards, or how nonclimate stressors (such as unanticipated population growth, or the decline of a key local employer or industry) may be potent drivers of change on the ground. This may help the community to develop a range of scenarios that can be refined in subsequent steps of the process, before ultimately informing priorities and actions that are adaptable to changing circumstances.

There are a few major barriers that can prevent the more robust use of scenario planning in climate adaptation. These include how planners define and use scenarios in their planning efforts, and the level of expertise and technical skill that may be required.

One element that complicates the use of scenario planning in climate adaptation is the extremely broad use of the term "scenario" among local practitioners, in climate research literature, and by climate authorities like the UN's Intergovernmental Panel on Climate Change (Norton et al. 2019). These different ways of using the term in planning include normative scenario planning as used in the community visioning process, where a variety of scenarios are used to refine a singular future vision. Alternatively, scenario planning may be seen exclusively as a method for evaluating stakeholder feedback on a variety of proposed infrastructure designs or housing types. Finally, "scenarios" may also refer to modeled futures of greenhouse gas emissions and their consequent impact on ice melt, precipitation, or sea level rise (Norton et al. 2019). This usage can be problematic. For example, while a community may use a range of potential sea level rise scenarios early on in a process, subsequent planning that is based on the selection of just one of these scenarios would lack the features of adaptability that are necessary for planning in an uncertain environment. Rather, an exploratory approach that develops an array of possible futures based on potential future climate conditions and other drivers of change, against which a series of policies can be tested, would more fully account for future uncertainties (Fierman, Field, and Aldritch 2012). This approach may allow planners to better identify "no-regrets" actions that apply to the widest set of future scenarios.

Scenario planning, given its reliance on potentially unfamiliar data sources and models, and the need to balance a wide variety of variables, can be more technically demanding than other more linear approaches to planning. This is especially true as it relates to climate adaptation planning and the multitude of climate tools, models, data, maps, projections, and forecasts that may be necessary for using scenario planning in concert with climate adaptation planning. At all stages of the planning process—from the identification of potential climate and nonclimate stressors, to the use of these stressors in understanding local risk and vulnerability over a defined period, to the development of adaptation strategies—scenario planning may require more active management, sustained engagement, and technical skill than most communities have the capacity for. In the discussion on hazard mitigation planning above, the "simplified decision-centered approach" used existing and well-understood data combined with relatively basic mapping tools to formulate scenarios. However, in communities where a more in-depth analysis that includes other variables (such as a multitude of potential climate impacts) and drivers of change may be preferred, this approach may not be suitable. Here, a more in-depth analysis of local variables and future climate risks is likely necessary. It is easy to be overwhelmed by the variety of tools available for visualizing climate change and its impacts, so communities and planners should also seek to clearly define the scope of their adaptation plan to rely on a core set of a tools and data sources that are well understood and that serve the goals of the planning effort.

Case Studies

Communities across the United States are using scenario planning in conjunction with or as a framework for their climate change adaptation efforts. Planning work in Cape Cod, Massachusetts, and Seattle offers helpful examples of how communities have sought to use scenario planning to develop

multiple future scenarios based upon the impacts of climate change and other external drivers of change in collaborative stakeholder-driven processes.

Cape Cod

Between 2010 and 2011, the Interagency Transportation, Land Use, and Climate Change Cape Cod Pilot Project took place. This federally sponsored project aimed to develop a future multi-agency transportation and land-use development scenario for Cape Cod that would incorporate the reduction of greenhouse gas (GHG) emissions and consider the effects of sea level rise.

Initially, scenario planning was used as an educational tool, aiming to inform stakeholders about the issues that climate change will bring to transportation and land-use planning. These scenarios, however, were later applied in the decision-making process to better understand the complex interactions between regional development potential, future transportation needs, and the impacts of sea level rise.

To develop the scenarios, five indicators were used: global GHG emissions, transportation energy use, congestion and vehicle miles traveled, the preservation of natural and existing ecosystems, and costs associated with particular decision pathways. Ultimately, the project resulted in the development of nine scenarios—five created by the scenario planning consultant, and four by stakeholders (including representatives of towns in the region, the county, the metropolitan planning organization, and a variety of other local agencies and organizations) that participated in local workshops.

Rather than being driven by a single overarching variable (for example, sea level rise) modeled over time, these efforts are notable for analyzing several distinct drivers over multiple scenarios. By including a variety of potential inputs for their scenario planning efforts, the community was better able to identify specific no-regrets actions that apply across several different potential futures. This helped to address significant uncertainties and better orient the community toward decision-making.

Seattle

Over the last 30 years, communities in the Pacific Northwest have struggled to address challenges related to either too little or too much water. The primary cause of this dynamic is more frequent and impactful droughts, warmer winters (with less snowpack), and periods of heavy precipitation. Seattle Public Utilities (SPU) has been planning and adapting to manage extreme weather conditions, trying to understand how climate change is impacting the present situation and how these trends may worsen into the future. Over the last two decades, SPU has been using scenario planning techniques to better understand the range of potential impacts to water supply associated with periods of drought and flood, and the role played by climate change in both.

Future conditions such as the impacts of sea level rise, worsening rates and frequency of extreme precipitation, and drought aren't a requirement for water utilities to consider in their water planning efforts in the state of Washington. However, SPU found that the inclusion of these variables allowed for more adaptable and dynamic decision-making in the present, which was particularly important given the rate of observed change at the local level. The most recent plan produced by SPU, the *2019 Water System Plan*, primarily focuses on the next 10 years, although it also discusses the view for 2040 and beyond. Its objective is to plan ahead to meet future water demand, ensure its quality, and maintain the water system at the lowest life-cycle cost.

In previous planning cycles, notably in 2007 and 2013, SPU had been relying on three to four scenarios. However, in the latest plan, the department worked with the Climate Resiliency Group and climate scientists at the Climate Impacts Research Consortium to create 40 scenarios. Notably, these futures considered several external drivers of change in addition to the primary climate-focused variables such as sea level rise and precipitation rates. These drivers included changes in population, changes in the locations and intensity of development, changes in natural systems, and the integration of secondary climate-related drivers such as wildfire. This allows SPU to test how its systems would work in a variety of equally plausible futures, and to identify actions that address both the most extreme and the most common potential outcomes.

Action Steps for Planners

The practice of foresight and exploratory scenario planning can be an effective tool for developing hazard mitigation and climate adaptation plans that are nimble and adaptable to future circumstances. However, it can also be more technically demanding than other planning methods, and the potential range of future uncertainties can be overwhelming. Sources of data may be difficult to identify and models may be difficult to understand. Unfamiliar information that planners may not be well acquainted with, such as climate change data, may further obscure the process. To help with this process, APA is now publishing an annual trend report to help local planners better understand critical drivers of change and to make their integration into local planning efforts more feasible. The following action steps represent key strategies that planners can use to overcome some of these challenges and effectively use scenario planning in hazard mitigation and climate adaptation efforts.

Review the hazard mitigation plan for ways to include scenario planning techniques. While examples from practice are relatively limited, existing hazard mitigation planning guidance from FEMA allows for the use of alternative planning processes in developing the hazard mitigation plan. Additionally, scenario planning isn't just a larger framework for organizing planning efforts but is also useful tactically to make existing planning processes more robust. Planners should evaluate their existing hazard mitigation plan for elements that may be especially suitable for the use of scenario planning techniques. This may include stages such as developing an outreach strategy, performing a risk assessment, developing a mitigation strategy, and plan monitoring. Each of these stages likely include points

of intervention where a wider array of potential scenarios and outcomes informed by future conditions should be considered.

Expand the use of existing terminology and sources of data. Hazard mitigation planning tends to use a set of standardized and formalized terminology and sources of data that are broadly familiar to practitioners. While this can be seen as a drawback to considering the role of climate change on historic weather patterns, it is also an opportunity to identify ways that data can be used to make assumptions about the future. In the "simplified decision-centered approach" outlined above, this includes developing scenarios based upon the informed assumption that storms may become more severe and frequent (Norton et al. 2019) over the life of a given asset. This can allow for the development of a set of climate futures that can be weighed against a series of policy options and approaches and compared to community and economic development scenarios to avoid development in or retreat from unsafe locations.

Use the climate adaptation plan to inform the hazard mitigation plan. If your community already has a climate adaptation plan that uses scenario planning techniques, it is likely worthwhile to identify ways it can be used to inform your hazard mitigation planning efforts. An existing set of tools, models, or maps that are already vetted and used for understanding future climate impacts as part of a climate adaptation plan can be used to build a more robust and adaptable hazard mitigation plan. This can be more challenging if hazard mitigation and climate adaptation are performed in different municipal jurisdictions (for example, a county hazard mitigation plan versus a city climate adaptation plan), but there still may be useful guidance and information that can be integrated.

Embrace the update cycle. Plan monitoring and adjustment are crucial to effective use of foresight and scenario planning. Foresight practice is typically performed in cycles, in which trends and drivers of change are identified and evaluated in regular intervals. This allows foresight practitioners to better understand the emergence and evolution of trends over time and their potential impacts on the community. This is conceptually similar to the plan monitoring and review cycles that communities are familiar with. FEMA requires hazard mitigation plans to be updated every five years. By embracing the five-year update cycle, planners can regularly monitor how uncertainties, variables, and drivers of change are evolving within an actionable time horizon. For some communities, plan update cycles may even be as short as every two years. This can allow for timely adjustments to mitigation strategies that are reflective of emerging science and data.

Develop a local foresight practice to identify other drivers of change. While a climate adaptation or hazard mitigation plan should be primarily concerned with future hazard and climate impact scenarios, these are many other seemingly unrelated variables that may play a role in future outcomes. The future isn't only about managing the uncertainty of natural hazards and the disruption associated with climate change. Seemingly small technological changes, given enough time, can have major ramifications on the local level. An unforeseen development boom in a particular location, the decline of a key industry, or a shift in commuting patterns all will eventually result in changes on the ground. Each of these changes may in turn interact with the impacts of climate change or a natural disaster in unforeseen ways. Therefore, embedding scenario planning within a broader practice of foresight can be beneficial. Developing a local foresight practice, in which the community works to identify emerging trends and other drivers of change (such as technological or societal shifts), can be helpful in producing more robust scenarios, more thoughtful plans, and ultimately, better long-term decision-making.

Focus on a well-defined scope for climate adaptation plans. The sheer volume of potential decision-support tools, data sources, maps, and other sources of information that can be used to inform scenario planning efforts can be overwhelming. This can get even more complex when considering other long-term drivers of change that may be traditionally outside the scope of an adaptation planning effort. Dedicate time early in the planning process to define the overall scope of the plan and identify the tools and data that you will be using to develop your scenarios, and stick with them.

Use scenarios to identify critical no-regrets actions. Scenario planning, by design, results in a wide array of potential futures that can (and should) be used to guide decision-making. By comparing different scenarios, communities can better understand commonalities and identify specific actions that may address multiple long-term risks and vulnerabilities. These types of "no-regrets" actions, in targeting outcomes associated with multiple plausible future scenarios, may help to ease concerns about decision-making in highly uncertain environments.

Conclusion

There is no getting around the reality of uncertainty and complexity in planning. In the context of natural hazards and the role of climate change, deep uncertainty and high levels of complexity are simply unavoidable. Foresight and exploratory scenario planning are an attempt to work with and make sense of the future by acknowledging and accepting complex systems and the role they play in our communities.

By embracing uncertainty, planners can better immerse themselves in the reality of an ultimately unknowable future. And by staying up to date with these emerging practices, planners can help to prepare communities, reduce long-term risks, and build a strong foundation for adapting to a future of change.

About the Authors

Petra (Stieninger) Hurtado, PhD, is the research director at the American Planning Association, heading APA's research programs and foresight practice. Her areas of expertise and research include foresight, urban futures, urban sustainability, smart cities, emerging technologies, and environmental psychology. Prior to joining APA, she worked as an advisor, planner, researcher, and educator in the global urban sustainability arena.

Joseph DeAngelis, AICP, is a planner and research manager at the American Planning Association, where he focuses on climate adaptation, natural hazard risk, and community resilience. He holds a Master of Urban Planning degree from CUNY-Hunter College.

This edition of PAS Memo is available free to all thanks to financial support from FEMA through the Cooperating Technical Partners program.

References and Resources

Dixon, Timothy J., and Mark Tewdwr-Jones. 2021. *Urban Futures: Planning For City Foresight and City Visions*. Policy Press/Bristol University Press.

Federal Emergency Management Agency (FEMA). 2013. *Local Mitigation Planning Handbook*. March.

Fierman, Elizabeth, Patrick Field, and Stephen Aldritch. 2012. "Managing Risk and Uncertainty: Collaborative Approaches for Climate Change." *Land Lines*, July.

Futrell, Janae. 2019. "How to Design Your Scenario Planning Process." *PAS Memo*, July/August.

Gidley, Jennifer. 2017. *The Future: A Very Short Introduction*. Oxford University Press.

Hurtado, Petra. Forthcoming. APA Learn course on Futures Literacy.

———. 2021a. "Planning with Foresight." *PAS QuickNotes 94*.

———. 2021b. "The Future of Planning Is Agile, People-Centric, and Technologically Advanced." APA Blog, February 10.

Hurtado, Petra, Joseph DeAngelis, Alexsandra Gomez, and Sagar Shah. 2022. *The 2022 Trend Report for Planners*. American Planning Association and Lincoln Institute of Land Policy.

Krznaric, Roman. 2020. *The Good Ancestor: A Radical Prescription for Long-Term Thinking*. Penguin Random House Ltd. and The Experiment LLC.

Mohammadi, Neda, and John E. Taylor. 2021. "*Thinking Fast and Slow in Disaster Decision-Making With Smart City Digital Twins*." *Nature Computational Science* 1(December): 771–73.

National Oceanic and Atmospheric Administration (NOAA). n.d. "Steps to Resilience." U.S. Climate Resilience Toolkit.

Norton, Richard, Stephen Buckman, Guy Meadows, and Zachary Rable. 2019. "Using Simple, Decision-Centered, Scenario-Based Planning to Improve Local Coastal Management." *Journal of the American Planning Association* 85(4): 405–23.

Rasmussen, Ben, Lindsey Morse, David Perlman, Gina Filosa, and Carson Poe. 2012. *A Framework for Considering Climate Change in Transportation and Land Use Scenario Planning: Lessons Learned from an Interagency Pilot Project on Cape Cod*. U.S. Department of Transportation, Volpe National Transportation Systems Center.

Seattle Public Utilities. 2019. *2019 Water System Plan*.

Stapleton, Jeremy. 2020. *How to Use Exploratory Scenario Planning (XSP): Navigating an Uncertain Future.* Lincoln Institute of Land Policy.

Water Utility Climate Alliance (WUCA). 2019. "Decision-Making Under Deep Uncertainty." In Chapter 3, Plan, in *Online Training for Water Utilities*. U.S. Climate Resilience Toolkit.

Webb, Amy. 2016. *The Signals Are Talking: Why Today's Fringe Is Tomorrow's Mainstream*. Public Affairs, Hachette Book Group.

PAS Memo *is a publication of APA's Planning Advisory Service. Joel Albizo, FASAE, CAE, Chief Executive Officer; Petra Hurtado, PhD, Research Director; Ann F. Dillemuth, AICP, PAS Editor. Learn more at* planning.org/pas.