



# Provost's Task Force for Energy and the Environment

## Executive Summary

Provost Nadine Aubry launched the Task Force for Energy and the Environment in February 2021 to identify major areas of research, scholarship, education, and civic engagement where Tufts can make a significant impact on climate change and the environment. This report marks the first milestone in a three-part process to set the university on a path toward making such an impact. It answers the question of *what* the university wants to do by identifying Major Areas of Strength where near-term investments can increase the chances of long-term success. Second, the Provost must identify *who* will play key roles in each Major Area of Strength. Third, the faculty in these key roles must work with the Provost to develop detailed plans for *how* to make such an impact.

Recommendations include:

1. Supporting Major Areas of Strength for research, scholarship, education, and civic engagement.  
Based on our assessment of Tufts' historical and current areas of strength, and an intensive dialogue among Task Force members representing Tufts' eight schools, we have identified five Major Areas of Strength: *Cities & Communities*, *Energy*, *Food*, *One Health*, and *Water*. Of these areas, recognizing the existing school-based strengths in *Food* and *One Health*, we recommend establishing *Cities & Communities*, *Energy*, and *Water* as Major Areas for the Provost's near-term investment in transdisciplinary research, scholarship, education, and civic engagement.
2. Promoting transdisciplinary work on climate and the environment.  
We encourage the Provost to work with the Deans to develop a strategic plan for hiring, promotion, resource allocation, collaboration, and education in the recommended Major Areas and in other transdisciplinary work on climate and environment.
3. Enabling the Tufts Institute of the Environment (TIE) to convene and support these activities and its broader mission.  
We encourage the Provost to reflect on the elements of this report that speak to the history and value of the Tufts Institute of the Environment (TIE) in the eyes of the Task Force. TIE can play an important role as an integrator and a convener within and between the Major Areas discussed. Finally, we encourage the Provost to maintain support not only for the Major Areas, but also for TIE's broader mission as a meeting place for community members from different disciplines.

Submitted on Earth Day, April 22, 2021.



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## Preface and Dedication

In 1962, Tufts University became one of the first academic institutions to offer courses that addressed humanity's impact on the environment. Since then, Tufts Presidents have prioritized the environment as an area for research, scholarship, education, and civic engagement. President Jean Mayer (1976-1992) welcomed, among other entities, the graduate department of Urban and Environmental Policy and Planning (UEP), Tufts Center for Environmental Management, the Friedman School of Nutrition Science and Policy, and the Cummings School of School of Veterinary Medicine. In 1990, President Mayer convened a group of university presidents from around the world to ratify the [Talloires Declaration](#), a 10-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations, and outreach at colleges and universities (ULSF, 1990). President John DiBiaggio (1992–2001) created the Tufts Institute of the Environment (TIE) and the Tufts Climate Institute (which later became the Office of Sustainability). Current President Tony Monaco's focus on sustainability has led to the creation of several sustainability councils, formalized funding mechanisms for campus sustainability, increased emphasis on sustainability education, and funded CREATE Solutions (Climate, Renewable Energy, Agriculture, Technology and Ecology), a research priority area, supported by the Office of the Vice Provost for Research (Tufts, 2018).

Immense environmental challenges remain. To this end, Provost Nadine Aubry launched the Task Force for Energy and the Environment in February 2021 to identify Major Areas of Strength in research, scholarship, education, and civic engagement where Tufts can make a significant impact on climate change and the environment. For the purposes of this document, “center-level” funding, as referenced by the Provost, refers to major externally funded grants (\$3-10 M/yr for 3-10 years) that can support sustained transdisciplinary research, scholarship, education, and civic engagement for multiple faculty.

*This Report is dedicated to the memory of our dear colleague, Professor Jonathan E. Kenny (1953 - 2020) whose devotion to environmental and sustainability issues in his nearly 40 years at Tufts inspired generations of students and faculty to pursue lasting solutions to the world's most pressing environmental challenges.*

## Introduction—Provost's Charge

The Provost convened a 22-member university-wide Task Force (see Appendix for membership) to address the following charge:

1. Based on our strengths, how can we be bold and ambitious to meet the major challenges recognized through future federal center-level funding and make the largest possible impact in the areas of:
  - a. Research and Scholarship;
  - b. Education; and
  - c. Civic Engagement.
2. What are the 2-3 focus research areas within Tufts – or between Tufts and partners – for center-like convergent research?
3. What are 2-3 bold ideas for the education of our students for next generation workforce – educational centers?



## Task Force Response to Provost's Charge

The Provost's charge presents an opportunity for Tufts University to rise to the great challenges faced by our university, the United States, and the world, during a time of climate disruption. We envision Tufts University as a nationally recognized leader with a distinctive climate action culture that infuses our community's research, scholarship, education, and civic engagement. We see strong parallels among what we investigate in our research, teach in our classrooms, and live out in our daily lives through our own shared community.

Climate change is one of the most pressing global issues of our times. It threatens the lives and welfare of billions of the world's inhabitants, both human and other species, and is a threat multiplier that can trigger intensified challenges to human dignity, security, health, and equitable access to energy, food, and water. Our Task Force envisions a university-wide transdisciplinary mobilization for research, education, and civic engagement that offers solutions to mitigate and respond to the challenge of climate change, and its resulting injustices. Our Major Areas of Strength, listed below, position Tufts to lead on climate action both as a center of cutting-edge research and scholarship as well as a living laboratory that has reimaged its own campus facilities and practice.

In a spirit of advancement through specialization and recognition of comparative advantage, we identify five Major Areas of Strength fundamental to our climate action agenda, each of which have systems, science, and policy dimensions.

- 1) *Cities & Communities*: re-imagining how our cities and communities are planned and organized is both an essential element of developing a zero-carbon economy as well as an important response to designing holistic, just solutions to climate change adaptation that reach across boundaries of race, culture, and human security;
- 2) *Energy*: fossil fuel use is the single largest driver of the growing stock of greenhouse gases in our atmosphere. Shifting to a zero-carbon energy system is an essential step in addressing climate change and requires innovations both in new technologies and policy design and implementation;
- 3) *Food*: climate change has the potential to be a major disruptor to food production, distribution and access, with resulting consequences for human nutrition and food justice. Agricultural policy will be an important focus for climate mitigation and adaptation;
- 4) *One Health*: human, animal, and environmental health are interrelated and are all affected directly by climate change through disruption to natural and human ecosystems; and
- 5) *Water*: climate change both directly and indirectly impacts water through the consequences of changing variability and intensity of precipitation leading to drought, sea-level rise, and flooding of the built and natural environments, which contributes to multi-scalar geopolitical, governance, and management challenges.

Our vision is motivated by a sense of public purpose. The Provost's charge and this report in response build on Tufts University's tradition of leadership as exemplified by the 1990 Talloires Declaration, which said:

*Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future.*

Our vision also recognizes substantial opportunities for Tufts University including:

- Stronger global recognition as a place of innovative and constructive climate action, with potential advantages for research funding (including new center-level research funding), student recruitment and training for civic leadership-oriented careers, alumni engagement, and faculty and staff recruitment and retention; and
- A revived sense of engagement and partnership among university leaders, faculty, staff, student activists, and community stakeholders working together to build the skills and institutions needed to address the urgently required social and political transformations.

One of Tufts' greatest strengths as a university is the willingness and ability of its faculty to come together from different schools and disciplines to collaborate on areas of common interest in a manner that recognizes and values common cross-cutting themes. TIE has played an important role as a convener and a connector of faculty, staff, students, and community partners in areas related to the environment. This role has been described as a "meeting place," a "third space," and a "watering hole" where faculty are supported and encouraged to engage intellectually with one another on matters of energy and the environment. While all of these descriptions suggest a physical space, we recognize the importance of bringing our three campuses together in relationship to one another and that it is therefore the connections between faculty, students, staff, and guests from different disciplines that are important.

We understand the notion of "hallway conversations" as the kinds of spontaneous, relationship-based interactions that happen and develop over time among colleagues within a community who share similar interests and values. These interactions do not necessarily occur in a particular hallway or at a particular watering hole; rather they reflect a safe cultural space that is free from transactional imperatives, the business of daily life, and the strictures of thinking within a single discipline. TIE offers the opportunity for Tufts community members to engage in ways consistent with our common understanding of intellectual freedom, pursuit of truth, passion for the greater good, native curiosity, and joy in working together for the benefit of society.

We believe that if this cultural third space is valued, prioritized, and held by Tufts University, our collective ability to develop trust, stand up for our values, realize our ideas, and make an impact on climate change and the environment through research, scholarship, education, and civic engagement will reach its full potential.

## Tufts' Strengths in the Environment

Figure 1 shows five Major Areas of Strength for transdisciplinary work at Tufts University as identified and affirmed by the consensus of the Task Force members: *Cities & Communities*, *Energy*, *Food*, *One Health*, and *Water*. As shown on the left-hand side of Figure 1, all of these Major Areas can be organized within the context of *Climate Change, Environment, Sustainability & Biodiversity*—the encompassing circle. At their core, they aim to achieve *Equity & Justice*—the heart of the circle. *Resilience*, *Security*, *New Technologies*, and *Civic Engagement* are cross-cutting themes that are relevant to each Major Area. Figure 1 shows these Major Areas of Strength and cross-cutting themes next to the Grand Challenge Areas identified in the Tufts Research and Scholarship Strategic Plan (RSSP) that was developed by the Office of the Vice Provost for Research (Tufts, 2018).

Four of the Major Areas in Figure 1 are long-standing strengths of the university: *Cities and Communities* have been a focus of the work of the Department of Urban and Environmental Policy and Planning (UEP) for just under 50 years; *Food* dates back to the founding of the Friedman School of Nutrition; *One Health* has involved the medical, dental, veterinary, and nutrition schools for over a decade and has recently procured the \$100M STOP Spillover grant from USAID; and *Water* has a nearly two-decade history of multidisciplinary research, scholarship, education, and civic engagement across several Tufts schools.

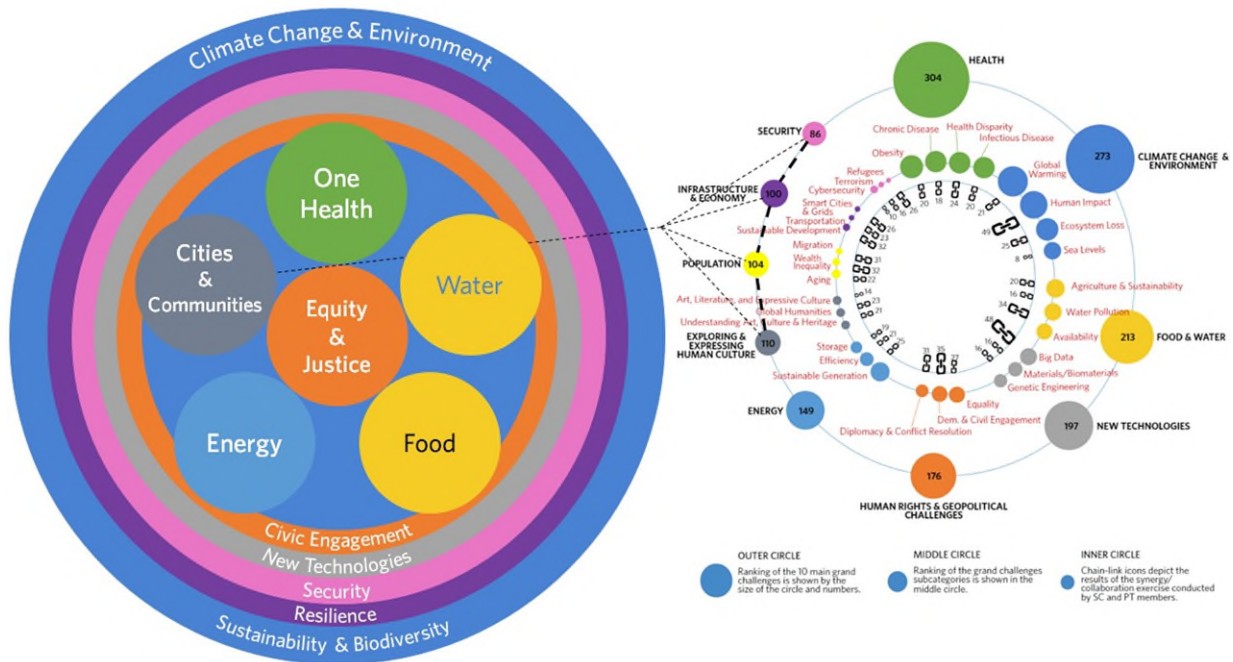


Figure 1. Tufts' Major Areas of Strength with cross-cutting themes (left). For the sake of comparison and legibility, the Major Areas of Strength and cross-cutting themes are color coded and located in a manner that is consistent with the Grand Challenge Areas as represented on page 12 of the Tufts Research and Scholarship Strategic Plan (RSSP) (right) (Tufts, 2018).

The remaining Major Area, *Energy*, has been a part of the Tufts culture for some time, however, it has often been subsumed under initiatives related to climate and sustainability. For instance, in 2011, the School of Engineering declared *Sustainability* to be one of its cross-cutting strategic areas (Tufts SOE, 2011), and within that area, the school engaged in an energy-cluster hire of six faculty across all departments.

With the global recognition that we must complete our transition to a net-zero economy by 2050, largely through the decarbonization of our cities, *Cities & Communities* and *Energy* have emerged as Major Areas of Strength worthy of university-wide attention. For instance, one area of emerging research in this area includes the interconnections between human security, climate change, migration, and cities, involving scholars from A&S, Engineering, Fletcher, and Friedman. These interconnections are illustrated in Figure 1 by the mapping lines between several of the smaller Grand Challenge Areas on the right and the *Cities & Communities* Major Area on the left.

Recognizing that *One Health* and *Food* represent existing school-led initiatives, we recommend that the **Provost work with faculty to grow *Cities & Communities*, *Energy*, and *Water*** as Major Areas of Strength for transdisciplinary work across Tufts in research, scholarship, education, and civic engagement.

The Appendix provides brief descriptions of each Major Area, university-wide collaborators (including TIE), programs of interest at other universities, and the Task Force membership, process, and timeline.



## Opportunities for Transdisciplinary Collaboration

### Transdisciplinary Work and Convergence

The term *transdisciplinary* has emerged over the past decade as a form of collaboration between disciplines that goes beyond *interdisciplinary* or *multidisciplinary* research. It has become central to the National Science Foundation's (NSF) discussions of *convergence*, which amounts to a problem-focused or mission-driven approach to the collaborative intellectual enterprise (scientific, social, arts, and humanities) (NRC, 2014; NSF, 2018). No single discipline can solve the environmental challenges we face on a global scale. The disciplines must come together in a new way that results not only in novel solutions to specific problems but also in new fundamental knowledge. Collaborative work that yields such knowledge is transdisciplinary.

*Multidisciplinary research adopts tools and techniques from many disciplines to provide innovative solutions to problems. Transdisciplinary research transcends disciplines through transformative interactions that change the evolution of disciplines and create new fields at the intersection of disciplines.* (Ludstrom and Wong, 2013)

Transdisciplinary work unfolds on the boundaries between disciplines and, in the context of transdisciplinary work, the word *boundary* has taken on the specific meaning not of enclosing, but in opening up the possibilities for entirely new kinds of knowledge. The literature of convergence identifies boundary organizations, such as universities, which

*Are seen as neutral parties and facilitate and supply technical information to public policy decision-making processes that address Earth-scale and regional-scale environmental and energy system issues.* (Tonn et al., 2013)

Understanding Tufts University as a boundary organization clarifies our mission as more than a center for knowledge creation, preservation, and sharing. The knowledge must also serve the good of society and the University must act as an honest broker who can help the public and private sectors use knowledge correctly to meet environmental and social challenges. Trust is paramount. Knowledge on its own can be misunderstood and misused. In the context of the global climate crisis, therefore, the University can offer what no other sector of society can provide: expertise that is impartial and shared in good faith. Understanding that we ultimately owe our unique position to the public trust, it is clear that the University has a vital role to play as a boundary organization, which nurtures and supports transdisciplinary work in the service of society.

Central to the role that boundary-crossing plays in *convergence*, the concept of a *boundary object* is helpful in connecting together the great challenge of finding solutions through transdisciplinary work with the physical reality of environmental problems that are so obvious, they can be recognized by all.

*Boundary objects are both adaptable to different viewpoints and robust enough to maintain identity across them.* (Star and Griesemer, 1989)

A discussion within the Task Force about toothbrushes provides a useful example and points toward a broader lesson. Toothbrushes are ubiquitous and sit at the nexus of health, sustainability, and even intercultural literacy. They therefore serve as useful boundary objects in the convening of larger transdisciplinary conversations. The goal of giving everyone in the world a toothbrush provides health benefits, but also raises concerns about enormous amounts of plastic waste. Cleaning teeth can be accomplished using other mechanisms, like miswak (Jamaica), miswaki (Swahili), and neem (India) - a tree that makes a natural toothbrush - the 'stick toothbrush.' Thus, this problem can be thought about both in terms of the polymer chemistry of biodegradable toothbrushes, but also culturally in terms of world-



wide dental care practices. The toothbrush works as a boundary object to ground multiple disciplinary perspectives in the real world.

In every school, Tufts is connected to the real world in ways that can be leveraged to increase the relevance of our scholarship and inspire the relevance of our education. It is critical to create and strengthen new lines of scholarship that are use-inspired and mission driven, e.g., clean water, global health, just sustainabilities, racial equity, the energy transition, and prevention of climate-induced humanitarian crises. Taking their inspiration from the real world, these lines of scholarship are not cordoned off within a single discipline, rather they naturally cross disciplinary boundaries. The traditional 20<sup>th</sup> century structure of the university, traditions of evaluation and promotion, and incentive structures have made it hard for faculty to work across disciplinary lines (NRC, 2014). Nevertheless, several Tufts faculty have developed relevant scholarship that does cross disciplinary lines. It is critical for these faculty to share their stories and to co-develop a system of recognition and reward that enables transdisciplinary creativity.

### Strengthening Transdisciplinary Collaboration at Tufts

Achieving the goals we have articulated above will require substantial effort and hard work across departments and schools. We see several opportunities for the Provost to encourage and strengthen transdisciplinary collaboration at Tufts:

- Study and implement best practices for transdisciplinary tenure and promotion processes (NRC, 2014, p. 75);
- Create new faculty positions in the context of transdisciplinary programs;
- Develop simple business models that support transdisciplinary work;
- Create pathways for course and curriculum innovations that can be developed and evaluated from a transdisciplinary point of view; and
- Support the creation of new faculty lines in departments with high student-faculty ratios to free up faculty for non-discipline specific teaching.

Tufts comes to this discussion with distinct strengths that include:

- Our size as a small research university where faculty from different departments and schools can easily intermingle on the Medford (A&S, Fletcher, SOE, Tisch), Boston (Dental, Friedman, Medical), and Grafton (Cummings) campuses; and
- The fact that our undergraduate and graduate students can seamlessly move between Engineering and A&S, thereby encouraging synergies between the schools.

### Education for Convergent Problem Solving on the Technology | Policy Interface

Central to the Provost's charge is the question of education, which forces faculty to confront the difficulties of helping students synthesize knowledge across domains. This subsection provides language based on a previous NSF graduate traineeship proposal by Tufts faculty to educate Science, Technology, Engineering, and Math (STEM) students together with students in policy and social sciences in the Major Area of *Energy*.

Transdisciplinary education requires a language for problem formulation that supports effective communication between different disciplines (Murray et al., 2019). Essential to this language is a pedagogy that conveys the creative and practical ramifications of identifying an appropriate level of model complexity for a given situation (Transtrum et al., 2018). STEM professionals must be able to judge when a simple model will advance research and communication and when a complex model is warranted. Likewise, business and policy professionals must be able to judge the usefulness of a given



numerical model. A shared vocabulary is critical both for the formulation of problems, and for the communication of results to decision makers and diverse stakeholders.

Notwithstanding their rigorous technical training, STEM graduates often lack preparation to solve open-ended, complex problems that they encounter in the workplace (Jonassen et al., 2006). Computational power both enables this potential, by simplifying the effort required for analysis, and obscures it by overstating and distorting the value of complex analysis. What gets lost amidst such distortion is the insight that “well-formed instrumental problems are not given but must be constructed from messy problematic situations” (Schön, 1983, 47). Within their formal education, STEM students experience complexity as a challenge to their knowledge, thus stimulating them to dive ever deeper into their discipline, or to simply trust the computer. Experienced mentors can encourage students to create simple conceptual models, described with numbers, to get into the right ballpark before attempting to develop more accurate answers. Besides helping students develop a feeling for the problem at hand, such simple models also enable high-level discussions regarding external facts and circumstances.

Key historical examples present astoundingly simple and accurate calculations for critical engineering innovations (Billington, 1979). These suggest a path for the rigorous use of case studies and simple calculations in interdisciplinary STEM graduate education. Engineers working alone often miss important social, political, and economic constraints that can drive a design, while regulators and decision makers working alone often miss the creative potential inherent in different technical approaches to the same problem.

In each Major Area of Strength proposed, there is strong potential for an approach to education that provides a common curriculum of three to four courses across schools that integrates the scientific, social, artistic, and humanistic aspects of our transdisciplinary work.

## Tufts’ Campuses as Living Laboratories

Our own Tufts campuses and university community can be “living laboratories” for the principles discussed in this report. A robust partnership of local and global focus can contribute to all three domains in this report’s strategy:

- In research and scholarship, funded programs with global implications can benefit from local applications and opportunities for piloting ideas;
- In education, students gain from working with faculty on campus issues, enhancing depth and excitement in teaching about climate and the environment; and
- In civic engagement, living out the principles we preach strengthens Tufts’ ethos of moral leadership and attracts and retains students and employees.

A sustainability peer review in 2020, sponsored by the Provost’s office in collaboration with the Executive Vice President, emphasized the need for such partnership:

*Tufts has deep roots in sustainability and a few stunning examples of research, practice, and collaboration; however, we were left with the impression that these elements are not working as well as they could be toward a clear vision of sustainability, or toward a sense of collective global impact. We ... believe more joined-up work, collaboration and messaging could raise Tufts’ profile and demonstrate significant impact. (Tufts-SPR, 2020)*

Several successful examples related to Tufts’ campuses serving as living laboratories already exist, from the formal (Advanced Project Management course offered by the Gordon Institute) to the informal (student-initiated campus-based projects). However, the structural mechanisms established to ensure projects align with organizational strategy, realize academic outcomes, and adhere to operational standards are sparse. Creating and maintaining sustainability initiatives and ensuring they feed into each



other over time and through multiple challenges requires dedicated energy and resources. The benefits to the student experience are significant and there is potential for benefit to university operations as well. For example, the procurement of carbon-free energy for the university is a multi-million dollar decision that would benefit from the input of Tufts faculty who are well versed in energy policy and climate science. These faculty, along with students, can help Tufts develop goals and priorities for climate action in our own community that align with Tufts' ethos of justice, diversity, equity, inclusion, and civic engagement.

## Recommendations

The Task Force would like to offer the following recommendations to the Provost:

1. To support Major Areas for Research, Scholarship, Education, and Civic Engagement, the Provost should:
  - a. Establish *Cities & Communities*, *Energy*, and *Water* as Major Areas for transdisciplinary focus within Tufts for research, scholarship, education, and civic engagement;
  - b. Designate TIE as a focal point to facilitate the activities of faculty within each of these areas beginning in Fall 2021 with the goal of identifying their campus communities, external partners, leadership structures, near term goals for center-level convergent research, campus-wide educational plans, and plans for civic engagement; and
  - c. Work with faculty leaders in each Major Area to determine goals, a multi-year timeline, and a budget for pursuing center-level activities.
2. For the purpose of promoting transdisciplinary work on climate change and the environment, the Provost should work with the Deans to:
  - a. Address the challenges of attribution, evaluation, tenure, and promotion for faculty focused on transdisciplinary research and education;
  - b. Develop cluster hires and bridge professorships in these areas, and provide resources to develop 21<sup>st</sup> Century transdisciplinary educational content and practices; and
  - c. Enable clear paths for cross-registration between schools and explore the potential for putting more schools on the same calendar and footing for sharing students.
3. In order to enable the Tufts Institute of the Environment (TIE) to convene and support these activities, as well as its broader mission, the Provost should:
  - a. Consult with members of the faculty on appointing a new director for TIE;
  - b. Work with the Office of Sustainability (OOS) to convene a working group, *Campus as a Living Laboratory*, tasked with echoing themes from the left-hand side of Figure 1; and
  - c. Establish as a high priority the goal of seeking a major gift to support TIE and the three Major Areas of Strength prioritized in this report.



## Appendix

### Cities & Communities

*Cities & Communities* are a Major Area of Strength across Tufts' Schools. As the site of habitation for most humans on the planet, cities are a locus of policy making and planning around Tufts' four other Major Areas of Strength and transdisciplinary expertise: *Energy, Food, One Health, and Water*. Cities are also leading the fight against climate change. [Cities@Tufts](#) is a cross-disciplinary academic initiative which recognizes Tufts University as a leader in urban studies, urban planning, justice, and sustainability issues. Anchored by UEP, it aims to highlight our impressive contributions in community strategy, civic democracy, ethnographic research, big data analytics, urban and community health, food justice and security, urban politics and economics, social inequalities and GIS. Cities@Tufts works with students, academics, policymakers and planners, businesses and community stakeholders to develop cross-disciplinary and cross-sector collaborative and community-based research. It aims to develop solutions to today's urban challenges and opportunities based not on presupposed notions but on being critical: first asking the right questions.

Coastal communities are directly and indirectly impacted by climate and Tufts is positioned to be a leader locally, nationally, and internationally. Tufts has locally and nationally known expertise in urban air pollution monitoring, modeling and health-impacts research. With funding from NIH, HUD, EPA and other organizations, Tufts faculty and students from the Schools of Engineering and Medicine have collaborated on research to better understand exposures to pollutants and environmental stressors that are uniquely elevated in cities. Climate change predictions for the coming decades suggest that more frequent and longer duration heat waves and heat-related air pollution episodes will be common in the future. Tufts researchers in the Schools of Medicine and Engineering – along with community partners in the Boston area – have begun to develop collaborative projects around urban heat and expect to write successful proposals to agencies such as NOAA (where one proposal is currently pending) and NIH in the next 1-2 years.

### Energy

With the precipitous decline in the costs of wind energy (70%) and solar PV (90%) in the last decade, it has become clear on a national scale that these two technologies will be central to any national plan to achieve net-zero emissions (NASEM, 2021). These developments within the global marketplace, combined with the *U.S. Executive Order on Tackling the Climate Crisis at Home and Abroad* (U.S., 2021) and the recent White House announcement of a \$2 trillion infrastructure bill (Parlapiano and Tankersley, 2021) including: \$46 billion for clean energy manufacturing, \$40 billion for research infrastructure, \$35 billion for climate technology, \$52 billion for domestic manufacturing, \$50 billion for supply chain support, \$48 billion for work force development, and \$20 billion for community investment, have made the energy transition to a net-zero economy a central part of U.S. efforts to combat climate change.

The energy transition is not just an issue of technology but one of policy, civic engagement, and biodiversity as well. As governments move forward with plans for massive spending on infrastructure and climate technologies to achieve a transition to low carbon energy, it is critical that this effort not only deliver solutions for clean energy but do so in a manner that promotes inclusive economic growth, reverses the toll of historical environmental injustices to underserved communities, and sustains equitable, forward looking economic development. In policy evaluation, new frameworks and evaluative tools are required to ensure that the energy transition produces lasting and dignified jobs at home while alleviating conditions of poverty and strife in the developing world likely to become more severe due to climate change. Tufts unique capabilities in policy evaluation and social justice lay the groundwork to serve as a source for important work in this area.



In addition, to fully protect natural ecosystems, siting of infrastructure such as solar and wind must be made in consultation with local stakeholders (such as fisherman and tribal communities) and be consistent with laws designed to protect endangered species. As importantly, humanity's dependence on biodiversity further highlights the need to be aware of how our actions impact the viability of populations and communities of interacting organisms. Systems have to be built to sustain wild populations and to enhance the resilience of human, managed and natural systems.

### Energy Policy and Planning

Such a major transition of the U.S. energy system, as envisioned in the energy section above, will require substantial changes in U.S. energy policy, both at the federal and the state level. Tufts is well positioned to provide leadership in assessing current policy, potential future policies, and barriers to policy reform. Arts & Sciences has particular strengths in the Departments of Economics and Urban and Environmental Policy and Planning, among others. Fletcher has particular strengths in the Center for International Environment and Resource Policy (CIERP), the Climate Policy Lab, and the Maritime Studies Program.

Tufts has created a new doctoral program in Economics and Public Policy, that is offered jointly by A&S and Fletcher. Currently in the 4th year of operation, this program received 255 applications for 5 slots for the coming year, making it the most competitive doctoral program at Tufts. The program is unique, and a recent external evaluation suggested that it be increased in size. It trains students to use economics to address public policy issues both in developed and developing countries. Currently two fields are offered, development and environment. TIE has been a valuable asset to this program, offering TIE Fellowships to several students for their doctoral research and space to house them as well.

The Fletcher School has added a new 16-month master's degree program in Global Affairs that includes a required major practicum in a select field of study. Two of the fields allow for concentration related to climate and energy. The two subfields that include multiple courses on energy and climate or energy and technology (including cyber security) are International Development and Environmental Policy and Technology and International Affairs and cover topics related to decarbonization policies. A substantial number of faculty at Fletcher teach master's level courses with a focus on climate, security, and energy and/or the intersection of all three.

### Wind and Wave Offshore Renewable Power Systems

Since 2008, Tufts faculty have been involved in the offshore wind industry, designing the infrastructure that established Massachusetts as a leader in the U.S. industry. Tufts researchers are at the forefront of transmission expansion planning for offshore wind power, wave power, and the energy transition in general. Anticipating significant growth in these new industries, for which Boston has become a major hub, Tufts has worked to establish itself as a leader in the U.S. offshore renewables research space since 2015, leading the Partnership for Offshore Wind Energy Research (POWER-US, 2018). Since this time, offshore renewables research at Tufts has grown to include both wind and wave energy and to comprise \$5+ million in Tufts-led projects situated within \$14+ million in affiliated team science projects.

The research and scholarship, educational, and civic engagement activities of the offshore renewables program are organized within an emerging *Center of Excellence* framework for *Offshore Wind Infrastructure, Supply Chain and Transmission* connected to cutting edge research in ocean science, policy, and maritime affairs. Current *Equity & Justice* and *Civic Engagement* activities include international collaborations on occupational health and safety, U.S. job creation, and pathways programs for black, indigenous, and people of color (BIPOC) students in partnership with major multi-national corporations.



## Solar Photovoltaic and Thermophotovoltaic Renewable Power Systems

While the history of solar photovoltaic research at Tufts goes back several decades, the research entered a new phase starting in 2008 with a cluster hire of new faculty. Tufts researchers are developing new photovoltaic materials and systems for terrestrial use through programs funded by NSF, DoD, and DoE. Additional photovoltaic systems are being developed for space and other planets (e.g. Venus) through programs with NASA and the intelligence community (e.g. CIA, NRO, DIA). The Tufts Epitaxial Core (TEC) Facility, opened in 2018, is one of the few facilities in the world that can create the research grade materials needed for some of these next generation PV and TPV devices. Tufts students are highly interested in solar panels as a technology and have participated in solar home competitions at the national level and have formed companies based off of their capstone projects related to photovoltaics.

Thermophotovoltaics (TPVs) are a less well-known cousin to solar photovoltaics. Whereas solar PV converts visible and UV light into electricity, TPVs convert heat (infrared light) directly into electricity. TPVs can replace the electromechanical systems that power plants have used for the last century with a solid-state system without moving parts. Additionally, TPVs can harvest the nearly ubiquitous waste heat from modern devices (e.g. cars, computers, furnaces, even humans) and convert it back into electricity to reduce power generation demand, as well as HVAC requirements. This could be a critical step in creating a net zero GHG emission society.

The solar PV and TPV work at Tufts crosses multiple departments/schools and extends beyond basic research and into the social justice issues of power generation directly. Solar panels are an easy technology to apply to social justice issues related to clean and accessible power. Solar panels are innately scalable from rooftop solar on individual houses/buildings, to neighborhood, to grid level power. Rooftop solar with battery storage can mean energy independence for homes and neighborhoods. Additionally, solar thermal systems have recently been shown to be the cheapest option for 24/7 power generation in some regional environments and directly competitive in all but the most northerly environments.

## Food

*Food* has a central focus at Tufts within the Friedman School of Nutrition, founded in 1978, which is ranked globally among the top schools of its kind (Friedman, 2021). Faculty within the Schools of Arts & Sciences, Cummings School of Veterinary Medicine, Engineering, Fletcher School of Law and Diplomacy also work on critical issues in the food system. There have been substantial efforts to find synergies among the schools. Undergraduate and graduate students frequently cross enroll in courses. Tufts undergraduate students, for example, take courses in nutrition and in agriculture policy, Friedman students take Food Justice: Critical Approaches in Policy and Planning taught in UEP. Undergraduates and graduates from Arts & Sciences, Cummings, Engineering, Fletcher, and Friedman often co-enroll in *Food for All: Ecology, Biotechnology and Sustainability* a course taught in the Department of Biology.

The Agriculture, Food, and Environment (AFE) program at the Friedman School has longstanding partnerships with TIE, the Tisch College, and the water systems programs (including WSSS and SWM). Friedman has hosted the MS in Sustainable Water Management (SWM) and has longstanding links to the Water Systems, Science & Society (WSSS) program, fostering collaborations across sectors and schools. The AFE program draws on nutrition, sustainability, agricultural science, environmental studies, and public policy principles to address ecological, political, economic and social aspects of food production and distribution (<https://nutrition.tufts.edu/academics/degree-programs/agriculture-food-environment>).

Several topics related to climate and the environment have potential for development into substantial center-level research centers with opportunities for cross-fertilization with education and civic engagement in the spirit of this report. Two examples illustrate the potential:



- *Sustainable Dietary Guidelines.* Friedman School faculty have been involved for decades in the development of the Dietary Guidelines for Americans (DGA), an important document released once every five years by the federal government as the basis for federal nutrition policy. Friedman School faculty and others from UEP, have played a leading role in national discussions of incorporating sustainability issues into dietary guidelines. An area of strength is research on the costs of healthy and sustainable diets.
- *International Food Systems Under Pressure from Extreme Events.* Faculty at the Friedman School and the Feinsein International Center (in collaboration with the Fletcher School) are recognized internationally for work on famines and food emergencies. Several of the key channels by which climate change may cause economic and social disruption involve the food system. There is potential for new center-level research related to cascading and compounding effects of climate change on agricultural breakdown, famine, and migration.

## One Health

*One Health* is a collaborative, multisectoral, and transdisciplinary approach—working at local, regional, national, and global levels—to achieve optimal health and well-being outcomes recognizing the interconnections between people, animals, plants and their shared environment (definition from One Health Commission and CDC). As eloquently explained by current DVM/MPH student Evan Griffith, who holds a leadership position with the International Student One Health Association,

*at its core, One Health... is rooted in understanding the interdependence of human and natural systems and promoting interdisciplinary collaboration. Some of the global issues One Health works to address include environmental contamination, habitat use conflicts, biodiversity loss, emerging infectious diseases, antimicrobial resistance and ecosystem function degradation. In addition, the social determinants of health (e.g. socio-economic status, education, neighborhood and built environment, social and community context) play a critical role in health and thus, there's a strong social and environmental justice aspect to One Health.*

Tufts University has a long history of visionary leadership and programmatic development in *One Health*. The health sciences professional schools were founded on the One Medicine principle, an earlier name for what is now called *One Health*. Until the Veterinary School campus was fully developed, the Boston campus hosted the Medical, Dental, and parts of the Veterinary School programs. Foundational courses such as physiology and histology were team taught by faculty members from across the professional schools to unified classes from all programs. This novel approach created a shared understanding of the commonalities and relationships among humans and other animals and helped to break down traditional disciplinary siloes. Other *One Health* relevant programs unique to Tufts include the Center for Conservation Medicine and associated MSc in Conservation Medicine, and components of the work of the Tufts Institute for Human-Animal Interaction, Tufts Clinical and Translational Science Institute, and many grant-funded projects and programs.

Current *One Health* activities at Tufts University include the \$100 million USAID project, STOP Spillover, involving faculty from all of the Tufts professional schools as well as the School of Arts & Science (A&S) and the School of Engineering (SOE). Tufts, and specifically the Cummings School, has been a key partner in USAID projects using a *One Health* approach to address emerging zoonotic infectious diseases since 2009. There is no doubt that the successful bid for the STOP Spillover project would have been impossible without the long term, trusting, synergistic relationships that were formed among the diverse Tufts University school and faculty members over time. There is a significant opportunity to leverage the deep history of *One Health* at Tufts and the current One Health-relevant projects to create additional opportunities around energy and the environment.





Tufts University School of Dental Medicine (TUSDM) has long term community service outreach efforts. Oral health promotion, prevention, and disease management programs have been active in Africa (Zambia, Rwanda), South America (Peru) and the Caribbean (Jamaica, Haiti, and the Dominican Republic). The programs provide access to communities, Ministries of Health and Educational Institutions. We have not fully explored the leveraging these relationships from the perspective of integrating information in our programs regarding energy and the environment. TUSDM also reaches large population groups domestically and is the second largest dental school in the U.S.

## Water

Global demand for water is intensifying due to the growing needs for agriculture, energy production, industry, and cities. The United Nations' Sustainable Development Goals directly refer to water in Goal-6, "to ensure the availability and sustainable management of water and sanitation for all." However, water quality and quantity weave through all seventeen goals, from gender equality to health and well-being, from zero hunger to peace, justice, and strong institutions. Water research and education play a fundamental role in national and global development. Understanding and solving complex water-related challenges require an interdisciplinary approach, both in scholarship and in practice.

Currently, the world is facing droughts, water distribution inefficiency, outdated urban water management systems, flooding, systemic water quality issues, degradation of water resources, water policy deficiencies, and conflicts over transboundary water rights. These deficiencies intensify with the impact of climate change. Socially vulnerable communities, such as communities of color, low-income communities, women, indigenous people, and people with disabilities, are disproportionately impacted by the lack of adequate water policies, management, and infrastructure. Water is instrumental in linking social and environmental justice; it intersects with energy, food, one health, security, and agriculture.

Water-related research and training are routinely supported on the federal level by NSF, NIH, EPA, USDA, NOAA, USGS, among others. Earlier this month, the Biden Administration declared a historic \$2 trillion investment plan that is poised to significantly impact climate and environmental research. The plan includes funding for infrastructure modernization across the country, as well as for research in the climate and environmental areas. One of President Biden's top priorities is upgrading the United States' aging water infrastructure with an intended investment of \$111 billion over the coming years. The plan centers on environmental and social justice, and it aims for greater equity to benefit disadvantaged communities across the country. Notable are several across the board initiatives designed to bolster climate technology research and development, research infrastructure, climate resilience, and resilient infrastructure. Significant investments in R&D and the creation of jobs are also expected as part of the energy transition plan. This includes investments in hydropower plants that currently makes up 22% of the renewable energy sector, third after biomass (43%) and wind (24%).

At Tufts, *Water* has been identified as a Major Area of Strength, central to two of the top two grand challenges developed by OVPR in 2018: 'Water and Food', and 'Climate Change and Environment.' Water crucially intersects with many of the remaining Grand Challenge Areas and their subcategories, including Global Warming, Human Impact, Ecosystem Loss, Health, Agriculture, Sea Levels, and others. It was recognized as one of Tufts' priority areas under the Climate, Food and Energy group: the water-food-energy nexus.

## Water Research at Tufts

In the last 35 years, every University President— Drs. Mayer, DiBiaggio, Bacow, and Monaco— has furthered Tufts' commitment to environmental research and activities in general and to the field of water specifically. Notable initiatives include: the establishment of a university-wide Sustainability Council to examine the areas of water, waste, and energy, the convening of the Thematic Area Working Group on Water (TAWG), the establishment of the educational programs, WSSS and SWM, the identification of water as a priority area in the Research and Scholarship Strategic Plan (RSSP), and the convening of the



Energy and the Environment Task Force. These initiatives render Tufts a global leader in *Water* research and education.

Tufts faculty leadership in *Water* research has been strengthened and sustained by a number of unique facts: Tufts' long-standing commitment to the environment; the University's relationship with the Mystic River watershed; the establishment of the Center for Environmental Management's (CEM), the Department of Civil and Environmental Engineering, and the Urban and Environmental Planning and Policy Department; and the excellence and global reach of the professional schools, among others. Tufts has demonstrated research strengths in six main areas: Water, Climate, and Environmental Change; Water and Public Health; Water Pollution and Remediation Science; Watershed Management; Water, Food, and Livelihood Security; and Water and National and International Security. (TAWG Report, 2015)

In the early 2000s, Paul Kirshen (SOE), Beatrice Rogers (Friedman) and Richard Vogel (SOE) led the research effort at Tufts on Integrated Water Resource Management (IWRM). This group assembled like-minded faculty from across the university to identify gaps and challenges in IWRM research and education. Among the main challenges for universities was the siloed nature of schools and departments, constraining the integrative work in groups, including in the field of graduate training. In 2010, William Moomow (Fletcher) and Shafiqul Islam (SOE) received a five-year NSF grant (IGERT) of \$4.2M for the interdisciplinary training of doctoral students in Water Diplomacy. The program trained 14 students in total, who received their degrees from: Fletcher (2), CEE (7), Biology (1), Friedman (2), and the Interdisciplinary Doctorate Program (2). Many faculty members are working directly or indirectly on *Water*. They are mainly associated with the following units: Civil and Environmental Engineering; A&S (Biology, Economics, UEP); Fletcher (CIERP); Friedman; and the Medical School (Public Health).

In 2012, President Monaco charged The Thematic Area Working Group on Water (TAWG) to investigate *Water* as one of several cross-school themes which, if pursued rigorously, would position Tufts especially well for continued academic excellence and international leadership. In its 2015 report, TAWG made nine recommendations:

- (1) deploy the TIE/WSSS budget to create a new water-focused institute for interdisciplinary water research and education, in line with successful models at other institutions;
- (2) charge the director and the steering committee with a strategic planning effort for the new institute;
- (3) charge the director and the steering committee with developing a new charter for the institute;
- (4) establish an external board for the new institute;
- (5) form working groups to look at educational opportunities and a master's program;
- (6) commit seed grants for development of interdisciplinary research;
- (7) work on fundraising with Corporations and Foundations Relations Office;
- (8) identify and fund bridge professorships/cluster hires in strategic target areas, identified by the Steering Committee; and
- (9) identify key international partners to provide collaboration opportunities for faculty and students.

A number of the recommendations have been implemented since 2015.

### Water Educational Programs at Tufts: Training Water Professionals

Tufts has been a leader in *Water* education both nationally and globally. Under the Provost's Office, Tufts Institute of the Environment (TIE) leads interdisciplinary academic graduate water programming through two programs: the Sustainable Water Management (SWM) MS program, launched 2018, and the Water: Systems, Science, and Society (WSSS) certificate program, launched in 2004.

#### *Sustainable Water Management (SWM) MS Program*

SWM is a twelve-month program aimed to train interdisciplinary water professionals to address complex and multifaceted water challenges domestically and globally. The structure includes co-taught, unique



core courses, track-based electives, and a real-world practical experience during the summer. It is designed to give the students a strong background in water science and systems, policy and economics, quantitative and qualitative research methods, and soft skills, such as leadership and teamwork. Drawing on Tufts' cross-school expertise as well as the demands of the profession, the SWM program developed four unique tracks: water infrastructure for human settlement; water-food-energy nexus; water diplomacy; and water, sanitation, and hygiene (WASH) in international development and humanitarian response. The SWM program was developed at TIE under the leadership of Director Linda Abriola. The program has a large body of faculty from various Tufts schools as well as external recruits, who took on the roles of instructors and track leaders. Stockholm Environment Institute (SEI) partakes in the course instruction.

### *Water: Systems, Science and Society (WSSS) Certificate Program*

The primary mission of the Water: Systems, Science and Society (WSSS) graduate research and education program is to prepare Tufts graduate students to address the challenges affecting water resource management and to create a thriving intellectual community at Tufts, dedicated to addressing these challenges in an interdisciplinary manner. Approximately 45 faculty members from all Tufts campuses have been associated with the WSSS program over its lifetime. The program has over 200 graduates and is used in departments' and programs' marketing and recruitment efforts. For example, the WSSS program has been a significant factor in the recruitment and retention of many graduate students across the university. After winning an internal competition, the WSSS program was selected by the Provost's Office as a program worthy of university-wide support. It was funded by the Provost's Office between 2004 and 2015. In 2015, WSSS was incorporated into TIE and added to the overall programmatic portfolio of the institute.

## Environmental Education at Tufts

Interest in the environment among students, both at the undergraduate and graduate level, is strong within the School of Arts & Sciences and the School of Engineering. These students are highly motivated to be change-makers and engage in research and extra-curricular activities (e.g., internships, environmental activism, special projects). Through TIE, there is a great opportunity to work with existing units to connect faculty, centers, and programs with motivated students.

Within A&S, many undergraduate students with an interest in the environment major in or co-major with Environmental Studies (ENVS). ENVS is an undergrad student-centered program. Dr. Colin Orians, Department of Biology, became director in 2010 and his charge was to expand the program, revise the curriculum, and increase its visibility among students, faculty, alumni and our host communities. It has seen a 223% growth in student enrollment in the last decade and is now viewed as a signature interdisciplinary undergraduate program within the University. Its success has benefited from (1) substantial investment from the Deans of Arts & Sciences through cluster hires and fund-raising, (2) a strong network of faculty across the university that have collaborated on teaching, research and campus-wide events, (3) the launch of a weekly Environmental Lecture Series in 2011 (renamed the Hoch Cunningham Environmental Lecture Series thanks to a generous gift from two alumni), that features presentations by Tufts and non-Tufts faculty and practitioners (many of whom are alumni in leadership positions), and (4) the building of strategic partnerships. Partnerships with TIE, OOS, UEP, Tisch College, Career Services, Friedman, and the School of the Museum of Fine Arts (SMFA) have served to bridge the schools, connect students to research, and to build new programs. For example, ENVS helped create a 4+1 program with UEP that we view as a model for other such programs.

ENVS majors are highly diverse in terms of disciplinary backgrounds, typically co-majoring in one of about 25 different disciplines in any given year. The most common co-majors are Biology, International Relations, and Economics. Other common pairings include Sociology, Architectural Studies, Community Health, and Earth and Ocean Sciences. About 65-75% of majors are evenly split between Track I Environmental Science and Track II Sustainability, Policy and Equity. Track III Environmental



Communication, Track IV Food, Nutrition and the Environment, and Track V Environmental Humanities all have steady enrollments. A future programmatic goal is to link students with researchers in these disciplines across the University.

At the graduate level, UEP has a strong tradition of practice-based education that emphasizes sustainability and green environmental solutions. UEP is the top Masters only urban policy and planning program in the US (Planetizen 2021). UEP's mission is centered at the intersection of planning, policy, justice, and sustainability. UEP offers 4 Masters programs *Master of Arts in Urban and Environmental Policy and Planning*, *Master of Science in Environmental Policy and Planning*, *Master of Public Policy* and a *Master of Science in Sustainability*.

UEP has partnered with many other departments to develop joint programs. UEP offers Joint Masters degrees in *Environmental Economics and Urban Planning and UEP/Engineering*. The joint Masters program with Economics, for example, highlights the synergies can be brought to bear by combining the discipline specific tools of these two departments to study and propose solutions to environmental problems. UEP also offers [dual degrees](#): *UEP/Fletcher*, *UEP/Nutrition*, *UEP/Boston College Law School and UEP/Engineering*.

A second example of cross-cutting educational programming is the recent doctoral program in Economics and Public Policy, joint with the Fletcher School. This program has identified Energy and Climate as one of its three broad focus areas (along with Development and Political Economy) and applicant interest in the program is strong (see earlier mention in this Appendix for more details).

Within SOE, students with interest in the environment typically major in Environmental Engineering, Civil Engineering, or Chemical and Biological Engineering. Of the three, Environmental Engineering is the most common route. The Environmental Engineering major at Tufts was approved by ABET in 1997, under the guidance of CEE Prof. Lin Brown (emeritus), and derived from strong student interest within the CEE department for there to be an independent and more focused major on environmental applications of engineering. Since its creation, enrollments in environmental engineering have increased steadily and are currently around 12-15 students per year. In addition to these majors, SOE also hosts the Environmental Science and Policy minor, which is restricted to SOE majors and is administered by ENVS. This minor affords SOE majors the opportunity to study aspects of environmental science in greater detail and to better understand how environmental policy works and the process of translating science into local, regional, and national policy. On average, between 5-7 SOE majors per year enroll in the minor. In addition to course work and research, SOE students with interest in the environment often conduct internships and participate in student organizations such as the ASCE student chapter, The Tufts Energy Group, and Engineers Without Borders.

## Sustainability

Students and faculty at Tufts have demonstrated their interest and passion around this subject through: the numerous calls for divestment of the endowment from fossil fuels; clubs related to environmental and social sustainability; and co-curricular opportunities like the sustainable living communities and internships and employment through the Office of Sustainability and external organizations. This reflects trends in the broader population. An increase in the general public's interest in sustainability has been evident, a 2019 national online survey in the U.K. found that 91% of students agree that their place of study should actively incorporate and promote sustainable development, while 81% say sustainable development is something they would like to learn more about, and 70% want sustainable development incorporated and promoted through all courses (SOS-UK, 2020). The Office of Sustainability at Tufts has employed over 270 students as year-long interns or Eco-Reps in the past decade and paid over 100 students last year alone to support sustainability initiatives on campus in some capacity.



On average, each year Tufts offers 450 courses in 109 departments related to sustainability writ large (across all schools) and there are at least 158 faculty doing research related to one or more sustainable development goals. Additionally, the University supports sustainability efforts through [public commitments](#) to carbon neutrality, resource conservation, and student education; an innovative sustainability-themed housing option for undergraduate students; the Office of Sustainability, which is dedicated to making the university operations more sustainable through culture change and operational improvements; infrastructure changes; governance structures such as the President's Sustainability Council; and funding mechanisms such as the energy revolving fund and the Green Fund. Actions related to sustainability occurs across departments, schools, campuses, and populations, linking students, faculty, and staff together around a common goal.

## Collaborators

### Data Intensive Studies Center (DISC)

The careful and comprehensive use of data science in tackling environmental and energy challenges has been fundamental to our understanding and effective action in these domains. Climate change analyses and adaptation strategy development with consideration of equity and justice while ensuring economic advantage require new tools for decision making. Tufts has recognized this opportunity and invested in such capacity. The Data Intensive Studies Center (DISC) and a developing AI center will provide invaluable leverage for the developing foci of activity in energy, water and the environment. The opportunity and challenge in this domain lies in the successful integration of models of physical, economic and social systems to guide investment and policy.

Examples of such activity are plenty. Tufts' Offshore Wind faculty and DISC are partnering on developing holistic approaches to renewable energy related research using aptly named digital twins that integrate physical systems models with data science methods like machine learning to provide predictive models. CEE faculty have a long and successful record of integrating data science methods in water resources research and disaster response.

### Office of Sustainability (OOS)

Tufts campuses represent a microcosm of civil society and work done to transition the operations of Tufts campuses into a sustainable and carbon-neutral organization parallel larger local, national, and international efforts. Connecting students to real-life challenges and solutions helps link university scholarship to students' experiences after they graduate, deepening learning and even enhancing the operations of the university.

The Office of Sustainability regularly facilitates the connection of faculty and students to the campus through targeted course projects, theses, and extracurricular activities.

The Office of Sustainability acts as a resource, catalyst, and advocate for sustainability at Tufts, often serving as the bridge between ideas and their practical application. It is the repository for information and data related to environmental sustainability efforts on campus. It reports publicly on Tufts progress towards its goals. It also facilitates community-informed planning and decision-making around Tufts goals and aspirations related to sustainability.

### Tisch College

Tisch College is the only college of its type in the country. Tisch is distinctive in that it conducts cutting-edge research about civic engagement and provides both academic courses and experiential opportunities for Tufts students that situate learning in the context of the community — which can be local, global, and everything in between. Research at Tisch College is highly interdisciplinary: it ranges from advanced theory to pragmatic applications and attracts research partners from across the university.





Tisch College research is funded externally— \$3.5 million in foundation grants, government awards, and individual donations this year. Tisch College spends approximately \$1.5 million annually to support faculty from around the university to teach, to conduct research, and to develop programs on different aspects of civic life.

Tisch College also provides academic programming and interdisciplinary opportunities for faculty collaboration within Tufts. It supports both the Civic Studies program and the program in Science, Technology, and Society (STS) as well as interdisciplinary spaces for student learning in and beyond the classroom. The Tisch Faculty Fellows Program brings together researchers and educators from across the university and aims to provide a space for faculty from a diverse variety of disciplinary backgrounds to workshop and integrate civic engagement into their respective projects.

Tisch College's expertise on civic engagement is relevant and important for environmental issues. Both the environment and our knowledge of it require civic engagement. People affect environmental policies and outcomes by way of civic engagement: by voting, boycotting, leading social movements and environmental activism, etc. In turn, environmental change affects and sometimes prompts civic engagement. An example is the stress that climate change creates for common-pool resources, such as fisheries, which must be sustained by human cooperation (Ostrom 1990; Ostrom 2002; Hess and Ostrom 2007). Both Civic Studies and STS address issues like this.

Knowledge about the environment is also a shared resource that depends on civic inputs, ranging from courses in K-12 schools to systems for digital earth imagery (Levine 2007). How we share our knowledge across disciplines, develop common vocabulary, and engage the public in knowledge-creation are all fundamentally civic issues as well.

Tisch College has a special expertise on harnessing civic engagement to implement environmental policies, not just to analyze them or advocate for them. This is captured in our CivicGreen project: <https://sites.tufts.edu/civicgreen/>. CivicGreen is the leading national source on that particular topic, and brings together writers, researchers, natural resource managers, and political organizers from across the country.

### The Tufts Institute of the Environment (TIE)

The Tufts Institute of the Environment (TIE) is an interdisciplinary institute that initiates, facilitates, and promotes interdisciplinary environmental education, research, and outreach at Tufts. Started in 1998, TIE is strategically positioned under the Office of the Provost to bring together students and faculty from across the university to address critical environmental challenges. Through its multiple programs and initiatives, TIE creates environmental research spaces, discussion platforms, and leadership forums that allow students and faculty from across the university to meet, share ideas, and find common purpose in the pursuit of lasting solutions to pressing environmental problems.

TIE's programs and initiatives offer research and educational opportunities to undergraduate and graduate students as well as to faculty. Among these programs are: the TIE Graduate Fellowship program, TIE-SEI Fellowship program; Tufts' Energy Conference; Tufts' delegation to the United Nations' Climate Negotiations; TIE Venture Grants; Travel Grants; Faculty and Alumni Awards; TIE Speaker Series; and the WSSS Water Symposium. These programs are offered annually by TIE.

TIE has a history of incubating graduate education opportunities. TIE launched the Water: Systems; Science, and Society certificate program (an interdisciplinary certificate available to all matriculated graduate students at Tufts), helped design the Conservation Medicine Program at the Cummings School, and launched a unique Master's program in Sustainable Water Management (SWM). The SWM program's four tracks leverage strengths within Tufts: WASH, Water Diplomacy, Infrastructure, and the





Water-Food-Energy Nexus. In the past three years, SWM enrollment rates have grown steadily and the quality of applications have continuously increased.

TIE has also helped to establish collaborations with external partners. For example, in the last four years, TIE has led Tufts' partnership with the cleantech accelerator, Greentown Labs, creating unique research opportunities for the Tufts community. In 2016, TIE revitalized Tufts' MOU with the Stockholm Environment Institute (SEI) and strengthened the partnership. As a result, SEI scholars are now more integrated in the faculty body, which allows them to bring real-world experience to the classrooms. In addition, TIE and SEI established a fellowship program, offering graduate students the opportunity to partake in development projects in the fields of energy, food, water, and public health.

Through its involvement with Tufts students and faculty and partner organizations, TIE is committed to the pursuit of a just and sustainable future, with the guiding principle that environmental challenges related to energy, water, biodiversity, health, and food are complex, interconnected and require interdisciplinary thinking and approaches.

### Tufts Interdisciplinary Advanced Materials (TIAMAT) Center

Dramatic technological progress tends to be preceded by significant discoveries in materials. This fundamental importance of materials research is recognized by the outsized participation in materials research at Tufts. Uniting over 50 materials researchers at Tufts spread over nine departments, the TIAMAT Center is an example of how transdisciplinary research is central to the Tufts research model. Created in 2015, alongside a new MS program and a joint-PhD, the center has driven multiple center proposals and is presently preparing for the next set of large materials-oriented center RFPs; e.g. NSF-MRSEC. A significant area of overlap between *Energy* and TIAMAT is in the area of Energy Materials.

### Programs of Interest at other Universities

The following programs were suggested by Task Force Members as potentially of interest to the future work of TIE in facilitating work in the Major Areas of Strength identified in Figure 1.

Columbia University—School of Climate: [Columbia Climate School](#)

Rice University—Kinder Institute for Urban Research: [The Kinder Institute for Urban Research | \(rice.edu\)](#)

Swarthmore College—Lang Center for Civic & Social Responsibility: [Lang Center for Civic & Social Responsibility :: Swarthmore College](#)

University of British Columbia—Future Waters Research Cluster: [University of British Columbia Future Waters Research Cluster](#)

University of California Davis—Honda Smart Home: [Honda Smart Home at UC Davis West Village Offers Vision For Zero Carbon Living | UC Davis](#)

University of Michigan—Mcity Test Facility: [Mcity Test Facility - Mcity \(umich.edu\)](#)

University of Texas—Pecan Street: [PECAN STREET – Pecan Street Inc.](#)

University of Washington—Urban at UW: [Urban@UW \(washington.edu\)](#)

### Task Force Membership and Process

Task Force Members were recommended by the Deans of their respective schools and invited by the Provost to participate on the Task Force. Table 1 lists the 22 Task Force Members in alphabetical order by last name.

Table 1. Task Force Members			
Name	Representing	Name	Representing
Julian Agyeman	Faculty Senate	John Morgan	Dental Medicine
Hellen Amuguni	Cummings	Amy Myers Jaffe	Fletcher
Ujjayant Chakravorty	Arts & Sciences	Felicia Nutter	Cummings
Laura Corlin	Medicine	Colin Orians	Arts & Sciences
Erin Coughlan de Perez	Friedman	Matthew Panzer	School of Engineering
John Durant	School of Engineering	Abani Patra	DISC
Samantha Fried	Tisch College	Ryan Rideau	CELT
Eric Hines	(chair)	Beth Rosenberg	Medicine
Ellise Lamotte	STEM Diversity	Thomas Vandervelde	School of Engineering
Melissa McCracken	Fletcher	Parke Wilde	Faculty Senate
Gilbert Metcalf	Arts & Sciences	Tina Woolston	Office of Sustainability

Task Force meetings were structured as follows.

1. Four All Task Force (ATF) Meetings provided opportunities to receive updates from all three working groups, for the Task Force to identify common ground, and to formalize recommendations.
  - a. Kickoff 1: February 18, 2021
  - b. Round 1 Summary: March 11, 2021
  - c. Round 2 Summary: March 25, 2021
  - d. Round 3 and Task Force Summary: April 8, 2021
2. Three Rounds of engagement allowed faculty to meet in 7-member working groups to discuss ideas in preparation for ATF Meetings.
  - a. Round 1: February 26—March 11, 2021
  - b. Round 2: March 12—March 25, 2021
  - c. Round 3: March 26—April 8, 2021
3. The Task Force Chair attended and moderated all working group meetings. In addition, TIE Staff (Parlee and Kaltcheva) attended all working group meetings and developed transcriptions of each meeting that have been archived as reference materials for this document. The Chair invited each member of the Task Force to at least one individual meeting to discuss the Provost’s Charge and to check-in on the Task Force process.
4. V01 of this Task Force Report to the Provost was shared with the Task Force on Monday, March 29, 2021. Round 3 working group meetings focused primarily on feedback on and discussion of the Report by Task Force Members.
5. V02 of this Report was shared with the Task Force, with full comments from the first WG meetings of Round 3, at midday on Friday, April 2, 2021.
6. V03 (clean copy) shared with the Task Force on Saturday, April 3, 2021.
7. Comments were received by Tuesday, April 5, 2021.
8. V06 (clean copy) shared with the Task Force on Wednesday, April 7, 2021.
9. Comments were received by Friday, April 9, 2021.
10. V09 (clean copy) shared with the Task Force on Sunday, April 11, 2021.
11. V10 (clean copy) shared with the Task Force on Wednesday, April 14, 2021.
12. Comments were received by Monday, April 19, 2021.
13. V11 (clean copy) shared with the Task Force on Tuesday, April 20, 2021.
14. An additional All Task Force Meeting was held on Earth Day, Thursday, April 22, 2021 to finalize and approve this report and its recommendations to the Provost.
15. V12 is the clean copy of this Report sent to the Provost on Thursday, April 22, 2021.
16. The Task Force met with the Provost on Thursday, May 6, 2021 to discuss this Report.

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