



Sustainable Solutions for Climate Adaptation: Weaving Traditional Ecological Knowledge and STEAM

Project Overview

Developing collaborative strategies for climate adaptation that are sustainable and just.

Climate change solutions often focus solely on narrow technological and economic metrics, without considering the lived experiences, environmental histories, and social complexities of communities most impacted. This project adopts a fundamentally different approach by integrating traditional ecological knowledge (TEK) with the disciplines of science, technology, engineering, art, and math (STEAM) to develop collaborative strategies for climate adaptation that are sustainable and just. These co-created strategies are designed to enhance coastal community resilience in ways that are effective, equitable, culturally responsive, and ecologically appropriate. A key motivation for the project is the need to develop more comprehensive frameworks for climate resilience – ones that respect Indigenous knowledge, promote intergenerational learning, facilitate cross-cultural exchange, and inform climate policy and action through the convergence of knowledge systems.



Janelle Knox-Hayes

Led by Professor Janelle Knox-Hayes (Department of Urban Studies and Planning), as well as Stephen Hart, Carolina Bastidas, Jean-Luc Pierite, Leslie Jonas, and John Walkey, this team has built a collaborative network between academic, community, and policy groups across Massachusetts to mainstream TEK-STEAM knowledge in identifying critical regional socio-ecological systems that must be addressed to improve equitable sustainability and adaptation outcomes for both Indigenous and non-Indigenous communities.

The project took an ongoing, four-phased, multi-year approach, including:

- Establishing advisory groups and cross-sector collaborative networks for stakeholder engagement
- Conducting ecological and cultural site assessments
- Hosting co-design and knowledge-sharing convenings, such as symposia and workshops
- Disseminating outcomes through case studies, papers, policy briefs, and academic outputs such as educational curriculum



The project aligns closely with the MCSC's Social Dimensions pathway.

Findings & Outcomes

The team's work led to relationship-building, knowledge sharing, and opportunities to move the needle on policy.

The research team established an MIT-wide Indigenous Community Planning Initiative to develop new graduate-level curricula and build reciprocal relationships with tribal organizations and communities both domestically and internationally. The initiative also helped expand a collaborative network that integrates TEK-STEAM adoption to better address socio-ecological issues at various scales through environmentally practical and culturally grounded climate adaptation solutions. It informed water security research in La Pista, Colombia, in collaboration with the UN World Food Programme and J-WAFS, and aims to foster new research opportunities focused on applying Indigenous energy planning to support the scaling of bioeconomy initiatives in the Peruvian Amazon Rainforest to conserve biodiversity and promote sustainable development.

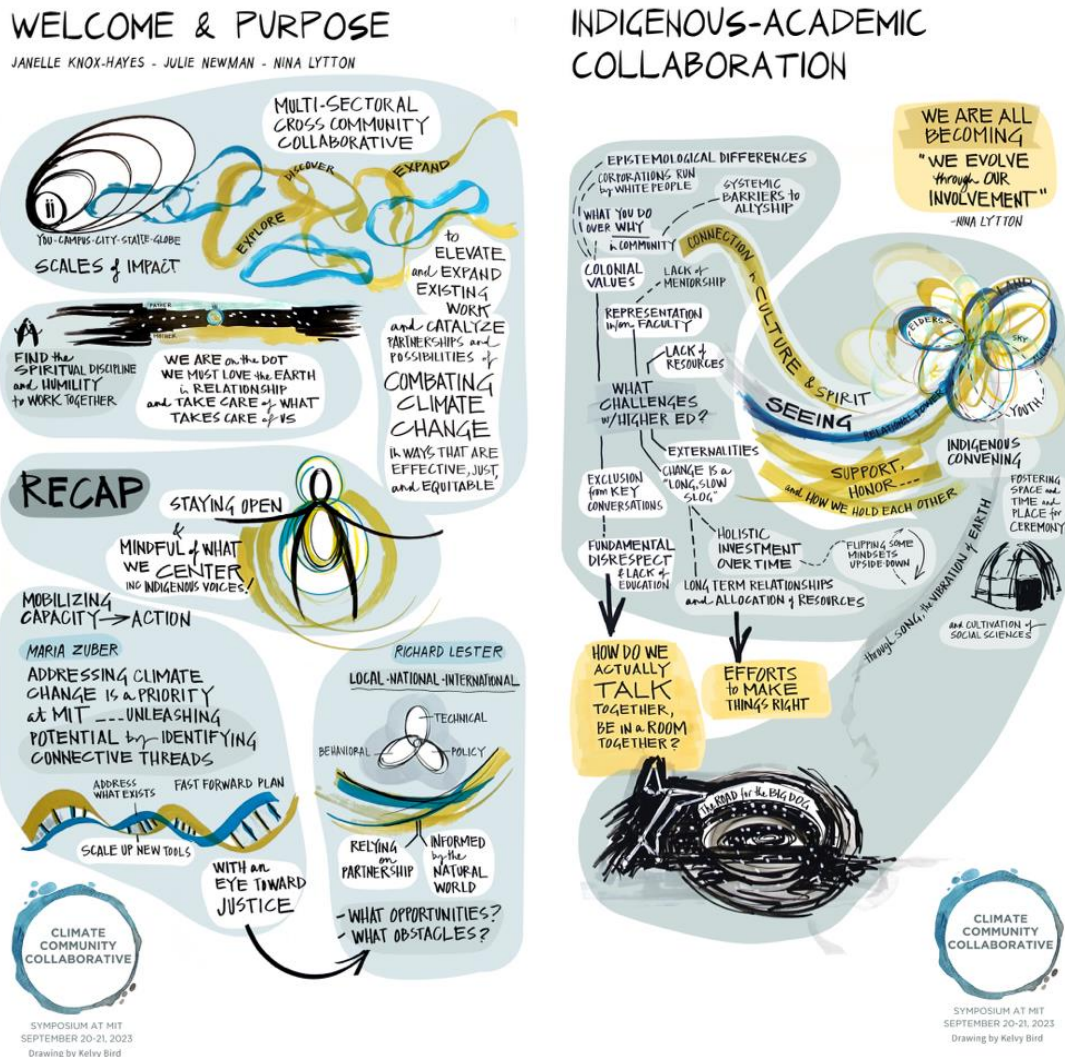


Figure 1.

Field Engagement Examples Include:

- Multiple site visits to Wampanoag Common Lands and coastal urban Environmental Justice Communities
- Volunteer cleanups
- Participatory TEK informed ecological restoration
- Cross-cultural and cross-generational citizen science BioBlitz events
- Community mapping and Climate Adaptation Plan development with Shinnecock Nation
- Tree sound frequency data collection on Wampanoag Common Lands
- Woods Hole Oceanographic Institute Preserving Our Homelands Camp Project

Policy & Advocacy:

- Legislative engagement with Massachusetts tribes
- Consultation and meetings with NYSEERDA, NY DEP, and the Shinnecock Nation regarding offshore wind energy transitions
- Team member Leslie Jonas nominated by Massachusetts Governor Healey to the US National Seashore Advisory Board and appointment confirmed by Congress
- Team member Jean-Luc Pierite became Co-Chair of the Commemoration Commission for the City of Boston

Knowledge Sharing & Education:

- Pilot of Indigenous Water & Energy Planning Reading Seminar
- Served 12 Indigenous client organizations via DUSP Indigenous Environmental Planning Practicum
- Led the Climate Community Collaborative Symposium for Greater Boston
- Urban TEK Workshop with CBIKS, NLC, GreenRoots, City of Chelsea
- Hosted equitable resilience workshops for SLOAN and MCSC
- Presentations at:
 - MCSC Annual Symposium (*poster sessions, roundtables*)
 - WHOI Lecture Series
 - Leventhal Center for Advanced Urbanism
 - MIT Global Summit on Mining Tailing Innovations
 - NOAA Sea Grant
 - Indigenous Peoples Day community events
 - Bi-weekly consortium meetings and CBO-academic institute site visits
 - RE + Northeast 2025 Conference
 - Institute on Collaborative Language Research (CoLang)
 - Uncommon Dialogue – Large Scale U.S. Solar Development: Integrating Climate, Conservation, & Community
 - Salata Institute, Harvard Climate Week
 - Harvard Water, Land-Water Linkages, and Aquatic Ecology Class
 - Mindful Actions for Climate Change Symposium @ Thich Nhat Hanh Center for Mindfulness & Public Health
- Two case studies, one white paper, and an Indigenous Environmental Planning Handbook

Throughout the project, the team engaged several collaborators including: NOAA Sea Grant, Native American Indian Center of Boston (NAICOB), GreenRoots, Native Land Conservancy (NLC), Mystic River Watershed Association, City of Chelsea, Leventhal Center for Advanced Urbanism (LCAU), MIT SOLVE, MIT Office of Sustainability, MIT Environmental Solutions Initiative (ESI), Shinnecock Nation, Mashpee Wampanoag Tribe, US Department of Energy (DOE), Harvard Forest, Eastie Farm, and the Center for Braiding Indigenous Knowledges & Sciences (CBIKS).

Opportunities for Implementation

The researchers have identified several potential ways to move their work forward:

- Pilot culturally informed restoration and sustainability practices in partnership with tribal and community stakeholders.
- Apply outputs (e.g., site data, co-designed frameworks, TEK-STEAM engagement models, and ecocultural restoration practices) to inform nature-based climate resilience solutions and just transition strategies for energy siting and natural resource development, such as community solar, offshore wind, and mining of essential minerals.
- Support cross-sector workshops, training, and co-learning sessions that deepen understanding of Indigenous knowledge systems and strengthen community engagement.
- Collaborate with policy-facing teams to incorporate TEK-STEAM convergence into sustainability practices, ESG reporting, climate risk disclosures, natural resource management, and environmental governance planning.