Climate Action in Higher Education

R O A D M A P

Findings and recommendations from workshops for academic leaders at University of California Santa Cruz April 2024 and July 2025

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Significance Statement

The climate crisis and its attendant difficulties present more challenges than any single government, institution or individual can fix. From one perspective, universities and campus-community members have responded actively, creating new schools and centers, refocusing research, and doing their best to tackle the challenges of a warming world. More practically, however, current efforts are often a siloed mosaic of individual strategies. Time is of the essence – we must face the reality of almost certainly exceeding a 1.5° global temperature rise and potentially a 2.0° rise, if not more (1). **This paper is a call for a more comprehensive, strategic, and coordinated response to the threat of climate change.**

This white paper presents a bird's-eye view of how a campus's many components – administrators, faculty, staff, students, academic departments, interdisciplinary groups, operations units, and outreach services – can work together. Compiling the perspectives of United States and Canadian higher-education faculty and administrators from two workshops in 2024 and 2025, it highlights effective strategies and suggestions for expanded implementation, many without significant additional investment. This paper encourages a refocus of normal academic procedures like updating research goals and course curricula and an expansion into additional efforts. This conference synthesis and collection of current examples and opinions attempts to provide inspiring ideas, encouragement, and potential benefits to sustain readers as they work to create real-world change.

However, we recognize that thus far, institutions from the Global North have dominated both public discussion and scholarly publication on just and sustainable climate response (2). A compilation of ideas from North American faculty and staff, this paper continues that trend. Thus, in addition to submitting our own ideas, we urge readers to join us in consciously and purposefully including a wider global distribution of concepts, cultural considerations, and initiatives. An effective climate response must encompass a diversity of approaches – site-specific and integrated with local culture and customs – and also a worldwide dialogue about best practices and epistemic approaches.

We believe that the next level of impact requires *more thoughtful, coherent strategy* and *better communication and coordination* across campus units, among campuses themselves, and with influential individuals and the general public. To that end, this paper presents an extensive menu of practical suggestions.

But our intention is not that any institution or individual should feel compelled to implement *all of these changes, or even any one specific change*. Rather, preserving institutional autonomy and academic freedom, universities and their members must choose climate adaptations that work within their own capabilities, interests, and values. Institutions have a responsibility to focus on

the highest-impact changes. Language in this paper around "must" and "should" is directed toward universities as a group, reflecting our belief in needed transformational change. A diversity of individual and institutional responses can produce the necessary collective growth.

How To Use This Paper

For campus-community members who want to elevate their personal or collective climate-response activities, this paper provides:

- ***Two overarching general principles ("Whole Institution Leadership" and "Coordination and Communication")*** to enable the next level of impact and effectiveness in higher-education climate response.

- ***Concrete, solution-oriented recommendations****,* many optimized for relatively quick implementation even with limited resources (marked with a "☆"), including ***pilot projects, trial programs, or easy-to-try, low-cost adjustments***.

- ***An honest assessment of diverging opinions*** (See Sections 8.1 and 13) – this "real talk" about disagreements over tone, climate education, and campus activism suggests models for moving forward even when consensus is not easily reached.

- ***Specific action steps by campus role****,* including suggestions for administrators, researchers, educators, and learners to fine-tune or enhance their climate responses. For those struggling with full plates, institutional obstacles, or climate-crisis overwhelm, we hope ***at least one recommendation will resonate****,* providing a place to begin.

- ***Information on challenges faced by campus members****,* crucial to building empathy and understanding for powerful collaborative action – administrators who want to encourage faculty climate research or students seeking administration support will find a wealth of insight into incentives and obstacles for groups they want to win over.

- ***Stimulating prompts for group discussions*** to help motivated clusters of interdisciplinary and transdisciplinary climate actors launch their own transformations.

From the plurality of contributors in many campus roles and from many campuses, this paper attempts to distill guidelines and recommendations for every member of the campus community. A 15-page summary *Climate Action in Higher Education: Highlights and Recommendations for Decision-Makers* is available at our working group page **Academics for Climate Action**. Please consider joining us in the next generation of higher-ed climate response.

1. Executive Findings and Recommendations

While campus-community members have worked hard to create a multiplicity of climate-change responses, the reality is that greenhouse gas emissions continue to rise, threatening the stability of life on this planet. Building on decades of work (3–12), we call on universities to begin the next level of deep transformations to meet multi-faceted climate challenges. Mohandas K. Gandhi said, "You must be the change you want to see in the world." This paper collates best practices and suggestions towards that goal.

Time is of the essence – climate impacts are accelerating and compounding at every scale. Unprecedented wildfires, severe multi-year droughts, and deadly heat waves are on the rise. Catastrophic hurricanes are devastating communities, while record flooding threatens the Midwest USA, and Canadian wildfires blanket cities in hazardous smoke. Globally, extreme weather is displacing millions, heat and drought are creating widespread food insecurity, and critical ecosystems from coral reefs to Arctic ice, rainforests to ocean fisheries are in decline or collapsing. These cascading crises are intensifying beyond our capacity to manage and adapt without immediate, coordinated action. This paper is a call for a more comprehensive, strategic, and coordinated response to the climate crisis.

However, the goal is not to create crisis-focused institutions. Rather, universities must enhance their nimble, dynamic capacities. Proactive, innovative responses can apply interdisciplinary, systemic and cross-sectoral approaches to boost climate research, teaching/training and community engagement.

Greater impact will require universities to adopt a Whole Institution Approach to climate. The current profusion of ad hoc, fragmented responses must coalesce into a strategic evaluation of best practices yielding big impacts on short timelines. Institutions need strategies that can weather shifting political and financial support and meet developing needs of global, national, and local communities. Leadership across all campus sectors must step up to operationalize structures that prioritize, incentivize, and coordinate the most efficient, highest-impact activities (see Section 5).

Material desires exist across human societies. In addition, colonial and extractive systems and Western-led industrialization have supported patterns of unlimited consumption. Political, economic, and social structures - including capitalism, racism, patriarchy, and ableism - separate those who benefit from extraction from those who bear its costs. These systems of othering enable privileged populations to continue damaging the planet precisely because the immediate

harms fall on communities rendered disposable by these same structures. Thus, climate response is everyone's responsibility.

This white paper is the product of discussions, consensus, and disagreements raised during two workshops of academic leaders: faculty and high-level university administrators from a wide range of United States and Canadian higher-education institutions. Addressing the Institutional Challenges and Opportunities to Effective Climate Action in the Academic System was held in April 2024. A second, smaller meeting, Climate Action 2025, focused on finalizing this white paper. Thus, our recommendations reflect a North-American-centered lens. While we believe they can be helpful to institutions worldwide, we recognize that in some places, institutions may be well ahead in implementation (13).

This paper uses "climate" as an umbrella term to denote a range of inter-connected challenges affecting the habitability of the biosphere – including climate change, biodiversity loss, unsustainable development and consumption patterns, mobility behaviours, and outdated land-uses, technologies and energy usage – sometimes referred to as the "polycrisis" (14,15).

The acronym MAST (Mitigation, Adaptation, & Societal Transformation) was introduced at climate resilience summits (16) to encompass the range of activities needed in society-wide response to climate challenges. A Whole Institution Approach integrates climate response across all university functions (teaching, research, service, governance, etc.) as a framework for institutional transformation (5,17,18).

This Roadmap is built around two guiding principles (GP1 and GP2), found below with top level recommendations. Each chapter includes additional recommendations. Those marked with a "☆" are ready-to-implement with limited resources, even in changing political landscapes.

Two Guiding Principles and Attendant Recommendations

GUIDING PRINCIPLE 1 (GP1): Whole-Institution Leadership
Leadership must dedicate resources to ensure that climate-related activities (mitigation, adaptation, and societal transformation) are part of the core mission and operationalized in *all* aspects of higher education: teaching, research, leadership, service, operations, and policy.

GUIDING PRINCIPLE 2 (GP2): Coordination and Communication
To increase impact, university leaders and campus community members must ramp-up efforts to work together and discuss climate information and actions with each other, between campuses, and to society with intellectual honesty and transparency regarding the scope and scale needed to address climate change.

RECOMMENDATIONS for GP1:Whole-Institution Leadership

R1.1 **Create high-level, resourced leadership positions** (e.g. president/provost/academic senate level) to originate, communicate, and coordinate climate-related activities.

R1.2 **Create dedicated, overarching academic structures** (e.g. climate headquarters, institutes, schools, or meta-departments (see Section 7.4) to create space, time, permission and incentives for sustained high-level, interdisciplinary research, teaching, and outreach.

R1.3 ☆**Rework incentives and support to enable faculty and staff to boost climate and sustainability research** by pivoting their focus or integrating climate-related topics into individual projects, teaching, or interdisciplinary collaborations.

R1.4 ☆**Immediately begin to prioritize high-impact, easily implementable climate response strategies** to create rapid transformation, learning lessons from the COVID-19 response.

R1.5 **Transform campus operations, energy use, and supply chains to prioritize low emissions, sustainability, and efficiency** on timelines aligned with Intergovernmental Panel on Climate Change scenarios, consistent with international climate agreements.

R1.6 ☆**Leverage "campus as a living laboratory" models** to boost climate research opportunities, enhance climate education, and trial low cost, real-life sustainability strategies.

RECOMMENDATIONS for GP2:Coordination and Communication

R2.1 ☆**Engage university actors in discussion on climate communication and tone.** Recognize and discuss genuine differences in opinion about balancing optimism and realism in communicating about the climate crisis.

R2.2 ☆**Use a two-tier approach to impart climate education** from multiple lenses:
- *Tier 1* – broad-based mandatory climate Gen Ed requirements or choice-based options
- *Tier 2* – discipline-specific content, including professional and workforce education

R2.3 ☆**Develop and deploy climate literacy training** to ensure that every staff and faculty member on campus understands climate impacts.

R2.4 ☆**Strengthen cross-university collaborations** on research and teaching to develop best practices and share effective, freely available climate-education materials.

R2.5 ☆**Normalize and support climate action, advocacy and constructive activism by all campus community members** (see Section 3 for definitions).

R2.6 ☆**Expand climate-related innovation to include resilience mindsets and social transformation** as well as material and technology advances.

R2.7 **Implement and strengthen research and partnerships with government agencies, NGOs, industry, and local community groups**, drawing from best practices modeled by existing entities including the United States public university cooperative extension framework and boundary organizations that translate research to action.

R2.8 **Designate an enduring office or center as a point of community contact** to support long-term community engagement.

R2.9 ☆**Create public spaces for open and honest discussion** of difficult ethical and moral questions raised by the climate crisis, including activities to build consensus on research priorities and a campus-wide dialogue on climate-related academic activism.

R2.10 ☆**As much as possible, seek consensus with like-minded institutions to speak with a more coherent voice** and leverage the power of collective action across academic institutions.

R2.11 ☆**Expand capabilities and channels for academics to communicate with policy makers and the general public**, translating climate research into accessible, evidence-based messages that counter misinformation, build trust, and empower action.

R2.12 Engage all campus members, from science to the arts, to **translate Shared Socioeconomic Pathways into stories that convey predicted real-lived experience** under future emission scenarios. Beyond statistics, graphs, and numbers, we must make the future come alive.

Sections below discuss successful implementations of many of these recommendations, providing further details and examples.

2. Context and Guiding Principles

2.1 Context

The urgency and magnitude of the climate crisis warrants collective action across academic disciplines. Climate change threatens academic institutions, from infrastructure viability to adaptive capacity. Currently, many factors limit staff and student engagement in research and action to confront these challenges. However, obstacles also offer unprecedented opportunities to transform our institutions to make them more equitable, resilient and interdisciplinary.

Pivoting, adapting, and enhancing core elements of the academic mission to meet climate change is the key work of this moment in institutional planning and growth. Climate change is touching everyone, everywhere, changing how we all live and work. A majority of citizens world-wide support climate action (19). We must act now.

2.2 A New Social Contract

In 1994, Lubchenco et al. (20) called for a new social contract for science to meet wicked challenges like climate change. So called because of its thorny resistance to easy solutions, a "wicked" problem, involves multiple interdependent systems, resists simple categorization, and defies conventional right-and-wrong answers (21). The climate crisis affects every bioregion, sector, community and individual planetwide (22). Yet, stakeholders may have differing goals and priorities. A solution that can seem "right" to one group may seem "wrong" to another. Thus, while the "new social contract" originally addressed science, the open, dynamic, and complex nature of the polycrisis now encompasses all academic departments. Although basic research remains critical, a growing number of scholars have called for academia to transform to address new challenges that transcend traditional departmental silos (11,23–27).

2.3 Statement of Values

Disclosing values and beliefs is key to presenting honest arguments and building trust. Although societies, including universities within them, have not achieved consensus on the seriousness of the climate crisis, the authors of this paper – backed by decades of strong scientific evidence and consensus (28) – argue that continued green-house gas (GHG) emissions and their impact on Earth's climate will have extremely serious and potentially dire consequences which mandate accelerated academic action (22,27).

Important beliefs and values that underpin our assessment include:
- *The climate crisis represents an existential threat* to human societies, including universities themselves.
- The potential impacts of temperature rise are large enough that *significant action is warranted*.

- As institutions tasked with promoting the general good, *universities should support the health and well being of all life on the planet*: human, animal, plant and environmental.
- *Institutions of higher education should lay foundations to promote greater sustainability* in view of climate change and other regional and global pressures.
- Universities have been given social privilege and thus have *a responsibility to mobilize their resources to meet society-wide challenges*.
- Although academic credibility rests on scholarship and impartiality, *academics can advise and advocate based on our expertise*, pursuing research and teaching related to social issues that matter to us and the communities we serve.
- *Climate justice requires addressing root causes*, including colonial, capitalist, and racist structures that separate those who benefit from extraction from those who bear its costs. Universities must confront their complicity in these systems.
- *'Planetary health' offers a unifying framework* for integrating climate science, ecological limits, and human health outcomes.

2.4 Balancing Solutions with Uncomfortable Honesty: Our Debate Over Tone

Everyone who attended the "Addressing Institutional Challenges in Climate Action" workshops and contributed to this paper appreciated the dangers and difficulties of climate change.

However, attempts to find the most productive way to discuss those provoked sharp debate, like the question of whether to write "climate crisis" or "climate change". Tensions emerged around pace and urgency. Some conference attendees called for broad, rapid transformative change and argued that anything less bordered on greenwashing. Others felt that humans become stressed by long-term urgency and advocated slowly pushing systems in a better direction.

A sentence from a website summarizing University of California climate-friendly accomplishments ("For over 15 years, UCLA has used a student-led 2-quarter course to address energy, water and other sustainability issues") provoked this response:

"While laudable in principle, these decade-and-a-half efforts by themselves were never going to transform the trajectory of Scope 1 and 2 emissions of UCLA. In 2023, [UCLA emitted 208,783 metric tons of CO_2 equivalents mostly from its fracked methane co-generation plant](). These emissions were the same as a decade earlier (44). Without an overhaul of campus energy systems, such small, student-based projects are not stepping stones to net-zero."

Exchanges like these highlighted difficulties in trying to build consensus on an intellectually and emotionally challenging topic. Ultimately, communication preferences fell into two camps:
1. ***Optimism with Solution-Oriented Language*** – Since everyone is aware of climate change and news tends to harp on negative scenarios, the most productive response is to

focus on positive achievements to maintain encouragement and momentum. It is important to be honest about needed transformation, but instead of focusing on obstacles or challenges, it is better to present solutions or opportunities to improve.

2. ***Unfiltered Assessments of Challenges and Difficulties*** – Realistic discussion of obstacles is intellectually honest and focuses attention on areas that need the most analysis and problem-solving. Too much small-win celebration and/or solution-oriented language risks allowing thorny, difficult areas to escape both notice and remediation.

It was easy for individuals in any camp to point out problems with other approaches. Those who preferred optimism called unfiltered assessments "alarmist" or "negative," potentially less likely to generate climate action. Those who preferred honesty about what wasn't working insisted that positivity can become a cover for greenwashing or greenhushing. They referenced situations like Duke University's early declaration of 'carbon neutrality' using the now-debated strategy of purchasing offsets or Vanderbilt University's partnership with Climate Vault, whose 'Climate Vault Tech Chamber' (chaired by Dr. Ernst Moniz, the former Energy Secretary who oversaw the fracked shale gas boom in the United States) promises investment in Carbon Removal Technologies that do not yet and may never exist at scale. These participants were concerned that quick public-relations opportunities can delay actual decarbonization to reduce GHG emissions.

Participants did agree, however, on a few core principles:
- More campus engagement in climate response at multiple levels is good, and celebrating progress can encourage more participation.
- It is vital to remain intellectually honest about scale and complexity, making realistic, science-based evaluations of necessary changes. Small programs or accomplishments should not be emphasized over the hard work of transformational change.

Humans respond differently to a crisis. Thus, every institution and campus unit has to find its own balance between optimistic solutions and unfiltered assessment. Our experience suggests that rather than focusing on one discussion style and criticizing those who would like a different focus, climate actors can discuss and acknowledge their own communication preferences. As one workshop participant said, *"In my opinion, the best approach is to somehow merge these or hold them in one's mind and heart at the same time."*

The authors of this paper have tried to use various strategies – optimism, solutions, and unfiltered assessment – to talk about climate change and effective responses.

2.5 Guiding Principles For Academia's Climate Response
The current "hybrid" approach of adding climate-crisis activities to traditional academic structures has dotted campuses with a multitude of ongoing climate-related efforts. However, we believe that regarding climate as just one of many competing concerns has fragmented

academia's efforts and diminished its impact. To fundamentally transform academia's approach and embrace a new, focused suite of potential strategies, this white paper urges institutions to elevate climate action as a core campus mission.

Our two guiding principles for transformative change are 1) Whole Institution Leadership and 2) Coordination and Communication.

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Our first guiding principle recognizes that increased social impact requires a more coherent, purposeful, "nose-to-tail" approach. Arguably, no other current challenge – self-governance, income inequity, health, the role of AI – spans such a breadth of disciplines, from science and social science, arts, humanities, and engineering to professional schools. Equally, every other challenge to the human race impacts and is impacted by climate. Without also attending to climate, any attempt to address these other challenges is effectively incomplete. The polycrisis affects institutional structures and physical plants. As educational institutions, universities must also increase climate literacy and train engaged citizens and workers. We believe this multiplicity of needs requires far-reaching, total-mobilization.

Our second guiding principle recognizes that timely and efficient impact requires closer communication and coordination. Without immediate steep reductions in greenhouse-gas emissions, worldwide temperature increases are projected to exceed 1.5° by 2035 or sooner. Thus, individual institutions cannot let crucial information languish far from the people who need it or waste time duplicating efforts. Universities must stop encouraging an "uncoordinated actors" approach where groups or individuals develop independent responses because there is no coordination or communication of coherent goals or strategy. While academic freedom and choice should be preserved, campuses must support collaboration to reduce redundant efforts and accelerate the adoption of proven approaches and best practices.

In addition to boosting interdisciplinary and inter-institutional coordination, universities must urgently improve their ability to communicate and engage with the general public. Research

must be co-developed with community members and results communicated in accessible, useful language for actionable, real-world application. Thus, Guiding Principle 2 advocates for more attention, resources, and training for coordination and communication.

This paper focuses on "climate" and its attendant issues, but many recommendations also enhance academia's responses to other challenges, including stresses from maturing AI and questions about governmental capacity to effectively handle diverse, new threats.

Universities aren't the only ones confronting environmental, social, and technological changes. In some countries, normal political swings seem to be amplified, creating uncertainty around ideological and financial support for climate work. But such tumultuous times also create opportunity. Faced by unprecedented challenges, some institutions may be willing to contemplate changes formerly blocked by academic tradition. With bold initiatives, careful planning, and calculated risk-management, universities can transform for better climate-crisis responses now and a more environmentally friendly, socially equitable future. This document presents dozens of viable ways to restructure university resources.

Sections 4 through 12 of this paper present a series of recommendations following GP1 and GP2. The closing Section 13 considers new ways to marshal transformed university resources to engage audiences in informed and effective climate-response planning and action.

3. Definitions and Disclaimers

In our workshops, *Climate Action*, *Climate Advocacy,* and *Climate Activism* emerged as core themes. While the lines between these can blur (29), we adopt the following definitions:

Climate Action – academic activities advancing climate mitigation, adaptation, and societal transformation (16) embedded in research, education, public service, and institutional initiatives.
- Administrators dedicating resources and personnel to climate-related work
- Faculty bringing climate into discipline-specific research and teaching
- Academic leaders increasing incentives for engaged public service
- Instructors and staff preparing students for climate-related careers
- Students studying avenues for climate mitigation, adaptation and responses

Climate Advocacy – influencing an audience through communication and persuasion, including through articles, papers, interviews, recommendations, and public statements. From expressing general support to promoting specific climate-related causes or policies, many will be grounded in faculty disciplinary expertise, particularly effective in advocating for policy changes.
- Administrators removing barriers to and normalizing engagement with the general public and partners outside academia
- Faculty advocating for climate-related legislation
- Students lobbying for specific climate policies

Climate Activism – direct and overt activities to raise awareness and spur change often falling outside traditional academic roles, sometimes challenging the status quo. The Routledge Handbook of Grassroots Climate Activism (30) lists many forms: community organizing, creation and mobilization of grassroots movements, teach-ins, nonviolent civil resistance, protests, and civil disobedience. These go beyond traditional academic activities of research, education, advising, or informing.
- Administrators removing fossil-fuel executives from university governing boards and advisory councils
- Faculty, staff, and students marching to support campus decarbonization

The authors of this paper agree that climate action is within the purview of all campus community members (See Section 12). Climate advocacy is broadly protected by academia's free-speech traditions though clarification may be needed around who is speaking, for whom, and in what capacity. We believe universities should encourage and normalize climate action and advocacy in all forms: writing op-eds, informing campus policy and practices, connecting with local government, speaking at council meetings, serving on commissions, volunteering expertise on local non-profit boards. For faculty, such activities should be valued as part of the traditional 'Service' component in Academia.

However, the rights and responsibilities of climate activism – and who is entitled or obliged to engage in it – elicited a spectrum of opinions among these writers (see Section 12).

Disclaimers:
- This document was written by humans using discussion, analysis, and critical thinking. AI was not used to produce text for any portion of this document.
- In this document, "we" indicates the opinions of the document authors, not those of other workshop participants or any attendee's home institution.
- Many of our recommendations are framed as directives (e.g. "Universities must reduce barriers between departments.") We purposefully choose the word 'must' to signal our belief that climate-crisis response is a moral imperative and highlight critical steps for maximum impact. However, we recognize that every actor – institutional or individual – must make nuanced choices based on context, resources, values, and goals.
- Many examples and recommendations come from workshop participants and, thus, draw from United States and Canadian institutions. They do not constitute an exhaustive list. Institutions in other countries may be more rapidly embracing changes advocated here.
- The David and Lucile Packard Foundation and some universities provided funding for this project, but neither the Packard Foundation nor any of these institutions is responsible for this paper's viewpoints, nor has any endorsed its findings or conclusions.

4. Universities as Societal Leaders and Models

4.1 Leverage Universities' Leadership Strengths

Full of bright, questioning, innovative minds resourced to explore new ideas, universities are uniquely positioned to lead on society's most urgent challenges. Among the few social institutions explicitly charged with serving the public good, in theory their communities strive to lead from evidence, knowledge, and reason rather than profit or political ideology. In moments of deep civic polarization, university leadership can anchor public debate in facts, mobilize knowledge for responses, and co-develop solutions for a more just and sustainable society.

Universities also have unparalleled capacity to act as powerful and trusted agents. Multi-discipline expertise positions them to foster real-world, interdisciplinary problem-solving and collaboration. They can convene local governments, nonprofits, businesses, and residents to co-develop mitigation strategies, build equitable climate resilience, and raise public awareness. Universities can provide local technical assistance to translate academic research into practical solutions. As teaching institutions, universities prepare each generation to meet its defining challenges, launching teaching, research and operations to support action.

It's already clear that academic thought leadership is having a significant impact on global climate response although not always for the equal benefit of all global citizens.

A recent analysis of publications, journals, and citations (2) shows that a small number of scholars and journals overwhelmingly associated with the Global North have disproportionate influence on academic climate-response discourse. This has led to an emphasis on technological solutions at the expense of structural political change, inclusive sustainable development, global inequality remediation (Example 1), and societal transformation (see Section 9.9). Thus, academic thought leadership is powerful. But that power should be used with careful consideration and intention. Impact should not be concentrated among a relatively small number of actors promoting a specific perspective.

So, in addition to leading climate responses in general, universities must also become more aware of their members' own conscious or unconscious biases around which responses deserve scholarly attention, where those come from, and who benefits. Exercising social leadership requires expanding university focus to include those who may be least resourced to express their own perspectives or access academic benefits, both in local communities and across the globe.

Campus communities also offer unique innovation capabilities. More nimble than large businesses or government agencies, universities' smaller constituencies allow greater control over policies and facilities. Thus, they provide ideal "living laboratory" testing grounds for new ideas (Example 2) (31–33). Decarbonizing major categories of campus emissions like the built environment, transportation system, and supply chain provide microcosms of broader societal challenges to urgently and dramatically reduce GHG emissions. These settings allow universities

to trial low-carbon clinical practices, heat- and disaster-resilient care models, sustainable procurement strategies, and climate-informed care pathways, while simultaneously educating learners, upskilling the workforce, and serving surrounding communities.

IN ACTION: The Living Laboratory Model

"Campus as a living laboratory" applies the core university missions of research, teaching, and service to directly solving real-world problems. Campus facilities, procedures, and policies become laboratories for learning at scale in a real-world setting.

In response to climate change, for example, students can apply skills, theories, and models to developing a sustainable campus. Implemented at a few institutions for several decades, this approach is now being adopted by hundreds of campuses worldwide. Because applied research, technology demonstrations, courses, and student projects are all Living Lab opportunities, these programs can be funded by in-place campus resources (Example 3). Academic health centers, hospitals, clinics, and community health sites also function as living laboratories where climate mitigation, adaptation, and societal transformation intersect with patient care, workforce education, and equity.

As a result of a two-year, fossil-free-pathway planning activity, the ten-campus University of California system formally embraced campus as a living lab as its primary mechanism for engaging the campus community in decarbonization. Aligned with the core university mission, decarbonization becomes a valuable, tertiary outcome of innovative education and research (34).

UC Living Labs involve student, faculty, and staff curricular and extracurricular collaborative projects, incorporated into general education, capstone courses, majors across campus, graduate and undergraduate research. Examples from Sprint #5 - Campuses as Living Laboratories for Climate Solutions include:
- UC Davis – improved campus energy efficiency by integrating research and project-based education. Co-curricular activities include faculty-sponsored, staff-supervised research positions in the UC Davis Energy Conservation Office and workshops to transfer knowledge to energy managers beyond campus.
- UC Santa Cruz – art students developed creative designs for distributed decarbonization stations serving buildings not connected to central heating.
- Other campuses – vehicle-to-grid power flow, energy storage, and microgrids.

The living laboratory educational approach offers a multitude of benefits:
- **Appeal to students** who want value-aligned education and career preparation. Surveys, focus groups, and activism reports highlight overwhelming student

interest in climate crisis responses (35). Over the past decade, the demand for general-education climate change electives has greatly increased.

- **Provide roles for humanities and the arts alongside engineering and natural and social science** to help shape how and what people think and develop approaches to stem climate warming (36).
- **Make universities more relevant in addressing existential challenges** through integrated climate solutions, sustainable campus initiatives, and related research and experiential learning.
- **Open novel funding opportunities and improve staff engagement** by connecting to resources that support the core academic mission.

At the operational level, living labs enable universities to practice what we teach and turn our world-class research and education into broad social benefits.

Ultimately, universities will not be able to pursue their core missions without using campuses as living laboratories for climate resilience and solutions. Science, technology, health care delivery and a continuing record of social innovation require creating and demonstrating more effective, efficient, or equitable solutions.

In short, in times of societal urgency and public contestation, universities should not shrink; they should lead with conscious thought and awareness of their own influence.

4.2 Develop Consensus on Where To Lead

We believe that universities struggle to lead on climate-change response, in part, because of disagreements about what should be done. Many academic sources promote grim predictions of significant global warming (22) but efforts to boost climate action are stymied by surging climate disinformation aimed at minimizing the need for immediate action. Without stronger societal and political consensus, future planning remains hampered. Therefore, we submit that universities must lead by coming to a stronger consensus themselves. Deciding what they want to do – each within its own campus and then joining with like-minded institutions – universities will produce crucial foundational guidance and momentum for mobilizing resources.

To develop their own internal climate consensus, many universities require much broader on-campus discussion and debate, incorporating Indigenous traditions, traditional ways of knowing, and alternative approaches to climate response. While they may attempt to lay out an unbiased spectrum of facts, *university members must also acknowledge their opinions, beliefs, and values* on the climate-crisis response (37). Then, those who are willing must take a point of view on what should or should not be done.

4.3 Use Consensus-Building To Discuss Social Change

Such discussions create an entry point for very real conversations reevaluating social and economic structures that have propelled us beyond sustainable planetary limits. Basic human predispositions toward the continual accumulation of material wealth, often in relation to others, have been shaped and intensified by colonial and extractive systems and Western-led industrialization. Eons of human evolution have motivated humans worldwide to exploit science better to realize more material benefits.

Deep, fundamental changes are needed to wealthy and privileged lifestyles, instead of just assuming "green energy" will solve the problem. Enabled by Western-led patterns, including industrialism, colonial extraction, racism, and ableism, those with privilege are insulated from climate impacts: immediate harm falls into other people's backyards, not theirs. This acceptance of disposable peoples, allows the wealthy to create a disproportionate share of ecosystem impact.

However, exacerbating dynamics aren't just a Global North versus Global South phenomenon. Many members of the upper and middle classes in the developing world consume without reference to climate impact. Even within first-world countries, climate change impacts low-income communities disproportionately. Thus, societies across the world must engage in deep, honest, and critical self-assessments to evaluate necessary changes in economic and social systems to reduce climate impact and promote climate justice.

The contained spaces of university campuses – full of inquisitive, innovative actors yet with relatively smaller social footprints – are ideal places to ramp up these discussions (Example 4).

Campus-community members must gird themselves for challenging, ongoing work around climate consensus-building. Universities must involve local communities, diverse interests, and divergent points of view. At present, well-informed and well-intentioned people disagree on what should be done, so discussions must provide safe spaces for people to change their minds in light of unfolding events and new evidence. Universities must prepare for obstacles like potentially disturbing conclusions which discourage some people from grappling with the topic at all (38,39), academic siloes limiting interdisciplinary viewpoints, and potential adverse reactions from some university supporters. But in dealing with these obstacles, universities will provide inspirational success stories, models for emulation, and strategies that work.

4.4 Use Consensus To Create a Strategic Plan

Having developed a consensus supported by campus community members, universities might take the dramatic step of making a particular climate response policy the official institutional stance. With administration and faculty support, this would provide a strong impetus for realigning university resources to drive climate-response strategies, practices, and incentives.

Acting on **Guiding Principle 1,** leadership must work with campus-community partners to **create a strategic plan**:
- Integrating climate considerations into the core of governance and daily operations
- Ensuring that every policy, practice, and program advances the consensus agreement on principles of MAST: Mitigation, Adaptation, and Societal Transformation (Example 5)
- Elevating the role of societally impactful research (40)

Addressing not only teaching and research, but also budgeting and operations, construction and transportation, hiring, community engagement and technical assistance allows universities to lead, experiment, test, and innovate in a wide range of climate-related human activities.

Once a plan is developed, campus-community members can lead by implementing **Guiding Principle 2: Coordinating and Communicating**:
- Chancellors, presidents, provosts, and governing boards coherently and consistently prioritize and communicate climate commitments as core to the institution's mission
- University members connect with each other and community partners to disseminate activities, results, and opportunities

Establishing a campus-wide communication and coordination mandate allows universities to experiment with effective communication modalities that government and industry will need. University leadership to produce messaging that connects meaningfully with its recipients' daily activities and choices will support grounded, coordinated action (Example 6).

4.5 Lead in Healthy Community Engagement
In many places, long histories of academic engagement with local communities have *heavily prioritized academic interests rather than creating mutual benefit.* Whether with good intentions or ill, local communities and Indigenous groups have been viewed as subjects for study. Traditional practices and Tribal knowledge have been derided as non-scientific or appropriated and extracted without credit or even permission.

Many analysts predict futures with considerably less energy and fewer resources available per person than the present North American average. Indigenous and local communities have been navigating these challenges for millennia. Their wisdom can contribute vitally important foundational strategies and principles to the consensus-building process.

But universities must shift academic approaches to create spaces where local communities and Indigenous groups can define, lead, and drive solutions based on their lived experiences and knowledge of how climate is impacting them (Example 7).

Universities aren't alone as major institutions with a checkered history of local and Indigenous interactions. Government institutions, corporations, and energy companies have all followed in colonialist footsteps, viewing local communities as holders of resources to be extracted. Universities – staffed by experts on history, sociology, and cultural change – are poised to understand these errors. Pioneering new styles of co-development and collaboration, universities can develop more just, equitable, and sustainable relationships with groups who have been custodians of the planet since long before universities arrived (more in Sections 11.1-3).

IN ACTION: UNIVERSITY-WIDE SOCIAL LEADERSHIP

After consulting with hundreds of campus community members, Simon Fraser University in Vancouver, Canada, created a five-year Strategic Research Plan identifying community-centered climate innovation as a primary institution research priority.

Executive leadership enabled the development of an innovative research-for-impact platform. Strategic units and staff support researchers and community partners in interdisciplinary research collaboration and transdisciplinary relationship-building.

The platform enables three main objectives:
- ***Promoting interdisciplinary collaboration*** – workshops, research cluster development, seed funds
- ***Advancing research co-creation with community-based partners*** – outreach, design jams, community-engagement sessions
- ***Mobilizing knowledge beyond research publications*** – funding for policy briefs, op-eds, podcasts, videos, targeted reports

Though still in the early stages, this platform is expected to scale effective, impactful innovations for accelerated climate action.

Recommendations For University Social Modeling and Leadership

- ☆**Experiment with a variety of consensus-building and resource-mobilization approaches. Assess which are effective in which circumstances,** balancing coherent directives with flexibility to accommodate changing opinions and evidence.
- ☆**Dedicate resources, time, and space to listening to local communities and Indigenous groups**, building relationships and trust to co-develop solutions.
- ☆**Create forums for supportive discussions of varied opinions on the climate crisis and appropriate responses**, including campus members and the broader community.

- ☆From this plethora of ideas, **distill and communicate a coherent, focused strategy** that campus members and resources can mobilize behind.
- ☆**Reorient climate-change coordination and communication to look forward and outward,** developing new communication channels and leveraging on-campus expertise to **co-develop and communicate with broader society** (Section 11).

Examples for University Social Modeling and Leadership

Example 1: The University of the Witwatersrand, South Africa has a climate-leadership position titled "Pro Vice-Chancellor: Climate, Sustainability and Inequality." Unlike high-level climate leadership positions in the United States, which often focus more on "sustainability" or "planetary health," many Global South climate-leadership positions explicitly recognize the need to address social and communal components of climate-response as well as technological, environmental, and economic considerations.

Example 2: Stellenbosch University, South Africa uses its Facilities Management Division as a living laboratory to pursue its net-zero commitment, resulting in smart metering and performance improvements and a partnership with its Department of Mechanical Engineering to advance data integration technologies.

Launched in 2009, and expanded to two campuses, the University of British Columbia's Campus as a Living Lab initiative has resulted in a number of "first of a kind" innovations including a timer-framed high-rise residence hall, waste-wood bioenergy center, and seed grant competitions for new climate-related projects and collaborations.

Example 3: The University of California's Global Climate Leadership Council created a pilot program giving money to three campuses – Merced, Riverside and Berkeley – to support staff and launch formal living laboratory programs.

Example 4: Researching how behavior affected food waste, students at Dickinson College proposed a Pick Your Portions dining hall program. A poster instructed students in the correct terminology – taste, half portion, single portion, double portion – and dining hall staff were trained on standardized serving sizes. Arising from a half-day "Behavioral Design for Sustainability" workshop, this student-proposed initiative illustrates how campus communities can serve as petri dishes for behavior alteration.

In March 2025, the Asian Institute of Technology promoted AIT Earth Hour, achieving a 200 kW decrease in electrical usage. Designed to showcase the impact of small behavioral changes adopted by an entire community, the program included the Earth Hour Photo Challenge. This

innovative form of social engineering encouraged participation by rewarding participants for documenting their buildings with the lights switched off.

Example 5: In 2016, Yale University launched its campus-wide "Yale Sustainability Plan 2025." Since then it has incorporated sustainability and climate considerations into:
- **Research** – a new Center for Geospatial Solutions
- **Funding** – seed grants for interdisciplinary climate-related research teams
- **Materials** – a Center for Industrial Ecology program to develop recyclable electronics
- **Transit** – enhanced shuttle services to local train stations and parking structures
- **Construction** – new buildings with electric heat pumps
- **Employee Wellness** – a guide encouraging employees to use green spaces, garnering "Tree Campus Higher Education" recognition from the National Arbor Day Foundation
- **Emissions** – programs and monitoring to decrease thorny Scope 3 emissions
- **Environmental Justice** – a collaboration between Yale Schools of Law, Medicine, Public Health, and the Yale Child Study Center, partnering with local community groups

Example 6: Yale Climate Connections is a climate news service which produces articles, a daily radio program, and a podcast on the climate crisis and options for responding, including lifestyle change, fact-based "real talk," and political action (More in Section 5).

Example 7: Through the Pacific Institute for Climate Solutions housed at the University of Victoria, Canadian universities are partnering with Indigenous groups to support the implementation of the BC First Nations Climate Strategy. Other initiatives include the "Livable Cities Forum: Indigenous Knowledge and Climate Action" and Indigenous Climate Fellowships.

San Diego State University co-leads the Collaborative of Native Nations for Climate Transformation and Stewardship with the Climate Science Alliance, funded by a $7.1 million California Climate Action grant in 2023. This project represents a paradigm shift in how climate action is envisioned and implemented by centering Tribal leadership rather than treating Indigenous communities as research subjects.

5. Leadership and Vision

5.1 Embrace the Agency Of Administrators

Administrators are lynchpins for both of this paper's **Guiding Principles: Strategic Leadership** and **Coordination and Communication.** No comprehensive climate-crisis response can hope to thrive without active, top-down support and management. Regents, presidents, chancellors, provosts, deans, department chairs, and their various cabinets and teams from both academic and operational units have exceptional opportunities and responsibilities.

Our theory of change – which motivated the workshops series and this paper – is that *academic leadership positions hold unique and powerful levers for rapid transformation*. However, workshop participants cautioned that the job description for a campus provost on climate must be carefully considered. **This position must genuinely support campus-wide collaboration and coordination – including elevating existing grassroots efforts – and not be used for personal "empire building."** (see "In Action: A Distributed Leadership Model" in Section 6). Providing leadership support to the most motivated efforts creates the most rapid change.

University leaders influence where the rest of the team follows. Although faculty exercise enormous autonomy, many "umbrella" transformations – including campus-wide communication and coordination, clean-energy sustainable-campus initiatives, and questions of fossil-fuel divestment – can only be addressed by administration with appropriate consultation from other stakeholders. Leaders must *transition from intellectually acknowledging to actually operationalizing climate change*.

In practice, transformative actions on climate and sustainability within many universities involve combined administrative, faculty, staff and student leadership over decades. Especially in multi-campus systems with layered leadership reporting to a systemwide President, perhaps also managing or co-managing external units, a long tradition of shared governance creates collaborative responsibility. Some systems must also preserve the authority of a governing Board of Regents and multiple Academic Senates. Each of these entities, therefore, has a part to play.

Critically, we emphasize that it is important for leadership to consider a Whole Institution Approach, where climate and planetary health are embedded across all university functions (including teaching, service, research, and operations). In 2015, the Okanagan charter similarly called for health (including planetary health) to be integrated across university pursuits (41).

5.2 Create Dedicated Leadership Structures To Advance Guiding Principles 1 and 2

Specific leadership resources should support more strategic direction, coordination, and communication. While many universities have created climate-related leadership positions – a dedicated provost, climate "czar," climate champion, or advising council – there are other ways

of designating individuals and groups to exercise strategic leadership on climate. Interestingly, new research on climate action within large corporations also identifies high-level climate positions (e.g. chief sustainability officers) as critical levers for climate action (35).

Workshop discussions identified four main, and not mutually exclusive, climate-leadership types:
- ***Dedicated positions in the provost's and/or president's office*** (Example 1) – while titles, portfolios and position descriptions differ, high-level official positions signal climate as an institution-wide priority and resource pursuit of climate-based initiatives.
- ***Leaders of created or realigned schools or colleges*** – top officials become default climate or sustainability campus leaders (Example 2).
- ***Influential figures at new centers, institutes, or affinity groups*** – faculty in climate-related units centralize resources and effort for greater impact (Example 3).
- ***Academic Senate committees on climate*** – dedicated committees fast-track climate education and faculty reward incentives and provide subject-level expertise to operational and policy decisions by campus administration (Example 4).

The position of de facto point-person for climate-change communication and coordination can also be assumed, in practice, by a single, motivated individual or a group. This paper details examples of bottom-up initiatives later incorporated into or funded by university structures.

As a place where faculty advocate for each other, the Academic Senate is uniquely positioned to understand challenges and create actionable, effective support for climate response. Regular tasks like updating curricula, approving new promotion and tenure requirements, and reviewing peer-recognition criteria can boost climate-forward activities. In fact, many suggestions in this paper's Sections 7 and 8 depend heavily on Academic Senate cooperation. Additional steps to promote climate-friendly agendas include:
- Facilitating communication between climate-related standing committees and those that involve regular university operations
- Promoting communication and coordination across a wide swath of campus community
- Creating a standing "climate action" committee, ensuring that urgent climate initiatives are not bogged down in lengthy waits for consideration or review
- Developing and engaging with campus "climate champions" who can support individual programs and bring university-bred research and practices to off-campus audiences
- Promoting a culture of open discussion about the challenges of confronting climate change both personally and professionally
- Engaging with senior campuses administrators to promote long-term climate-response

While student leaders are often seen as ephemeral or transient, they have motivated some of the most successful campus-wide climate transformation efforts: curriculum change, campus decarbonization, and resource-sensitive dining hall options (Example 5). Studying student

climate efforts like the University of the South Pacific's Pacific Island Students Fighting Climate Change, which has won historic landmark litigation (Example 6) would help faculty and staff recognize and cultivate allies for bottom-up transformation. Students in formal leadership roles – student body and class officers, newspaper editors, and student group organizers – might also be interested in using their influence to promote climate-related activities. To train future climate leaders, universities should honor and encourage students as vital members of the campus climate-leadership team. Programs that build "impact-to-action" leadership skills can draw dynamic would-be student leaders to campus.

IN ACTION: CLIMATE - FORWARD LEADERSHIP

President/Provost Level Positions – In 2023, Yale created a new position in its Office of the Provost for a Vice Provost of Planetary Solutions. Harvard, Michigan, and Duke have created similar positions. These create critical centers of prestige, influence, and resources for coordinating campus climate activities.

Academic Senate Committees – In 2019 UC San Diego created the standing Senate Committee on Campus Climate Change. It played an important role advancing the UCSD climate General Education requirement (see Section 8, Example 4) and proposing the Fossil Free Memorial, a system-wide petition from the University of California Academic Senate urging UC Regents to divest from fossil fuel companies and reduce on-campus fossil fuel combustion.

Climate-Related Leadership Groups - Established in 2014, the University of California Office of the President's Global Climate Leadership Council has an impressive record of fostering climate-related initiatives and programs. It includes leaders from across the UC and California State University systems, faculty and student representatives, and community college advisors and non-academic stakeholders.

5.3 Leverage Tools for Creating Change
University leaders can employ several critical levers to prioritize climate action:
- Working with faculty governance, **allocate three central resources** – funding, space, and faculty positions – as "carrots" including small grants, locations for centers and institutes, or support for novel, interdisciplinary research and teaching (Example 7)
- **Encourage creative faculty initiatives** using current resources
- **Set fund-raising priorities** and support faculty teams to pursue large, institutional grants and court private, non-governmental funding (Sections 9 and 10)

- **Suggest, or even mandate, that research units consider environmental impact** in designing and evaluating research projects (Example 8)

IN ACTION: CLIMATE - FORWARD ADVISORY COUNCIL

The University of California's Global Climate Leadership Council (GCLC) advises the UC President and other campus leaders and advances climate action on UC campuses and beyond. Cooperating with the UC Sustainability offices and programs, the GCLC helps conceive and implement campus-based programs. It also collaborates with the Academic Senate, encouraging and supporting faculty leadership in climate action.

Programs funded in part and supported by the GCLC include:
- [Bending the Curve climate education curriculum](#)
- [Climate Action Student Fellowships Program](#)
- [Cool Campus Challenge](#)
- [UC Center for Climate Justice](#)
- [UC Center for Climate Health and Equity](#)
- [UC-CSU Environmental and Climate Change Literacy Projects](#)
- [Community-Academic Partnerships for Equity-Focused Climate Action](#)

The GCLC also works with state-agency and private-sector leaders to advance climate action. Notable achievements include:
- The Climate Change Research Program of California's Strategic Growth Council brought state cap-and-trade dollars to initiate research programs that addressed state climate change goals, advancing tangible outcomes and filling research gaps.
- A $100 million investment by the California legislature in UC research designed to have a swift and measurable impact on climate resilience.

5.4 10x Communication and Coordination Efforts
Following **Guiding Principle 2: Coordination and Communication**, academic leaders must increase information flow and collaboration on campus and outside the university.

On campus, communicating climate-related efforts can create all of the following:
- **Scale for ambitious climate programs** that need all hands on deck
- **Wide support** to increase success for campus initiatives
- **Reduction of inefficiencies** and duplicated efforts
- **Rapid information deployment** and "word of mouth" channels
- **Widespread adoption** of new initiatives

- **Higher rankings** in sustainability assessment tracking programs (Example 9)
- **An engaged campus community** motivated by effective advertising of climate-related achievements, rewards, and honors

Leaders should not assume that campus-based units or members will automatically disseminate information on campus or beyond. Instead, leaders must set priorities, insisting that efforts must coordinate and communicate with the very societies academia is tasked to serve (Example 7).

Successful communication beyond campus can achieve:
- **An outward-focus on local individuals and organizations**, clarifying that university resources should not benefit only those inside the academic system
- **Input from concerned stakeholders and intended beneficiaries** to avoid making assumptions or imposing university-bred solutions (more in Section 10)
- **Coordination with other institutions** to share best practices and successful approaches
- **Useful information from extra-academic sources** that – while perhaps not data driven or scientifically motivated – contribute valuable wisdom to university efforts
- **A respectful and enriching dialogue with local or Indigenous partners**, allowing campus members to learn from traditional ways and supporting off-campus partners to speak up in the face of colonial or extractive actions (see Sections 10.1-3)

Following Guiding Principle 2, leadership can designate dedicated specific climate communicators, promote new vehicles and leverage existing channels like websites, newsletters, forums and listservs. Since access to official campus email lists is often restricted, those with access can spread the word through informal interest groups and in-person forums. Students are excellent disseminators as they habitually engage with local businesses, entertainment venues, and volunteer organizations. A student climate ambassador program would be an innovative way to get local input, communicate living-lab results, and create partnership and trust.

If university leaders have not prioritized coordinating or communicating with local community members or other institutions, they may need to develop new channels, including:
- community forums
- workshops
- co-development jams
- discussion groups
- community leader consultations
- local print or video advertising

New channels can target the recurring communication gap between faculty and staff, like the [Institute for Civic and Community Engagement (ICCE)](#) at San Francisco State University which mobilizes faculty and staff to connect the university to the wider metropolitan community. Instituting informal and regular social hours for faculty, staff, researchers, postdocs and graduate students can build communities of practice and encourage brainstorming between campus-community members who may not regularly interact (Example 11).

IN ACTION: IMPROVING CLIMATE COMMUNICATION

Yale University has created **a mutually supportive communication system** where on-campus climate expertise creates both student education and effective climate communication for campus-community members and the general public.

The [Yale Program on Climate Change Communication](#) *builds knowledge* through research and global, national, and local studies. Projects include:
● Climate Change in the American Mind
● [The Yale Climate Opinion Maps](#)
● International Attitudes & Behavior

It *enhances climate-related communication* through [Yale Climate Connection](#), including an online climate news service and national radio broadcast.

The program *boosts climate-communication education*, offering an [Online Certificate in Strategic Climate Change Communication](#) for working professionals and [resources for middle- and high-school teachers](#) to use the program's tools in their classrooms.

5.5 Create an Atmosphere of Trust
In light of shifting political support, the emotional impact of global armed conflicts, and the overwhelming nature of the climate crisis itself, campus-community members may be struggling to find their places – and their voices – in their institutions' climate-crisis response. To create an inclusive campus environment where everyone can find a role, university leadership must build trust. This requires time and effort. Supporting students, faculty, and staff to develop their own climate-crisis responses – individually and collectively – will not happen overnight.

Campus community members who are training for professions on the front-line of climate change impacts require tools to combat moral distress, burnout, and psychological strain. Universities must recognize this emotional labor and incorporate trauma-informed education, institutional supports, and spaces for reflection in their climate-response strategies.

Workshop participants suggested that pro-active leaders could promote more transparent funding management, increase active communication about academic and non-academic social justice activities, and regularly assert that all campus community members have roles to play in climate-crisis action, advocacy, and activism.

5.6 Encourage Faculty to Pivot Their Focus

One of our workshop's key recommendations is that universities should incentivize and reward faculty for reorienting towards climate-crisis response activities (more in Sections 6 and 7). Because academic leaders significantly influence research directions and advancement criteria, they can encourage faculty to pivot toward climate-aware topics, recognize and reward community engagement and socially relevant research, and facilitate training and reskilling for faculty to engage with partners from other disciplines and outside academia.

☆Relatively uncontroversial, high-impact, cost-effective mechanisms for this could include:
- **Spearheading a consensus-led rework of personnel advancement criteria**, including **encouraging faculty to add climate-related efforts to personal review statements**
- **Building institutional frameworks** to help faculty transition to new research foci
- **Creating one-time climate sabbaticals** like the [Pivot Fellowship from the Simons Foundation](#), perhaps funded by private donors
- **Founding a campus-wide yearly award and/or lecture series** to recognize individuals engaging in significant climate-action related activities

5.7 Support Bottom-Up Change Agents

While empowering and incentivizing faculty and students can have tremendous impact, top leaders can view bottom-up change agents as troublesome, destabilizing, or difficult.

However, numerous examples show the transformative value of bottom-up change. Faculty at CSU Chico State created the award-winning Faculty Learning Community in Teaching Climate and Resilience. Following such grassroots efforts, the [California State University system has now tasked all 23 campuses with embracing sustainability](#). The University of California San Diego climate General Education requirement was a student- and faculty-led effort (42). A combination of advocacy and grassroots efforts, including town halls and [documentaries](#), prompted a University of California system-wide pivot on decarbonization in only a few years, from defending an offset-based "Carbon Neutrality" program to publicly repudiating offsets in favor of direct decarbonization. A relatively small number of faculty from Bard College organize a yearly high-impact, worldwide [climate and justice education early teach-in](#).

Thus, even when power nexuses outside administration org charts cause discomfort, administrators should remember that all climate change advocates share a common goal. *We are playing different positions on the same team*. Instead of viewing grassroots activities or student activism as problems to overcome, administrators could work with students and faculty to motivate certain types of change that top leaders may struggle to initiate. When politics or funding limitations tie the hands of administration, other campus-community members can act.

If top leadership can study how bottom-up change pathways complement the considerable transformative power of university administration, bottom-up and top-down change agents can work together to achieve common goals. Supporting faculty, staff, and students agitating for change builds partnership and goodwill, laying the groundwork for compromise in hashing out the details of actual campus transformation.

> ### IN ACTION: MULTI-LEVEL LEADERSHIP
>
> The University of California's commitment to sustainability reflects collaboration between multiple leadership nexuses, dating back to the first Earth Day in 1970.
>
> In 2007, the **UC President** signed the American College and University Presidents Climate Commitment (ACUPCC) on behalf of the ten UC-system Chancellors. This committed UC, along with other United States and international universities, to action on climate change, preparing students through research and education to "solve the challenges of the 21st century." (42)
>
> However, **student** and **faculty** input significantly altered the administration's path to climate response. In 2013, the UC President launched the UC Carbon Neutrality Initiative, committing to net-zero Scopes 1-2 emissions by 2025 to be achieved largely via carbon offsets. After a student-produced documentary and a series of peer-reviewed publications identified important problems with carbon-offset permanence and verification (45), the UC system switched to a direct decarbonization approach.
>
> In 2014 the UC President created a diversified climate-action advisory body, which includes **faculty, administrators, students and experts from inside and outside the university**. The Global Climate Leadership Council (GCLC) is tasked with increasing awareness of and engagement with campus emissions-reduction goals and programs.
>
> In 2019, the UC Academic Council, made up of systemwide **Faculty Senate leaders**, endorsed a 3-point statement calling for:
> - deploying faculty expertise to meet critical decarbonization objectives
> - promoting faculty participation in climate-change mitigation and adaptation activities, adding this expertise to UC's research, teaching and service missions
> - developing climate champions to share UCs considerable operational experience with campus, professional and community networks (46)
>
> This program was endorsed by the UC President, and the GCLC was reorganized with **joint administrator-faculty leadership**. This was followed in 2022 by a systemwide **Academic Senate** Memorial on Reducing Fossil Fuel Combustion, which passed with 85 percent of the Senate members voting in favor.

The coordinated efforts of administration, faculty, staff and student leadership have guided the University of California towards climate response and decarbonization.

5.8 Prioritize and Fast-Track Impactful Change

Universities are notorious for strategic plans that merely collate submitted ideas and fail to *identify, prioritize, and fund the most transformative ones* (27). While it can feel inclusive to consider every agenda, this can also be a cover for talking over acting.

While consensus-building should give all voices a chance to be heard, university leaders must distill that multitude down to a handful of priorities that follow the scientific consensus on climate change and its consequences. The prospect of a 1.5°-2° increase in the next decade means that the time for pet projects is over. Backed by data and with shared governance, university leaders must make firm decisions, elevate feasible high-impact ideas, and cut through bureaucratic overhead. Initiatives like establishing a climate senate committee and increasing climate curricula cannot wait.

5.9 Take a Stand In Public Statements

University leaders must make – and differentiate between – institutional and personal communications about climate.

Institutional communication can include statements about university priorities and activities, climate as a strategic research and teaching priority, and outspoken support for climate action (Example 12). The authors of this paper all adhere to the scientific consensus that the climate crisis poses a grave threat and that a rapid transition to a fossil-fuel-free society is in the best interest of humankind. If a regent, president, chancellor, provost, or dean expresses a strong view on climate, does that commit their institution to any steps? Is the standard different depending on institutional role: can an Environmental School dean issue climate-related statements while a Humanities dean cannot? Does the right to take a position depend on the level of leadership, and is it stronger or more curtailed at higher levels (Example 13)?

Thus, it can be difficult for university leaders to exercise personal freedom of speech separate from their leadership roles. Which statements made by university leaders represent, implicitly or explicitly, official positions of their institutions? The Israel-Hamas war has highlighted this issue as some politicians and academics have called on universities to maintain institutional neutrality. In fact, some of the strongest statements are coming from private universities and public institutions outside the United States because many US public universities are constrained in policy and politics, answering to legislatures and voters.

5.10 Support Campus-Community Members To Speak Out

Whether university leaders feel willing or able to publicly support climate action themselves, they are responsible for safeguarding academic freedom: the right of members of the academy to speak on any issue without fear of professional reprisal. This applies strongly to public statements and professional publications but is more curtailed in classrooms which prioritize balanced scholarly perspectives. Faculty web pages fall into a grey area in between.

Widespread campus discussion might be needed to clarify these issues. Regardless of what policies an institution adopts, they must be clearly stated. Advocacy statements must identify who is making the statement, their relevant expertise and authority to make it, and whether they are made on personal title or on behalf of an organization. Some universities might adopt a practice similar to a newspaper editorial page where opinions are clearly separate from news stories. While some institutions have policies on how faculty should communicate positions, we encourage each institution to initiate discussions and develop guidelines on statements made by all community members, especially on the climate crisis and whole-institution-climate-response activities (more in Section 12).

5.11 Build a Wider Academic Consensus: United With One Voice on Climate

While individual leaders or institutions may be constrained, when universities speak together, their impact grows. This may, in some cases, protect individuals from reprisals or repercussions. For example, the American Association of Colleges and Universities (AAC&U) issued a public statement in 2025 condemning government overreach and calling for constructive engagement. This offers a model for collective statements on climate. Recent political events in the United States have illustrated the fragility of government and industry support. Universities worldwide need to join with like-minded institutions to speak loudly about the importance of funding climate-change activities to support economic and social well-being. Hundreds of academic institutions have signed onto collective statements supporting the transition to a "zero carbon world" (43) or declaring a climate emergency (Example 14).

Recommendations To Boost Climate Leadership

- **Create leadership structures** (e.g. president/provost level leadership positions; new or redefined college, school, or research institutes; standing academic senate committee) to support climate research and action.
- **Adopt a whole-institution approach to climate by prioritizing climate research, teaching, and engagement** in institutional strategic plans. **Clarify expectations, incentives, and rewards for faculty and staff to participate**.
- ☆**Create new strategies to incentivize and support faculty and staff who wish to pivot** professional activities towards climate-crisis response.

- ☆**Support student and faculty initiatives** for new climate-related programs, units, and research efforts.
- ☆**Accelerate and expedite the most impactful new climate initiatives** (e.g. climate teaching, see Section 8).
- ☆Be prepared to **make hard decisions to prioritize and elevate the most impactful ideas** in the strategic plan.
- ☆**Allocate key resources (funding, space, faculty positions) to support the most impactful strategic priorities**.
- **Realistically evaluate long-term climate impacts** on universities' abilities to fulfill their missions, including effects on physical plants, finances, and the surrounding community.
- ☆**Ensure protected academic freedom** for faculty advocating climate action, and **develop clear principles for advocacy statements** made by university leaders and units.
- ☆**Work with other universities to speak with one voice**. Consider collective public statements such as the Call for Constructive Engagement from the American Association of Colleges and Universities.

Examples for Climate Leadership

Example 1: Institutions with President/Provost-level leadership positions include Harvard and Duke (Vice President and Vice Provost for Climate and Sustainability - a single position with a dual reporting structure), Yale (Vice Provost for Planetary Affairs), Michigan (Associate Vice President for Campus Sustainability & Vice Provost for Sustainability and Climate Action), National University of Singapore (Vice President for Sustainability and Resilience)

Example 2: Dedicated climate-related schools or colleges include Stellenbosch University School for Climate Studies, Indian Institute of Technology Madras School of Sustainability, Arizona State University College of Global Futures, Columbia Climate School, Stanford Doerr School of Sustainability, and University of Michigan School for Environment and Sustainability.

Example 3: Large-scale, campus-wide climate institutes include Nanyang Technological University, Singapore's Center for Climate and Environmental Health, Harvard's Salata Institute for Climate and Sustainability, Simon Fraser University's Climate Innovation Institute, and the University of California Los Angeles Institute for the Environment and Sustainability. Similarly, the California State University Climate Adaptation Consortium (CSU ADAPT) is an example of an affinity group whose leaders support climate action across a large university system.

Example 4: At the University of California San Diego, the Academic Senate's Climate Change Committee assesses the results of campus-wide climate initiatives and makes recommendations for change on multiple time scales. This committee was also crucial in UCSD's creation of the climate-related General Education requirement (more in Section 8.1).

Example 5: The Plant-Based University movement brings together 80 teams of students in 11 countries working to transform university catering options to save money and reduce emissions. Cambridge University students generated an initiative to remove all animal products from dining hall offerings. Many universities are increasing support for vegetarian/vegan students.

Example 6: In 2019, 27 law students at the University of South Pacific in Vanuatu founded Pacific Island Students Fighting Climate Change. Six years later, they won a landmark victory at the International Court of Justice, an advisory opinion confirming states' legal obligations to prevent climate harm. The organization has received official university commendation. In 2025, it won the Right Livelihood award (often called the alternative Nobel Prize).

Example 7: At UC Berkeley, the Vice Chancellor for Research provided seed funding to support a campus network of environmental centers and institutes. Subsequently, one dean joined. The effort became the Berkeley Climate Change Network, eventually garnering modest support ($1,000-$3,000) from more than 15 deans across almost all campus schools and colleges. BCCN supports a regular mailing list, convenes meetings of center directors, and hosts webinars and other activities that provide infrastructure for campus-wide climate-change engagement.

Example 8: In 2022, the French Centre National de Recherche Scientifique, which oversees more than 1000 research units, recommended that the environmental impact of research should be taken into account when designing new research projects.

Example 9: The Association for the Advancement of Sustainability in Higher Education has a Sustainability Tracking, Assessment & Rating System which elevates a campus's ranking based on better climate-related communication and engagement. However, the program weights the tracking of "Greenhouse Gas Emissions" (Credit OP-6, which covers Scope 1, 2, and, in newer versions, Scope 3 emissions) as only 16 of a total of 250 points (6.4%) in their 3.0 version, and only 8 of a total of 206 points (3.9%) in their 2.2 version (Credit OP-1). These weightings as compared to total scores for sustainability are woefully unrepresented and need to be prioritized.

Example 10: The University of Worcester Sustainability and Communications Engagement Plan 2025-2030 leverages existing campus communication networks and creates new communication vehicles to increase awareness of climate-related activities for its 10,000 campus members and the surrounding community.

Example 11: At University of California Santa Cruz, the BE Climate Connectors events put on by the Baskin School of Engineering provide informal and regular social hours for faculty, staff, researchers, postdocs, and graduate students to build communities of practice and facilitate brainstorming. In UCSC Climate Salons, faculty present on climate-related topics.

Example 12: The University of Michigan's "Look to the Innovators" public statement expresses the institution's commitment to climate action and social justice, outlining teaching, community engagement, research, and environmental damage mitigation. During a university-sponsored session "Championing Human Rights-Based Research and Reaching Towards Climate Justice in Africa" at the Right Here, Right Now Global Climate Summit, The University of Cape Town's Vice Chancellor made explicit statements about commitment to climate-response.

Example 13: In the University of California system, the Board of Regents is legally allowed to pass a public resolution supporting or opposing a ballot measure that impacts the university. Since the climate crisis impacts all universities, the argument could be made that UCs can take a stance in certain types of public statements about political events relating to climate change.

Example 14: Some universities have made standalone climate emergency declarations (44) while others have signed the Global Universities and Colleges Climate Letter. In 2021, a letter from 75 higher education institutions was sent to then United States President Joseph Biden.

6. Timeline and Pace

6.1 Understand How to Create Institutional Change

Universities have shown they can be nimble in response to pressures, both internal and external. COVID-19 forced universities to remove students from high-density on-campus housing and implement remote instruction in a matter of days or weeks. Evolving student interest (Example 1), social and economic priorities, and academic foci drive curricular change as new programs of study arise while others are sunsetted. Some institutions are more flexible than others, but every university can transform in response to the climate crisis.

While theories of institutional change highlight a sense of urgency, we believe that a top-down declaration of a climate crisis (43) is insufficient. To impart a sense of stability and continuity -- i.e., non-emergency -- universities often declare an "external" crisis, not an "internal" one (27). A study of faculty in the UK found mixed reactions to climate emergency declarations with the majority reporting only small changes at the university level (43).

Instead, campus community members must *focus on starting* action items that align with the institution's climate-response strategy (more in Section 4.4). Lengthy and costly processes like physical-plant decarbonization and resource management require taking steps towards goals decades in the future (Example 2). To support change, universities can institute programs to bolster personal, collective, and institutional resilience and efficacy (44). Institutions must balance restructuring existing commitments with creating new structures, based on the interests, resources, and consensus of individuals involved.

IN ACTION: A Distributed Leadership Model

San Francisco State University's Climate HQ balances centralized coordination with distributed initiative ownership. Administratively housed in the College of Science and Engineering, it operates as an interdisciplinary, justice-centered initiative intentionally spanning all colleges. The structure presents curricular and administrative challenges but enables broad institutional transformation.

Three co-directors serve as integrative leaders, meeting weekly to maintain strategic coherence and taking primary responsibility for fundraising, administrative communications, and multi-domain initiatives. A support team of ten faculty and staff members, each representing at least one academic college, lead specific initiatives:
- Climate Change Certificate
- Faculty Learning Communities
- mini-grants

- community engagement
- climate justice internships
- the campus farm

Crucially, each team member receives 1-2 course releases annually for their efforts.

The team's composition is deliberately inclusive across race and ethnicity, gender, sexuality, rank, and discipline and draws from tenure-track faculty, lecturers, and staff, with several members serving or having served as department chairs. This strategic choice strengthens connections with upper administration and facilitates peer-to-peer communication across the university. The full team convenes biweekly to maintain alignment across initiatives.

Notably, the team *invested significant time in foundational work that many similar efforts bypass*: months of deliberation on success metrics, the meaning and implementation of climate justice, and optimal organizational structure. This broad-based, grassroots, donor-funded team is a model for creating comprehensive climate action.

6.2 Fast-Track Transformation: Internal Reconfiguration and Increased Education

While the COVID-19 response proves universities can change quickly, responding to the climate crisis requires long-term transformation *in concert with other institutions and outside actors*. COVID-19 had clear, short-term recommendations and technology-based solutions: "shelter in place" and vaccines. However, the climate crisis resists quick fixes and involves large-scale change across socio-economic systems. Universities must transform their partnerships with other institutions and boundary organizations (45) like NGOs, think-tanks, and academic institutes to generate required visionary thinking, trans-disciplinary approaches, and accelerated social change (more in Section 10) (Example 3).

Modifying existing, well-entrenched structures requires a multi-layered, time-sensitive approach. Table 1 shows characteristic turnover timescales of university people and programs.

Faculty 50% turnover – 25 years	New centers or research units – 8-10 years
Undergrad/postgrad turnover – 4-6 years	Major curriculum change – 5 years
Faculty 10% turnover – 2-5 years	Individual faculty research pivot – 2-5 years
Decisional timescale for resource allocation – 12-18 months	

Table 1. Estimates of university timescales based on the experience of workshop participants

Because faculty turnover is slow, we argue that internal reconfiguration is an accessible way to ramp-up climate-related research on short timescales. Cluster hires or new schools or centers may be cost-prohibitive and take decades, but many faculty are interested in contributing to or re-focusing their careers on climate solutions and research (Example 4). Removing barriers for pivoting faculty and encouraging post-tenure faculty to move to climate-related fields can boost required interdisciplinary expertise relatively rapidly (more in Section 7.3-5).

Undergraduates and postgraduates can be impacted quickly via curricular changes. Authors of this paper agreed that climate education is essential. However, we had a range of opinions on the best way to affect this (see Section 8.1). Whatever approach is chosen, campus leaders must step in to combat bureaucratic inertia to accelerate the deployment of climate literacy for all.

6.3 Anticipate Future Financial Limitations

Each university must plan its own timeline to transformation, anticipating tighter financial constraints. In 2023 the US EPA set the social cost of carbon at \$190 per ton CO_2, incorporating modeling developed by Rennert et al., 2022 (46). However, the uncertainty on this number is large, with more recent research from Bilal and Kanzig 2024 suggesting that the climate crisis's economic cost could be much larger than previously estimated (47). Adaptations to a warming climate (e.g., increased air conditioning and protection against sea level rise) will be costly, and disasters triggered by more erratic severe weather patterns are projected to cause large economic damages. Tighter budgets will constrain new climate-response activities and require universities to scale back other existing programs (Example 5). Universities must plan now to adapt to future financial constraints, identifying which current programs they can minimize to release resources to fund high-impact, essential climate action (more in Section 11).

Recommendations for Rapid Effective Institutional Change

- ☆**Assess similarities and differences with the COVID pandemic as a model for accelerated change**.
- ☆**Embrace internal reconfiguration and encourage existing faculty to pivot** to climate-related activities and research.
- ☆**Increase climate curriculum** to reach every undergraduate (more in Section 8).
- ☆**Embrace partnerships as change accelerators**, collaborating with local community groups, NGOs, regional university associations, and professional schools: business, law, medicine, public health.
- ☆Anticipate future budget constraints and **build plan for de-scoping existing programs while increasing climate action capacity.**

Examples for Rapid Effective Institutional Change

Example 1: In 2023, a student-led occupation of campus by the anti-fossil fuel organisation End Fossil Barcelona motivated the process to create a mandatory climate class at the University of Barcelona. Student activism also helped to move the University of California system away from carbon offsets (48). In 2014, students from Fossil Free ANU organised the first student-initiated referendum at the Australian National University, leading to divestment from seven companies.

Example 2: In 2020, the University of Cape announced its commitment to becoming a net zero water campus by 2050. After nearly running out of water in 2017 and 2018 due to severe local droughts, the university created a five-pronged strategy it expects to take nearly 30 years to implement. Answering the City of Cape Town's call for improved custodianship of water as a finite resource, the university has committed funding and planned steps in pursuit of this goal.

The University of California Davis 'Fossil Free Pathway Plan" projected that delaying the implementation of its ambitious 17-year direct decarbonization plan by ten years would ultimately cost twice as much. It identified early investment in climate mitigation as the fiscally prudent course of action.

Example 3: The Environmental Association for Universities and Colleges, the climate action non-profit Second Nature, and the United Nations Youth and Education Alliance organized climate emergency declarations via the Global Universities and Colleges Climate Letter.

Example 4: The *New York Times* article "Alarmed by Climate Change, Astronomers Train Their Sights on Earth" details examples of faculty who want to incorporate more climate-related material into their research.

Example 5: The University of California spent the better part of 2024 dealing with severe budget cuts due to a $68 billion deficit in the state budget. UC administrator co-authors on this paper noted that these budget cuts impacted the roll-out of new climate initiatives.

7. Mobilizing and Communicating University Research

7.1 Create a Campus-Wide, Climate-Related Research Strategy

French sociologist Bruno Latour has advanced the idea that scientific work, far from being disconnected and objective, in fact is highly influenced by the environment in which it is conducted (49). Successful scientists and innovators leverage but are also shaped by connections which fund and support their work. Applying his ideas to all departments highlights the importance of consciously tuning a university's research ecosystem for enhanced climate-crisis response. *To be effective, research must be socialized.* Or as Latour put it, "Scientists now have the choice of maintaining a [disconnected] 19th-century ideal of science or elaborating—with all of us, the hoi polloi—an ideal of research better adjusted to the collective experiment on which we are all embarked." (50)

Collectively, university research has immense capacity to improve our understanding of the climate crisis's biophysical and societal impacts. Generating strategies and solutions requires embedding research-for-impact incentives into institutional structures, turning universities into climate-response anchors.

In accordance with **Guiding Principle 1**'s call for a Whole-Institution Approach, the consensus-building process should develop a coherent, targeted, clearly articulated, campus-wide climate research strategy (Example 1). To maintain academic freedom, campus community members can choose whether and how their research will align with this plan.

Each campus will identify its own priorities, but basic elements could include:
- **3-4 research themes around which faculty and student climate-related research could coalesce**, broad to provide topic flexibility but targeted to inspire real action and catch the imagination of campus members and donors.
- **Support for faculty** who want to pivot research focuses or engage in interdisciplinary collaborations
- **Pathways to translate research into new teaching initiatives and courses**
- **Strategies to communicate research results** to other institutions and the general public in ways that inform and also *inspire action and social transformation*
- **A funding plan to dedicate campus resources** to pursuing these themes
- **External marketing materials** to leverage donor excitement about contributing directly to climate-related research for the greater social good

It may be tempting to create a campus research policy driven by administration, faculty, and staff. However, to prepare graduates to engage with climate challenges, universities must engender student enthusiasm. The campus research strategy might include a student-driven component, revised every four years. This would help universities stay relevant to evolving student interests and provide a competitive advantage to draw applicants to their institution.

7.2 Coordinating Climate Research Efforts On Campus

Following **Guiding Principle 2**, research coordination must be interdisciplinary and cross-cutting, not siloed to a specific department, division, or school. Top leadership roles must promote coordination efforts that include research and service, not just campus operations, surpassing the activities of most campus sustainability offices.

Some campuses have formal networks that communicate campus climate activities (Example 2). Other coordination efforts could include:

- hubs
- workshops
- cluster research thrusts
- newsletters

- coffee hours
- chancellor speeches
- calls for climate-related projects
- events like "climate week"

7.3 Rework Faculty and Staff Incentives To Expand Climate-Related Research

Many campus community members are feeling the call to incorporate more climate-related content into their research (Example 3). Those who do may reap professional and personal benefits. Researchers with career-long, single-field expertise can enjoy exploring fresh angles on familiar problems. Those interested in lasting impact for long-term social benefit will thrive building complex, multi-faceted responses to climate challenges. These are the sorts of ground-breaking activities that make academic reputations.

But there are two main obstacles:

1) *The current academic system induces researchers to develop deep, single-discipline expertise* following a "publish or perish" model.
2) *Academic success relies heavily on competition*. Faculty tend to be promoted based on individual efforts. Institutional prestige often accrues through metrics driven by a relatively small number of individuals, leading to a focus on "super star" faculty.

Both of these work against highly interconnected, multi-disciplinary research needed for climate-crisis response. By rewarding professional prestige and neglecting the socializing of research called for by Latour, they also inhibit the translation of that research into materials useful for the general public. This contributes to current skepticism about scientific research, fueling a widespread lack of confidence in higher education (51). Changing this requires developing pathways to increased climate research and communication and reworking multi-layered reward structures that support them (Example 4).

Universities who want to support and reward more climate content, interdisciplinary collaboration, or pivoting to new, climate-related fields should consider reworking a three-layered incentive structure.

1) **Tangible** – funding, salary, tenure review, promotion
2) **Social** – campus-wide recognition, departmental honors, speaking engagements, invitations to contribute to high-profile papers
3) **Personal** – the satisfaction of tackling societies' great challenges, coffee hours to enjoy new collegial relationships

Examples of new reward structures could include:

- **Promotion and Tenure considerations** that encourage concrete research applications, creativity, ingenuity, and collaboration along with publications or citations
- **New peer review criteria** elevating community engagement or advocacy
- **Fellowships** for faculty who want to pivot to a climate-related field (Example 5)
- **Funding for an academic prize** for team teaching across departments
- **A special "Best Paper" category** for faculty who have pivoted to new fields
- **A featured speaking invitation** for a research team who produced actionable materials for community use rather than an academic publication
- **A lifetime achievement award** for interdisciplinary collaboration

Can we envision an academic reward structure where *a climate resilience worksheet used by an entire school system of 4th graders, or a You Tube video that translates the Shared Socioeconomic Pathways (SSPs) into real lived experiences (see Section 13), has as much prestige as an academic paper with thousands of citations?* That might be what we need to move the needle on climate action. The proposed meta-department (see Section 7.5) could be a structure in which these types of "big-picture" efforts are imagined and rewarded.

Reworking researcher rewards and personnel review criteria, is a critical climate action lever. We encourage all university actors to advocate for new personnel review criteria. As argued by (48), an "Inside-Outside" approach that combines bottom-up and top-down advocacy is likely to be the most effective.

7.4 Encourage Interdisciplinary Checks and Balances

The history of innovation is littered with solutions that looked good from one perspective but failed to take into account wider community concerns, economic considerations, or even game theory around how people actually act with new sources of energy. What seems like a brilliant idea from the perspective of a single department often has downsides that researchers in other departments can identify and mitigate (Example 6). Thus, if universities want to be the breeding grounds of effective climate-response activities, they need to incentivize the sort of collaborative, interdisciplinary work that creates real solutions.

The goal is not to hamper faculty and staff from pursuing individual research interests. Rather, universities must induce campus community members to combine those efforts into impact

addressing society's challenges, not just individual publication credits or "superstar faculty" status. In an ideal campus research environment, faculty and staff would be free to pursue their own research goals *and also* encouraged to reach out beyond their department to design projects that address concrete climate challenges. Engineering might work with business, sociology, humanities and arts to understand how a proposed adaptation solution might be funded or affect user communities.

7.5 Create a Home For Interdisciplinary Faculty and Research: A Meta-Department

Many institutions have created interdisciplinary departments, schools, or centers (Example 7). However, cost can be an impediment with the founding donations of some exceeding one billion dollars. To boost collaborative research and support trans-disciplinary faculty more economically, we propose the new idea of a "meta-department."

The "meta-department" accommodates three facts about university research and researchers.

1) It is difficult for early-career scientists to develop a research portfolio that is both interdisciplinary and high-impact.
2) While universities may continue to hire highly specialized assistant professors, after having received tenure, some will want to expand their research scope to include big-picture projects.
3) Truly interdisciplinary faculty struggle to find an academic home, appointments, or support in the current siloed academic structure.

A "meta-department" addresses these by creating a high-level, research-oriented "think-tank," an academic hub without discipline- or speciality-based divisions. Providing a home for multi-disciplinary faculty who might not fit into a single traditional department, a meta-department could also internally recruit post-tenure faculty ready to incorporate broader topics into their research. Meta-department faculty would work on high-level questions (see Section 13) and synthesize other faculty research, reflecting it back and generating a bigger picture. For example, a meta-department could be charged with helping top leaders identify the most impactful research thrusts or create a meaningful and effective strategic plan.

A meta-department could differ from an interdisciplinary school by virtue of its position within the university organizational chart. Situated at the Provost level, above schools or divisions, the meta-department could be connected with new climate leadership positions. Such a unit would give these leadership positions greater impact by adding a powerful, independent synthesis research body. The Environmental Collaboratory at Drexel University has leveraged its position in the Office of the Provost to facilitate cross-disciplinary expertise, promote internal grant programs, and create high-level partnerships, including securing significant external funding.

While a meta-department need not be focused on climate, the model's unique structure connecting post-tenure faculty around urgent questions neatly overcomes several interdisciplinary climate research barriers. With home-department teaching or service relief as a perk of appointment, meta-department members would have more time and flexibility for non-tenure-boosting collaborative research. They would be less beholden to individual academic success, and the department's special status outside traditional academic structures positions its members for unique perspectives, transformative insights, innovations, and recommendations.

To gain traction, a "meta-department" appointment would have to be positioned as a promotion rather than a sign of being "put out to pasture." Special perks like salary increases, honorific titles, and public university spokesperson duties would signal this as a high honor that faculty members should seek (Example 8).

7.6 Overcome Barriers to Funding Climate Research

Funding sources affect what academics can research. Universities must overcome climate funding obstacles by boosting their own support for climate research (more in Section 9).

Traditional funding sources present myriad challenges for climate research. Money for interdisciplinary projects is hard to obtain. The highly competitive federal funding environment pushes researchers toward ideas that fit into the siloed lines that funding agencies recognize. Additionally, very few traditional funding mechanisms sustain and scale pilot projects. And often funding requires peer-reviewed publication, which works against fast-tracked projects or research on advocacy, outreach, and community engagement.

Since climate, in particular, has become a political football, climate-research funding fluctuates with political leadership. Academic dependence on federal funding in the United States became a flash point in 2025. As government funding tightens, universities become more dependent on private funding and public-private partnerships. This can accelerate the translation of research into commercial applications, but it also risks too much marketplace focus, which may not always align with broader social benefit or academic consensus (see Sections 9.2-3).

However, there are funding sources that support or even favor interdisciplinary, pilot, experimental, or community-oriented projects. Instead of focusing exclusively on big-number grants from industry or government, universities can cultivate a diverse climate-funding network that includes internal, educational, community-based, private, and individual sources.

Internal Funding – Since we believe that the climate crisis threatens the academic enterprise itself, we urge universities to shift financial support toward responses and adaptations, even if that means de-funding other, historically prioritized activities. Internal competitive 'seed' grants could provide dedicated funding for climate innovation. A percentage of unrestricted endowment

payouts could be earmarked for climate-related projects. Climate-focused living-laboratory models (more in Sections 4 and 11) and campus-based green energy and waste-reduction programs can save money (Section 5, Example 6). Leveraging the campus as a teaching ground for pilot projects creates space for climate research without expensive new facilities. This economical, low-resource, experiential approach trains students and faculty in exactly the type of "get more for less" thinking the climate crisis requires.

Teaching Funds – A significant portion of university research is supported by education and workforce training. In practice, graduate student research labor is often supported through teaching assistantships (TAs). A large institution might support 5,000 TAs annually in STEM fields alone, representing roughly $500 million in funding. However, teaching duties are often not full-time. The remaining time is spent on research. If universities specifically tied some teaching assistantships to climate-related research topics, these teaching funds would induce students and faculty mentors to pursue climate research and innovation projects. Linking research topics to classes would synergize research and educational efforts. Viewed creatively, teaching funds represent an underutilized resource that can allow universities to prioritize climate innovation even in the face of attacks on external funding.

Community Organizations – Members of the local community are important beneficiaries of climate research. While major research in resource-intensive scientific fields often requires large blocks of funding, people-centered psychology or sociology projects need less seed money and more willing volunteers. Thus, they can leverage community organizations to provide funding and research subjects (more in Section 10). A project designed to benefit the elderly, disabled individuals, disadvantaged youth, or the homeless could find modest funding and support from local organizations that serve those populations.

Local Businesses – Some portion of university research is highly theoretical, far from implementation, or dependent on large-scale manufacturing for roll-out. But the climate crisis also calls for modest, small-scale projects for immediate adoption and effect. Researchers interested in real-world applications can partner with local businesses to design projects that save money and energy. Funding gathered from a broad community base would allow businesses to support research that benefits them.

University-Spawned Funding Sources – Universities often think of corporate funding as external: businesses must be courted with commercially appealing projects. However, universities themselves – their faculty, students, and postdocs – are huge sources of potential commercial funding. Spin-off companies can not only generate revenue through intellectual property or equity shares, but successful university-spawned businesses also create a deep well of philanthropic giving, as commercial hubs around Stanford in California and Harvard/MIT in Massachusetts demonstrate. This long-range strategy for endowment-building allows universities

to do an "end around" market myopia. Spin-off revenue uses industry funds to support climate research without the need for immediate marketable applications (more in Section 9.5).

Private Donors – Traditional funding sources may focus on siloed departmental avenues, but individual donors are often passionate about unique, interdisciplinary, or cutting-edge projects (Example 9). Collaborating with campus communication experts – in marketing, graphic design, and even psychology – researchers could put together exciting and novel research concepts and assign students to create donor-friendly materials. Producing graduates who know how to generate enthusiasm and dollars for climate-related projects is a win-win.

While it may be painful to switch from a primarily top-down, big-grant funding model to a more diverse portfolio that also includes bottom-up, grassroots sources, this transition can support university research that helps communities where people need it the most.

7.7 Cut Ties With Fossil Fuel Research Financing

Historically, fossil fuel-based energy systems funded university research as part of a wider strategy to co-opt academic reputations and ensure public and policy acceptance (52,53). These problematic but often poorly or not-at-all disclosed potential Conflicts of Interest – also evident in tobacco and pharmaceutical funding – combat general scientific consensus on the necessary rapid phaseout of fossil fuel combustion. Thus, many students and faculty have called for divestment and dissociation between their institutions and fossil fuel companies.

Hundreds of universities have divested endowments and pensions. In 2013, San Francisco State University became the first public university and first West Coast institution to divest from coal and tar sands companies. In September 2022, the SF State Foundation strengthened its investment policy with ambitious goals to divest fully from fossil fuels by 2025, reach net-zero emissions from its investment portfolio by 2040 (100% reduction from 2022 levels), and integrate racial equity in investment strategies. The Foundation committed to limiting no more than 5% of its endowment in fossil fuel companies during the interim period.

In 2019, the University of California divested its portfolio. In an op-ed for the Los Angeles Times, UC Chief Investment Officer and Treasurer Jagdeep Singh Bachher and UC Board of Regents' Investments Committee Chair Richard Sherman wrote, "We believe hanging on to fossil fuel assets is a financial risk. That's why we will have made our $13.4-billion endowment 'fossil free'...and why our $70-billion pension will soon be that way as well." They indicated that while "[this] may not be the moral imperative that many activists embrace," they believe there are better, less risky investment opportunities in new energy sources than in old fossil fuels. This fiduciary argument for divestment is borne out by long-term analysis of leading stock indices like the S&P500 by the Institute for Energy Economics and Financial Analysis. The data demonstrate that fossil fuel stocks consistently and starkly underperformed relative to the rest of the S&P500 over the 2015-2024 decade. In doing so, they reduced overall benchmark

performance. This trend alone should be ample motivation for universities to divest from the fossil fuel sector.

While the [Responsible Asset Allocator Initiative](#) at New America recognized UC Investments as one of the world's 25 most responsible institutional investors, foundations at the individual UC campuses also manage endowments but have not disclosed whether their portfolios have been divested from fossil fuels.

A smaller but growing number of universities are dissociating research funds from fossil fuel companies and lobbying organizations, citing a lack of commitment and accountability to decarbonization required by the Paris climate accords. Even without institutional commitment, many individual researchers are following their own moral compasses and refusing to accept fossil-fuel-based contributions (Example 10).

Perhaps the most compelling motivations for fossil-fuel disassociation and divestment combine ethical and financial rationales. Morally, it is difficult to justify academic institutions' aligning with organizations whose sole viable business model is incompatible with their students' right to a clean and healthful environment and a livable future. Practically, savvy financial managers recognize that fossil-fuel investments enhance risk through stranded assets, structural underperformance and financial volatility.

Ultimately, institutions and researchers must make determinations based on historical understanding, practical considerations, and ethical or moral beliefs. However, full transparency regarding sources of research and philanthropy dollars – conforming to well established norms in most academic disciplines – should be a priority.

7.8 Increase Training For Research Communication and Advocacy

Universities are full of expertise about how to communicate, awarding degrees in journalism, marketing, and even communications itself. Yet, with the exception of agricultural extension services, many United States universities direct relatively little expertise toward effectively communicating about research itself.

Research-related communication falls into two categories:
- Research efforts and results communicated to other academics
- Results and recommendations communicated to decision-makers and the general public

These come with concomitant challenges:
1. Academic discussions are often studded with non-intuitive jargon and discipline-specific terms that hinder communication.
2. "Academic speak," while intelligible to other academics, is notoriously impenetrable to anyone outside higher education.

3. Academic focus on information and analysis may not create materials that motivate change, support concrete implementation, or translate scientific insights into real-world experience for the non-specialists (see Section 13).

Thus, we suggest campus leadership promote programs that train academics to communicate with specialists in other fields, policy-makers, and the general public (Example 11, more on "climate champions" in Sections 5.2 and 11.1).

Faculty who wish to engage in interdisciplinary research or collaboration could benefit from training to notice when discipline-specific jargon pops up and switch to commonly understood terms or provide an explanation. Written communication could have a "for potential collaborators" section with less technical language. Adaptations like these would go a long way to sparking exciting collaborations at multi-department "meet and greet" coffee hours. A report from the *Pathways to a Fossil Free UC Task Force* includes recommendations for effective communication targeted to to reach audiences in different roles on campus.

Many workshop participants felt that, to promote the greater good, universities should also train, incentivise, and support interested faculty to influence policy and inform policy-makers. The Honest Broker model (54) suggests that academics play various roles, including "Science Arbitrator," "Pure Scientist," "Issues Advocate," and "Honest Broker" (more in Section 12). Originally applied to scientific advising, this model can be extended to all university divisions. Video modules or on-campus workshops could provide training on how to build relationships with influential partners and distill high-level expertise into simple, actionable recommendations.

Some institutions might also decide to create a special center or hub to research and/or implement communication best-practices (Section 5, Example 6). Academic expertise in personal resilience and community transformation can inform marketing and graphic design to create materials that support audiences to translate research results into adaptation. Institutions with existing outreach arms like agricultural extension services should share their decades-long public communication expertise with other campus units (Example 12, more in Section 10.2). A campus could truly become a climate-response leader by establishing research thrusts on how to motivate and support climate adaptation and social transformation.

7.9 Supplement "Peer-Review" With Faster Pathways to Public Communication
University research must maintain credibility and trust; however, peer-reviewed research can take many years from start to finish, impeding the translation of cutting-edge research results into timely implementation. Some topics like advocacy, science-based outreach, and community engagement are not always well suited for peer-review. In fact, the perceived need to "shoe-horn" research into a peer-review process can lengthen and complicate such efforts.

Yet peer review is not always necessary to generate impact. For example, Bilal and Kanzig's 2024 working paper (47), published by the US National Bureau of Economic Research, on the macroeconomic impacts of climate change has been hugely influential despite not yet being a formal peer-reviewed publication.

Thus, to fast-track climate research results dissemination, we recommend that universities develop a broader set of research-evaluation metrics, better suited for advocacy, outreach, and community engagement. This document is non-peer-reviewed academic communication!

However, the advantages of timely communication must be balanced by careful investigation into motivations and potential impact of information. A non-peer-reviewed 2011 report from the MIT Energy Initiative (55) that did not disclose its authors' significant ties to the oil and gas industry played an important role in United States' development of methane fracking. One of the report's main authors – Ernst Moniz – went on to serve as President Obama's Energy Secretary from 2013-2017. During his tenure, the United States became the largest producer of fossil methane gas in the world. This development has caused massive environmental damage to predominantly poor, black coastal communities in Louisiana where fracked methane is exported as LNG (Liquefied Natural Gas) and has become a source of geopolitical strife as the United States is pressuring the E.U. and Japan to lock in long-term LNG purchasing agreements.

To guard against the potential downsides of fast-tracked communication, long-term action and policy should not be set based solely on a single, or small number of non-peer-reviewed sources. Shorter, expedited research reports could present the "best available science," often used by government agencies and cited in US federal laws, like the Endangered Species Act. Acknowledging that research is dynamic and constantly evolving, experts across disciplines and the most valid, reliable and up-to-date information can inform urgent, necessary actions prior to the release of a formal, peer-reviewed publication. Then, reviewed publications can be consulted for final or high-impact decision-making.

Another model for expedited but safe-guarded publications might be technical memos with internal reviews to ensure quality control, as created by government agencies like the National Oceanographic and Atmospheric Association (NOAA). As an alternative, universities could establish an internal committee to vet content for quality, accuracy and conflicts of interest.

IN ACTION: PUBLICATIONS FOR THE GENERAL PUBLIC

The Cooperative Extension arm of the UC system, called the University of California Division of Agriculture and Natural Resources (UC ANR), produces a wide array of

outreach methods and materials to share research-based information and promote best practices to various audiences.

These are available in multiple formats, not only peer-reviewed publications but also blogs like *UC Delivers*, news releases, and social media. UC ANR's internal review process verifies the technical accuracy of materials such as manuscripts, video scripts and online courses for sensitive content.

At the national-level, the National Extension Climate Initiative links climate change-related education and research across Extension program areas and associations. Formed in 2019 by Extension faculty and staff, this volunteer network coordinates and manages climate-outreach activities, shares resources, provides networking opportunities, and promotes professional development within and between states and regions.

Given the climate crisis's urgent time constraints, universities might consider similar vehicles for rapid communications on climate research and action.

Recommendations For Promoting Climate-Forward Research

- ☆**Prepare a coherent climate research policy**, crafted through mutual consultation, codified in a written strategic document, and supported through administrative fund-raising and extra-campus contacts.
- ☆**Rework researcher and program success metrics to reward collaborative work**, partnerships, and co-production, not just individual efforts, high grant volume, or publication frequency.
- ☆**Encourage climate advocacy as part of university service.**
- ☆**Provide a clear process and organizational support for pivoting researchers** seeking to switch departments and/or develop new interdisciplinary expertise.
- **Create interdisciplinary teaching and research structures** (meta-departments, schools, or research units or centers) to support the institution's climate consensus strategic plan.
- **Develop diversified funding streams** that include private, community, and local or state government sources to decrease dependence on federal and corporate funding.
- ☆**Promote cost-effective climate focused "living laboratory" and experiential learning models** (more in Section 8.6 and 11.6) that integrate research and training.
- ☆**Leverage campuses as models for testing small-scale pilot projects** (from carbon footprint reduction to influencing change within political power structures), paving a scalable implementation path from university campuses to cities to regions.
- **Pursue a practical strategy to divest endowments and research funds from fossil fuel organizations** that are not taking steps to meet international decarbonization standards.

- ☆**Create a larger, administration-led strategy to actively facilitate faculty connections with media and decision makers**, including inducements, tools and training in communicating and collaboration with non-academic partners.
- ☆**Develop new communication pathways** to promote the best available knowledge, inform policy design, and support immediate action, focusing less on peer-reviewed publications and citation metrics.
- ☆**Emulate agricultural outreach offices** as an existing model for effective climate-information delivery.

Examples for Promoting Climate-Forward Research

Example 1: Launched in January 2023, Simon Fraser University's five-year Strategic Research Plan (SRP) was produced through hundreds of interactions with campus community members. Campus consensus identified clear themes of interest, including climate-crisis response, human-health research, interdisciplinary collaboration, and incorporation of Indigenous perspectives and knowledge. The plan relates these themes to the institution's core values and highlights specific research approaches to guide projects and target priority areas. The implementation plan includes support for campus community members who have questions about how this affects them and their research

Example 2: UCSC Climate Action Now Network is a faculty/staff led initiative that updates campus-community members and the general public on climate-related events and offerings at the University of California Santa Cruz.

Example 3: Astronomers for Planet Earth is a grassroots movement working to address the climate crisis from an astronomical perspective.

Example 4: A white paper from the Pew foundation provides a scan on how to support societally impactful research (56). New rules from University of California on faculty reward systems promote community engaged research.

Example 5: The Simons foundation has created the Pivot Fellowship to support faculty who want to change their research direction.

Example 6: From the single perspective of sequestering as much carbon as quickly as possible, planting monocultures of fast-growing species became the "go-to" strategy for companies looking to offset their carbon use. However, this turned out to exacerbate fire risk and decrease biodiversity. Interdisciplinary collaboration and research has demonstrated that planting a range of species results in greater long-term carbon sequestration and resilience.

Example 7: Climate or sustainability schools include Schools of the Environment at Yale and Duke, Stanford's Doerr School of Sustainability, and University of Michigan's Graham Institute of Sustainability. University of California Santa Barbara's Bren School of Environmental Science and Management includes interdisciplinary degree paths.

Example 8: United Kingdom universities have prestigious chair positions for community engagement, including the Oxford Simonyi Professor for the Public Understanding of Science.

Example 9: Search for Extraterrestrial Intelligence (SETI) is a highly respected, academia-adjacent organization that has found 40 years of funding, in part by appealing to the unique interests of private donors.

Example 10: As guidance for researchers considering fossil-fuel-based contributions, the Vrije Universiteit Amsterdam lists criteria for new research collaborations, recommending only fossil-fuel-sector companies "that demonstrably commit in the short term to the objectives of the Paris Climate Agreement and the level of decarbonisation required to limit temperature increase to a maximum of 2°C, and ideally to 1.5°C."

Example 11: COMPASS provides training, leadership development, coaching, and support to help scientists communicate to policy-makers and the general public about conservation issues.

Example 12: The Cooperative Extension arm of the UC system, University of California Division of Agriculture and Natural Resources (UC ANR) employs extension specialists, advisors, and community educators to promote community engagement and provide research-based information, educational programs, and technical expertise. UC ANR communication methods and materials provide a wealth of interesting models for outreach.

8. CLIMATE LITERACY FOR ALL CAMPUS MEMBERS

8.1 Take a Two-Tiered Approach To an Obvious Place for Progress
Central to the traditional academic mission, teaching is a key arena for strong climate action (57). *Greater climate literacy was a consensus agreement among workshop participants.*

Our top recommendation is a two-tiered Student Climate Literacy approach in which everyone:
1. **graduates with basic climate literacy and understanding of climate solutions, mitigation, adaptation, and societal transformation**
2. **understands how climate relates to their chosen major and career possibilities**

Tier 1: Expand Climate Teaching to Every Undergraduate
Beginning with a fierce commitment to students' livelihoods and futures, effective climate education helps students develop their values and navigate tensions that arise in climate-action work. Many from communities disproportionately affected by climate change understand the crisis as an issue of intergenerational justice. Rather than treating students as passive recipients, universities must recognize them as knowledge producers and change agents.

Opinions among authors of this paper coalesced into two camps regarding pathways to basic student climate literacy. Most supported climate General Education requirements. However, since a mandatory education requirement does not suit all institutions, either structurally or philosophically, some workshop participants favored other, choice-based approaches.

Option 1: A Climate General Education Requirement – specific courses or a suite of options

This would reach the largest number of students (Figure 1) and fulfills a fundamental university responsibility: preparing graduates to thrive and prosper amidst the challenges of their day.

Two key questions involve curriculum content and pedagogy. Ideally, all students would gain a broad, high-level, interdisciplinary understanding of the climate crisis: underlying causes, cascading impacts, and solutions that advance mitigation, adaptation, and leadership. However, any single instructor would be challenged by the required breadth, spanning sciences, humanities, engineering, policy, law, design, psychology, and more.

Existing climate courses tackle these questions in different ways. The University of California's "Bending the Curve" presents recorded lectures in many academic disciplines, covering climate-crisis causes and solutions (Example 1). University of California San Diego, one of the first institutions to institute a climate General Education requirement, took the pragmatic approach of certifying a menu of pre-existing classes that contain the required 30% climate-related content (Example 2). To avoid creating a bottleneck impeding student graduation,

San Francisco State University modified an existing General Education requirement, re-certifying classes as part of its option menu to create "Environmental Sustainability and Climate Action," which explicitly centers climate justice and action (Example 3).

Each approach has pros and cons. An overarching curriculum might produce graduates with a more curated and consistent understanding. "Repurposed" General Education menus expose students only to pieces of the larger puzzle, but they are easier to implement quickly and allow faculty to expand expertise at a measured pace. Importantly, they are readily accommodated in students' already crowded schedules. To avoid increasing time-to-degree, some institutions exempt transfer students or enable students to double count classes for multiple requirements.

The creation of climate- and sustainability-related General Education courses can follow many paths. At the University of Barcelona, a student sit-in included the creation of a climate General Education requirement as one of its demands, building on a Spanish law mandating that all students at public universities receive some climate education (Section 12, Example 4). At the University of California Davis, faculty approached Senate leadership multiple times in vain and ultimately took a bottom-up approach.
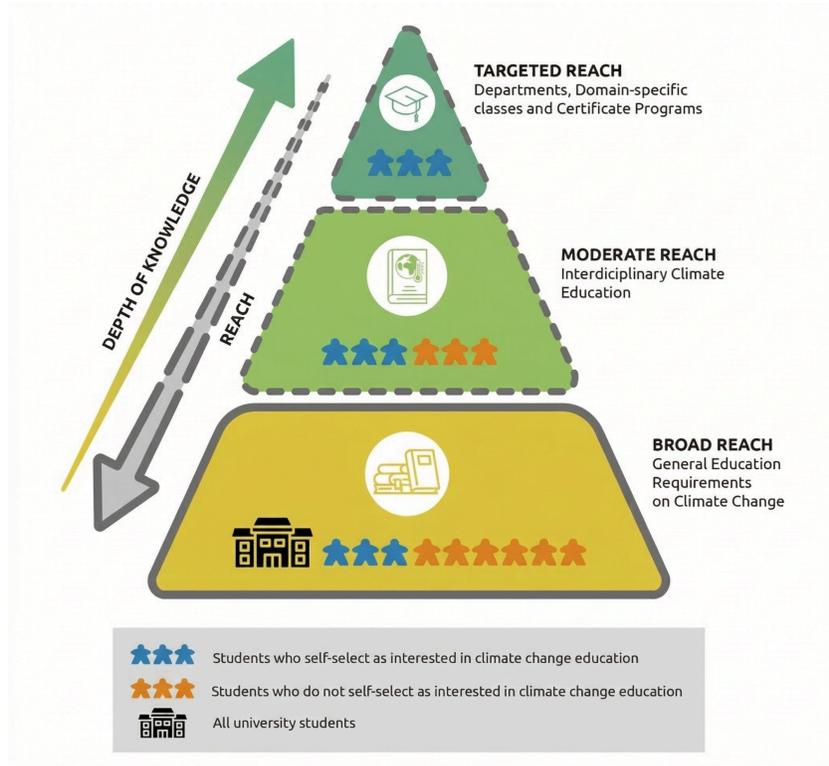

Figure 1: A multi-layered and multi-disciplinary approach ensures that students receive climate instruction through multiple lenses (Stoltz et al. in press).

In 2023, UC San Diego approved the [Jane Teranes Climate Change Education Requirement](#) mandating that bachelor degree candidates complete a one-quarter course approved by the Academic Senate, starting in 2024.

Faculty spearheaded the effort to create the requirement from the bottom-up. They maintained pressure via student protests and worked through the divisional Academic Senate's standing climate-change committee – the same committee that developed and proposed the 2022 Fossil Free Memorial to the Systemwide Academic Senate. University administrators were looped in only secondarily. Further details on UCSD's "Inside-Outside" strategy of grassroots movements and student activism can be found in Nelson et al. 2025 (48).

Similarly, in 2025, San Francisco State University voted to require that all bachelor degree candidates complete a one-semester course in Environmental Sustainability and Climate Action, which is grounded in climate justice. This work was driven by SFSU Climate HQ – a faculty, staff, and student hub for climate justice – in collaboration with the Academic Senate.

Option 2: Choice-Based Approaches to General Student Climate Literacy Education – appealing classes, research projects, freshman orientation content, or other delivery vehicles embedded into institutional culture and priorities

Some authors argued that mandatory General Education requirements don't leverage the power of student choice and might crush future enthusiasm for climate-response activities. Additionally, such an approach might not be ideal or even possible for every institution (Example 4).

Universities have successfully instituted climate education through institution-wide support for climate teaching, gamified learning, and positioning climate education as both ethically responsible and also useful for developing resilience and self-determination (Example 5). Experience shows that when climate-related classes are perceived as well taught and interesting, students flock to them without mandates, with the best examples even spreading to other institutions (Example 6). Additionally, formal courses are not the only potential vehicle. For example, the topic could be addressed in an enrollment video or discussion forum as part of campus orientation, encouraging students to choose climate-related courses going forward.

Some institutions recognize that students need preparation to face a range of rising challenges and present climate as one of several options.

The University of Michigan Dearborn includes climate as one of 14 challenges its engineering students can tackle through the National Academy of Engineering (NAE) Grand Challenges for Engineering program. A similar program is scheduled for ramp-up in the College of Literature, Sciences, and the Arts at U Michigan Ann Arbor.

Tier 2: Incorporate Climate Into Every Department and Connect Workforce Development
Students also need to understand how climate and sustainability intersect with their academic majors and vocational paths. Some experts have argued that, in the future, "every job will be a climate job" (58). Interviews conducted by one workshop participant found that students were most interested in knowing how climate intersects with their careers. Domain-specific classes (Example 7) and curriculum integration can educate students to pursue academic interests with climate sensitivity and prepare for potential career effects. *Thus, each discipline must teach on climate-crisis related topics and forecast impacts on graduates working in related fields.*

Health professions education demonstrates the value of longitudinal integration rather than reliance on stand-alone courses. For example, in nursing and medical education, climate and planetary health concepts can be embedded across foundational sciences, clinical training, ethics, population health, and community practice, reinforcing relevance and application throughout the learner's educational trajectory.

Including climate material in all academic disciplines requires strong leadership and faculty-administration collaboration. Each major could be required to address the intersection between climate and their discipline in at least one or two upper division classes (Example 8). Going a step further, the Duke University climate commitment incorporates climate-awareness into education, research, external engagement, and university operations.

8.2 Address Climate Curriculum Development Challenges
Workshop members highlighted the importance of collaborating with students and faculty to develop appealing, functional climate-related courses (Example 5). Curriculum designers must investigate what students actually do know and create sufficient pathways for bottom-up as well as top-down education. Accordingly, the consensus-development process (Section 4.2) is critical to building a climate literacy program that serves campus community members. Simple protocols like making sure that related courses include the word "climate" in the title can help students identify and engage with the content they seek.

As consensus develops, universities may benefit from creating a set of desired learning outcomes, perhaps building on existing K-12 models (Example 9). Flexibility is key. Inevitably, climate curricula will evolve as new climate impacts, research, and models develop. Curriculum designers must be broad-minded and adaptable, responding to the concerns of their constituents while making challenging decisions about the best conclusions and practices of their own institutions and the wider academic community.

Effective climate education must extend beyond cognitive understanding to include applied skills, ethical reasoning, emotional resilience, and action under uncertainty. To focus institutional resources, some universities have adopted a multi-pronged approach, designating specific campus members as custodians of climate-education (Example 10).

IN ACTION: Preparing Faculty to Teach on Climate

> In response to the lobbying of one pro-active professor and approval from a student-wide campus ballot, Chico State launched Teaching Climate Change and Resilience. What began as a series of workshops on a single campus in 2021 is now a multi-campus California State University program preparing professors to integrate climate content.
>
> It attracts hundreds of faculty across disciplines and includes a toolkit of resources and ongoing faculty development discussions for incorporating climate-related instruction into all disciplines. Creating this earned Chico State a Campus Sustainability Award from Association for the Advancement of Sustainability in Higher Education.

8.3 Leverage a Variety of Climate Teaching Strategies
Institutions have adopted a wide range of approaches to delivery, audience, and content.

- **Individual faculty incorporate climate into courses** even when not the primary topic.
- **Departments or other units offer climate-related certificates** with larger collections of courses and credits, sometimes linked to climate-related careers (Example 11).
- **New advanced or professional degree programs** explicitly address climate issues and/or connect climate with other disciplines (Example 12).
- **New climate-related majors or schools** expand climate teaching (Example 13).

8.4 Share Teaching Materials and Resources
Allowing instructors to use shared curricula or develop their own with expert input on content and pedagogy can minimize "reinventing the wheel." Using pre-developed classes will enable faculty to employ tested content with a proven track record (Example 14). However, not all

teaching materials are freely available. More inter-university cooperation is needed. Collaboration with boundary organizations that support climate education (Example 15, more in Sections 10.4-7) can also spur creation and/or elaboration of free online materials.

8.5 Implement Strategies to Boost Teaching Capacity

Universities must remove barriers and incentivize faculty to become *comfortable, effective, interdisciplinary climate educators*. The Figure 1 framework highlights the need to balance topic breadth with knowledge depth. Since faculty in most institutions are hired to teach their own expertise, some may need encouragement and incentives to teach climate-related and/or pre-packaged course material. However, experience indicates that many faculty welcome the chance to improve their climate-education skills (Example 16).

Instructors who are willing may benefit from professional development on interdisciplinary teaching methods and climate specific topics like emotional sensitivity and personal resilience (Example 5). Traditional information-heavy academic approaches may fall short when applied to the climate crisis's wide set of personal, emotional, and social implications. Well-meaning efforts that focus only on intellectual or scientific aspects can do unwitting harm if they do not also support students' mental and emotional well-being in the face of an uncertain future.

Methods for boosting teaching capacity include:
1. ***Encourage teaching on the intersection between climate and disciplines* –** In upper division classes, faculty may not need to be climate experts to discuss the intersection between climate and their field.
2. ***Create professional development to support climate-education skills* –** While some faculty already understand and can communicate climate impacts effectively, others may need moderate to significant professional development to impart how their disciplines interact with the climate crisis.
   a. An institutional or system-wide **Climate Education Hub** where campus-community members could submit climate curricula for review and/or utilize materials developed by other climate educators
   b. **Faculty Development Workshops** and **Faculty Learning Communities** where campus climate experts can support interested faculty (Example 9)
   c. **Clear expectations and documentation** with proven structures and best practices on including climate material into curricula
   d. **Financial incentives** such as paying faculty to attend professional development (Example 17) or course relief for developing a new class with climate content
   e. **Communication pointing faculty toward high-quality climate education materials** and climate-events calendars (Example 18)
3. ***Institute interdisciplinary teaching expectations for new climate-related faculty hires* –** Expertise from new, interdisciplinary faculty can boost climate teaching capacity. Cluster hires spread across departments should have clear expectations of interdisciplinary

teaching. At the workshop, we heard from a dean at a US institution that only hires faculty who have some climate expertise in addition to their main discipline. This practice could rapidly boost climate teaching capacity across disciplines.

4. ***Support and reward co-curriculum development and team teaching*** – Revising review and promotion criteria to prioritize interdisciplinary activities would encourage siloed departments into inter-departmental collaboration. Faculty who talk together, teach together (more in Section 7.3-4).

8.6 Expand Education from Classroom Learning to Training and Research

Universities must train students who not only know about climate but are also empowered to act. Climate literacy must encompass professional and workforce education. Instructors can give students hands-on experience in climate activities that build internal efficacy and resilience. Existing "action to impact" course models could be adapted to focus on climate-related activities (Example 19). Undergraduate and graduate research, capstone, and thesis projects are rich training grounds for individual and team efforts.

Campus decarbonization programs provide potential opportunities for Climate-related Course-based Undergraduate Research Experiences (C-CUREs), where students explore real-world research by participating in study design, implementation, analysis, and interpretation (59). University land-holdings offer sites for student construction projects, and campus biospheres support a rich palette of potential research questions. Successful examples can be scaled up to broader application (Example 20). Supervising teaching and mentorship teams may also include practitioner mentors from the local community, governmental agencies and NGO partners (Example 21). Students can build skills and develop professional networks that facilitate climate activities and future employment (Example 22).

University campuses are also natural living laboratories for teaching climate action in both formal and informal settings. Society-wide transformation requires understanding adoption-drivers for new technologies and behaviors, political and cultural barriers, and effective communication strategies. Thus, while campus clean energy, transportation, and climate adaptation projects naturally involve science and engineering, they also support social science, humanities, and arts research in social innovation and community dynamics (see Section 9.7).

Living laboratory programs can also train the MAST (Mitigation, Adaptation, and Social Transformation) framework and multidisciplinary, systems-thinking approaches. Instead of just considering an engineering design project or a climate-psychology experiment in their own departments, educators could seek out collaborators in other disciplines to design systemic-living, research-and-implementation education opportunities. This would give students experience in real world collaboration and build a foundation for subsequent waves of interdisciplinary scholarship (see Section 13).

8.7 Circulate Teaching Resources With the Broader Community

Universities need not carry the climate-crisis teaching burden on their own. Partners in business, government, NGOs, and local communities have expertise, connections, and vocational experiences that academics lack – and students need. Most students will graduate and confront climate impacts *outside of academia*. Teaching them solely from the perspective of higher-education does students a disservice and forces educators to approximate or theorize about challenges that other professionals could explain from personal experience. Opportunities to co-teach with domain-related professionals range from one-time guest speakers, to field trips, to team-teaching engagements.

Climate curricula would be incomplete without Indigenous and traditional perspectives as permitted by the traditions and preferences of knowledge holders. Integrating different knowledges and ways of knowing can better prepare students for engaging in community-centered climate work. These opportunities can also highlight where Indigenous perspectives and approaches to climate resilience (e.g., "nature-based" solutions) have reemerged, often without attribution, in climate adaptation teachings and practice (60). Many students identify as members of these communities and have their own perspectives to add.

Additionally, local communities harbor their own educators eager to benefit from university resources and training. Campus community members can partner with local K-12 educators, (e.g. hosting a Summer Teachers Climate Institute) to provide cutting-edge updates on the latest research and co-develop effective ways to convey climate science, resilience work, and mindset innovation (Example 23). Experience shows that an effective workshop targeted at interested and dedicated teachers can have an outsized impact, reaching thousands of students (Example 24).

Fulfilling the broadest interpretation of their mandate to educate, universities can also provide climate-education opportunities directly to members of the public (Example 25). Strengthening community partnerships (Section 10) will support higher education beyond the classroom. A truly innovative program like a Climate Corps (based on the Peace Corps model) would require deep collaboration but could provide a wealth of practical advantages for students and society if energized, active, minds were willing to take it on.

8.8 Center Equity and Social Mobility in Climate Education

Because climate impacts fall disproportionately on marginalized communities, climate education must intentionally serve students from those groups (Example 26). Campuses with large numbers of first-generation and underrepresented students face unique opportunities and responsibilities. Universities can advance equity in climate education through coordinated system-wide approaches, faculty development that crosses institutional boundaries, graduation requirements

that explicitly address justice dimensions, and community partnerships that provide reciprocal learning opportunities.

As institutions develop climate education programs, they must recognize several key principles to reach diverse student populations:
- Explicitly connect climate awareness with justice, equity, and social mobility
- Highlight climate literacy and workforce preparation for students pursuing economic mobility
- Validate lived experience, traditional practices, Indigenous wisdom, and community expertise, creating bridges for students to *bring knowledge to and from their communities*
- Create faculty development programs that integrate climate and justice (Example 27)

Students from communities already experiencing climate impacts bring essential lived experience and cultural knowledge to climate solutions. Climate education frameworks must recognize students not just as learners but as knowledge holders and future leaders in climate action (Example 28).

8.9 Increase Faculty and Staff Training on Climate, Sustainability, Justice, and Equity
Workshop participants also discussed faculty and staff training as a critical and under-utilized climate lever. Many societies have reached consensus that certain domains are everyone's responsibility, like a civic duty to vote to uphold democracy. Ultimately, climate impacts will touch everyone, everywhere. Thus, we believe every citizen is responsible for learning about and respecting long-term planetary sustainability.

However in academia, pressures like siloing and "publish or perish" imperatives have created impressions that "climate response" is the responsibility of researchers in only certain, select disciplines. Some workshop participants expressed dismay over comments from colleagues like, "That is climate work. It's not my job." Additionally, participants indicated that some colleagues did not seem to understand the predicted scope and impacts of climate change on other environmental challenges. A 2024 survey of nearly 2,000 researchers at 127 institutions in the United Kingdom indicated that almost 50% were uncertain whether their colleagues saw climate action at work as a priority or knew how to address climate change within the university setting.

Developing a true Whole Institution Approach to climate will require onboarding all staff and faculty, regardless of department or job description. Examples of current offerings include:
- **Optional education programs for the campus community at large** – These are often short (multi-hour or day-long workshops) and general (basic climate-change information and impacts for all campus community members). They can be developed in-house or by boundary organizations or outside interest groups (Example 29).

- **Optional training for faculty and staff training –** Academic experts or sustainability offices offer services *for units that request climate training*, creating presentations tailored to unit members' campus roles and expertise (Example 30).
- **Mandatory climate awareness and/or campus emissions reductions training** – By institutional policy, faculty and staff are required to undergo climate-awareness and sometimes emissions-mitigation education. This was the rarest type of offering, but it seemed to have the largest potential to impact staff and faculty campus-wide (see "In Action" box below).

Staff and faculty training on climate impacts, decarbonization, and equity and justice in decision-making and implementation represents low-hanging fruit with high-impact potential. It is a direct, actionable, and relatively easy-to-implement path to bring climate into the discourse in every department and campus unit.

IN ACTION: Mandating Faculty and Staff Climate Literacy + Action

In 2019, 37 institutional partners in Higher Education Sweden created The Climate Framework for Universities. After signing on, the **KTH Royal Institute of Technology**, Sweden produced Objectives and Measures for KTH's Implementation. Key steps included mandated climate knowledge and mitigation training for faculty and staff.

The 2019 document set two milestones for employee climate awareness:
- By 2022, all university employees must have knowledge of climate challenges and actively work to reduce their on-campus climate impact
- By 2025, those in leadership must undergo climate-related training

The document recognized the need to develop training programs that related climate awareness and emissions mitigation to staff activities in specific departments like operations, procurement, and IT.

Recommendations to Enhance Climate Literacy

- ☆**Impart climate education from multiple lenses to all students, using a two-tier approach:**
  - Tier 1 – broad education via a mandatory climate General Education requirement or choice-based options
  - Tier 2 – discipline-specific climate content, professional and workforce education

- **Rework student training, incorporating shared governance and student co-design** with flexible form and presentation. Create professional certificate programs to prepare graduates to address the climate crisis in non-academic and academic careers.
- ☆**Following institutional consensus-building, create a set of desired learning outcomes**, including understanding broader socio-economic climate implications.
- ☆**Increase climate teaching capacity** by sharing resources, creating campus- or system-wide "education hubs," developing co-teaching frameworks, offering professional development, and/or hiring new faculty.
- ☆Create structures that support broad teaching networks like faculty learning communities to **strengthen cross-university collaborations creating high quality, freely available teaching materials and professional development.**
- ☆**Increase interdisciplinary climate teaching** opportunities.
- ☆**Add incentives to share knowledge, course syllabi, program curricula** to counteract current siloing habits and rewards.
- ☆Institute incentives like summer salary or teaching relief **for faculty to create new courses or infuse climate education into current offerings.**
- ☆**Bolster opportunities for students to test out their ideas on campus** and institute "living lab" best practices:
  - Formal Curriculum
    - Offer project-based, team-taught classes focused on campus sustainability.
    - Organize faculty workshops on how to assign projects in existing classes that address aspects of campus sustainability.
  - Co-curricular
    - Create a student fellowship program or other cohort model with paid student positions paired with faculty/staff and/or alumni mentors.
    - Encourage student governments to create their own sustainability offices with sustainability directors or eco-senators (Section 11, Example 15).
    - Create a program with student peer learning coordinators in student housing, often called "Eco-rep" programs.
- ☆**Strengthen opportunities for teaching and learning with community partners,** including auditing for climate-resilience courses and workshops or conferences which normally target academics.
- ☆Recognize that serving diverse, first-generation, and underrepresented students requires **centering equity and social justice in climate education**.
- ☆**Develop and deploy staff and faculty climate literacy training** to ensure that every employee understands climate impacts and workplace mitigation.

Examples for Enhancing Climate Literacy

Example 1: Originally developed by University of California San Diego faculty in response to a 2015 report on climate-crisis solutions, UCs "Bending the Curve" (BtC) climate curriculum includes dozens of modular online units in many areas of expertise. The diverse content library allows the course to be taught effectively by an instructor in any field, who acts as a learning facilitator, modifying the content as needed. BtC can also be used to enrich existing courses with climate-related content that a lecturer feels less competent to develop themselves. A 2025 study found "Bending the Curve" graduates displayed increased belief in, understanding of, and personal responsibility for climate-crisis response (61). Self-reported actions showed a significant reduction of students' carbon footprints.

Content is available for University of California university instructors and those from other institutions with negotiated access to UC servers, including free availability to Global South institutions. A MOOC version is available to the public online.

The growing digital archive is actively adapted by universities and other institutions worldwide:
- BtC:American Medical Association (AMA) Learning Hub 2024 for medical education
- BtC:Los Angeles Unified School District (LAUSD) 2025 and BtC:National Education Equity Lab (NEEL) for teacher training and high school course development
- BtC:One Health Alliance Workforce Academies (OHWA) 2024 in 46 universities and institutions across ten countries in Africa as well as 95 universities in eight countries in Southeast Asia
- BtC:En Español an adaptation and Spanish translation for Latin American audiences in collaboration with Universidad Nacional Autonoma de Mexico (UNAM) including new modules focused on Latin America 2022-24.

However, although "Bending the Curve" offers a curated climate curriculum, it is neither a graduation requirement nor consistently taught at all UC schools.

Example 2: In 2023, the University of California San Diego introduced a mandatory climate undergraduate General Education requirement. UC Davis and UC Santa Cruz have proposals on the table for climate General Education requirements.

Example 3: Arizona State University, Oakland Community College, and San Francisco State University have Sustainability General Education requirements. The requirement at SFSU will soon focus on environmental action and climate justice.

Example 4: Adding new General Education requirements would be difficult in the California State University system given concerns about increasing student time-to-graduation..

Example 5: Co-created with students, the University of Michigan's "Advancing Climate Education" (ACE) initiative supports the institution's 19 schools and colleges to incorporate climate-response training across the curriculum. It includes emotional support, professional development, and innovative techniques to fulfill the institution's commitment to "equip students with the knowledge, skills, and mindsets to address the interconnected challenges of climate, sustainability, and justice."

Example 6: A class on climate-change resilience co-developed by psychology professors at the University of California has gained momentum and is now taught across all ten UC campuses.

Example 7: Duke University has introduced a climate class for nursing. Professor Travis Rector (University of Alaska Anchorage) has published a textbook on teaching climate specifically for astronomers. Professor Adam Aron (UCSD) developed a climate curriculum guiding students in climate advocacy.

Example 8: At Harvard Medical School, climate-crisis material has been integrated into the primary medical education curriculum.

Example 9: "Developing Student Outcomes For Environmental Literacy in K-12 Education" identifies four dimensions to bridge the gap between environmental education and formal pedagogies. This collaboration between the University of Maryland and NOAA provides a rich set of knowledges, actions, and attitudes that could be adapted for higher education.

Example 10: The University of Toronto's Sustainability Pathways Program recognizes students' involvement in extracurricular sustainability activities with a three-tiered framework: from foundational learning, through deeper engagement, to leadership for official recognition on the co-curricular record, emphasizing hands-on experience and reflection (62).
1. *Sustainability Citizen*: Foundational engagement, requiring an introductory module and participation in eligible activities like events, community service, or student group roles, culminating in a final reflection.
2. *Sustainability Connector*: Deeper, more consistent engagement, possibly bridging sustainability initiatives or connecting people.
3. *Sustainability Leader*: Leadership in campus sustainability efforts, perhaps involving significant project management or advocacy.

Example 11: San Francisco State University offers a 13- 22 credit climate certificate. University of Victoria, BC fields an 8-course Climate Action Certificate program

Example 12: Climate-related advanced or professional degree programs include UC Santa Cruz MFA in Environmental Art and Social Practice, New York University Center for Sustainable Business, and UC Berkeley Masters of Climate Solutions. The International Centre for Climate Change and Development, a climate-related non-profit collaboration between the International Institute for Education and Development (UK), Bangladesh Centre for Advanced Studies, and Independent University, Bangladesh offers an M.Sc. in Climate Change and Development.

Example 13: Climate or sustainability schools include Schools of the Environment at Yale and Duke, Stanford's Doerr School of Sustainability, and University of Michigan's Graham Institute of Sustainability. University of California Santa Barbara's Bren School of Environmental Science and Management includes interdisciplinary degree paths.

Example 14: Free online classes for teaching training include The Chamber's Environmental Changemaker Modules, and AASHE's faculty resources. At the University of Michigan, students and faculty co-designed the Massive Open Online Course "Act On Climate: Steps to Individual, Community, and Political Action" reaching thousands of participants worldwide (63,64).

Example 15: Boundary organizations that support climate education include Subject to Climate, the Higher Education Association's Sustainability Consortium, The Association for the Advancement of Sustainability in Higher Education, and Students Organizing for Sustainability.

Example 16: In 2001, 2004, 2011, and 2014, one workshop participant conducted Education for Sustainability professional development workshops for faculty from Historically Black Colleges and Universities and Minority-Serving Institutions. Feedback showed a great appreciation.

Example 17: San Francisco State University pays faculty to attend climate-teaching professional development. The University of California's Global Climate Leadership Council sponsored incentives for faculty who added climate to their courses.

Example 18: The Climate Literacy and Energy Awareness Network provides a repository of high-quality, peer-reviewed climate materials for kindergarten through college education. Educators can use materials from the award-winning collection or submit their own for review and inclusion. The California Environmental Education Interagency Information Network (CEEIN) maintains a calendar of environmental-education conferences and events.

Example 19: Professor Scott Lipton-Meyers at San Jose State University developed the "Teaching Social Action" course model, refined over 17 years, training students to create impact.

Example 20: The MycoToilet (a composting toilet using mushroom biocomposites to turn waste into a renewable resource) is one of multiple innovations developed by student researchers at the

University of British Columbia. Currently in field-testing, its goal is to demonstrate a distributed waste treatment solution which could be deployed in remote or water-scarce locations.

Example 21: Since the 1980s the University of Michigan has supported students working in interdisciplinary teams with clients from the local community under supervision of faculty.

Example 22: Cal Poly San Luis Obispo's Initiative for Climate Leadership and Resilience (ICLR) coordinates with local jurisdictions to identify climate and sustainability projects that fit into existing courses, allowing students to gain professional experience while cities receive no-cost support for climate action plans, resilient energy assessments, and other deliverables. ICLR received $10 million (2022) to bring the Californians For All College Corps to Cal Poly, creating paid fellowship opportunities for students focused on climate action. This model provides students – many from working-class backgrounds – with paid pathways into climate careers while serving community needs.

Example 23: The University of California-California State University Environmental and Climate Change Literacy Project aims to develop climate-related K-12 curricula.

San Francisco State University's Climate HQ offers the nation's first Climate Justice Education Certificate program designed specifically for PK-12 educators. Unlike traditional environmental education programs, this certificate explicitly centers justice, equity, and systems change alongside climate science. It prepares teachers to help students understand not just what climate change is but who is most affected and why. The program equips educators to integrate climate justice frameworks across disciplines, enabling them to reach thousands of students in communities already experiencing disproportionate climate impacts.

Example 24: In 1994, 1995, 2000, 2001, and 2004, one workshop participant secured funding from the EPA and UNCF Mellon and conducted Summer Teachers' Environmental Institutes. The 2001 Institute survey found that participating teachers were reaching about 5,000 students.

Example 25: Direct-to-public climate education opportunities include Simon Fraser University's Continuing Studies Climate Action Certificate and University of California Merced's climate-related Shakespeare in Yosemite.

Example 26: More than half of the California State University's 460,000 students across 23 campuses come from traditionally underrepresented backgrounds, and over one-quarter are first-generation students. Many of their communities are already experiencing climate impacts such as poor air quality, heat islands, and limited access to green space. The CSU Climate Adaptation Consortium (CSU ADAPT), launched in 2025, explicitly focuses on supporting "student success and preparation for emerging climate career opportunities" while facilitating

partnerships with community colleges (which serve as primary pathways for low-income and first-generation students).

Example 27: The CSU system-wide Faculty Learning Community in Teaching Climate Change and Resilience enables faculty across disciplines – from nursing to engineering to business – to integrate climate content. Having reached hundreds of faculty since 2022, this community ensures that students in all majors (not just environmental science) can gain climate literacy relevant to future careers. This is particularly important for first-generation students who may be entering fields where climate knowledge creates competitive advantages in the job market.

Example 28: San Francisco State University's 2025 climate justice graduation requirement ensures all students can "identify solutions to address the root causes and impacts of environmental and climate injustices," preparing graduates to advocate for their own communities. The requirement explicitly recognizes students from marginalized communities as both disproportionately affected by climate change and also leaders in developing just solutions. SFSU Climate HQ's Climate Action Fellowships offer financial support, mentorship, and community for student climate-justice projects, creating pathways for students from underrepresented backgrounds to develop expertise and professional networks.

Example 29: The Green Academy at Nottingham Trent University, UK, offers a variety of programs designed to educate campus-community members on climate, including Carbon Literacy Training and Climate Fresk, a hands-on workshop developed by a French NGO of the same name. These serve students, staff and faculty.

Example 30: The University of Waterloo, Canada, has a free Employee Learning and Development module which educates staff and faculty about sustainability and climate change, covering key issues like energy, transportation, food, biodiversity. and the university's own sustainability commitments and campus programs. The module is tailored to a unit's specific focus and activities. Unit leaders must contact the Campus Sustainability office to schedule.

9. Translating Innovation: Technology, Mindset, and Social Solutions

9.1 Turn Knowledge into Action

In the past, it might have seemed sufficient for researchers to investigate and share what they discovered. However, academics increasingly recognize that knowledge creation and transfer are not sufficient. For millennia, humans have poured energy into new technologies, materials, and social evolution. Now, we face the challenge of *consciously channeling these natural innovative impulses* to **develop *technologies, mindsets, and social systems* to live within planetary limits** (more in Section 13). *Knowledge alone does not move the needle*.

Since mitigation, adaptation and social transformation require action, universities must boost their capacities to test out new ideas and partner with those who can bring promising innovations to broader society. Working with industry and community groups (Section 10), universities can co-develop recommendations, best practices, and adaptations to transition towards healthier, more sustainable futures. Collectively, this "solution innovation" encompasses *a transformation of the market itself through individuals and systems that comprise it.*

This can proceed along three tracks, requiring contributions from all academic departments:
1. **Materials and Technology** – areas typically associated with "innovation," including new materials, energy sources, and products to mitigate climate change
2. **Mindset and Resilience** – the strategic identification of new values and economic systems where "comfort" and "prosperity" do not automatically mandate greater consumption and growth, including transitions from current wealth- or comfort-driven motivations to more sustainable, wholesome, and holistic drivers
3. **Social Habits** – options for structuring human settlements, social interactions, and ways of living to create thriving, sustainable communities within long-term planetary limits

9.2 Support Discussion about Healthy Partnerships and Funding

It's easy to blame industries, corporations, or economic systems for unchecked overconsumption, but in fact, many technologies and products flourish because humans provide a market for them.

A definition of "progress" focused on economic growth and technological advancement without sufficient boundaries and wisdom – what the Consilience Project calls "naive progress" – has led to technology adoption without consideration of how it might impact human quality of life or biosphere health. Thus, a new, healthier relationship with technology and industry requires ramping-up nascent efforts to set better boundaries, clarify long-term results, and *guide societies' technological and economic trajectories rather than simply being guided by the urge for more*.

In universities, this can start with a dry-eyed, honest, historically-aware discussion of academic-industry partnerships and funding.

Academic acceptance of industry financing has a checkered past. Big-Tobacco-funded research on smoking masked the dangers of tobacco use; energy companies backed research that favored natural gas over other fuel options (see Section 7.7). History suggests that universities must not blindly accept research funds from companies with vested interests in pre-determined research results. "Academic capture" is a real and present danger (53).

However, industry-funded university innovation has also boosted many climate-forward technologies and products, including battery technology, precision agriculture, solar energy, and smart grids. Thus, the right attitude is not "should we or shouldn't we?" It's "how can we develop better guidelines and best practices" around accepting industry research funds and partnerships?

During their consensus-building processes (more in Section 4.2), institutions engaging in industry-connected research must debate questions such as:
- Will funding from **certain types of industries be discouraged outright**?
- Do **strategic indicators or directives** help researchers evaluate which funding might be accepted (Section 7, Example 10)?
- What **institutional peer-review or other processes** guard against academic capture?
- What guidelines ensure that **social justice and equity** are evaluated alongside potential profit or marketplace impact?
- **Should researchers could consider company-culture factors** like diverse workforces, underserved market focus, or charity or donation-based activities
- How do institutions prioritize **industry partnerships with diverse beneficiaries** – disadvantaged communities, the Global South, early-impacted equatorial regions – not just those with the greatest marketplace potential?
- How do industry-partnership projects support **constituents outside the human marketplace** like animals, plants, and ecosystems?

Because an emerging industry and its technical needs motivate future grant opportunities, academics must leverage insights of business and social-science colleagues regarding potential beneficiaries of research thrusts. Industry challenges or profit opportunities must no longer be the prime drivers in research allocation. University researchers must consider academia's mandate to pursue a higher good for all of Earth's citizens – human and animal, and the biosphere itself.

9.3 Change Academic Perspectives to Prioritize Sustainable Application
Climate-aware translation of university-bred technologies to the marketplace requires that researchers think on longer time scales and in wider contexts about potential impacts. Social and environmental consequences must be considered alongside a project's technical novelty or

funding potential (65). Researchers must be careful to avoid ideological bias and academic condescension (67) in evaluating the needs and resources of potential beneficiaries. However, the basic tenets of intentional thought about "*appropriate for where*" and "*sustainable for how long*" are common-sense additions to the research toolkit. Prioritizing deployment context and available materials has inspired innovations like solar cell-phone-charging systems for areas with inconsistent electrical grids and biomass cooking stoves for locations with significant agricultural waste. Colleagues with expertise in game theory, social engineering, or community dynamics might help science or engineering researchers understand potential impacts before fund-raising or prototyping efforts begin.

9.4 Support Scaling Academic Innovation into the Marketplace

Despite significant challenges, the long-term outlook for academic climate innovation remains robust. Historically, universities have pioneered fundamental research, maintaining a vibrant and productive relationship with industry and serving as vital engines for societal advancement (53). The Bay Area, California, the Raleigh-Durham Research Triangle, North Carolina, and Boston, Massachusetts show how innovation hubs in strategic sectors coalesce around research institution clusters. And while some members of the general public may have lost trust in aspects of academia, many still revel in university-led scientific discoveries or rely on university hospitals when family members require the most advanced treatments.

Translating academic research into applied technologies scaled by outside partners addresses two imperatives for universities.

- ***Preserving The Research Enterprise*** – Climate innovation and adaptation is necessary to preserve universities and their research capacities. As Thierry et al. say in their 2023 paper, "there is no research on a dead planet" (27) .
- ***Support Host Country Economic Strength*** – No nation can afford to fall behind in addressing ecological threats to its own economy. A university that dedicates resources to these challenges is investing in the wellbeing of the nation that supports it.

With these goals in mind, academia can do more to support the scaling of climate-related innovation. Universities must become better incubators of nascent businesses (64). Training potential faculty entrepreneurs and supporting more and earlier faculty-founded businesses would give universities more vehicles to invest in (Example 1). Additionally, non-profits may also present attractive models for university entrepreneurs. The Aravind Eye Care System, a non-profit that provides eye-care services and professional training programs in India, has become the largest eye-care provider in the world, expanding ways in which not-for-profit organizations can thrive, scale, and provide value.

Better support of technology translation and commercialization requires university investment. The internal funding models and campus support strategies described in Section 7 can be

leveraged specifically to support *early* innovation and technology translation as well, where external funding is difficult to obtain. With expanded commercialization efforts, more mature innovation research can begin to pay for itself in several ways.

(1) Increased Funding Through Better Commercialization

Industry-sponsored, climate-targeted research guided by healthy collaboration and sustainable application can generate valuable revenue streams. Universities should work to reduce barriers to sponsored research *in the climate space* by reducing overhead rates, legal red tape, and intellectual property (IP) restrictions.

In early stages, IP claims make sense, preserving an institution's ability to benefit from its significant investment in supporting initial research. *But in the long run, limits on the use of university-bred inventions slow commercialization and can undercut potential future benefits.* Because IP revenue is usually not a significant funding source compared to other streams amplified by successful commercialization (Example 2 and "In Action" below), universities should encourage more spinout companies and negotiate increased equity shares instead of IP rights. Positioned at the hub of the start-up-rich Silicon Valley, Stanford University often negotiates 10% equity stakes in spinout companies.

(2) Increased Philanthropic Giving

Leveraging successful spinout companies strengthens industry partnerships. Founders and employees often give back to institutions that supported their companies' growth. Over time, this creates a legion of empowered stakeholders. At Harvard and especially Stanford, this has birthed enormous philanthropic business communities, each with a university as a focal point.

IN ACTION: IP REVENUE VS. SPINOFF-BOOSTED DONATION FUNDING

Stanford University (private, single campus) and the University of California (public, ten campuses) illustrate the relatively small percentage of IP revenue compared to donations.

Stanford, with its roughly $10 billion annual operating budget and $36.5 billion endowment, receives around $2.2 billion in outside research funding annually (Stanford Facts). Charitable giving accounts for another $1 billion per year (as reported in 2019). Yet, its intellectual property (IP) revenue is only about $50 million per year.

With a $47 billion budget and a $180 billion endowment (UC Budget Summary, UC Investment Summary), the UC system brought in $6 billion in research funding and received a record-breaking $3.45 billion in charitable donations during the 2023–24 fiscal year (2023-24 Annual Report on University Support). Yet, according to the UC Regents 2021 Report From Discovery to Societal Impact: A Roadmap to Unleashing UC

[Innovation and Entrepreneurship](#), from FY2010-FY2019, IP revenue across all ten campuses was very modest. UCLA, the largest beneficiary, generated approximately $30 million annually over the 9-year period, and the annual average of all 10 UC campuses was under $12 million.

These figures underscore an important reality: *revenue from IP pales next to research grants, donations, and endowment payouts* (at institutions that have those). Since a fair fraction of the charitable giving and at least a portion of university endowments connect to past commercialization success, universities should prioritize initiatives to increase commercial spinoffs and decrease barriers for faculty or student entrepreneurs.

9.5 Translate Wide-Boundary Thinking, Not Just Technology

Siloed, specialist thinking (see Section 7.4) is all too common in industry. Engaging with industry through sponsored research, commercialization, consulting, and workforce training, academics can bring wider-boundary considerations into industry's approach to innovation.

In this way, the cross-departmental and inter-generational discussion on "healthy innovation" (Section 9.2 and 7.5) – discussions perhaps uniquely suited to the university setting – can flow into industry as well. Ultimately, healthy innovation supports a more sustainable economic system, enhancing long-term profitability for today's businesses and products and fertile ground for tomorrow's startups.

Universities can play a more active role in this kind of knowledge transfer by:
- *Supporting Consulting Professors* – Faculty encouraged to consult can receive campus support for contextualizing their expertise, providing direct value to industry and raising awareness of broader impacts, including equity and justice considerations.
- *Advising Public Institutions and NGOs* – Subject matter experts with wide-boundary perspectives also give vital advice to public institutions, local communities, and private individuals wrestling with climate challenges and technology choices (see Section 10.2).
- *Raising Awareness in Workforce Training* – Job fairs and expos conducted on university campuses can include explicit discussion of wide-boundary impacts through keynote speakers, panel discussions, and information booths.
- *Linking to Classroom Activities* – Courses incorporating climate and wide-boundary, global-systems impacts (Section 8) link to industry-knowledge transfer and workforce training through event advertising, guest lectures, and internship programs.

In industry, the primary profit motive can encourage questionable practices and fraudulent companies like [Theranos](#). While academics require funding, their primary currency is peer-reviewed publications. This can bring rigor and validated expertise to a market-driven

enterprise. University researchers can also provide balance by partnering with small and medium-sized companies for local impact and helping to develop guidelines on company policies and products. Such engagement fulfills academia's role as a counterweight to purely financial economic drivers.

9.6 Target Research Topics With Broader Acceptance and Benefits

Big social changes naturally face strong resistance from certain domains. Shifting political winds can create fluctuating, short-time-scale resistance that can undercut long-term projects. Resilient, flexible, smaller-scale funding models (Section 7.6) can mitigate this. But for expensive, high-visibility projects, it can be pragmatic to prioritize innovation areas with broader support across political ideologies.

It can be natural for researchers to highlight project benefits that mean the most to them. Yet not every donor will get behind saving trees, being gentler to the planet, or helping disadvantaged populations. On the other hand, many value saving money, increasing efficiency, streamlining resource use, and protecting vital infrastructure. Thus, researchers might phrase upsides to attract potential funders with diverse political persuasions and priorities. For example, electrification, grid enhancement, and "green" solutions may find wider support when presented as cost-saving.

9.7 Facilitate Transitions To Sustainable Mindsets and Community Systems

While many modern, industrial societies may not focus on lower-consumption or holistically-aware mindsets, spiritual and indigenous traditions are rich in wisdom on this topic. Encouraging related scholarship, creative arts, and social innovation in the campus setting can help universities prepare societies for the transition to futures lived within planetary limits.

Academic contributions to mindset, resilience, and social innovation could include:
- **Personal resilience programs and toolkits** (Example 6)
- New tools for **fostering local, in-person social connection** (especially given social-media fueled mental health challenges of teens and young adults)
- Activities and systems that center a **daily, ecologically-aware mindset**, weaning off old assumptions that more comfort and consumption are paramount to happiness
- **Problem-solving and enrichment activities**, like environmentally aligned and localized economic systems, social support networks, repair/reuse training, creative activities
- **Innovations that modify consumption habits** to align within planetary and local energy and resource limits
- **Fact-finding tools** that uncover deceptive or lax practices, for example, allowing manufacturers to claim eco-friendly status without independent, third-party verification
- Practices and systems that address **psychological and spiritual impacts of climate change** and enhance individual climate-change adaptation (Example 7)

Many societies already recognize some of these as keys to mental and emotional well-being.

The innovation lies in *creating transitional social systems that purposefully instill them as substitutes to current market-driven consumption*. Mindset and social innovation are at the core of the conscious decisions societies must make about how to change values and priorities to support authentic ecological thinking and long-term sustainability.

Mindset innovation also provides a wealth of short-term benefits:

(1) Changing the market itself
Environmentally aware consumers can counter Industrial Revolution legacy mindsets that "better stuff" is the key climate-crisis solution. We can begin the needed shift in culture now.

(2) Elevating the roles of humanities, social sciences, and the arts in climate innovation
It is easy to think of science and technology when we hear the word "innovation," but for every high-tech climate solution, equal or perhaps greater innovation is needed in human psychology, social dynamics, education, artistic expression, and mental and emotional health. Without that, we risk a purely "techno-futurist" approach that fails to address new mindset and social habits required to support long-term change.

(3) Enabling direct, immediate, relatively low-cost delivery
Mindset and social innovation programs allow universities to provide climate-crisis value directly to individuals without long research-to-manufacturing run-ups or market-value myopia. Working with individuals through government and other public institutions, non-profit organizations, and community outreach (Example 3, more in Section 10) social science, humanities, and arts research-to-implementation programs can flourish without huge sums of federal or corporate funding, which may be increasingly under political pressure.

IN ACTION: Climate Social Transformation Research

Founded in 2011, the African Climate and Development Initiative (ACDI) was set up by the University of Cape Town's Office of the Vice-Chancellor as one of four strategic research initiatives to tackle challenges in the natural and social worlds. The ACDI illustrates multiple components of successful research into social transformation:

- **Merging climate change and development issues**, combining research and teaching previously separated in a variety of departments and research centers
- **Incorporating expertise in community dynamics and local production ownership** alongside social sciences, economics, and natural science
- **Uniting the needs of the environment and ecosystem *with the capacities of local communities*** to generate and sustain adaptations

The ACDI produces a [quarterly newsletter](#) that highlights ongoing research initiatives, student efforts, and information on topics like climate-resilient development, urban flooding research, and climate-change action that remediates poverty and inequality.

This is an outstanding example of how institutions in the Global South are diverging from the Global North focus on technological solutions and capital-intensive programs.

Recommendations for Supporting Climate Innovation

- ☆**Expand the definition of "innovation"** to include mindset and social systems in addition to new materials and technologies.
- ☆**Develop systems to guard against academic capture**, including institutional criteria, department review, and guidelines to prioritize justice, equity, and ecological awareness.
- ☆**Reduce university claims on IP ownership** in university-originated startups to attract the private sector to invest and collaborate.
- ☆**Negotiate increased equity shares in spinout companies** instead of hoarding IP.
- ☆**Increase training and support for potential faculty and student entrepreneurs.**
- ☆**Strategically present research benefits** to appeal to a variety of potential donors.
- **Co-develop and co-create innovation projects with local community members and nonprofit organizations to** ensure desirable and useful deliverables.
- ☆Stop lionizing big-dollar grants and equally **publicize projects that study ecological thinking and climate-related mental and emotional health.**
- ☆**Encourage small-scale innovations** using affordable, accessible technologies.
- ☆**Increase pathways for university innovations and projects to reach individuals,** including courses, workshops, and other programs to co-develop lifestyle habits increasing satisfaction with fewer resources or materials.
- ☆**Boost funding and recognition for innovation outside hard science and engineering,** elevating personal resilience, problem solving, and community coherence as key components of human capital.

Examples for Supporting Climate Innovation

Example 1: Faculty Entrepreneur Training is provided by National Science Foundation [I-Corps](#) and [I-Corps Regional Hubs](#) and the [Activate Fellowship](#).

Example 2: For more information on the relation between IP and spinouts, see the University of California San Diego [Venture Catalyst](#) Program and [Stanford University Investments in Startups Involving Faculty](#).

Example 3: At the <u>University of California Agriculture and Natural Resources</u>. academics and extension agents <u>work with farmers</u> to incorporate climate information into investment decisions.

Example 4: Seed grants to fund translation of technology into innovation include <u>Innovation Catalyst Grants</u> and <u>Carbon Fund</u> at the University of California Santa Cruz.

Example 5: University of California partnered with New Energy Nexus to get a California Energy Commission grant to form the <u>CalTestBed</u> initiative, offering more than 70 world-class TestBed facilities at nine UC campuses and the Lawrence Berkeley National Laboratory.

Example 6: The <u>ALEC (Latin America for Climate Education) Project</u> hosted at the Universidad del Rosario, Bogota, Colombia linked universities across Latin America to create resilience-focused climate-related pedagogical material. The teaching guide and handbook address emotional responses to climate change and emphasize the importance of empathy and collaboration along with critical thinking and problem-solving skills. To date, the project has reached more than 17,000 teachers directly and indirectly.

Example 7: Faculty at the <u>Kwame Nkrumah University of Science and Technology</u>, Ghana conduct ground groundbreaking research on psychological and mental health climate-change impacts. Key research thrusts include ecological grief (66) and climate-related coping strategies. While previous research has focused on economic or adaptation choices, these investigations into lived experience identify mindset and mental health action drivers or impediments, laying the path for more effective future support and adaptations.

10. Partnerships for Climate Activities

10.1 Develop Guidelines for Community Partnerships

In many countries, the modern academic model traces its origins to walled monastic settlements that withdrew from society to create protected places for scholarship. But this isolationist mindset does not help academia address the climate crisis. Additionally, many communities outside those walls have long memories of academic interactions characterized by bad practices, failed promises, extractive relationships, and academic derision and scorn. Overcoming these will take *time, trust, and sensitive attention to new, respectful co-development and co-creation.*

To become experts in community engagement and partnership, universities need to dedicate significant effort to answering vital questions:

- **How can universities center equal valuation of knowledges,** honoring local, lived experiences and traditional/Indigenous knowledges alongside academic approaches?
- Given that they are not funded to develop solutions *only* for themselves, **are universities on equal footing with local communities, or should they defer to community experts** who know more about what is needed and wanted?
- **How can universities contribute to societal change without pushing other hands off the rudder?**
- **How do campus-community members change their self-image,** adding new roles as technical assistants and partners to traditional identities as researchers and scholars?

This is not just about isolated self-reflection. It requires building connections with local communities and deeply listening before responding (Example 1). Creating expertise in healthy community engagement now can train the next round of intergenerational climate stewards.

Academics who want to build healthy partnerships with local community and Indigenous groups could consider the following practices:

- *Value the wisdom and priorities of local communities to create new, ethical patterns of engagement* – Academic partnerships must respect, honor, and serve community partners, not just seek research subjects, audiences, or knowledge.
- *Understand the sensitivities of people outside of academia* – Academics often skip right to proposing a collaboration without taking time to build trust. The saying "dig your well before you get thirsty" applies here. Academics must meet local community members where they are, understand perspectives, and create mutually enjoyable relationships, not just build academic-style collaborations to achieve goals.
- *Focus on useful deliverables, not just published papers* – Academics must discover what members of local communities want and can use. No more developing "solutions in search of a problem" or writing formal papers that only benefit academic careers.

- ***Designate an enduring office or center as a long-term point of contact*** – Community and Indigenous partners need support and follow-through when researchers move on to other projects or other institutions. Universities need resourced units to build institutional experience and wisdom for effective engagement (see "In Action" box below).
- ***Strengthen existing climate applications centers*** – In the U.S., the federally funded, university-based [Climate Adaptation Partnerships Program](#) (initiated by NOAA in 1994), and [Regional Climate Adaptation Science Centers](#) (recognized as part of the DOI climate response in 2009) are examples of sustained, government partnerships that universities can build on to achieve broader campus and community engagement.

These priorities rest on the reality that *collaborations outside of academia are not the same as those inside.* Researchers who want successful community partnerships need expertise in both.

IN ACTION: FUNDING COMMUNITY ENGAGEMENT

Sustained relationships between the university and state officials can be key to garnering financial support for following **Guiding Principle 2** by funding coordination and communication with community partners.

After years of relationship cultivation by the University of California Office of the President's Global Climate Leadership Council, California State legislators [awarded $100 million to the UCOP in 2023](#) for investment in research that would have "a swift and measurable impact on climate resilience."

A key component of the ensuing seed and matching grants was the strong intentional involvement of community, industry, Tribal, and public agency partners. Using funds from the California Strategic Growth Council, ten projects received additional [Community-Engaged S/Hero Supplements](#) to support community engagement. This follows earlier awards totaling over $30 million by the Strategic Growth Council from Cap-and-Trade funds in 2018-22 for research advancing California's climate goals.

10.2 Dedicate Resources for Training and Expertise in Community Engagement
Academic collaborations leverage a common background, easily perceived mutual benefit and deliverables, and shared technical vocabulary. Partnerships with those outside academia – boundary organizations, individuals, Indigenous groups, local businesses, volunteers, politicians – have none of those advantages. Additionally, many academics think in terms of months or years for projects while community members need help for decades.

Thus, universities should consider designating a specific leadership position, center or office as a point of contact and training for community partnerships (Example 2). A repository for knowledge and ethical and practical training could include information on:

- Which community groups are available for partnership
- Best practices for working with each of them, including preferred points of contact
- Analysis of past projects' successes and challenges
- Specific cultural or historical considerations for respectful collaborations
- Ethical practices like community- or data-sovereignty agreements (Example 3)

Long-term continuity is essential to maintaining relationships. Dedicated staff could follow up with community members even when individual researchers move on. Results could be monitored for years to identify impact and distill best practices. Researchers interested in future collaborations and engagement could receive training, wisdom, and the advice of long experience to make partnerships as respectful and fruitful as possible.

For example, professional health-care schools act as community conduits for academic resources, operating as educators, care providers, community partners, and trusted public messengers. As climate change manifests in health impacts, health education offers a repository of best-practices for translating university-bred climate knowledge into societal benefit. The Carnegie Classification for Community Engagement has a well-developed set of criteria and resources for application which could provide useful information and suggested priorities.

Additionally, universities could designate specific appointments for community engagement (Section 7, Example 8). Creating dedicated faculty positions, like agricultural extension agents, for such contributions keeps system-wide expectations for promotion and tenure separate, assuaging concerns of faculty who want to focus on traditional research, teaching, and service.

IN ACTION: DEDICATED COMMUNITY ENGAGEMENT CENTERS

Since 1999, the California State University (CSU) system has been connecting academic resources to local communities through their Center for Community Engagement. Each of the 23 CSU campuses and the Chancellor's office has a dedicated community engagement office and staff, providing consistent points of contact and enabling connections between thousands of faculty and community organizations system-wide. Not only does this provide a conduit for faculty and student service projects, students also find on-the-job learning opportunities.

While institutions may initially feel that adding a community engagement center or office is one more burden on an already financially strapped system, the CSU center's activities have proven a reliable source of fundraising, producing $24 million from a variety of

[funders and public initiatives during the 2023-24 academic year alone](#). This is a 20x return on investment.

Such centers, when managed correctly, can produce significant financial benefits.

10.3 Emphasize Respectful Co-Creation and Co-Development

While most academics decry the actions of past researchers who removed Indigenous artifacts for ethnological collections or appropriated local knowledge without sensitivity or permission, well-meaning modern researchers can still fall into unhealthy habits. To avoid prioritizing academic goals, methodologies, and products, academics must serve local communities and embrace co-creative input. That starts with asking better questions and listening carefully.

*(1) **What do potential partners want?*** What support, resources, or information would they appreciate? What are their goals and priorities? Stop assuming that what looks most important from an academic perspective is actually what local communities *are or should be* interested in.

*(2) **How do they want to participate?*** Jumping right to ideas and proposals without asking how partners would like to interact may unwittingly rehash old, extractive models.

*(3) **What information do they want to contribute?*** Just because they aren't data-driven, peer-reviewed, or experiment-based doesn't mean local practices and traditional techniques lack value. Indeed, some community groups have been responding to climate change for far longer than the university system has even existed. On the other hand, not all knowledges are freely available to outsiders. Furthermore, what is vouchsafed to a few, trusted individuals may not be intended for wider public broadcast.

In view of extractive historical practices, it behooves academics to err on the side of over-asking for clarification and permission about acceptable uses. Existing rubrics like [CARE](#) (**C**ollective Benefit, **A**uthority to Control, **R**esponsibility and **E**thics) and [FAIR](#) (**F**indable, **A**ccessible, **I**nteroperable, and **R**eusable) are solid places to start redressing the long history of misappropriation and inappropriate Indigenous data use.

Indigenous peoples themselves are not a monolith. What is acceptable in one group may not be in another. At first glance, this might seem like a recipe for "everybody has an idea, and no one is satisfied." But in fact, groups may already have protocols for establishing consensus. Additionally, many members of campus communities also self-identify as members of Indigenous groups. They can provide valuable information, advice for collaborations, and bridges back to their own communities for positive relationships and enriching partnerships.

Academics pride themselves on being open-minded to new ideas and investigating before coming to a conclusion. *There is no better place to embrace these core academic values than when encountering the wisdom of local communities and Indigenous peoples.*

10.4 Leverage Boundary Organizations To Bring Research To Those Who Need It

Community groups that operate at the interface of research and societal action, boundary organizations (45) serve as bridges for resource management, policy, or social change. They boost key components of climate action: technology innovation and transfer; policy acceleration; connections between researchers and local, state, and national policymakers; and community partnerships and engagement. They include government agencies and centers or institutes that reside within universities (Example 4). NGOs function as boundary organizations when they apply research expertise to action and policy (Example 5). In the climate arena, the [Intergovernmental Panel on Climate Change](#) could be considered a boundary organization, bringing together teams of scientists worldwide to synthesize research and develop consensus recommendations for policymakers. Governmental agencies like the [Office of Science, Technology, and Policy](#) serve as boundary organizations when they bridge the gap between research and policy. Engaging with boundary organizations accelerates the impact of university research, educating and influencing policymakers and the public.

Boundary organizations are especially vital to supporting projects between researchers and smaller community groups that may lack the capacity and expertise to work with university or government bureaucracies or compete effectively for funding (Example 6). University partners can provide supporting research to climate justice organizations who explicitly pursue political advocacy. We see great potential for partnership creation and/or growth between these dynamic organizations and university researchers who provide vital information.

10.5 Understand Boundary Organization Strengths and Challenges

Boundary organizations apply climate-action research to varying degrees, depending on their location and funding. Centers and institutes within universities benefit from faculty and student proximity and their home institution's brand value and convening power. However, university-based centers may feel pressure to avoid appearing too advocacy-driven or focused on social mission instead of academic integrity. Boundary organizations outside university governance can be more explicit in their advocacy goals. However, they may face challenges in building public trust, especially if they produce research.

Boundary organizations are crucial for climate adaptation and resilience because they connect universities with their immediate communities, a targeted location for research impact. Important examples include University of California Los Angeles's partnership with the Los Angeles Sustainability Coalition and the New York Climate Exchange led by State University of New

York at Stony Brook (Example 7). As with any initiative, the success of these partnerships depends on sustained commitment from both academic and civic communities.

In the United States, the Cooperative Extension programs of the Land Grant Universities (LGUs) present important historical models for boundary organization success. In 1887, the Hatch Act established agricultural experimentation stations at land-grant universities to bring academic agricultural research to local farmers. The programs were codified in the Smith-Lever Act (1916), which created a permanent funding stream, now in the Farm Bill. Directed to every state's LGUs, this funding currently exceeds $300M per year. These Cooperative Extension services, such as the [University of California Agriculture and Natural Resources](#) division continue to assist farmers with climate change challenges today (67). Thus, they provide a time-tested structure for direct community engagement. The extension model is ripe for non-LGU's to imitate or for federal or state government expansion to focus more broadly on climate adaptation and resilience (9).

10.6 Use Boundary Organizations to Coordinate Multi-Campus Efforts
While faculty collaborate prolifically, universities often view each other as competition for students, donors, and government funding. However, in some cases, a free-standing NGO can take a leadership role, allowing universities to join as members of a network (Example 8). For example, Second Nature hosts the Climate Leadership Network with over 400 academic institutions committed to addressing climate change. It also hosts a University Climate Change Coalition, which the University of California played a leadership role in launching. In other cases, one university can host a secretariat or home office on behalf of a network. Tsinghua University, China hosts the home office of the NGO [Global Alliance of Universities on Climate](#). Leveraging boundary organizations to coordinate multi-campus efforts requires a sustainable resource model, with multiple universities making multi-year financial commitments.

IN ACTION: Community Engagement, Partnerships, and Impact

Developed by a faculty-led process starting in 2012, the University of California Los Angeles's [Sustainable LA Grand Challenge](#) combines university resources with input from local stakeholders to create climate-forward responses and impact. With a diverse set of core initiatives and programs, the Grand Challenge models several community engagement best practices:
- The multidisciplinary Climate and Wildfire Research Initiative (CWRI) **merges academic research with local community expertise** to understand the impact of climate change on the safety of greater Los Angeles neighborhoods.
- The Undergraduate Research Scholars Program (URSP) **gives students from diverse majors the chance to work** with local NGOs, government bodies, and volunteer organizations**.**

- **University scholars are partnering with a government agency,** the Los Angeles Department of Water and Power, to help Los Angeles equitably achieve its ambitious goal of transitioning to 100% renewable energy by 2035.

UCLA's Sustainable LA Grand Challenge illustrates a progressive model of partnership: universities deploy academic expertise and train students in real-world environments, and communities pursue their own, self-selected goals with university support.

Recommendations for Improved Climate-Response Community Partnerships

- ☆Consciously re-shape the traditional "academics as experts" lens to **elevate co-development, co-creation, and even deference to local community members**.
- ☆As part of the consensus building process (see Section 4.2) **set guidelines and priorities for community engagement** and create a coordinated strategy for building partnerships with boundary organizations.
- **Designate an enduring office or center as a point of community contact** to support long-term information collection, institutional wisdom, and relationship building.
- ☆**Consider the specific history of academic interactions with local community organizations and Indigenous groups** to ensure sensitive and effective collaboration.
- ☆Consult specialists in local groups to **understand protocols and traditions for appropriate interaction.**
- ☆**Provide training for academics who wish to engage with community partners**, highlighting differences between academic and non-academic collaboration styles.
- ☆**Identify and replicate successful models** of boundary organizations serving regional climate resilience needs (Example 3).
- **Build on the United States Cooperative Extension model** to support translational research and community engagement.
- ☆**Rework merit review criteria to reward community-engaged research and boundary organization interactions.**
- ☆**Support on-campus hosting of government-sponsored boundary organizations**, such as regional climate-adaptation centers.

Examples for Improved Climate-Response Community Partnerships

Example 1: Climate Coffee Meetups hosts a network of regular meetings across the globe that connect academics with industry and local community members. An active one in Santa Cruz, CA is sponsored by Santa Cruz Works, a business networking organization.

Example 2: Several universities have specific units dedicated to partnering with local and Indigenous groups, including the University of Alberta's [Office of the Vice-Provost (Indigenous Programming & Research)](#) and McGill University's [Office of Indigenous Initiatives](#). Sefako Makgatho Health Sciences University (SMU) in South Africa has a [Deputy Vice Chancellor: Teaching, Learning and Community Engagement](#).

Example 3: [The Tribal Working Group Climate Science Alliance](#) offers a series of Community Agreements which center safe, respectful, confidential approaches to knowledge and data sharing, upholding the values and protocols of Indigenous Data Sovereignty.

Example 4: Centers or institutes residing within universities include the [Center for Coastal Climate Resilience](#) (University of California Santa Cruz), the [Center for Law, Energy, and Environment](#) (University of California Berkeley), the [Atkinson Institute for Sustainability](#) (Cornell University), and the [Pacific Institute for Climate Solutions](#) (Simon Fraser University and the Universities of Victoria, British Columbia, and Northern British Columbia).

Example 5: NGO boundary organizations range from large, science-heavy groups like the [Environmental Defense Fund](#) to local community groups with strong university connections. The [Degrees Initiative](#) is an NGO dedicated to solar radiation modification in the Global South. Based in the UK organizationally, it collaborates with academic institutions in Africa, Asia, Latin America, and the Pacific. The non-profit [Climate and Wildfire Institute](#) is a boundary organization connecting science to public policy and practice.

Example 6: Examples of knowledge co-creation and advocacy with smaller community groups include the [Community-Academic Partnerships for Equity-Focused Climate Action](#). Funded by the UC Global Climate Leadership Council, University of California and California State University faculty partner with climate and environmental justice community groups. The network of [UCSD Community Field Stations](#) are located in underserved border communities, for collaborative climate adaptation, research, education, cultural activities, and urban development.

Example 7: Regional climate adaptation centers include the [Los Angeles Sustainability Coalition](#) and [New York Climate Exchange](#).

Example 8: Examples of NGO-led global academic alliances include the [Africa Asia Scholars Global Network](#), the [South East Asia Sustainability Network](#), and the [University Climate Change Coalition](#) hosted by [Second Nature](#).

11. Campus Decarbonization and Resilience

11.1 Pursue Decarbonization for Institutional, Social, and Planetary Benefit

Universities must decarbonize to reduce their carbon footprints (68). Realistically, it is much easier to talk about the possible effects of emissions – and teach about them – than to actually change campus infrastructure to decrease them. Talk is cheap until you have to find the funds and political will to dig up the campus and retrofit 1,039 buildings (as in the case of UC Davis).

Yet, institutional leaders are judged not by what they say or even what they write, but the marks they leave on campus at the end of their tenure. Thus, campus facilities and energy use are key places for leaders to utilize political capital, accrued goodwill, and inter-institutional collaborations. Strategic changes can align climate and fiscal benefits, reducing greenhouse gas emissions and achieving cost savings. University of California Davis determined that the cost of postponing its investment in net zero by ten years would be twice as expensive as decarbonizing immediately. Its decision to replace an aging campus steam heating system with a hot-water heating district was cost-effective and close to the best for emissions reduction.

Guiding Principal 1: Strategic Leadership and **Guiding Principal 2: Communication and Coordination** are essential. A well-planned decarbonization plan must consider financial resources, state and regional renewable-energy goals, and a just transition away from fossil fuels. With bold decision-making and coordinated follow-up, leaders can inspire and educate the next generation of climate responders and make a concrete, lasting impact.

Campuses must address the information gap within the campus community that can limit active engagement and support for decarbonization measures. While studies across the University of California system have found that students, faculty, and staff have a strong interest in advancing decarbonization, they had limited knowledge and sense of agency regarding campus-based decarbonization programs and options. However, there is strong evidence that they support local and on-campus solutions over market offsets (69). Linking student learning and faculty research with staff efforts to decarbonize can bridge this gap.

Campus decarbonization can take many paths, from high-capital, campus-wide transformations to coordinated patchworks of relatively low-cost experiments that generate enthusiasm for more significant investment. While universities thus far have struggled to wean off of legacy fossil fuel systems, we believe that creative problem-solving, political will, and determination can bend an institution's resources toward its stated commitments. Decarbonization is a key proving ground for dedication to climate response.

Colleges and universities have climate impacts comparable to those of small or medium cities: *direct* greenhouse gas (GHG) emissions from fossil-fuel combustion for energy and transportation (Example 1) and *indirect* emissions through supply chains, waste management,

water consumption, construction, and investments (Examples 2,3). Institutions have a responsibility to measure, disclose, and act to reduce both.

Ideally, changes in campus operations should align with the urgent need for dramatic reductions in GHG emissions that students learn about in the classroom. To train effective climate champions, universities must communicate honestly about technical, financial, and cultural issues and tackle them with collective expertise.

11.2 Learn From Prior Campus Decarbonization Efforts

Universities use fossil fuel to provide heating, cooling, electricity, and transportation. Campus emissions vary depending on size, location, and structure, but generally the majority comes from buildings and transportation. At large research universities with extensive scientific facilities and campus-based student housing, energy-intensive buildings typically drive emissions. Community colleges or Undergraduate/Graduate-Master's universities with fewer research-intensive buildings and less on-campus student housing produce a larger proportion of emissions from commuting. This paper focuses on building decarbonization because it constitutes the largest category of emissions even for some commuter campuses, and institutions have more direct control over buildings than student and employee commuting.

Campuses facing higher utility prices have long promoted energy efficiency and conservation to manage costs as well as reduce environmental impacts. In the 2000's, colleges and universities started committing to energy efficiency, clean energy, and broader climate action, beginning by measuring and reporting energy use and greenhouse gas emissions from direct and some indirect sources. Since 2007, more than 600 college and university presidents have signed the American College and University Climate Commitment. While significant, this only represents about 15 percent of the nearly 4000 degree-granting colleges and universities in the United States. The working paper from Barron et al. (70) documents the progress and the limitations of two decades of U.S. higher education decarbonization efforts.

11.3 Prioritize Electrification as a Primary Path To Decarbonization

Institutions working most diligently to reduce building emissions have pursued the dual strategy of boosting clean energy sources while also reducing energy consumption. However, aside from a handful of exceptions, most have struggled to significantly reduce Scope 1 emissions due to onsite combustion of natural gas.

This means that the primary thrust of campus decarbonization is really phasing out natural gas and electrifying the campus so that it can transfer to 100 percent clean electricity. While not every institution has access to that now, the electricity grid is rapidly decarbonizing. Compared to the very limited, expensive, and controversial net-zero biomethane required to replace fossil gas, campuses can *more readily get clean electricity* from onsite or offsite renewable sources.

Thus, the Barron et al. working paper (70) references *three basic steps of decarbonizing buildings*:

1. **Use energy efficiently** – Retrofit existing buildings and ensure new ones are highly energy efficient to decrease overall campus energy needs and emissions.
2. **Electrify buildings** – Design new buildings and retrofit existing ones to use electricity instead of natural gas.
3. **Use renewable energy** – Install and/or purchase clean electricity, creating no operational carbon emissions.

IN ACTION: ACHIEVING A ZERO-CARBON SINGLE CAMPUS FOOTPRINT

Strathmore University in Kenya is the first educational institution in sub-Saharan Africa to achieve a zero-carbon footprint. Its 2,400 solar panels on the roofs of six buildings generate more power than the institution needs, producing a surplus sold back to the national grid. Having developed its own solar expertise, the institution trains engineers for national and regional employment.

On route its goal of achieving true "net zero," the institution has pursued green building design, waste management, and collaboration in international networks like Education Race to Zero. Together with Kenya's Ministry of Energy and the British High Commission Nairobi, Strathmore University jointly launched the Kenya Carbon Emission Reduction Tool (KCERT 2050), an energy and emissions model to assist Kenya in achieving its climate goals.

Climate leaders like the Deputy Vice-Chancellor for Research and Innovation have championed changes to help Strathmore achieve its clean energy goals.

11.4 Be Transparent about Decarbonization Complexity and Justice

Transitioning campus buildings and utility infrastructure from fossil gas to clean electricity is expensive, complex, and lengthy, with challenges unique to each institution. While replacing fossil gas boilers and chillers with more efficient heat pumps and geoexchange systems can save money in the long-run, few institutions can afford the capital investment required to electrify the campus energy infrastructure all at once as Stanford University did (Example 4). Many will decarbonize in phases, integrating decarbonization investments with campus-wide capital planning to synergistically address capital renewal, deferred maintenance, and decarbonization one building or section at a time (Example 5). Campuses with aging or poorly maintained

infrastructure will have a stronger financial case for more immediate decarbonization than those with newer, well-maintained central plants.

If poorly planned, the transition to clean energy can leave some people and communities behind. Thus, modeling a just transition entails:

- **Reducing emissions without adversely impacting student tuition or programs** – Institutions must avoid financial repercussions to students and faculty that might cause a backlash and derail progress. Decarbonization urgency must not push the cost of higher education even further out of reach.
- **Supporting campus labor transitions to renewable energy** – Campus operational staff may need encouragement to become invested in the energy transition and not fight to keep their jobs maintaining legacy fossil-fuel systems and equipment. Maintenance and operations staff may need training to transition to new electrical systems jobs and skills.
- **Building consensus with campus constituents** – Decision-makers must make special efforts to include all members of the campus community, from faculty to students and operational staff, including those with less access to leaders' ears.
- **Incorporating justice, equity, and inclusion around who is hired to plan, design, and build and where off-campus clean energy projects are located** – Both on-campus decarbonization and off-campus clean-energy projects funnel funding to specific businesses, labor forces, and communities. Institutions must evaluate their planning and bidding processes, ensuring that actors involved reflect the university *and its surrounding community*. Decision-makers have an opportunity to counteract inequity and exclusion that limit who gets consulted and hired for big-ticket design and construction projects.

Crafting a practical and just transition to clean energy is an important aspect of social transformation. Colleges and universities should use this complexity to educate students about the balance required to urgently decarbonize while not causing financial hardships or increasing inequity for vulnerable communities (Example 6).

IN ACTION: LESSONS FROM UC'S ZERO-CARBON CHALLENGES

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1) Statements do not create reality
After signing the American College and University Presidents Climate Commitment (ACUPCC) in 2007, the University of California President's launched the UC Carbon Neutrality Initiative (CNI) in 2013. Its initial pledge was net-zero Scopes 1-2 emissions by 2025. A 2019 systemwide Academic Council statement was followed in 2022 by a systemwide Academic Senate Memorial on Reducing Fossil Fuel Combustion. The UC President created the Pathways to a Fossil Free UC Task Force which oversaw development of campus-based decarbonization plans

In 2023 the UC Sustainability Steering Committee called for *a 90% reduction in total emissions by 2045* with purchase of 100% clean electricity (Scope 2) by 2025. Thus, 19 years after signing the ACUPCC, the University of California now hopes to meet its net-zero goals *20 years after the initial deadline*.

While top-down declarations may be a necessary start, the nitty-gritty of decarbonization does not happen just through words. Statements must be followed by planning and action.

2) Because resources do not automatically translate into change, leadership at all levels must pull together
In a 2025 [evaluation of UC's decarbonization strategies](), the Pathways to a Fossil-Free UC Task Force co-chairs noted, "Campus leadership is critical…. Some campuses, in our view, tackled the considerable operational and financial challenges with greater commitment, imagination, and alacrity….Others do not appear to be ready, and we worry that financial exigencies will put their plans on the metaphorical shelf to gather dust."

UC Davis has pursued its [Fossil Fuel Free Pathway Plan]() with a 17-year horizon and $1.2 billion total estimated investment. Focusing on early progress, campus leadership dedicated $180 million over three phases and is now on an advanced track to larger, long-term decarbonization goals with a [projected 40% reduction in on-campus fossil fuel combustion by 2027](). This commitment to ambitious mid-term reductions is an excellent example of campus leadership finding the political will to muster solutions for needed campus changes (although emissions at UC Davis Health are still increasing).

UC Berkeley found [additional state funding]() to implement its [Clean Energy Campus Utility Improvement Project](). This will replace its steam system with efficient, all-electric heating and cooling. Phase 1 will reduce total campus carbon emissions by approximately 60% and significantly reduce future maintenance by removing deteriorating infrastructure and outdated in-building equipment.

But two of the three wealthiest campuses in the UC system – UCLA and UCSD – claim that they require longer to make significantly more progress towards net-zero. So far, they have followed relatively less-ambitious near-term emission reductions. Thus, without buy-in from leaders at individual campuses or facilities, system-wide plans may not create system-wide progress.

3) Even amidst overall progress, some places require special attention
While UC Davis overall has taken bold steps toward net-zero in campus heating, emissions at the UC Davis Health campus in Sacramento have increased.

A single decarbonization strategy may have significantly greater or smaller impacts in each campus unit. An innovation like reducing food waste by controlling portion size might make a big difference in a student dining hall yet have relatively little impact in a hospital, where portions are already more regulated. Units with divergent needs or emissions sources may require individual troubleshooting.

4) There are many decarbonization opportunities

The University of California is also decarbonizing its financial investments. In 2015, UC sold direct holdings in companies earning revenue from the extraction of thermal coal and oil sands, and in 2020-22 sold holdings in companies that earn more than 10% of their revenues from exploring and extracting oil, gas and thermal coal. UC now screens out companies with any amount of "proved and probable" fossil fuel reserves.

In addition to reducing physical-plant emissions, universities should pursue decarbonizing financing sources, including investments, endowments, and research funding. Funding sources are included in Scope 3 admissions.

11.5 Develop a Low-Emission Climate Resilience Plan

To succeed in the long-term, decarbonization must be integrated with climate adaptation and resilience planning (Example 7). From Florida to New York and Louisiana to California, institutions have already been impacted by flooding, wildfire, smoke, drought, sea level rise, and extreme heat – the deadliest form of extreme weather (71). Universities with front-line healthcare systems have had patient-care capacity disrupted by wildfire or flooding evacuations. Thus, campus efforts to mitigate climate change must be paired with planning to make campus communities more resilient.

Climate resilience planning must underpin all future campus infrastructure and building design. Forward-thinking institutions are developing guidelines to help campus decision-makers understand, evaluate, and decrease climate-related vulnerabilities (Example 8). Resilience must be considered as a vital performance indicator alongside operational energy usage, utility cost, and other more conventional metrics. Critically evaluating systems for resilience improvements ensures safety for on-campus and surrounding communities and improves business continuity.

Climate resilience planning, especially with a focus on the most vulnerable campus-community members (Example 9), is not owned by any single unit or silo. Physical infrastructure is core to preparing for climate impacts, but social infrastructure is also essential. Planners must partner with on-campus experts in facilities management, planning/design/construction, and student life as well as community systems like local emergency response and transportation networks.

Institutions should coordinate with neighboring cities or regional climate resilience collaboratives where those exist (Example 10).

11.6 Use Campus As a Living Lab to Develop Multi-Disciplinary Solutions

As institutions build consensus and develop campus decarbonization and climate resilience plans, it becomes clear which pieces of the puzzle are missing. As innovation generators themselves and in concert with fellow institutions, universities can begin to fund programs that fast-track what is lacking (Example 11). Working in the laboratory they live in can marshal faculty resources and train students to not only think about how to reduce carbon emissions, but also to develop new social habits and strategies to live in a net-zero world (Example 12).

In addition to boosting education (Section 8.6) "campus as a living lab" provides significant advantages for campus decarbonization.

(1) *"Real talk" about what it takes to decarbonize*
Avoiding silver-bullet messaging and siloed approaches, universities can help students understand that one green building or one solar photovoltaic canopy will not decarbonize a campus. One bidirectional-electric-vehicle-charging-station demonstration project or one campus-decarbonization course does not make the campus a living laboratory. While programs can, of course, start with a single project or offering, universities must communicate that, eventually, "campus as a living laboratory" will require comprehensive curricular, co-curricular, and applied research components (Example 13). These must connect with wider communities through partnership with community-based organizations and local governments (Example 14). Such efforts will require strong leadership and communication.

(2) *"Real life" experiences with possible futures*
Living lab projects allow students to not only to experiment with decreasing carbon usage, but also experience what it is like to live with those solutions. In the world of the future, will the shower turn cold when a student has gone through their individual energy allowance? What level of price differential is enough to incentivize campus-snack-bar users to bring their own cups? Living-lab experiments can explore how such levers alter human behaviors and do or don't create change, pushback, or protest.

(3) *"Real time" adaptability and resilience training*
It is easy to imagine the challenges of re-training consumers to embrace more sustainable social habits. Living lab initiatives allow universities to produce graduates who are not just habituated to using less, but adaptable and flexible when resource availability changes. If clean solar becomes prevalent, people in some locations may be able to take longer hot showers in the summer when more solar power is available than in the winter. Students accustomed to living-lab experiments could take such fluctuations in stride, having learned not to rely on consistent resources for their sense of personal comfort or safety (Example 15).

The potential to trial various approaches with less commitment, less investment and more student engagement and interest makes "campus as a living lab" an important component in any campus decarbonization strategy.

Recommendations For Campus Decarbonization and Resilience

- **Pursue a <u>Sustainability Tracking, Assessment and Rating System (STARS)</u> rating** through the Association for the Advancement of Sustainability in Higher Education. Consider developing the STARS report as a class or graduate student research project. While over 1000 institutions of higher education have registered with STARS, many have not kept up with current reporting.
- ☆**Encourage top leadership to sign and participate in the higher education <u>Climate Commitment</u>** to achieve carbon neutrality and climate resilience. Over 700 have signed since 2007, yet it is estimated that only about 400 are currently active.
- **Mandate all-electric new buildings**, including laboratories and medical facilities.
- **Decarbonize existing buildings by electrifying campus energy infrastructure**, prioritizing aging systems and equipment.
- **Supply both new and existing buildings with clean electricity** (wind, solar, geothermal, biomass, or small hydropower), using both on-campus installations and off-campus procurement.
- **Electrify campus vehicle fleets and reduce greenhouse gas emissions from commuting** through programming and infrastructure to incentivize and enable sustainable transportation (walking, biking, mass transit, car/van-pooling).
- **Complete an inventory of "Scope 3" indirect GHG emissions** from supply chain, construction, waste, water, and investment activities.
- ☆**Model a just transition** by centering justice and equity in all campus climate action and resilience planning and implementation.
- **Complete an equity-centered climate hazard vulnerability assessment** and prioritize actions to address those vulnerabilities.
- **Address climate impacts and resilience challenges for all aspects of campus operations**, including foodservice, waste management, water, and procurement.
- ☆**Create a living laboratory program to overcome barriers to using the physical campus for research and education**. Include a formal process for partnering with operations staff and using physical facilities and procedures in education and research.
- ☆**Engage all disciplines in the living laboratory program**, including arts and humanities, not just social or natural sciences and engineering.

Examples for Campus Decarbonization and Resilience

Example 1: Hosted by the University of New Hampshire, the Sustainability Indicator Management & Analysis Platform (SIMAP®) is an online, comprehensive, and affordable higher-education carbon and nitrogen accounting platform that can help institutions meet their climate-response goals with tracking, analysis, and improvement of campus-wide sustainability.

Example 2: In 2025, The University of California published a UC Health Scope 3 Inventory Report which inventories seven categories of UC Health's Scope 3 greenhouse gas emissions, including supply chain, business travel, employee commutes, and waste disposal sources.

Example 3: Stanford has made meaningful progress in measuring and reducing Scope 3 emissions by developing methodologies across eight key emissions categories, including procurement, travel, and construction decisions. Targeted initiatives aim to drive reductions in areas like business travel and commuting. Cross-campus collaboration and improved data collection and reporting position Stanford as a leader in Scope 3 management.

Example 4: In 2015, as part of its Stanford Energy Systems Innovations (SESI) program, the university built a new Central Energy Facility (CEF) and retired its cogeneration and ice plants. SESI transformed the university energy supply from a 100% fossil-fueled combined heat and power plant to grid-sourced electricity and a more efficient electric heat recovery system. This helped Stanford achieve 100% renewable electricity. Independently developed by Stanford from 2009 to 2011, SESI may be the first large-scale example in the world of a technology roadmap for heating and cooling as outlined by the International Energy Agency (discussed in a comprehensive report for district-level implementation by the United Nations Environment Programme). This heat recovery system, along with Stanford's solar power procurement, reduces campus emissions by approximately 81% and realizes a more than 70% average annual water savings for campus energy generation.

Example 5: Ball State University was the first university in America to phase fossil fuel out of campus operations, creating the nation's largest ground-source, closed-loop district geothermal energy system in spring 2012, reaping both financial and environmental benefits. This first phase allowed Ball State to reduce its reliance on four aging coal-fired boilers and provided employment for several hundred contractors and suppliers, an estimated 2,300 direct and indirect jobs, according to Ball State's Center for Business and Economic Research study. Following second phase completion, the university retired the coal-fired boilers, cutting the campus carbon footprint nearly in half. The system now heats and cools 50 buildings.

Example 6: The University of California published a Framework for Incorporating Environmental and Climate Justice into Climate Action. UC locations are using this to integrate

equity into their climate action plans and activities, modeling pathways to a more just transition. Additionally, the "Pathways To a Fossil-Free UC" Task Force created an "Equity and Justice In Fossil-Free Planning" slide deck to address the question "*How might the transition away from fossil fuel usage at [UC location] improve and/or adversely impact the environmental and climate justice of people's daily lives?*"

Example 7: The University of Utah's updated Climate Action Plan outlines a path toward the institution's accelerated 2040 target for achieving net-zero greenhouse gas emissions. This builds on its prior Climate Resilience Assessment (including this Resilience Matrix), identifying steps to prepare for climate change impacts on campus facilities and members.

Example 8: The University of California system published a Framework for Justice, Equity, Diversity and Inclusion (JEDI) Centered Climate Resilience Planning. UC campuses use it to understand how climate impacts affect the most marginalized and at-risk campus groups.

Example 9: The California State University system published an infrastructure-related Climate Resilience Framework intended to support CSU campus planning processes. This document helps officials evaluating an infrastructure system replacement, repair, or improvement to identify campus-relevant climate hazards, vulnerabilities, and risks and choose appropriate mitigation strategies. Additionally, a CSU campus (or the entire system) undertaking capital expense planning can review this framework to identify climate-related vulnerabilities and prioritize actions needed to increase resilience.

Example 10: The Least Developed Countries Universities Consortium on Climate Change offers technical support for locally-led climate adaptation solutions. Founded in 2012, the Alliance of Regional Collaboratives for Climate Adaptation convenes climate workers and leaders across California. The University of Guadalajara and Tecnológico de Monterrey are both part of the Alianza para la Acción Climática de México, which aims to demonstrate commitment to climate action and strengthen Mexico's contribution under the Paris Agreement.

Example 11: The California State University System created a "Campus as a Living Laboratory" grant program with funding from the National Science Foundation. Faculty developed courses and projects in which students confronted real-world sustainability problems, incentivizing interested faculty and facilities operations staff to collaborate by incorporating specific campus-based challenges.

Example 12: For nearly 20 years, the University of British Columbia's Campus as a Living Lab initiative has been a cornerstone of innovation and applied research. Using campus as a vibrant and dynamic learning environment, the initiative integrates university operations, infrastructure, academic capacity and unique resources to address sustainability challenges. Applied research

projects benefit university operations, advance faculty research, and create opportunities for student learning and knowledge exchange.

Example 13: Stanford's <u>Campus as a Living Laboratory for Sustainability</u> initiative strategically activates the campus as a testbed for innovation, bringing together staff, students, and faculty to solve operational challenges, drive sustainability breakthroughs, and develop the next generation of leaders for local and global systems change. In addition to research partnerships, course collaborations, and tours, the initiative includes a student fellows partnership between the Office of Sustainability and the Doerr School of Sustainability, serving more than 60 students annually.

Example 14: Simon Fraser University engages multidisciplinary student teams in their <u>Civic Innovation</u> and Corporate Impact Labs. Generated by municipalities and corporate partners, projects develop scalable solutions that support complex climate and sustainability goals.

Example 15: The Association for the Advancement of Sustainability in Higher Education selected Tufts University for its <u>2025 Campus Sustainability Achievement Award</u>, recognizing work to redefine sustainability programming to meet student needs. Through its Office of Sustainability, Tufts was among the first universities to create a student-focused, residence-hall sustainability program in the 2000's: Eco Reps ran successfully for almost two decades, engaging hundreds of students with sustainable living practices and other campus initiatives.

With the onset of the pandemic and accelerating climate impacts in the early 2020's, Eco Rep students asked to center inclusivity, equity, and wellbeing. They partnered with Tufts's Office of Sustainability on a strategic planning process to align its programs with the university's education and research goals. Three resulting programs under the umbrella of *Resilient Climate Leaders* train students to tackle climate challenges by prioritizing community-building, reflection, and celebration. As students develop leadership skills, they acquire tools to deal with the complexity of climate change while preserving wellness. In their inaugural year, these programs engaged 47 direct participants and reached thousands of others through events.

12. Academic Climate Advocacy and Activism

12.1 Encourage Debate About Climate Activism

Section 3 defines "Action," "Advocacy," and "Activism" as distinct approaches to climate-crisis response. Even though, in practice, these concepts build on each other, we adopt a general dividing line separating Action and Advocacy as using "soft approaches" (like engaging, educating, and persuading) compared to Activism's "harder stances" (like staging rallies and occupying campus buildings).

Action and advocacy involve natural extensions of the academic skill set, including pedagogy, persuasion, education, outreach, and problem-solving. Thus, we agree that climate action and advocacy should be encouraged for all campus community members. While some universities provide training or guidelines on topics like disclosing conflicts of interest, many campus community members would benefit from guidance on advocacy, including when and how faculty and staff may speak on behalf of their institutions or themselves as individuals. Campus community members must be protected from retribution after exercising their free-speech rights.

However, climate activism in academic roles is hotly debated (24,29,72,72–75,75).

Some publications (24,73,74,76) and academic groups (e.g., Scientist Rebellion) call for increased climate activism within the academic sphere. However, universities themselves seldom directly support activism even when they support advocacy and free speech (Example 1). For example, activist work is rarely counted in merit reviews (Example 2). Activist faculty are less likely to obtain campus leadership positions, and activist groups on campus may receive little to no support (Example 3). Activism is often considered outside of the traditional sphere of academia, exiled by expectations that faculty statements and peer-reviewed publications must maintain a certain objective distance.

On the other hand, activism has played an important role in holding universities accountable and spurring significant climate action. Student and faculty activist groups have been major forces in fossil fuel divestment and the creation of climate General Education requirements (Example 4). Activists have also questioned the role of donors and outed vested interests from the fossil fuel industry (Examples 4 and 5). Whereas advocacy may take a "softer" and slower path, activism pushes for faster change and may lead to more immediate results.

IN ACTION: Advocacy vs. Activism

ADVOCACY: Founded by campus community members at the Massachusetts Institute of Technology in the 1970s, The Union of Concerned Scientists now includes nearly 250

scientists, analysts, policy experts, organizers, and communicators translating scientific insights and analysis into decision making for a healthy, safe, and just future. The organization's public mission statement expressly centers ***advocacy*** as members communicate with and influence the media, general public, and key decision makers.

Rejecting corporate and government funding, the group counts among its accomplishments changes in state utility law that increase access to solar energy and legislation extending compensation to community members exposed to nuclear radiation.

ACTIVISM: Scientist Rebellion takes the position that, despite some small wins, decades of advocacy has not changed rising trends in atmospheric CO_2 and global temperature. Thus it embraces ***activism*** in the form of non-violent, civil resistance as an appropriate and necessary pathway to more significant change. While the organization offers ways to support academics who have been jailed while engaging in public civil resistance, it also supports behind-the-scenes political and economic pressure.

The varying approaches, tone, and activities of the Union of Concerned Scientists and Scientific Rebellion illustrate diverse ways in which academics' own values, proclivities, and consciences move them to embrace climate related advocacy and activism.

Workshop participants debated two key questions about faculty activism.
1) **Is the impact of climate change potentially so severe that universities should make an exception to their general reluctance to support or encourage activism?** If so, does the climate crisis represent a special case, or are universities also opening doors for other forms of activism? Crackdowns on activism at United States institutions related to the Israeli-Hamas conflict have made answering this question even more difficult.

2) **To what degree is climate activism within the sphere of faculty academic duties?**
   If it is, who would arbitrate and review such activities? Universities are starting to recognize the need to support socially impactful research in Promotion and Tenure reviews (56). The University of California recently established guidelines for evaluating community-engaged research. However, whether to reward community-engaged climate mobilization is an open question (74).

12.2 Discuss the Pros and Cons of Possible Approaches to Academic Climate Activism
At the heart of this debate is the question of whether universities should maintain a politically neutral stance to preserve long-term credibility.

(1) Those in favor of encouraging climate activism
Proponents of academic climate activism argue that the window for needed change is so short that activism is warranted and even morally required (Example 6). For this group, categories outlined in the "Honest Broker" model (as described in Section 7.8) like "Science Arbitrator" and "Pure Scientist" represent inadequate responses. They argue that a "politically neutral stance" may not be possible in the face of powerful groups with vested interests, like Big Oil, which spend billions of dollars in campaigns to discredit scientific knowledge (24). Past social transformations like the Civil Rights movement show that academic activism can be crucial to propelling society forward. Nelson et al 2025 (48) see activism as crucial to the "Inside-Outside" strategy that advanced climate action at University of California San Diego (see Section 8.1).

(2) Those against
Those who want to limit climate activism in academia argue that, while it may bring about immediate advances, activism undermines the credibility vital to academia's constructive, long-term role. Thus, this group suggests that activism should be left to other social actors. Maintaining neutrality would boost universities' abilities to contribute new and innovative policy options, resolving political gridlocks that have exacerbated the climate crisis.

(3) A compromise
Allowing for both positions may create the strongest response. Some campus community members can choose a neutral role like "Honest Broker of Policy Alternatives" to serve groups from diverse political persuasions. Others can pursue greater activism and engagement, compelled by their perception of the severity of the situation.

At minimum, universities should engage in campus-wide debate on questions such as:
- In what scenarios would climate activism be included in academic duties?
- Do universities have a role to play in climate activism?
- Should climate efforts be treated differently from other forms of activism?

12.3 Increase Support For Academic Activism
Universities already have an obligation to permit climate-related activism events on their campuses. Going further, they could provide funding or other support, even permitting or encouraging employees to participate on university time. Nurturing activities beyond the traditional academic mission requires the right incentives. At the highest level, institutions could permit the use of the university name at off-campus sit-ins, rallies, or protests, taking a bold stand for academic influence in service of radical social change.

While not a key topic at our workshop, universities should consider how to nurture and protect student activism and involved faculty, including:
- Clear policies regarding methods
- Defined consequences
- Trained response staff
- Legal assistance

- Accessible resource support
- Student training

Consensus Recommendations For Climate Activism

Consensus recommendations are presented first, followed by further recommendations from authors who favor stronger efforts.

- ☆**Strive to encourage and protect free speech** as discussed in the Report of the Committee on Freedom of Expression from the University of Chicago.
- ☆**Encourage more faculty to engage with policy advocacy**, discussing the advantages and limitations of the "Honest Broker" model.
- ☆**Consider unified public-facing advocacy** beyond campus-based efforts (Section 5).
- **Establish regional and/or national advocacy networks** to harness the potential of collective university action to create strong societal impact (Section 10.6).
- ☆**Promote a campus-wide dialogue on the role of activism** in the context of the climate crisis.

Further Recommendations To Support Increased Climate Activism

- ☆**Increase support for climate advocacy, action, and activism** pathways to enable all members of universities to engage with the climate crisis.
- ☆**Recognize the importance and achievements of academic climate activists** by publicly promoting such efforts or including them in review and appointment criteria.
- ☆Instead of viewing them as a threat**, dialogue with and support grassroots faculty and student climate activist groups**.
- ☆**Consider steps to arbitrate or review climate activism** like creating Promotion and Tenure rules for community-engaged climate mobilization.

Examples for Climate Activism

Example 1: The University of Chicago Report of the Committee on Freedom of Expression notes that support for faculty advocacy or free speech does not always extend to activism.

Example 2: Faculty who engage in climate activism are likely to face stronger barriers at their institutions. A recent article from Nature documents the challenges faced by Professor Adam Aron who pivoted from Neuroscience and now engages with Climate Activism.

Example 3: Personal testimony from the workshop highlighted the lack of institutional support for climate activism efforts.

Example 4: Nelson et al 2025 (42) show how the grassroots student and faculty activist group University of California San Diego Green New Deal gained considerable wins at UCSD in 2019 on decarbonization, fossil fuel divestment, and the creation of a climate General Education Requirement. In 2022, students from End Fossil Barcelona organized a seven-day sit-in at the University of Barcelona that opened discussions about the creation of a climate General Education requirement. In an ongoing process and model for other Spanish institutions, the university is co-creating with faculty – including training and funding – and incentivizing students to certify existing classes to satisfy climate General Education requirements.

Example 5: Students from the group Fossil Free Stanford have questioned Stanford's Doerr School of Sustainability's choice to accept funding from the fossil fuel industry. In 2014, students from Fossil Free ANU organised the first student-initiated referendum at the Australian National University, leading to divestment from seven companies.

Example 6: One workshop participant said, "Civil disobedience is necessary. How do we make room for that?"

13. Envisioning the Future

13.1 Embrace a New Role for Universities: Storytellers of the Future

Up to now, this paper has detailed multiple ways to leverage and transform academia's core missions of research, teaching, and service to respond to climate change. **However, a vital concept, we believe, is missing.**

Collectively, strategies like boosting climate research or improving climate education increase academic relevance, trust, and ultimately, the social value of core university activities. *But we should not mistake this for actual impact on climate change.*

Perhaps this is unsurprising. The tripartite academic mission was not originally designed to affect broad environmental factors beyond a university and the community around it. While universities have a long record of contributing to social innovation, we are now at a point where much more is needed, including the difficult work of envisioning potential futures and considering long-term planetary solvency (71).

Like the proverbial sages describing the elephant as a wall, a snake, a tree trunk, and a rope, many academic disciplines have produced piecemeal predictions. The perspectives of individual specialties do little to create holistic, concrete visions that the general public can apprehend.

Climate scientists have built models to predict the possible futures of Earth's ecosystems and climates. The Intergovernmental Panel on Climate Change (28) has developed the widely used Shared Socioeconomic Pathways (SSPs) corresponding to varying levels of future CO_2 emissions. The novel IPCC Working Group I Interactive Atlas allows citizens worldwide to explore how parameters such as temperature and precipitation might vary under different SSPs. However, these future pathways are most useful for individuals trained in a scientific mindset, and it is left to the user to imagine, for example, how a change in temperature might impact human migration or food availability. Yet without a vision of such changes, many humans struggle to comprehend what is at stake…and decide how to respond.

As of this writing, many climate experts estimate a 3˚C probable global temperature rise by the end of this century. But 3˚ is just a number. How does it translate in lived experience?

Compare that to this statement: *according to one study* (77)*, when global temperature rises by 3˚C, one third of the world's population will be forced to migrate.* India will be uninhabitable, also most of Brazil, northern Australia and Indonesia, and parts of Africa. As livelihoods fail, some 1 billion people will be on the move (78), becoming climate migrants with profound consequences for their neighbors and the rest of the world.

It lands differently when there's an image with consequences, not just a number, a statistic, or a correlation with variables like "temperature" or "CO_2."

As is well known, stories can change lives (79). From Jules Verne's *20,000 Leagues Under the Sea* (80) to George Orwell's *1984* (81), future visions have captivated audiences and focused attention on social and technological developments. Some of those stories provoked society-wide debate and created a path for change (Example 4). To prepare for the future, to engage meaningfully with it, people need to see it in their minds first.

Thus, we propose that universities should undertake a new type of academic endeavor:

Marshaling expertise from all disciplines, universities should create concrete, consistent, and coherent roadmaps of future landscapes that students, academics, and society can use to plan (Example 5) (82)***.***

13.2 Take Four Steps To Communicate Possible Futures

To translate key predictions into galvanizing scenarios that people can actually use, universities can tackle a four-step process.

(1) Investigate real-life implications of SSPs through "focusing questions"

SSPs need to be translated into lived experiences that citizens worldwide can directly relate to. Crystallizing climate-crisis impacts into vivid, holistic scenarios could start with "focusing questions": obviously significant and requiring intensive, multidisciplinary collaboration.

Focusing questions for a possible 3°C warming might include:
- *How will potential supply chain disruptions affect medical care?*
- *What will local farmers be growing, and who will buy their produce?*
- *What is a realistic immigration policy for countries that may receive climate migrants, and how should it evolve over time?*

Plausible answers to these questions will depend on unraveling dozens of interconnecting social, geopolitical, and technological factors, which will demand communication, collaboration, imagination, and vision from scholars across many departments. As we have argued, ***this is exactly the boost climate-crisis research needs.***

An ideal home for such explorations could be the meta-department, a new kind of multidisciplinary on-campus think-tank described in Section 7.5. The meta-department is not just a bigger silo, but a focal point for collecting resources across the campus. It could propose a list of such questions, or they could be co-created via workshops involving the general public. Such lists could be distributed to universities as Grand Challenges to their current research and

teaching. "Focusing questions" could provide the impetus for universities to yield the big-picture syntheses that individuals, business, governments – and universities themselves – need to plan. Different answers from different universities would stimulate debate.

(2) Make the answers come alive with "future stories"
Having addressed a variety of focusing questions, universities could partner with artists and visionaries, writers and filmmakers to bring holistic scenarios to life.

Like a good movie, a "future story" will have compelling world-building, showing how people live and work in that future (Example 6). But, unlike current entertainment vehicles, each story would *also explain* how that future came about as a consequence of prior decisions. All details must mesh – how many people there are, how they live and work, feed and govern themselves, harness energy, and use material resources. The story should be tailored to capture audiences' interest and help them understand how society at large, and their own lives, might be affected.

(3) Stimulate and engage in society-wide debate
As "future stories" bring planetary limits to life, people will be forced to consider tradeoffs, triggering intense debate about what constitutes a "good" future for Earth and its inhabitants.
:
- More people living marginally vs. a smaller population with more energy per capita
- Energy-intensive healthcare for a few vs. more basic care for many
- Tackling child mortality vs. prolonging life for the very elderly

People will be moved to discuss a fundamental question: *what aspects of modernity are indispensable and should be prioritized?*

Each society across the world will need to build its own consensus about how to use available resources and energy. Having done this on their campuses (Section 4.2), universities can support these discussions. With their traditions of academic freedom and free speech, they can provide venues and suggestions for thrashing out opinions frankly but respectfully.

(4) Create a farther-future vision to guide and inspire
As society begins to grapple with these fundamental tradeoffs, *the existence and importance of planetary boundaries* must filter into every Earth citizen's awareness.

Focusing some fraction of future scenarios on the farther future – say the next several centuries – brings home the lesson that there is always an implicit timescale associated with the word "sustainability." The key question is: sustainable *for how long*? This is almost never addressed in current debates where the word "sustainable" has largely become shorthand for "less resource-intensive than whatever we are doing now."

Additionally, farther-future thinking will highlight how well our contemplated near-term strategies mesh with where we ultimately need to go – the "far future" is a compass that illuminates the long-term path. To develop solutions and make needed lifestyle changes, humans must feel the future is good and worth pursuing. Universities can lead by creating far-future scenarios where a higher quality of life is not inexorably tied to higher consumption. Whether we envision large numbers of people living very simply or smaller numbers with amenities like libraries, recorded music, and intensive health care, academia can bring the spectrum of such futures to life for deeper debate and scrutiny.

Finally, long-term farther-thinking will foster the higher degree of detachment necessary to properly contemplate such epochal issues. A person's vision for the next few decades is inevitably colored by loyalty to their tribe, institutions, and immediate progeny. In contrast, thinking on timescales of centuries frees us to imagine futures from scratch, worlds that work with a population size and environmental footprint fitting into long-term planetary limits. What truly sustainable futures would we ourselves want to live in and be proud to bequeath to future generations? What are possible paths to get there (Example 7)?

13.3 Align Teaching Outcomes With Consensus Future Scenarios
Returning to the most sacred mission of higher education – to educate – "focusing questions" and "future stories" can play a central role. Their vividness will bring society's challenges alive in the classroom, and the assumptions and predictions used to create them will be fertile material for discussion and analysis.

But beyond that, they can shift our teaching to focus on our best predictions of what future generations will need to thrive. In a transformed world, academia's current stress on specific disciplinary prowess may need to fade, replaced by more fundamental personal qualities like self-confidence, auto-didaction, composure in the face of challenge, resourcefulness, and social acumen. In this age of climate anxiety, bolstering such basic strengths should be core to every student's education (Example 8). Future visions will clarify how universities should diversify current educational approaches, giving more emphasis to educating the whole person. Many teaching strategies mentioned in Section 8 take steps in this direction. Their impact could be amplified if they were designed to serve these larger goals.

Recommendations For Envisioning the Future

- Taking the next step beyond SSP scenarios, combine research efforts to **create realistic, comprehensive, holistic scenarios that illuminate how people would live in possible futures** to illustrate the consequences of decisions being made now.

- ○ Develop vital **"focusing questions"** to motivate and inform future scenarios and channel relevant university research agendas.
  - ○ Work with creatives like writers, artists, and filmmakers to **bring scenarios to life to interest and inform the general public.**
- Engage in deep and sustained thought to **prepare for multiple possible scenarios**, including potentially catastrophic ones.
- **Widely broadcast estimates of Earth's long-term carrying capacity**, assuming different lifestyles and consumption profiles.
- ☆**Encourage research on sustainable energy and raw materials in the far future.**
- ☆**Publicize analyses of how societies and value systems might need to change** to embrace long-term sustainability.
- ☆Enrich educational offerings to **encourage holistic thinking, resilience toolkits, and academic and personal growth** to confront the challenge of living in a drastically transforming world.
- ☆**Leverage the resources of NGOs, boundary organizations, and public agencies** to make these actions effective and impactful.

Examples for Envisioning the Future

Example 1: Institutes confronting long-term holistic Earth futures include The Santa Fe Institute, The Center for the Study of Existential Risk, The Stockholm Resilience Center, The Future of Life Institute, and The Breakthrough Institute.

Example 2: Professor Tim Lenton at the University of Exeter and colleagues have defined the human climate "niche" and calculated maps showing which regions of the world become uninhabitable with a given global temperature rise.

Example 3: The "List of Existing Technologies Predicted in Science Fiction" Wikipedia page illustrates the success of writers and filmmakers in producing visions of the future that are both accurate and extremely appealing to audiences.

Example 4: In 1887, social critic Edward Bellamy published *Looking Backward: 2000-1887* (83). In this novel, the protagonist wakes up in a futuristic Boston of collective social ownership and a uniform standard of living. A bestseller, the book spawned "Bellamy clubs" where readers met to discuss possible futures. It impacted turn-of-the-century progressive movements and planted seeds of modern concepts like industry regulation and public utility ownership.

Example 5: "Making local futures tangible—Synthesizing, downscaling, and visualizing climate change scenarios for participatory capacity building" (Shaw et al, 2009) (82) investigated what components were required to turn global-level climate information into local climate action. The

study found that in order to practically consider how climate change impacted their own lives, participants required contextualizing, visualization, and knowledge co-production.

Example 6: The eight-episode science fiction TV series *Extrapolations* depicts life on Earth from 2037 to 2070. Excellent acting and high production values draw the viewer in. In the book *Future Scenarios: How Communities Can Adapt to Peak Oil and Climate Change* (84), the co-founder of permaculture David Holmgren, brings to life four likely cultural, political, agricultural, and economic implications of peak oil and climate change.

Example 7: Some organizations like Stockholm Institute of Resilience have taken steps towards far-future thinking about energy and resource use.

Example 8: Tongji University emphasizes a competence-oriented, generalist approach, focusing on its trinity of "Knowledge, Ability and Personality." It offers a generalist-oriented system in which majors or specialties are categorized as: generalist education, fundamental education, and elementary courses. The goal is to develop student competence for adaptability in the face of future challenges and social developments.

14. NEXT STEPS

Whether amazed at the plethora of potential strategies or overwhelmed by the areas that need transformation, we hope readers agree with us that there are plenty of places to get to work. Yet individual and institutional capacity for such work varies greatly. Whether at a deep-pocketed, dynamic institution with a clear mandate for change or a cash-strapped organization hampered by political pressures, every climate actor must grapple with limitations and marshal resources.

In light of **Guiding Principle 1: Strategic Leadership** and **Guiding Principle 2: Coordination and Communication,** we hope that readers already engaged in significant climate response might consider how to refine or boost their current efforts. Target more strategically or connect more effectively with other climate actors. Readers just starting their climate response journey might find a single first step to build individual and/or institutional impact, perhaps starting with one of our "starred" recommendations for relatively easier implementation.

We urge readers to keep three things in mind:

First, limitations can change. A plate that seems impossibly full now may open up in six months when a current project wraps up. Creative approaches to funding might reveal resources where there seemed to be none.

Second, we can all start thinking about our futures now: not worrying about what might happen or bemoaning inevitable changes, but applying our analytical capacity and inner compasses. *Think about what we would like to be working on and what campus community we would like to experience, within our understanding of planetary limits.*
- What actions could our current capacities support with thoughtful resource management and a hopeful attitude?
- If we start planning now, what could be fertile ground for change in the next two, three or five years?
- What is our best-case scenario for our own participation in climate action, advocacy, or activism? In 10 years, where would we love to see ourselves and our campuses?

Third, we don't have to do this alone. In discussions during the workshop and while writing afterwards, desires for community, conversation, and connection were consistent themes. W*hom can we collaborate with to exercise strategic leadership in our role and coordinate and communicate with other concerned climate actors?*

For tens of thousands of years, through ice ages big and small, continent-wide plagues, worldwide crop failures, even governmental collapse withdrawing vital economic, education, and transportation services, humans have demonstrated their ability to adapt, rebound,

restructure, and thrive. Now we are challenged with maintaining the most cherished of our modern advances while weaning off the technological mechanisms that got us here. *Yet we face this challenge with far more knowledge and resources than at any other time in human history.*

Thanks to academic disciplines, we know more about how societies thrive than any humans before us. Surely, we can co-develop a lifestyle that will allow us to continue within planetary limits for the next 200,000 years. That is our challenge but also our privilege.

Academia is resourced to tackle society's big questions. Readers who have gotten this far have come to this moment for a challenge such as this. We attended these workshops and wrote this paper to craft our own climate responses. Those actions moved us forward. We ask our readers to consider what new actions they want to take in response to climate change, the latest of humanity's great challenges.

If you'd like to share a shorter version of this paper with another concerned climate actor, a 15-page summary *Climate Action in Higher Education: Highlights and Recommendations for Decision-Makers* is available at our working group page **Academics for Climate Action**. Please consider joining us in the next generation of higher-ed climate response.

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