

# PAS QUICKNOTES

## ADAPTATION PATHWAYS FOR CLIMATE RESILIENCE

Adaptation pathways offer a flexible, phased approach to climate resilience. They facilitate proactive planning in the face of uncertainty around the timing, location, and extent of local climate change impacts. This approach moves beyond traditional “predict and plan” scenario-based approaches by tracking observed conditions against long-term projections, enabling threshold-based decision-making and phased investments in communities and infrastructure.

### BACKGROUND

Adaptation pathways define a sequence of adaptation actions that are triggered by observable events and impacts over time to achieve defined objectives under changing conditions. They have been used in climate adaptation planning since the 2010s to guide decision-making under uncertainty, providing an alternative to traditional scenario-based planning approaches.

Many government agencies and jurisdictions do not know where to start when it comes to adaptation planning, and pathways provide a helpful framework to achieve long-term resilience in the face of uncertainty. They enable planners and communities to respond flexibly to short- and long-term climate impacts such as sea level rise, extreme heat, and flooding, as well as episodic disasters. Pathways can be developed for individual buildings and infrastructure assets as well as for entire infrastructure systems, neighborhoods, and communities. The scale of application can be informed by anticipated impacts, asset types, physical characteristics, political boundaries, and other factors.

Pathways favor the use of “low-regrets” strategies that perform well under a range of future conditions, building in flexibility to prevent dependence on a single approach that may prove maladaptive. They support cost-effectiveness by spreading out investments over time and ensuring they sustain long-term goals. When developed through participatory planning processes, they allow communities to establish a long-term vision to inform adaptation strategies and sequencing.

### CREATING ADAPTATION PATHWAYS

Creating adaptation pathways involves several key steps:

- Defining a long-term vision and adaptation objectives through community participation, informed by shared understanding of localized conditions, vulnerabilities, and potential impacts.
- Identifying adaptation strategies and evaluating them against the vision and objectives, employing technical analysis to determine the feasibility and effectiveness of solutions.
- Determining measurable triggers for monitoring, such as flooding frequency, sea level increase, damage to the built environment, or existing infrastructure performance.
- Establishing relevant thresholds, or “tipping points,” at which an adaptation strategy no longer meets specified objectives and an alternative must be pursued.
- Visualizing the pathway to graphically illustrate the sequencing of strategies, dependencies, triggers, tipping points, alternative solutions, and other factors such as high-level costs, trade-offs, and benefits.

Developing adaptation pathways should be a participatory process that integrates technical expertise with local and traditional knowledge to evaluate feasibility, explore trade-offs, and identify the costs and benefits of potential strategies. This process requires ongoing stakeholder engagement to build an understanding of anticipated climate impacts, shared adaptation needs, and a collective vision

*This PAS QuickNotes was prepared by Melissa May, AICP, principal resilience lead, Haley & Aldrich.*



*Adaptation pathways offer a flexible and systematic approach to preparing for and responding to climate change impacts, such as worsening coastal erosion on the north shore of O'ahu, Hawai'i. Photo courtesy Rob Walker.*



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of desired versus unwanted change. Through this engagement, communities can establish clear objectives and criteria to guide pathway development. Involving diverse perspectives—including Indigenous ecological knowledge—enriches decision-making by incorporating varied beliefs, values, and historical understandings of land management, ultimately leading to more inclusive and context-sensitive adaptation strategies.

## INTEGRATING PATHWAYS INTO PLANNING AND BUDGETING FRAMEWORKS

Adaptation pathways may be developed as part of a dedicated climate adaptation planning process or integrated into existing planning frameworks. Pathway development requires technical skillsets not often used in comprehensive planning, including engineering, economic analysis, environmental science, and site-specific impact modeling. This expertise is important to understand localized vulnerabilities and impacts, evaluate the technical feasibility and effectiveness of adaptation strategies, and identify costs, benefits, and trade-offs. Planners should factor in necessary technical analyses when scoping and budgeting adaptation pathway planning processes and pursue cross-sector collaboration when undertaking these efforts.

Once pathways are developed, they must be integrated into existing plans and processes. These may include comprehensive plans, infrastructure and functional plans, hazard mitigation plans, community resilience plans, capital improvement plans, and agency processes. Visual depictions of pathways and strategies are useful in communicating and facilitating broad understanding, participation, and support among communities and decision-makers.

## ADDRESSING LOCAL BARRIERS TO ADOPTION

While not a new approach, adaptation pathways have not been widely or consistently employed. A key barrier has been the failure to integrate climate adaptation into planning frameworks due to factors including low political will, limited funding, lack of familiarity, and limited agency capacity.

Adaptation planning efforts are often driven by policies and regulations at the state or local levels that require consideration of climate change in existing plans or the development of dedicated climate adaptation plans. Federal policies and funding can also be a driver for adaptation planning through funding sources that support community disaster preparedness and infrastructure resilience. Without these drivers, adaptation planning and pathway development can be inconsistent and ad hoc.

Institutionalizing adaptation pathways requires a combination of funding and policies driven by political will and legislation, as well as commitment to aligning agency mandates, structures, and budgeting processes with proactive long-term planning and ongoing monitoring of climate change impacts. Political will may be strengthened through demonstrating the cost-effectiveness of proactive, flexible adaptation pathways and alignment with existing policy goals. At the agency level, training, additional staffing, and guidance may be needed to overcome technical and institutional challenges. Pilot projects and interagency collaboration can support the implementation of adaptation pathways through building capacity and demonstrating the efficacy of adaptation strategies.

## CONCLUSIONS

Adaptation pathways support responsive, resilient planning by helping communities prepare for long-term climate impacts and episodic disasters. They offer a flexible framework for decision-making under uncertainty and promote cost-effective, phased implementation of adaptation strategies. Increased awareness and integration into planning frameworks and agency processes can expand adoption, enabling communities to build resilience and proactively address climate risks over time.

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## FURTHER READING

### Published by the American Planning Association

Bucchin, Matthew, and Aaron Tuley. 2022. *Planning for Climate Mitigation and Adaptation*. PAS Report 601. Chicago: American Planning Association.

DeAngelis, Joseph, Haley Briel, and Michael Lauer. 2019. *Planning for Infrastructure Resilience*. PAS Report 596. Chicago: American Planning Association.

Hurtado, Petra, and Joseph DeAngelis. 2022. "The Use of Foresight and Scenario Planning in Hazard Mitigation and Climate Adaptation Planning." PAS Memo 113.

### Other Resources

Haasnoot, Marjolijn, Valeria Di Fant, Jan Kwakkel, et al. 2024. "Lessons From a Decade of Adaptive Pathways Studies for Climate Adaptation." *Global Environmental Change* 88: 102907.

Di Fant, Valeria, Andrew Warren, and Karianne de Bruin. 2023. *Methodologies for Adaptation Pathways Formulation*. Pathways2Resilience Project, Deliverable D6.2. Deltares.

Werners, Saskia E., Russell M. Wise, James R.A. Butler, et al. 2021. "Adaptation Pathways: A Review of Approaches and a Learning Framework." *Environmental Science & Policy* 116: 266–75.

Zandvoort, Mark, Inês Campos, André Vizinho, et al. 2017. "Adaptation Pathways in Planning for Uncertain Climate Change: Applications in Portugal, the Czech Republic and the Netherlands." *Environmental Science & Policy* 78: 18–26.