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## Research Publications

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Integrating Nature into Risk Science and Insurance: A Coastal Resilience Symposium

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# Integrating Nature into Risk Science and Insurance

A COASTAL RESILIENCE SYMPOSIUM



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## Summary

**RISKS FROM NATURAL DISASTERS** are multiplying in frequency and severity due to climate change and habitat loss. Both insurance and nature-based solutions (NBS) can play crucial roles in risk reduction. **Innovative adaptation solutions are being developed that synergistically harness both nature and insurance to mitigate risks and promote coastal resilience, but they are still nascent.**

**Impacts from climate change are here now and we must act now to adapt to protect coastal communities.** Just days before this event, the Pajaro River flooded in neighboring Monterey County when a levee broke, impacting the deeply underserved

and vulnerable community of Pajaro. This disaster highlighted the need to rapidly scale up adaptation efforts, while continuing carbon mitigation efforts, which are much more advanced. Currently, adaptation receives only 10% of climate funding globally, with the rest going to mitigation efforts. Adaptation funding must grow and California can and should become a leader in advancing adaptation innovations.

**There is substantial interest across public and private sectors in using nature and insurance for adaptation,** as evidenced by diverse and enthusiastic attendance at the symposium. The value of NBS for risk reduction is gaining traction, although there is a long way to go. The variety of ways that insurance can support nature while



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HIGHLIGHTS CONTINUED

building resilience are less understood across sectors, and there is an important need for knowledge sharing and collaborative innovation in this space.

Equity was a central theme throughout the two-day event, and there was a **broad consensus that adaptation solutions are largely absent for the most socially vulnerable communities and that must change.** Participants discussed ways to advance equity and support frontline communities through improvements to risk assessments, data accessibility, public funding pathways, private investment mechanisms, capacity building efforts, public outreach, and two-way learning.

**The event catalyzed conversations about on-the-ground initiatives** to test blended insurance and nature tools in California and spur innovation and investment in these new coastal climate resilience strategies (see **“APPLICATIONS FOR CALIFORNIA”** Boxes 1-6).

## Event Description

**TO ADVANCE THE USE OF NATURE AND INSURANCE IN COASTAL ADAPTATION,** a multi-sector symposium and workshop was held at UC Santa Cruz on March 16th and 17th of 2023, jointly hosted by the UCSC Center for Coastal Climate Resilience, the California Department of Insurance, the Ocean Science Trust, and the U.S. Army Corps of Engineers. Attendees included professionals from the private insurance industry, private risk modeling firms, government scientific agencies, conservation non-profits, academia, California state natural resource agencies, government regulators, local government planners, elected officials, and federal risk management agencies including the Federal Emergency Management Agency (FEMA).

**DAY ONE** of the event showcased panels of experts discussing a wide range of topics, including nature-positive insurance coverages, nature-based adaptation solutions, public and private risk models, policy incentives, and the equity of adaptation solutions, among other topics. **DAY TWO** built on these insights through workshop discussions, where participants developed next step actions to advance nature and insurance solutions in California (See Boxes 1-6). More information, including presenter slides, can be found [here](#).

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# Key Insights

## PANEL 1:

### Unlocking nature and insurance to build coastal resilience

- **Moderator: Deborah Halberstadt**  
*Senior Climate Policy Advisor at the California Department of Insurance*
- **Emily Corwin**  
*Director of Nature-based Engineering Solutions at Conservation International*
- **Lindsay Judd**  
*Senior Environmental Underwriter at AXA XL*
- **Nuin-Tara Key**  
*Director and North America Public Sector Lead at the Climate and Resilience Hub at WTW*

➤ **Knowledge and capacity are low** for nature and insurance adaptation solutions: Knowledge about insurance is very limited among the public, government agencies, NGOs, and academia. Knowledge about how insurance can support nature is limited across all sectors.

➤ **Insurance can build resilience and promote nature:**

Both indemnity insurance and parametric insurance can play roles in building resilience in coastal communities and supporting nature.

- **Indemnity insurance** is well-suited to situations where payouts must closely match actual damages, e.g., for property insurance, where a mismatch between payouts and damages could be devastating to a property owner.

An innovation that would make indemnity insurance nature-positive is incorporating nature's risk reduction benefits into premium pricing of property insurance policies.

- **Parametric insurance** is well-suited to situations where a fast payout is critical. It can pay out faster than indemnity insurance because payouts are linked to predetermined thresholds of a measured

## BOX 1:

### Breaking down silos and building insurance knowledge in CA

Local workshops can foster cross-pollination of ideas between the insurance industry, local governments, community groups, and conservation organizations. In February 2023, a workshop was held in Imperial Beach, CA, which successfully spurred conversations about developing local pilot projects that blend insurance and nature-based solutions. Similar workshops are needed in other regions, and there are opportunities to pursue these in coordination with California's regional climate collaboratives.

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variable (e.g. wind speed or precipitation amount) rather than time-consuming damage assessments. As such, parametric insurance has a higher basis risk (the risk that payouts do not match actual damages). It can provide useful additional coverage on top of indemnity coverages.

To date, existing insurance coverages that cover damages to ecosystems are parametric. Existing coverages are only for coral reefs (Mesoamerican Reef and Hawaiian reefs). There is opportunity to expand this type of reef coverage to additional habitats, such as mangroves and, significantly for California, salt marshes, wetlands, sand dunes, and seagrass meadows. Expanding insurance coverages would simultaneously increase resilience of ecosystems to natural disasters, and decrease risk for adjacent communities.

Communities are also experimenting with parametric insurances to provide rapid disaster-support, as an additional layer of coverage on top of indemnity coverages (*see Box 2 for an example*).

➤ **Equity should be a key consideration** in designing new nature and insurance-based adaptation solutions: Panelists discussed whether Community-Based Catastrophe Insurance (CBCI) coverages might be able to support socially vulnerable communities through innovative risk pooling premium payment structures that make coverage affordable (or free) to under-resourced households.

**BOX 2:**  
**Learning from a New York City  
Parametric Flood Insurance Pilot**

**Parametric community flood insurance**

is being piloted in NYC to provide rapid funds to low and medium-income households in the immediate aftermath of flood disasters. This innovative coverage was co-developed by the Center for NYC Neighborhoods, EDF, Guy Carpenter, Swiss Re, and others. The pilot is supported by an NSF grant that covers the insurance premium, among other things. The use of public funds (from NSF) to cover an insurance premium is an interesting precedent, suggesting the possibility of using government funds to incubate and support other innovative insurances that can help reduce risks and build community resilience.

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➤ **Public-private partnerships** can drive nature-positive adaptation solutions: In the early stages of innovation, it could be important for the government to foster ideas and fund demonstration projects to help ideas become established and mainstream. For example, it would be interesting to explore whether public funds could be used to pay premiums on new insurance coverages, such as community-based insurance or climate risk insurance, to help establish feasibility and demonstrate effectiveness.

**BOX 3:**  
**Climate Resilience Districts**

**Climate Resilience Districts** (CRDs) are a promising new governance tool that could help advance nature-positive insurance in California. Envisioned by SB-852, which was codified in 2022, carried by Senator Dodd, and supported by the California Department of Insurance and CivicWell, CRDs are special districts that can be created to span jurisdictional boundaries and facilitate planning and fundraising for climate resilience.



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**FIRESIDE CHAT**

- **Moderator: Ricardo Lara**  
*California Insurance Commissioner*
- **Mayor Fred Keeley**  
*City of Santa Cruz*

- **David I. Maurstad**  
*Resilience Associate Administrator (Acting) at the United States Federal Emergency Management Agency*
- **Stephen L. Hill, PMP, SES**  
*Director of Contingency Operations and Chief at the Office of Homeland Security with the United States Army Corps of Engineers*

➤ **Planning for risks in advance** is important and cost-effective: It is much more expensive to recover after a disaster than to mitigate risks in advance. Thoughtful planning to reduce risks in advance also creates the opportunity to include nature in the solutions. For example, FEMA's BRIC program supports building community resilience in advance of disasters through a suite of approaches, including nature-based solutions (NBS).

Insurance is also a powerful tool that can help minimize suffering and damage by providing fast resources during a disaster. We need local and national innovations and efforts to spur uptake of insurance, which can be quite low in some places and for certain hazards. For example, only 2% of Californians are covered by flood insurance. More public awareness and education is needed to drive uptake.

➤ **Greater resources need to be directed to socially vulnerable communities** for risk mitigation, and this is a top priority for state and federal agencies: More public and private funds must be channeled to vulnerable communities. This is a top priority in the federal government, as evidenced by the Justice40 initiative, which directs that 40% of benefits from federal investments should go to disadvantaged communities. FEMA has made strides in this direction. For example, recent changes in requirements for home ownership documentation allowed thousands more socially vulnerable people in Florida to get post-disaster assistance from FEMA after Hurricane Ian.

State and local government officials similarly are committed to supporting socially vulnerable communities. For example, the California Department of Insurance is prioritizing closing the protection gap for vulnerable and disadvantaged communities, including through the development of several pilot projects via AB-970, which is currently under consideration in the California Legislature.

➤ **Public policy can spur scientific advancements** that support nature-based adaptation solutions: For example, new policy and legislative mandates could call for and fund coastal feasibility studies that show where NBS could be effective at reducing risks. Agencies could be directed to develop much-needed guidance and examples of benefit-cost analyses for NBS. Requirements could be put in place to consider green infrastructure alternatives when planning risk mitigation projects.

Existing engineering guidance for NBS, which was co-developed by the U.S. Army Corps of Engineers, UC Santa Cruz, and other partners, is greatly supporting efforts in building agency knowhow on NBS. A valuable next step to build on this work would be developing more prescriptive and specific engineering guidelines for NBS.

**BOX 4:**

**Assess the potential for NBS risk reduction benefits along the California coast**

Key activities that will advance our understanding of NBS risk reduction potential include:

- Conducting a statewide assessment of NBS risk reduction potential to identify locations where NBS adaptation projects could yield the greatest and most equitable benefits
- Ensuring strategic investments in a diverse suite of nature-positive insurance pilot projects (see also p. 9) that are monitored comprehensively for performance
- Exploring opportunities for institutionalizing monitoring within anticipated State investments in coastal nature-based solutions more broadly

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**PANEL 2:**

**Improving risk science to reflect nature, equity, and adaptation**

- **Moderator: Dr. Guillermo Franco**  
*Managing Director & Global Head of Catastrophe Risk Research at Guy Carpenter*
- **Dr. Patrick Barnard**  
*Coastal Geologist, US Geological Survey*

- **Dr. Dag Lohmann**  
*CEO, KatRisk*
- **Dr. Maya Trotz**  
*Professor & Director, NSF Hub on Equitable Nature-based Solutions, University of South Florida*

➤ **Coastal risks are substantial and growing:**

In California, coastal flooding will threaten over 600,000 people and \$200 Billion (6% of GDP) in property by 2100.

➤ **Risk models need to better incorporate nature, social factors, and climate change:** These changes are critical for making adaptation efforts more nature-positive and equitable:

- **Nature**  
The technical knowledge exists for modeling the risk reduction benefits from nature-based solutions. Getting them incorporated into public and industry models is a matter of raising awareness among modeling organizations and securing the resources to do the (expensive) additional model runs needed to quantify nature's risk reduction benefits. This is a solvable problem; it is just a question of building appetite and raising funds.
- **Social Factors**  
The social information in risk model outputs is woefully inadequate, focusing largely (or solely) on impacts to high-value infrastructure. To make risk assessments support equitable solutions, more relevant social information must be incorporated into risk model outputs. A substantial amount of scientific and community engagement work is needed to figure out the best approach for incorporating social justice dimensions into risk assessments.

- **Climate Change**

Getting climate change into flood models is critical for informing our understanding of risks going forward. Federal agency modelers (USGS) and industry modelers (KatRisk) are interested in working to advance the incorporation of climate change into risk models. Next steps should be pursued to try to remove any barriers in the way of this work.

- **Risk data must be made accessible** to the public: Access to useful data is one important element of creating equitable adaptation solutions.
- **Storytelling and qualitative analyses** can play an important role in advancing equity in adaptation: In addition to quantitative analyses, there is a need for powerful stories and qualitative analyses to inform adaptation planning. These tools can help build trust and shared-understanding of coastal risks with front-line communities, fostering local receptivity toward meaningful, long-term engagement. California and the private risk industry could step into a leadership role in this storytelling space.



**PANEL 3:**

**Incentivizing adaptation**

- **Moderator: Dr. Jane “Carter” Ingram**  
*Executive Director at Pollination*
- **Chip Cunliffe**  
*Programme and Risk Director, Ocean Risk and Resilience Action Alliance*
- **Sarah Heard**  
*Director, MarketLab, The Nature Conservancy*
- **Dr. Heather Tallis**  
*Assistant Director for Biodiversity and Conservation Sciences at the United States White House Office of Science Technology and Policy*

➤ **De-risking investments in nature-based solutions (NBS)** will help mobilize private funding: Insurance can play a role de-risking NBS investments, through tools such as catastrophe wrappers<sup>1</sup>, insurance coverages for nature-derived carbon credits<sup>2</sup>, and insurance-backed performance guarantees<sup>3</sup> for NBS adaptation projects, among others. Another way to de-risk and mainstream NBS investments is to weave them in as one element in larger investments. For example, the InterAmerican Development Bank earmarked 10% of a large sanitation and public health loan to Brazil for nature-based approaches like watershed management.

➤ **Developing Benefit-Cost Analyses (BCAs) for NBS** will unlock public and private funding: Many public and private funding decisions are based on BCAs. Not having clear guidance on how to develop BCAs for NBS has severely hindered NBS implementation and this must change. To fill this technical gap, we need to monitor NBS projects that are currently being built to gather more data on costs and benefits.

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1. Catastrophe wrappers are parametric insurance products that “wrap around” and reduce the risks of other investment instruments, such as green and blue bonds. In the event of a covered catastrophe, the catastrophe wrapper provides a rapid payout that can be used to continue payments to investors.

2. Nature-derived carbon credits are tools that incentivize and facilitate carbon mitigation through nature-based projects (e.g., coastal wetland restoration).

3. Insurance-backed performance guarantees are instruments that pay out if a project does not perform to agreed-upon standards. They are currently offered for some new clean technologies.

**BOX 5:**  
**Creating a CA Adaptation Marketplace**

California became a global leader in carbon markets in 2012, with the creation of the California Cap-and-Trade program and the establishment of the CA carbon market. Now, California has the opportunity to become a trailblazer in adaptation by creating the first ever Adaptation Marketplace, which would facilitate private investment in adaptation projects, including NBS. Companies and individuals could meet some of their environmental commitments by purchasing verified adaptation credits in the marketplace, and trust that they were creating real and defensible benefits on the ground.

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➤ **Change benefit metrics to better reflect impacts on human well-being:** Most risk assessments and BCAs focus mostly (or entirely) on impacts to high-value infrastructure. This is an insufficient metric of human well-being impacts and under-represents impacts to socially vulnerable communities. More work is needed to identify relevant social metrics that can be incorporated into risk assessments and BCAs to make them more equitable.

**Well-monitored pilots** of NBS and insurance solutions are an important next step: They will inform BCAs and generate compelling stories that can help build awareness and appetite for these solutions among practitioners, funders, and the public. High priority pilot projects include the following:

- **Parametric insurance**  
At this symposium, participants explored opportunities for a variety of NBS insurance pilot projects throughout California’s coastline, as well as nationally and internationally.
- **Property Insurance That Reflects Nature’s Benefits In Premium Pricing**  
In California, coastal dunes provide substantial risk reduction benefits and there may be opportunities to develop dune NBS adaptation projects with an insurance element. There may also be opportunities to develop pilots for salt marshes or ecotone levees.
- **Community-Based Catastrophe Insurance**  
CBCI is a novel insurance tool and an important next step is developing pilot projects, even if they do not have nature-based elements to them. Later iterations of CBCI could be nature positive by, for example, including nature’s benefits in premium pricing.

➤ **Local champions** will help advance NBS and insurance solutions: Passionate and informed champions of adaptation solutions that use nature

and insurance would help spur uptake. Boot camps could be designed to raise awareness of these solutions and help build a network of champions within the risk industry, government, NGOs, and communities.

➤ **Empowering communities to lead their adaptation efforts** will promote equity: Many of the most vulnerable communities lack the capacity and resources to navigate complex planning, funding, and permitting processes for adaptation projects. These processes are particularly daunting for NBS, which often require engagement with multiple different agencies. Streamlining these requirements and simultaneously building community capacity around adaptation would lead to more NBS getting built and more equitable outcomes overall. NGOs, government agencies, and academic institutions can both learn from and support communities as they adapt.

**BOX 6:**  
**Permitting challenges and progress for NBS**

Permitting is a widely-acknowledged barrier to building more NBS that needs to be thoughtfully addressed while being careful to avoid compromising environmental protection. Recent progress has been made in the beneficial use of dredge, which is a high priority for USACE and has been allowed by the Bay Conservation and Development Commission in recent years.

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## Conclusion

**THIS EVENT** brought together experts from diverse sectors that often do not cross paths, allowing for cross-pollination of ideas and networks. Groundwork was laid to advance nature and insurance adaptation solutions and bring them to scale. Next steps include engaging clients of insurers and risk modelers, who can help motivate change in these organizations, and starting the

important work of engaging with local community leaders to collaboratively explore adaptation solutions. Locally-focused convenings, building on this momentum, could be key to catalyzing uptake of pilot projects that demonstrate the value of linking nature-based solutions with insurance mechanisms.

